

Full Length Research Paper

Prevalence and public health significance of ovine hydatidosis in Bahir Dar Town, Ethiopia

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Both cross-sectional and retrospective studies were conducted from October 2010 to April 2011 in Bahir Dar municipal abattoir and Azewa hotel to determine the prevalence and public health importance of hydatidosis in sheep. Hydatid cyst characterization was conducted based on routine meat inspection. Of the total of 400 sheep examined by thorough meat inspection in Bahir Dar municipal abattoir and Azewa hotel, it was found that 60 (15%) of sheep were harboring hydatid cysts. The infection of liver, lung, kidney and spleen were 60.87, 37.68, 0.25 and 0%, respectively. The rate of cyst calcification was higher in liver than in other visceral organs. There was a significant difference in the harboring of hydatid cyst between age groups and body condition scores. Hence, there was a significantly higher prevalence of hydatidosis in sheeps of age greater than 3 years ($p=0.032$) and in poor body condition score ($p=0.004$). However, there was no significant difference between sexes ($p=0.05$). Hospital and clinic case-book survey (2007 to 2010) was also performed in Felegehiwot hospital, Gambi clinic and Kidanemeheret clinic to investigate the retrospective prevalence of human hydatidosis. Case book analysis showed that out of the total of 68,179 patients admitted for ultra sound examination, 30 (0.044%) hydatid cases were registered.

Key words: Hydatidosis, prevalence, fertility, zoonoses, sheep, Bahir Dar, Ethiopia.

INTRODUCTION

Ethiopia has the largest small ruminant's population in Africa which is reared by farmers' mostly as subsidiary occupation or by poor people. It is more a way of life rather than a commercial enterprise. According to CSA (2009), the population of sheep and goats in Ethiopia is estimated to be 26.1 and 21.7 million, respectively. In spite of large livestock population in Ethiopia, the productivity remains marginal and this maybe mainly due to malnutrition, prevalent diseases and management problems. Hydatidosis (*Cystic echinococcosis*) caused by the larval stage (metacestode) of *Echinococcus granulosus*,

the most important worldwide parasitic disease of livestock that has both economic and public health significance (Kebede et al., 2009). In Africa *E. granulosus* has been recognized from most countries including Ethiopia. *C. echinococcosis* a zoonotic disease caused by the larval stages of the tape worm *E. granulosus* for which domestic intermediate hosts (IH) (cattles, sheeps, goats and camels) are major reservoirs for the disease occurrence in humans (Soulsby, 1982). Dogs are the obligate final host and become infected by ingesting infected offal's (lung, liver and spleen etc).

Sheep and other intermediate hosts contract hydatidosis by grazing on pastures contaminated with dog faeces containing eggs of the cestode. Man is an intermediate host and plays no role in the transmission of the parasite, unless he is eaten by a carnivore. Nevertheless, his

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Nevertheless, his sanitary habits make him the main agent responsible for perpetuating the infection by feeding dogs viscera that contain hydatid cysts (Jobre et al., 1996). The adult cestode of *E. granulosus* can live in a dog's intestine for about a year, but it remains fertile for just 6 to 10 months. Therefore, theoretically the infection would die out if man ceased re-infecting dogs by feeding them raw viscera (Chai, 1995). Domestic animals that serve as secondary hosts could still become infected for a time, since the eggs of *E. granulosus* are resistant to environmental factors, but the infection cycle would be halted if dogs were prevented access to the infected viscera. Close contact with dogs and deficient personal hygiene practices, such as failure to wash the hands before eating, vegetables and water contaminated with infected dog faeces are important factors in the transmission of human infection. Coprophagic flies may also serve as mechanical vectors of the eggs (Acha and Szyfres, 2003).

The infection does not usually result in any sign in livestock. *E. chinococcus* parasites are difficult to detect in faeces of definitive hosts due to their small size. Diagnosis has been performed by examination of purge contents for the presence of *E. granulosus*. Diagnosis of human hydatidosis is suspected based on the clinical symptoms and epidemiological circumstances. Imaging methods such as radiography, computerized topography, ultrasonography, and scintigraphy are used. Ultrasonography was the first choice because it is economical, non-invasive, simple, and accurate and detects developing cysts that generally cannot be found with x-rays (Suwan, 1995).

