Comparative prevalence of hydatidosis in slaughtered domestic ruminants at four abattoirs of central Oromia, Ethiopia

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Abstract

A cross-sectional study was conducted from October 2010 to May 2012 with the aim of investigating prevalence, associated risk factors and characterization of hydatidosis in domestic ruminants slaughtered for human consumption, in four selected abattoirs of central Oromia, namely Akaki, Ambo, Assela and Bishoftu. Regular visits to the abattoirs were made and a thorough examination of the visceral organs (liver, lung, heart, spleen, kidney and other tissues) were done by inspection, palpation and incision of each organs. The number, size of cysts and the organ from which the cyst recovered were also recorded. Samples of hydatid cysts were collected in a plastic bags for examination in the nearest veterinary clinic laboratory. Out of 770 camels, 2910 cattle, 20059 goats and 6680 sheep inspected for the presence of hydatid cysts, 74 (61.6%), 1896 (65.15%), 26 (0.13%) and 611 (9.15%) were found to be harboring hydatid cysts, respectively. Small, calcified and sterile hydatid cysts were found in agglomeration in the liver than other organs, while fertile and viable of medium and large cysts were most frequently observed in the lungs, spleen and abdominal cavity. Among the accessible offals to the definitive host, the lungs were found to be major contaminant viscera while the rest follow the pathway. In terms of frequency, size and fertility of the hydatid cysts, the lung was found to be the predilection site in cattle, sheep and goats, while liver in camels. This study revealed a high prevalence of hydatidosis in slaughtered domestic ruminants and thus the parasite requires serious veterinary attentions in the study area.

Key words: Abattoirs, Comparative prevalence, Fertility, Hydatidosis, Viability

Introduction

In Ethiopia, livestock production is a major component of the agricultural economy, contributing about 30% to the poor's nutrition. Among animal diseases, parasitism represents a major obstacle for the development of the livestock sector and hampers the poverty alleviation programs in livestock farming system in the country (Yilma Jobre *et al*., 1996). It is evident that cystic hydatidosis/echinococcosis is an endemic parasitic problem occurring in camels, cattle, goats and sheep in Ethiopia (Nigatu Kebede *et al.,* 2011). However, these animals play a crucial role in providing draught power, determining the wealth, social and food status of pastoralist living in mid-altitude and low land of Ethiopia, Africa and Asia (Getahun Abate and Belay Woldu, 2002). It is associated with severe morbidity and disability.

Hydatidosis/Echinococcosis is a cosmopolitan zoonosis caused by larval stages of cestode belonging to the genus *Echinococcus* (Craig *et al.,* 2007). Larval infection (hydatidosis) is characterized by long term growth of hydatid cysts in the intermediate host. Factors governing the prevalence of hydatidosis in a given locality may be associated with prevailing specific social cultural, environmental conditions and the dynamics of transmission between the dog and its intermediate host and human (Macpherson, 2005). The public health and economic significances of hydatidosis lies on the cost of hospitalization, medical and surgical treatment, loss of income and productivity due to permanent or temporary incapacity to work. The social consequence of hydatidosis is disability and mortality (Macpherson *et al*., 1985). In food animals, hydatidosis has an adverse effect on production causing decreased production of meat, milk, wool, reduction in growth rate and predisposition to other diseases (Nigatu Kebede *et al*., 2011).

Though a number of studies were carried out in Ethiopia, none of them were able to present comparative findings of cystic hydatidosis/echinococcosis to determine the extent and magnitude of the problem among the different domestic animals. In view of this, the objective of this study was to determine comparative prevalence of hydatidosis in different ruminant species slaughtered at four selected abattoirs of central Oromia, Ethiopia.

Materials and Methods

Study area

The study was conducted at four selected abattoirs of central Oromia, namely, Akaki, Ambo, Assela and Bishoftu from October 2010 to May 2012.

