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Study on prevalence of hydatidosis and cyst characterization in camels (*Camelus dromedarius*) slaughtered at Akaki abattoir, Ethiopia

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A cross-sectional study was conducted from October 2010 to August 2012 to determine the prevalence of camel hydatidosis and associated risk factors in camels slaughtered for human consumption at Akaki municipal abattoir. The results of this study revealed that out of 770 camels slaughtered, 474 (61.6 %) were harboring hydatid cysts with varying numbers and sizes in different organs (3850) in the following manner; liver (53.51%), lungs (40.39%), heart (0.13%), gastrointestinal track (GIT, 0.9%) and Kidneys (0.13%). The positive samples were put in plastic bags and taken to the laboratory for characterization of the cysts for fertility and viability. There was no significant variation between camels of different origins and the anatomo-morphological features of the cysts. The infection rates varied significantly among age groups ($p<0.05$), sex ($p<0.005$) and body condition score ($p<0.05$) of camels. The prevalence was found to be high (61.94%) in higher age group animals, that is, greater than 10 years as compared to 3 to 5 years (25%). The mean intensity of hydatid cyst among affected camels was found to be 3.1±5.8. Out of the examined cysts, 41.5% were found to be fertile and viable, while 18.3, 21.3 and 18.9% were non-viable, sterile and calcified cysts, respectively. The fertility of the cysts was 68.5 and 70.7% in liver and lungs, respectively.The high prevalence of camel hydatidosis affecting different organs indicates the seriousness of this disease particularly in the area of the origin of these animals that require an immediate control intervention.

Key words: *Camelus dromedarius*, cyst fertility, hydatid cyst, prevalence.

INTRODUCTION

Ethiopia is an agrarian country with huge livestock population in Africa possessing 23 millions heads of camels (MOI, 2005). Even though 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, little is known about their husbandry practices, productive and reproductive performances (Getahun and Belay, 2002).

Among parasitic diseases affecting camels, hydatidosis is a diseases with substantial economic and public health importance occurring in many countries (Lahmar et al., 2004) and is becoming more endemic in many African countries (Azlaf and Dakkak, 2006; Getaw et al., 2010).

Hydatidosis/Echinococcosis is a cosmopolitan zoonosis caused by larval stages of cestodes 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. Factor governing

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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, 1985). The public health and economic significances of hydatidosis lies on the cost of hospitalization, medical and surgical fees, 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 (Kebede et al., 2009b).

Previous studies (Mohammed, 1988; Abdul-Jawed, 1988) from different parts of Ethiopia reported the prevalence of cattle and sheep hydatidosis ranging from 25.7 to 63% and 4.4 to 18.8%, respectively. However, few reports (Woldemeskel et al., 2001; Salih et al., 2011) are available on the prevalence of camel hydatidosis in Ethiopia. Therefore, this study was designed to estimate the prevalence of hydatidosis, determining cyst fertility, viability and assessment of the associated risk factors in slaughtered camels at Akaki abattoir.

MATERIALS AND METHODS

Study area

The study was conducted at Akaki abattoir, which is located in Addis Ababa, the capital city of Ethiopia. The city is located at 9°1'48' North and 38° 44°-24' East at an average altitude of 2500 m above sea level. The annual rainfall is about 800 to 1100 mm^3 and a mean annual maximum and minimum temperature is about 21 to 27°C, respectively (NMSAE, 2012). Although the camel meat is not popular in Addis Ababa, the Somali community and some other Muslim communities who live in the city are the main consumers of camel meat from this abattoir. As a result the Akaki abattoir usually slaughters an average of eight camels per day. In addition, this abattoir, also give service to the hotels and restaurants of the Akaki town by slaughtering cattle, sheep and goats every day.

Study animals

The study was conducted on 770 one humped camels *(Camelus dromedarius)* brought from various camel rearing pastoral areas of the east and south part of the country, namely, Borena, Chiro, Metahara, Miesso and Kereyou.

Sample size determination and sampling procedure

It is reasonable to assume the systematic sample is a representative as a simple random sample. Therefore, the sample size was calculated using the formula given for simple random sampling (Thrusfield, 2005) with 50% expected prevalence, 95% confidence interval and 5% desired absolute precision. Accordingly, the calculated sample size was found to be 384. In order to maximize randomness as well as level of precision, a total of 770 camels which were slaughtered at Akaki abattoir for human consumption were sampled. The sampling was carried out using systematic random sampling (Thrusfield, 2005) in such a way that the sampling units were selected at equal intervals with the first animal being selected randomly.