E. granulosus tapeworm is more difficult to remove, but several drugs, notably, Praziquantel, are now available which are highly effective. In a definitive host, praziquantel is the first drug of choice. In intermediate hosts, the effective treatment is benzimidazole and praziquantel (Taylor et al., 2007). In man, hydatid cysts may be excised surgically although, Membendazole, Albendazole and Praziquantel therapies have been reported to be effective (Urquhart et al., 1996).

Control of *E. granulosus* based on the regular treatment and exclusion of dogs from their diet of animal material containing hydatid cysts. This is achieved by denying dogs access to abattoirs, and where possible, by proper disposal of sheep carcasses on farms (Oku et al., 2004). In some countries, these measures have been supported by legislation, with penalties when they are disregarded. Educating rural population about hydatidosis and its control, centralizing the slaughtering of animals for food in veterinary control units and ensuring sanitary condition for slaughtering done on ranches are also conventional control measures. However, the status of the problem is not well known in Bahir Dar. Therefore, this study was undertaken to elucidate the prevalence and public health significance of hydatidosis in sheep

slaughtered at Bahir Dar Municipal Abattoir and Azewa Hotel.

MATERIALS AND METHODS

The study was conducted in Bahir Dar town of Amhara National Regional state (ANRS), Ethiopia. The town is provided with one municipal abattoir, one public hospital, one health center and three higher private clinics.

Study design

The study animals constituted of local breeds of sheep coming from woinadega and kola areas of the country and slaughtered in Bahir Dar municipal abattoir and Azewa hotel. It was not possible to exactly trace back to the origin of sheep as they were mixed before or after they arrived at the hotels and abattoir. The study population was grouped into three categories; less than 1 year (young), 1 to 3 year (adult) and greater than 3 year (old) age groups. Regarding zoonotic impacts, case book survey of patients admitted for ultrasound examination in Felegehiwot hospital, Gambi clinic, and Kidanemeheret clinic were included.

Sample size and sampling method

The sample size was calculated according to Thrusfield (1995) by considering 10.6% expected prevalence from previous studies (Kebede et al., 2008) and 5% accepted error at 95% confidence interval using this formula:

$$N = 1.962 * P_{exp} (1 - P_{exp}) / d^2$$

Where, N = required sample; P_{exp} = expected prevalence; d = desired absolute precision. A total of 145 ovine samples were required but in order to increase the accuracy of the study, the sample size was increased to 400 ovine.

The study was both cross sectional and retrospective, which included sheeps, brought for slaughter from various localities to Bahir Dar. By systematic sampling method, 400 sheeps were selected at equal intervals. Retrospective hospital and clinic case-book survey was also conducted to determine the prevalence of human hydatidosis in patients that came to hospital and clinics present in Bahir Dar town.

Ante mortem examination

During ante mortem examination, each study animal was given an identification number and age and sex of animals was recorded. The age was determined based on dentition and owner's information. It was difficult to precisely trace back the geographical origins of all sheep slaughtered and relate the findings to a particular locality. The association of body condition scoring and hydatid cyst count was analyzed. Body condition of animals was classified in to three as lean, medium and fat (Nicholson and Butterworth, 1986).

Post mortem examination

During postmortem examination, organs of the abdominal and thoracic cavities namely; liver, lungs, heart, spleen and kidney were

Table 1. The anatomical distribution of hydatid cysts and their conditions in different organs of sheep slaughtered in Bahir Dar Municipal Abattoir and Azewa Hotel.

Organ	Hydatid cyst condition			
	No. (%)			
	Positive	Fertile	Sterile	Calcified
Liver	42(60.87)	25(49.0)	7(13.7)	19(37.3)
Lung	26(37.68)	12(44.4)	5(18.5)	10(37.0)
Kidney	1(1.45)	1(100)	0	0
Spleen	0	-	-	-
Total	69	38(48.1)	12(15.2)	29(36.7)

systematically inspected for the presence of hydatid cyst by applying the routine meat inspection procedures (Alula, 2010), if evidence of hydatid cyst was found. The primary examination involved visualization and palpation of organs and muscles. Secondary examination involved further incision of each organ; in the case, when and where a single or more hydatid cysts was found. Whenever and where ever the hydatid cysts were apparent, the number of cysts was recorded, as well as calcified cysts per organ and per animal was registered.

