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Camel hydatidosis: Prevalence and economic significance in pastoral regions of Ethiopia

Bayleyegn Gizachew*, Fikadu Kibru and Biruhtesfa Asrade

College of Veterinary Medicine, Haramaya University, P. O. Box 138, Dire Dawa, Ethiopia.

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Camel hydatidosis was studied at Addis Ababa abattoir, Ethiopia to determine the prevalence and financial losses associated. From 501 camels slaughtered, 328 (65.47%) were found harboring hydatid cyst. The prevalence between females and males was statistically significant (χ^2=35.74; P=0.000). Additionally, the disease was significantly different among the age groups (χ^2=18.71; P=0.00) revealing higher prevalence in older animals. In respect to origin, the highest prevalence was observed from Borena (65.67%). The lung (47.90%) was the most frequently affected organ. Majority of the cysts identified were non calcified cysts. 57.78 and 39.10% of the cysts were found to be fertile in the lung and liver, respectively. Of these fertile cysts 68.27 and 60% were viable in the lung and liver, respectively. 212 lungs, 209 livers, 21 spleens and 2 hearts were totally condemned and these results in financial loss of 1089758.8 ETB (61222.4 US Dollar) annually. In conclusion, hydatidosis is highly prevalent in camels slaughtered at Addis Ababa Abattoir resulting to high economic loss due to organ condemnation. Thus, an effort should be made to control and prevent echinococcosis in the camel herding areas.

Key words: Akaki abattoir, camel hydatidosis, financial loss, prevalence.

INTRODUCTION

Pastoralism accounts for the livelihood of 50 to 100 million people in developing countries, while 60% of this population lives in more than 21 African countries confined to the most arid regions of the continents (Sheik-Mohamed and Velema, 1999; UNDP, 2007). Pastoralists are migratory people whose livelihood largely depends on livestock rearing. Among the East Africa countries, Ethiopia has the largest pastoralist population accounting for 10 to 12% of the total population (USAID, 2005). Ethiopian pastoralists virtually depend on livestock for their livelihood, moving seasonally from place to place in search of water and pasture for their animals (Nori, 2005). The dromedary camel (*Camelus dromedarius*), which is adaptable and capable of living in desert areas serves as a source of milk, meat, and draft power for the subsistence of the pastoralists. Ethiopia possesses an estimated amount of 2.3 million of *C. dromedaries* (Central Statistical Agency (CSA), 2008) mainly distributed in the Southern, Eastern and Northeast pastoral regions (Workneh, 2002; Ministry of Information, 2005).

In spite of the great ecological and economical value of the dromedary camel, there is scarce research information on camel diseases when compared with that of other domestic animals (Zeleke and Berkeley, 2000). This reveals that camels may be either carrier, susceptible or suffering from several diseases(Demeke, 1998). In

*Corresponding author. Email: gzenew@gmail.com. Tel: +251911747923. Fax: +251255530102.

connection to these, parasitic diseases like hydatidosis appear to be the major constraints that are hampering the potential performances of the camels (Getahun and Kassa, 2002; Megersa, 2010). In farm animals, it causes considerable economic losses due to condemnation of edible organs, decreased meat and milk production (Polydorous, 1981; Romazanvoc, 2001). In Ethiopia no work has been done on camel hydatidosis except a prevalence report by Muskin et al. (2011). In this regards, as Ethiopian dromedaries are primarily reared by pastoralists, camel hydatidosis could have significant economic and public health consequences in the regions. To this effect, abattoir based epidemiological studies are needed to show the real picture of the disease and to know its impact on economy. Therefore, the objectives of the present study are to investigate epidemiology and assess economic significance of camel hydatidosis in pastoral regions of Ethiopia.

MATERIALS AND METHODS

Study area and subjects

The study was conducted at Akaki (Addis Ababa) abattoir on apparently healthy slaughtered camels. The camels slaughtered at the abattoir were both male and female that originated from pastoral parts of the country mainly from Borena (Southeastern part of Oromia region) and Afar (eastern regions of Ethiopia).