Study type and methodology

During the cross-sectional study, the ante mortem and post mortem inspection was carried out in accordance with the procedures of Ethiopian Ministry of Agriculture Meat Inspection Regulation 1972. During ante mortem inspection, the animals were placed in a collection barn for 24 h for visual observation. Animals which show clinical signs of illness and some pathological alterations, a checkup and treatment were carried out. Information concerning 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 according to Khan et al. (2003). The body condition scoring for camels was carried out based on the guidelines given by Faye et al. (2001). The scoring was conducted by looking at the back and flank and then classified as poor (0 and 1), medium (2 and 3), and good (4 and 5).

Post mortem inspection

Regular visits were made to Akaki abattoir and a thorough examination of visceral organs (liver, lungs, heart, spleen, kidneys, other viscera and tissues) was done by inspection, palpation and incision of each slaughtered camels. The number of cysts and the organ from which the cysts recovered were also recorded systematical and collected in a plastic bag for close examination in the laboratory to confirm the doubtful cases immediately.

Determination of cyst fertility and viability

After collection of samples from each hydatid cysts positive organs, the wall of the cyst was punctured by a large needle and opened with scalpel blade and contents were transferred into test tube. Based on the presence and absence of broad capsule containing protoscolices in hydatid fluid, cysts were identified and classified as fertile and infertile. The infertile cysts were further classified as sterile (fluid filled cysts without protoscolices) and calcified, as indicated by Macpherson (1985). To determine viability of protoscolices, a drop of the sediment of the cyst fluid with protoscolices was placed on microscopic glass slide and covered by 22 × 22 cover slip and then an amoeboid peristaltic movement (flame cell activity) was observed under the objective of 40× (Smyth and Barrett, 1980). When it becomes confusing to observe such movement, a drop of 0.1% aqueous eosin solution was added to equal volume of protoscolices to completely or partially exclude the dye, the dead one took the dye (stained red), whereas the viable one were not stained (Macpherson, 1985).

Data analysis

The data obtained from post mortem and laboratory findings were interred to Ms Excel sheet and then analyzed by using statistical Package for Social Sciences (SPPS) for window version 15, SPSS, Inc, Chicago, IL. Initially, unvariate logistic regression followed by multiple logistic regression analysis was employed to analyze the existence of association between the different risk factors and occurrence of hydatidosis. The 95% confidence intervals (CI) were also calculated. All value of $P<0.05$ were considered significant.

Table 1. Prevalence of camel hydatidosis based on age and Body condition score in Akaki abattoir.

Risk factors		No. of camels examined	No. infected camels	Prevalence (%)
Sex	Female	760	470	61.8
	Male	10	4	40
Age	3-5 years	8	2	25
	>10 years	762	472	61.9
BCS	Medium	712	434	61
	Good	58	40	69

Table 2. Prevalence of hydatid cysts based on anatomical sites.

Organs (Sites)	Total No. of organs examined	No. of infected organs	Prevalence (%)
GIT	770	7	0.90
Heart	770	1	0.13
Kidneys	770	1	0.13
Liver	770	412	53.51
Lungs	770	311	40.39
Total	3850	732	16.73

Table 3. Organ distribution of the hydatid cyst in each organ.

Organ	No. of organs infected	No. of cysts in each organ
GIT	7	15
Liver	412	3774
Lung	311	3132
Heart	1	1
Kidney	1	1
Total	732	6923

Table 4. Organ distribution of hydatid cysts on the bais of their size.

Organ	Small	Medium	Large	Total
GIT	4	2	1	7
Heart	0	1	0	1
Kidney	1	0	0	1
Liver	2150	1320	304	3774
Lung	1632	1217	284	3132
Total	3786	2540	589	6915

RESULTS

Prevalence and analysis of the risk factors

During the study period, from October 2010 to April 2012, a total 770 camels were examined, out of which 474 (61.6%) were found to be harboring hydatid cysts in their internal organs. The occurrence of hydatidosis significantly varied among age group ($P<0.05$), sex ($P<0.05$), and body condition score of camels ($P<0.05$) (Table 1).

Out of 474 camels infected, the prevalence from infected cases count the highest relative percentage in liver 53.5% (412/770), lungs 40.39% (311/770), gastro-intestinal track (GIT) 0.9% (7/770), heart 0.13% (1/770) and kidneys 0.13% (1/770) (Table 2).

Out of a total of 3850 organs examined for hydatid cysts, 732 organs were harboring cysts. The maximum number of cysts found in infected organ was 32, while the minimum was 1. The mean intensity of cysts in camels harboring hydatid cysts was 9.16 (Table 3).