Laboratory diagnosis

Fertility and viability tests

Positive or suspected samples were taken to the laboratory for the cyst identification, fertility and viability tests were performed. Of the collected hydatid cysts, individual cysts were carefully incised and examined for protoscolices, which were similar to the appearance of white dots on the germinal epithelium; such cysts were characterized as fertile cysts; fertile cysts was subjected to viability test. A drop of the sediment containing the protoscolices was placed on the microscope glass slide and covered with a cover slip and observed for amoeboid like peristaltic movements with X40 objective. For clear vision, a drop of 0.1% aqueous eosin solution was added to equal volume of protoscolices in hydatid fluid on the microscopic slide with the principle that viable protoscolices should completely or partially exclude the dye while the dead ones took it up (Macpherson et al., 1985). Furthermore, infertile cysts were further classified as sterile or calcified (Soulsby, 1982).

Case book survey

The cystic echinococcus cases from the total ultrasound that admitted patients during January 2007 to December 2010 to hospital and clinics in Bahir Dar was collected from recorded data of the hospital and clinics case book reports to determine retrospective prevalence of human hydatidosis.

Data management and analysis

Bahir Dar municipal Abattoir and Azewa hotel data about cystic echinococcus was collected and recorded and the data was carefully entered into Microsoft Excel Spreadsheet. The total prevalence was calculated by dividing the number of hydatid cyst positive sheep by the total number of sheep examined and finally, the magnitude of the difference of comparable variables were

analyzed using SPSS version 20.0 statistical software. Association between variables were said to exist if the calculated level of significance is less than 5% ($p < 0.05$) at 95% confidence level.

RESULTS AND DISCUSSION

Prevalence study

Of the total sheeps examined, 15% ($n=400$) were found harboring hydatid cyst. Out of the total infected organs, liver was the most commonly affected organ followed by lung which accounted for 60.87 and 37.68% respectively (Table 1), but spleen was the least affected organ (0%) since no cyst was examined from spleen. The relationship between body condition score and hydatid cyst prevalence in sheep slaughtered was statistically significant ($p < 0.05$); 30 (29.4%), 25 (9.4%) and 5 (15%) in a lean, moderate, and fat body conditions, respectively. Additionally, significant statistical difference between age groups and hydatid cyst prevalence was observed ($p=0.032$); the young 12 (10.3%), adult 20 (13.1%) and old 28 (21.5%). However, there was no significant difference recorded in harboring hydatid cyst by considering sex as a risk factor ($P=0.05$) (Table 2).

Retrospective hospital and clinical case-book survey

From the total of 68,179 patients admitted for ultrasound examination, 30 (0.044%) human cystic echinococcosis cases were registered between January, 2007 and December, 2010. Among these 11 were from Felegehiwot Hospital, 18 from Gambi clinic, and 1 from Kidanemeheret clinic. Accordingly Felegehiwot Hospital had the highest rate for hydatidosis cases 0.072% ($n=47659$) (Table 3).

This study was carried out to investigate the prevalence of ovine hydatidosis and its zoonotic significance in Bahir Dar area, North Western part of Ethiopia. Meat inspection records are among the important source of data on determination of prevalence of disease in animals (Kambarage

Table 2. Association between potential risk factors and hydatid cyst prevalence in sheep slaughtered in Bahir Dar Municipal abattoir and Azewa Hotel.

Variable	Level	No. examined	No. positive (%)	χ^2	P-value
Body condition	Lean	102	30 (29.4)	15.108	0.004
	Medium	266	25 (9.4)		
	Fat	32	5 (15.6)		
Age group	Young	117	12 (10.26)	6.870	0.032
	Adult	153	20 (13.07)		
	Old	130	28 (21.5)		
Sex	Male	137	17 (12.4)	1.308	0.05
	Female	263	43 (16.35)		

Table 3. Incidence of Echinococcus cases in the public hospital and private clinics in Bahir Dar town (January 2007 - December 2010).