Akaki Abattoir: The study was conducted at Akaki abattoir, which is located in Addis Ababa, the capital city of Ethiopia. The city is located at $9^0 1' 48'$ North and $38^0\ 44^0$ – 24' East at an average altitude of 2500 meters above sea level (masl). The annual rainfall is about 800 -1100 mm^3 and a mean annual minimum and maximum temperature is about 21°C – 27°C, respectively. The longest rainy season is between June and October while the short rainy season extends from March to May National Meteorology Service Agency (NMSA, 2001). This abattoir is specialized in slaughtering camel, goats and sheep for domestic consumption.

Ambo Abattoir: It is situated in Ambo town which is a capital city of western Shoa zone of Oromia regional state, located at about 105 km west of Addis Ababa. This town is located at altitude of 1900 to 2275 masl. This abattoir is specialized in slaughtering cattle for domestic consumption Ambo Agricultural and Rural Development Bureau (AARDB, 2004).

Assela Abattoir: This is located in Assela, the capital town of Arsi zone of Oromia region which is located about 175 km south east of Addis Ababa at altitude of 2400 masl. This abattoir is specialized in slaughtering cattle and sheep for domestic consumption Arsi Agricultural and Rural Development Bureau (ArsiARDB, 2004).

Bishoftu Abattoirs: They are situated in Bishoftu town, the capital city of Adda district is located in eastern part of Addis Ababa at 45 km. This town has an elevation between 1788 and 1825 masl (NMSA, 2001). These abattoirs are specialized in slaughtering cattle, sheep and goats for domestic consumption and export purposes.

Study Animals

The study animals comprised of local breed of domestic ruminants reared under extensive management system. All animals brought to abattoir were camel, cattle, goats and sheep. Approximately, 85% of these species were adult male, and 96% the camels were old. All the animals were brought from central Oromia, Ethiopia.

Sample Size and Sampling Method

A census type of sampling was employed involving examination of all animals slaughtered in all four abattoirs during the study period in order to ensure the representativeness as well as precision of the findings. Accordingly, it was possible to examine a total of 770 camels, 2910 cattle, 20059 goats and 6680 sheep slaughtered at four selected abattoirs of central Oromia, Ethiopia.

Study Design and Methodology

During the cross-sectional study, the ante mortem and postmortem inspections were carried out in accordance with the procedures of Mitchell, (1980). During ante mortem inspection, the animals were placed in a collection barn for twenty four hours for visual observation. Those animals which showed clinical signs of illness and some pathological alterations, a checkup and treatment were carried out. Information concerning the age, body condition score, sex, behavior, and nutritional status of all animals were properly recorded (Gracey *et al.,* 1999). The age of the sampled animals was determined by dental eruption (Llse Kohler-Rollefson, *et al.,* 2001; Khan *et al.,* 2003). The body condition scoring for animals was carried out based on the guide line given by Faye *et al.,* (2001).

Postmortem inspection

Regular visits were made to the above mentioned four abattoirs and a thorough examination of the visceral organs (liver, lung, heart, spleen, kidney, other viscera and tissues) was done by inspection, palpation and incision of each slaughtered animals (Mitchell, 1980). The number, size of cysts (small = 1-5 cm, medium = 5-10 cm and large = 10 – above cm) Nigatu Kebede *et al*., (2011) and the organ from which the cyst recovered were also recorded systematically, and collected in a plastic bag for close examination in the nearby veterinary clinic laboratories to confirm the doubtful cases immediately.

Determination of cyst fertility and viability

Individual cysts were grossly examined for the degeneration and calcification. Then, all hydatid cysts were sterilized with alcohol-iodine solution. The wall of the cyst was punctured by a large needle and a cut was given with scalpel or scissors to determine its fertility or infertility. The infertile cysts were further classified as sterile (fluid filled cysts without protoscolices) and calcified as indicated by Mcpherson, *et al.,* (1985). To identify the viability of the protoscolices, a drop of the sediment of the cyst fluid with protoscolices was placed on microscopic glass slide and covered by 22 x 22 mm cover slip and then an amoeboid peristaltic movement (flame cell activity) was observed under the objective of X40. When it is dutiful to observe the such movement, a drop of 0.1% aqueous eosin solution was added to equal volume of protoscolices to completely or partially exclude the dye while the dead one takes the dye and the viable not (Smyth and Barrett, 1980).