Post mortem examination

Thorough post mortem examination was carried out by visual inspection, palpation and systematic incision on visceral organs; lung, liver, heart, kidney and spleen according to procedures recommended by Food and Agricultural Organization (FAO, 1994). All organs harboring cysts were partially or totally condemned and were judged according to the guidelines on meat inspection for developing countries (FAO, 1994).

Whenever and wherever the hydatid cysts appeared, the number and the size of the cysts per organ and per animal were counted, measured and recorded. Accordingly, the size of cysts were measured systematically and classified into three based on their diameter as small (<4 cm), medium (4 to 8 cm) and large (>8 cm) (Oostburg et al., 2000). The cysts were randomly selected and collected from different organs and were taken to regional laboratory (Shola, Addis Ababa) for fertility and viability tests (Figure 1).

Cyst viability tests

Non-calcified cysts were randomly selected and collected from different organs and were taken to regional laboratory (Shola, Addis Ababa) using ice box for fertility and viability tests. The cyst was put on clean petri-dish and incised by sterile scalpel blade and the fluid part was poured in another clean petri-dish. The supernatant was discarded and resultant sediment was finally examined for the presence of protoscolesces that appear as white dot under the microscopic field at 40X magnification power. Fertile cyst was subjected to viability test. A drop of 0.1% eosin solution was added to equal volume of protoscolisces in hydatid fluid on petri-dish with principle that viable protoscolisces should completely or partially avoids the dye, while the dead once take it up. Furthermore, infertile cysts were classified as sterile or calcified. Sterile hydatid cysts were characterized by their smooth inner lining usually with slightly turbid fluid in its content. Typically calcified cysts produced a gritty sound feeling upon incision (Soulsby, 1982).

Data management and analysis

The data were entered and coded into Microsoft excel program. Pearson χ^2 was used to test the existence of association between sex, body condition, origin and age groups. P-value less than 0.05 ($P<0.05$) was considered as statistically significant.

Estimation of the financial losses was analyzed on the basis of secondary data (annual slaughter rate) from the slaughter house and the mean retail market price of the offal which was obtained from the abattoir workers and butchers, and associated economic loss was calculated on the annual basis according to Sariözkan and Yalcin (2009).

RESULTS AND DISCUSSION

There are few epidemiological studies published on camel hydatidosis in Ethiopia as well as in other countries. Based on post mortem inspection, the prevalence of camel hydatidosis was 328/501 (65.5%). In this study, the prevalence of hydatidosis in camel is relatively higher when compared to the previous reports in camel, cattle and small ruminants in Ethiopia by Ahmed (1998) (18.6%) in Eastern Ethiopia, Weldemeskel (2001) (18.86%), Mulatu (2013) (30.5%) in Dire Dawa and Jijiga Bitsat (2009) (28.5%) and Muskin et al. (2011) (22.6%), and elsewhere in the world: 39.65, 48.5, 35.25, and 32.85%, were reported in Kuwait (Abdul-Salam et al., 1988), Libya (Ibrahim, 1998), Iran (Ahmadi, 2005), and Saudi Arabia (Mohamed, 2010), respectively. The disease was highly prevalent in female animals 300/328 (91.5%) and was statistically significant ($\chi^2=35.74$; $P=0.00$). The result of the association of the different risk factors to the hydatid cyst is presented in Table 1. Among the age groups, the disease was also found to be in higher prevalence in older animals. The age dependent variation could be due to high probability of the exposure of older animals to the infection during their long existence in life for many years.

This is also true for higher prevalent record in female animals, because during inspection, these animals were found old due to the fact that most pastoralists sell the female animals after they finished their productive age. These results agree with the previous reports by Cleaveland et al. (2007) and Inangolet et al. (2008). In this case, it is also good to consider the chronic nature of cyst development in organs. Since camel can live around 40 years (Kinne et al., 2006), they are more affected than other domestic animals. Regarding the origins, camels from Borena area were more affected with disease than