Organ distribution of the cyst

Single and multiple hydatid cysts distribution were recorded in different organs. Higher number of large and medium sized cysts was found in the lungs (Table 4), while higher number of small and calcified cysts was encountered in the liver (Tables 4 and 5). Most of the hydatid cysts were concentrated in liver and lungs of camels.

Cyst fertility and Viability

Out of 732 cysts observed and examined for fertility and

Table 5. Distribution of fertile (viable, nonviable), sterile and calcified hydatid cysts in liver and lungs of camels slaughtered at Akaki abattoir.

Organs inspected	No. of organs infected	Status of cysts			
		Fertile cysts		Infertile cysts	
		Viable	Non-viable	Sterile cyst	Calcified
Liver	412	165 (68.5%)	76 (31.3%)	84 (20.4%)	87 (21.1%)
Lung	311	135 (70.7%)	56 (29.3%)	70 (22.5%)	50 (16.1%)
Total	723	300 (41.5%)	132 (18.3%)	154 (21.3%)	137 (18.9%)

viability, 68.5% (165/723) were found to be viable and fertile in the liver, whereas 31.3% (76/723) were dead. However, in the lungs, 70.7% (135/723) viable and fertile and 29.3% (56/723) were dead and calcified once. Details of the percentage of viability and fertility of cysts in livers and lungs were indicated in Table 5.

DISCUSSION

In the present study, the prevalence of the hydatid disease was 61.56% which is higher than reports of Bitsat (2001) and Woldemeskel (2001). On the contrary, a very lower prevalence of camel hydatidosis was reported from Harar (Eatern Ethiopia) by Wubet (1987). These variations in results could be due to the variations in the temperature, environmental conditions, livestock health practice, the nature of the pastoral grazing and the way of upbringing these animals in the study areas.

In the present study, majority of the slaughtered and inspected animals were females than few numbers of male camels. Hence, more than 50% of inspected females were found to be positive for hydatiodisis. Comparable findings have been reported in Kuwait (Abdul-salam and Farah, 1988). This might be related to the practices in the management of male and female camels that males are moved too far for grazing and watering, whereas females are usually managed around homesteads, at the backyard for milk purpose which commonly expose female animals to come in contact with infected dogs (Parija, 2004). In many camel breeding areas, offals are not consumed by the community rather given to dogs and this may increase the chance of environmental contamination, whereby dogs can easily acquire the infection and then continuously discharge eggs of echiococcus parasites. Consequently, as females remain longer than males for reproductive purposes in the area, the probability of getting more infection will be higher than male ones. Moreover, the situation becomes more exacerbated as dogs are not kept in-door for religious and traditional matters resulting in increased number of stray dogs favours further dissemination of the disease.

The result showed that the infection prevalence was higher in the older age (10 years) classes ($P < 0.05$). The age-dependent increase in infection rate among examined animals is in accordance with the findings of Azlaf and Dakkak (2006). The age variation can also be associated with differences in exposure to infection, because older livestock may have been exposed to more infective stages (Ibrahim et al*.,* 2011). It is also possible to relate this general fact that most of the camels are slaughtered in their old age when their milk and/or calf production and working capacity get reduced and they fall sick frequently.

Among hydatidosis positive camels, liver (53.51%) was found to be the most frequently infected visceral organs, followed by lungs (40.31%), other organs (0.91%), heart (0.13%) and kidneys (0.13). This result is in agreement with other studies associated with camels (Woldemeskel et al., 2001) in Ethiopia, Ahmadi (2005) from Iran and Ibrahim and Craig (1998) in Libya. On the contrary, Ibrahim and Craig (1998) documented a high liver infection than lungs in their works. The observed higher frequency of infection in liver might be attributed to the great capillaries netweork present in liver that could easily trap circulated oncohospheres (Getaw et al*.,* 2010).

The fertility rate among the organs was found higher in lungs (70.68%) compared to liver which was 68.46%. It has been stated that the relatively softer consistency of lung tissue allows the easier development of the cyst (Himonas, 1987). Our result was also in agreement with the reports of Ahmadi (2005) from Iran who demonstrated that the fertility of the cyst from lungs was 69.7% as compared to 58.7% from liver in slaughtered camel in five different abattoirs. The greater prevalence and high fertility rate of pulmonary cyst over hepatic cyst of camel indicate the importance of internal organs as a potential source of infection to dogs.

Conclusively, hydatidosis was found to be one of the most important parasitic diseases in camels slaughtered at Akaki abattoir. The distributions of hydatid cyst in different organs implicate the seriousness of this disease in camel health. Further epidemiological studies on the diseases status, public health importance and associated risk factors influencing the occurrence of camel hydatidosis should be conducted in the areas of origin of these animals. The high prevalence reported in the current study warrant serious attention for prevention and control of this disease.

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