Data Analysis

The data obtained from the study were coded and stored in Microsoft Excel sheet and then subjected to descriptive analysis by using SPPS for windows version 15, SPSS, Inc, and Chicago, IL. The main outcome, variables were the case of hydatid cysts detected during the routine meat inspection. Univariate screenings were done by Chi-square in order to look for the magnitude of the difference of comparable variables such as age, sex and origin of the animals. The 95% confidence intervals (CI) were also calculated. All values of $P<0.05$ were considered significant.

Results

Prevalence

The findings of the current study indicated that a large number of animals were found to be harboring hydatid cysts in their different visceral organs (Table 1.) There was a statistically significant difference in the prevalence of hydatid cysts in animals slaughtered ($P<0.05$) among the four selected study abattoirs. There was a statistically significance difference with the prevalence of hydatidosis among sheep ($P < 0.05$) slaughtered at Assela and Bishoftu Abattoirs. Accordingly, the prevalence of hydatidosis in sheep was 41.2% and 0.7% in Asela and Bishoftu, respectively. There was no statistically significant variation with the prevalence of hydatidosis among cattle ($P>0.05$) slaughtered

and inspected at Ambo and Bishoftu abattoirs. However, a significantly higher prevalence of hydatidosis was recorded in cattle slaughtered at Asela (76%) compared to Ambo (40%) and Bishoftu (40.2%) abattoirs. This was found to be statistically significant ($P<0.05$). The prevalence of hydatid cyst in slaughtered camel at Akaki abattoir was 61.6% (Table 1).

Table 1: Comparative prevalence and their relative percentage of cystic echinococcosis of camel, cattle, goat and sheep slaughtered in four Abattoirs of central Oromia

Study areas	Animal species	Nº animals	Nº Positive	Prevalence (%)
Akaki	Camels	770	474	61.6
Ambo	Cattle	675	270	40.0
Assela	Cattle	2031	1544	76.0
	Sheep	1393	574	41.2
Bishoftu	Cattle	204	82	40.2
	Goats	20059	26	0.13
	Sheep	5287	37	0.7
Total		30419	3007	9.9

Distribution of hydatid cysts based on size

There was difference in the size of hydatid cysts in different organs of the studied species of animals and categorized into small, medium or large accordingly (Table 2). Upon counting of the encountered hydatid cysts in a given organ, there were variations in number that ranged from one to thirty one.

Table 2: Distribution and relative percentage of hydatid cysts based on size

Geographical location	Species	Size			Total
		Small	Medium	Large	
Akaki	Camel	403 (53.52%)	193 (25.63%)	157 (20.85%)	753 (14.16%)
Ambo	Cattle	599 (71.57%)	184 (21.98%)	54 (6.45%)	837 (15.74%)
Assela	Cattle	437 (28.47%)	977 (63.65%)	121 (7.88%)	1535 (28.86%)
	Sheep	569 (49.52%)	400 (34.81%)	180 (15.67%)	1149 (21.60%)
	Goats	102 (53.40%)	77 (40.31%)	12 (6.28%)	191 (3.59%)
Bishoftu	Cattle	322 (40.71%)	401 (50.70%)	68 (8.60%)	791 (14.87%)
	Goats	59 (93.65%)	4 (6.35%)	0 (0%)	63 (1.18%)
Total		2491 (46.83%)	2236 (42.04%)	592 (11.13%)	5319 (100%)

Fertility and viability rates of hydatid cysts

In the current study, 1350 hydatid cysts were harvested from different species of animals such as camel, cattle, goats and sheep with 200, 700, 50 and 200 cysts, respectively for characterization. During anatomo-morphological examination of hydatid cysts, protoscolices either attached to the germinal layer or in it fluids were encountered. Hence, this suggests that the cysts are fertile. These types of cysts were common in the lungs than the liver while sterile and calcified cysts were found in the liver than the lungs (Table 3 and 4).