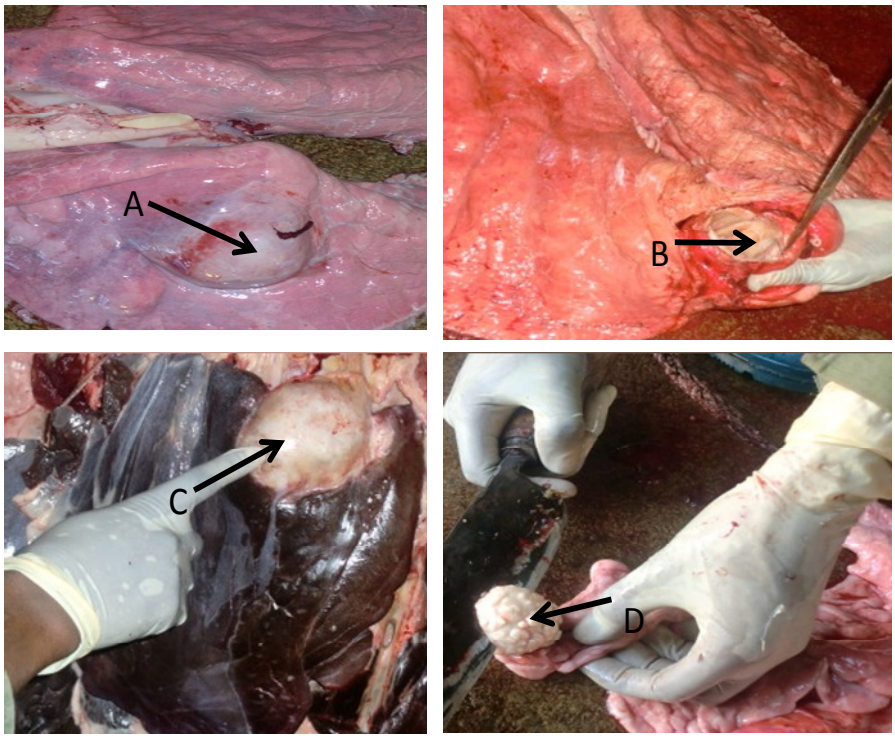

Figure 1. Hydatid cysts on different organs of slaughtered camels. A: None calcified hydatid cyst on the surface of camel lung; B: None calcified hydatid cyst in the lung exposed after incision; C: None calcified hydatid cysts on the surface camel liver; D: calcified hydatid cyst on camel lung.

Table 1. Association host related variables with camel hydatidosis.

Variable	No. of camels slaughtered	No. of positive Animals	% of positive animals	χ^2	P-value
Sex					
Female	423	300	91.5	35.74	0.00*
Male	78	28	8.54		
Age					
< 5	48	21	6.40		
5-10	172	103	31.40	18.2	0.00*
>10	281	204	62.20		
BCS					
Score 1	81	60	18.29		
Score2	38	29	8.84		
Score3	193	129	39.36	9.28	0.054
Score4	124	73	22.26		
Score5	65	37	1.28		
Origin					
Borena	329	233	71.04		
Afar	81	49	14.94	17.24	0.001*
Meiso	66	37	11.28		
Minjar	25	9	2.74		

*Statistically significant.

Table 2. Distribution of hydatid cyst on different organs of slaughtered animals.

Cyst location	No. of infected animal	Percent of infected animal
Lung	94	28.66
Liver	83	25.30
Spleen	2	0.61
Heart	0	0.00
Lung and liver	128	39.02
Lung and spleen	5	1.52
Lung and heart	1	0.31
Liver and spleen	2	0.61
Liver and heart	1	0.31
Lung, liver and spleen	12	3.66

camels from other origins. Theses could be due to the absence of similar environmental and climatic situations in the different areas (Mohamed, 2010).

In this study, it was also possible to characterize the nature of the cyst. Most of the hydatid cysts were recorded in lung and liver of camel. Single and multiple organ pathology with hydatid cysts are depicted in Table 2. The infection rate of cystic echinococcosis in each organ with relation to the cyst size is summarized in Table 3. Majority of the identified cysts were non-calcified. The distribution of calcified and non calcified cysts in relation to age is summarized in Table 4. Regarding the fertility of the hydatid cysts, this study indicated that cysts from the lung showed a higher fertility proportion as compared to cysts collected from livers (Table 5).

The reason for the difference may be attributed to the age of animals. An increased number of fertile cysts tend to occur in older animals (World Health Organization/ Office International des Epizootics (WHO/OIE), 2011); this strongly suggest that fertile cysts, are important factors that can influence the transmission of *Echinococcosis granulosus*, and are most likely found in older animals while the sterile one is found in young animals (Grayesm, 1986).