Table 3: Distribution of fertile (viable, non-viable), sterile and calcified hydatid cysts in lungs and liver of sheep and goats

Name of the abattoir	Spp.	Organs inspected	No of Cyst examined	Cyst condition									
				Fertile cysts						Infertile cysts			
				Viable		Non-viable		Sub total		Sterile		Calcified	
Bishoftu	Sheep			N	%	N	%	N	%	N	%	N	%
		Lung	100	27	73	10	27	37	37	51	51	12	12
		Liver	100	16	64	9	36	25	25	32	32	43	43
		Total	**200**	**43**	**69**	**19**	**31**	**62**	**31**	**83**	**42**	**55**	**28**
	Goat	Lung	25	11	58	8	42	19	76	2	8	4	16
		Liver	25	10	67	5	33	15	60	3	12	7	28
		Total	**50**	**21**	**62**	**13**	**38**	**34**	**68**	**5**	**10**	**11**	**22**
Assela	Sheep	Lung	100	53	86	9	15	62	62	32	32	6	6
		Liver	100	43	86	7	14	50	50	22	22	28	28
		Total	200	96	86	16	14	112	56	54	27	34	17

Table 4: Distribution of fertile (viable, non-viable), sterile and calcified hydatid cysts in lungs and liver of cattle and camels

Name of the abattoir	Spp.	Organs inspected	No of Cyst examined	Cyst condition									
				Fertile cysts						Infertile cysts			
				Viable		Non-viable		Sub total		Sterile		Calcified	
				Nº	%	Nº	%	Nº	%	Nº	%	Nº	%
Ambo	Cattle	Lung	100	23	64	13	36	36	36	52	52	12	12
		Liver	100	14	67	7	33	21	21	28	28	51	51
		Total	**200**	**37**	**65**	**20**	**35**	**57**	**29**	**80**	**40**	**63**	**32**
Bishoftu	Cattle	Lung	150	47	48	51	52	98	65	32	21	20	13
		Liver	150	56	56	44	44	100	67	25	17	25	17
		Total	**300**	**103**	**52**	**95**	**48**	**198**	**66**	**57**	**19**	**45**	**15**
Assela	Cattle	Lung	100	51	75	17	25	68	68	19	19	13	13
		Liver	100	42	73.68	15	26.32	57	57	13	13	30	30
		Total	**200**	**93**	**74.4**	**32**	**25.6**	**125**	**62.5**	**32**	**16**	**33**	**16.5**
Akaki	Camel	Lung	100	35	46	42	55	77	77	13	13	10	10
		Liver	100	49	61	31	39	80	80	9	9	11	11
		Total	**200**	**84**	**54**	**73**	**47**	**157**	**79**	**10**	**10**	**11**	**21**

Discussion

The current study revealed that hydatidosis is highly prevalent in ruminants in central region of Oromia, Ethiopia. The present study also showed that hydatidosis is widely spreading among camels in Ethiopia. A relatively higher hydatidosis prevalence (61.6%) among camels was recorded, which is higher than the previous reports of 4.5% in Harar, Ethiopia, Woubet Mulugeta, (1987), 39.65% Kuwait, Abdul Salam and Farah, (1988), 18.8% in Ethiopia, Yilma Jo-