Furthermore, the extensive practice and roadside slaughter of camels could have contributed to the maintenance of the parasite's cycle. In such a way, dogs have easy access to ingest the offal or organs harboring the cysts and become easily infected. This plays a crucial role in the transmission of the disease and enables the parasite to maintain its life cycle among the hosts. Moreover, pastoralists in east Africa move from place to place with their livestock including camels in search of feed where wild canids are found. This may favor the transmission of the infection between infected canids and susceptible camels and also be considered as risk factors in increment of the prevalence in this study. Moreover, Ethiopia has proclamation for animal disease prevention and control (Federal Negarit Gazeta (FNG), 2002). However, currently there is no documented and implemented rule and regulation for meat inspection in particular for camel meat.

The annual economic loss due to hydatidosis in camel slaughtered at Akaki abattoir was estimated by considering the main cost of organs (lung, liver, heart and spleen) (Sariözkan and Yalcin, 2009). The main price of respective organs at Addis Ababa city was obtained from abattoir workers and butchers during the study period.

These parameters were then fed to the following formula in order to compute the economic loss due to organ condemned, as unfit for human consumption due to cystic echinococcosis thus:

$$X = (AS \times C_{Lu} \times P_{Lu}) + (AS \times C_{Li} \times P_{Li}) + (AS \times C_{Sp} \times P_{Sp}) + (AS \times C_{Kid} \times P_{Kid}) + (AS \times C_{Hr} \times P_{Hr}).$$

where AS: estimated mean annual kill; P_{Lu}: percent involvement of the lung; C_{Lu}: local retail price of a lung; P_{Li}: percent involvement of the liver; C_{Li}: local retail price of a liver; P_{Sp}= percent involvement of the spleen; C_{Sp}: local retail price of a spleen; P_{Kid}: percent involvement of the kidney; C_{Kid}: local retail price of a kidney; P_{Hr}: percent involvement of the heart; C_{Hr}: local retail price of a heart; P_{SC}: percent of spleen condemned; C_S: local retail price of the spleen.

$X = (3201 \times 65.47\% \times 10) + (3201 \times 41.72\% \times 800) + (3201 \times 0.39\% \times 35) + (3201 \times 0.00\% \times 80) + (3201 \times 4.19\% \times 0) = 20957 + 1068365.8 + 437 + 0 + 0$

X = 1,089,758.8 ETB (61,222.4 US Dollar)

Conclusively, this study indicated that hydatidosis is a highly prevalent parasitic disease of slaughtered camels at Addis Ababa abattoir. In connection to this, significant

Table 3. Cyst size in different organs of infected camels.

Organ	Small	Medium	Large	Total
	N (%)	N (%)	N (%)	N
Lung	409 (39.10)	850 (57.32)	242 (63.35)	1501
Liver	627 (59.94)	613 (41.34)	136 (35.60)	1376
Spleen	10 (0.96)	19 (1.28)	3 (0.79)	32
Heart	0 (0.00)	1 (0.07)	1 (0.26)	2
Total	1046 (100.00)	1483 (100.00)	382 (100.00)	2911

Table 4. Calcification of cysts.

Age (Years)	No. cyst Examined	Non-calcified cyst	Calcified cyst
		N (%)	N (%)
≤5	19	10 (52.63)	9 (47.37)
5-10	152	115 (75.66)	37 (24.34)
>10	217	183 (84.33)	34 (15.67)
Total	388	308 (79.38)	80 (20.62)

Table 5. Cyst fertility and viability in relation to organ affected.

Cyst location	No. of cyst examined	N(%)			
		Sterile	Fertile	Viable	Dead
Lung	180	76(42.22)	104(57.78)	71(68.27	33(31.73)
Liver	128	78(60.93)	50(39.10)	30(60.00)	20(40.00)
Total	308	154(50.00)	154(50.00)	101(65.58)	53(34.42)

financial losses were recorded due to condemnation of edible organs from the domestic markets. Therefore, an effort should be made to control and prevent camel hydatidosis and further identification and characterization of causative agent would be useful towards the efforts made to control the disease.

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