bre *et al*., (1996), 48% in Libya, Ibrahim and Craig, (1998), 28.5% in Ethiopia, Bisrat Hailu, (2001), 61.4 % in Kenya, Njoroge *et al*., (2002), 35.25% in Iran, Ahimadi, 2005), 4.5% Egypt, Dyab *et al*., (2005) and 32.85% in Saudi Arabia, Mohamed, (2010). Many reports from the different corners of the world indicated relatively higher prevalence of hydatidosis in camel: 80% in Morocco, Pandey *et al*., (1986). These variations of the prevalence of hydatidosis from different countries could be due to the variations in the temperature, environmental conditions and number of stray dogs as well as other animal contact. In line with this, as the area becomes dry and hot, the survival of echinococcus onchospheres will be less likely. As there is frequent feeding of grasses contaminated by the feces of definitive hosts such as stray dogs or home kept dogs, the prevalence of hydatidosis increases in intermediate hosts such as camels. In addition, the slaughter houses are disposing the offals in shallow pits, where by the dogs can get access to it very easily. At times these offal's can reach the markets, where by the owners of dogs at home can buy for their animals and offering them without cooking. In this study, there was a high correlation between the prevalence of hydatidosis and the age of camels at slaughter. In most parts of African countries, owing to cultural reasons, dogs are kept in close association with the family and farm animals. In additions to this the dogs are not normally dewormed. The habit of leaving dead domestic animals unburied and leaving them open for scavenging carnivores create favorable condition of maintaining the life cycle. Moreover, the existence of backyard slaughtering of animals provides better access of offals to dogs. The age of camels at slaughter affected the prevalence of hydatidosis as animals brought to the abattoir at the end of long working life will tend to have higher prevalence.

The prevalence from the present study were comparable with the findings of Bersissa Kumsa, 1994 (22.2% in cattle and sheep) at Nekamte abattoir, Ethiopia. However, the prevalence of hydatidosis in ruminants from this study was higher than reports of Yilma Jobre, 1985 (12.2% in cattle, sheep and goats) at Bishoftu and that of Alemayehu Lemma, 1990 (2.2% in cattle, sheep and goats) at Arsi. The main reason for the occurrence of relatively higher prevalence of hydatidosis could be most of the slaughtered goats, sheep and cattle were adults. It is known that adult animals might be more exposed to the parasite and thus increased possibility of acquiring the infections. Similarly, previous studies strongly suggested that prevalence is heavily influenced by age (WHO/OIE, 2001). In addition, the variation in the prevalence may be due to the difference in the origin of animals brought for slaughter.

Organs distribution of hydatid cysts had been carried out in these different species of animals. It was interesting to mention that lungs and liver harboring abundant number of cysts while kidneys, spleen, heart and the other organs accommodate by far less number of cysts. This is probably due to the fact that lungs and livers possess high numbers of capillaries that are the first encountered by the migratory *Echinococcus* onchospheres via the portal vein before any other peripheral organs (Pandey, 1988).

The condition of viability and fertility rates were observed different from the findings of Umur, (2003) who reported 28.6% in sheep and 26.1% in goats. Lower fertile cysts were reported from other studies such as 4.0% in Sicily (Giannetto *et al*., 2004), 2.6% in Sardinia Scala *et al*., (2004) and 0.7% in Australia Bank *et al*., (2006). The fertility of cysts is an important factor that can influence the transmission of echinococcosis Mc Manus, (2006). While comparing the fertility rates of hydatid cysts by organs, it was observed that higher fertility in lungs than livers in cattle, sheep and goats. On the contrary, the fertility of hydatid cysts was higher in liver than lungs among camels. It has been stated that the relatively softer consistency of lung tissue allows the easier development of the cyst. Besides, the fertility rate of hydatid cysts may show a tendency to increase with advancing ages of the hosts. This indicate that when the texture of the parenchyma of an organ is loose connective tissue type then the parasite grows to it maximum size (Himonas, 1987, Daryani *et. al.,* 2007).

In conclusions, this study revealed a high prevalence of hydatidosis in slaughtered ruminant animals and camels suggesting a widespread occurrence of the problem in different agro-ecological zones of the country. In order to combat animal diseases such as echinococcosis with considerable economic and public health significance, efficient meat inspection service should function as an important monitoring agent. More importantly, a feedback from the slaughterhouses to the individual farm is of great value in the field of preventive veterinary medicine. Therefore, as the parasite requires serious veterinary and public attentions, further community-based participatory and integrated echinococcosis/hydatidosis control approaches are required.

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