Year	No. of patients admitted						Sub total	
	Felegehiwot Hospital		Gambi Clinic		Kidanemeheret Clinic		Admitted	Case (%)
	Admitted	Case (%)	Admitted	Case (%)	Admitted	Case (%)		
2007	2845	2(0.070)	9383	4(0.04)	894	0(0)	13,122	6(0.046)
2008	3478	3(0.086)	10143	3(0.03)	1114	1(0.090)	14,735	7(0.048)
2009	3985	2(0.050)	11195	5(0.05)	2040	0(0)	17,220	7(0.040)
2010	4960	4(0.080)	16938	6(0.04)	1204	0(0)	23,102	10(0.043)
Grand total	15268	11(0.072)	47659	18(0.038)	5252	1(0.020)	68,179	30(0.044)

et al., 1995). The overall prevalence of hydatidosis in our current study in sheep was found 15% (n=400). The prevalence rate recorded in this study is not supported by the previous findings of different researchers. This variation in prevalence rate may be due to the differences in the origin of sheep brought for slaughter and can also be due to changes in the environmental and epidemiological factors, which could affect the rate of transmission of hydatidosis.

Our current prevalence is lower than that reported by other investigators in different abattoirs of the country, such as 25.7% in South Omo by Jobre et al. (1996), 22.2% in Nekemt by Bersisa (1994), 21.18% in Arsi region by Alemayehu (1990), 18.8% in Soddo by Fikre (1994) and 16.4% in Addis Ababa by Getachew (1991).

However, our finding is greater than the findings by Kebede et al. (2008); 10.6% in Bahir Dar, Tamane (1986); 8.7% in Gonder abattoir, Wubet (1987); 9.38% in Hararge region, Abdujewad (1988); 10.8% in Jimma abattoir, Yilma (1984); 12.45% in DebreZeit, and Koskei (1999); 9.1% in Addis Ababa. This may be due to the fact that the cultural and religious taboos favor the keeping of dogs often in close association with the family and farm animals in our study area. Additionally, backyard slaughtering of ruminants is very common amongst almost all sheep owners, shepherds and urban dwellers

that 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 dewormed at all. These and other socio-economic realities render the study area to be the best suit for maintenance and further propagation of hydatid disease. The widespread of traditional offering of uncooked infected offal to pet animals around homesteads, poor public awareness about the disease, the absence of proper fencing and disposal of pits for slaughter house (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 create favorable condition for environmental contaminations by maintaining the life cycle of each *E. granulosus* in stray dogs and wild carnivores. The particular geographical features of Bahir Dar due to the presence of Blue Nile (Abay gorge) and bushy areas along the river side make it an ideal home for many foxes and hyenas. Hence, besides the domestic dogs, these wild carnivores play a significant role in maintenance of the life cycle and become a potential source of infection for domestic ungulates.

In this study, assessment was made to establish the relationship between hydatid cyst count and body condition. Animals with poor body condition were found to have higher hydatid cyst counts and the poor body

condition among animals is probably a reflection of the effect of relatively high cyst burden. Battelli (1997) in his study explained that in a moderate to severe infection, the parasite may cause retarded performance and growth, reduced quality of meat and milk as well as live weight loss, therefore, our study supports this fact.

In this study, estimation was also made to establish the relationship between age groups and hydatid cyst count and the finding showed that there was a significant difference between age groups ($p=0.032$). Larrieu et al. (2001) also strongly suggested in his report that prevalence is heavily influenced by age. The majority of 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 infections. It has been stated that the easier development of the cyst and the fertility rate of hydatid cysts may show tendency to increase with advancing age of the hosts (Himonas, 1987). This may be attributed probably due to reduced immunological compatibility of animals at their older age of infection.

The finding of Daryani et al. (2007) stated that the prevalence of hydatidosis is greater in female sheep than males. Additionally, female animals are usually exposed to different production and productivity related stress conditions than males and hence, are more likely to have a chance of harboring hydatid cysts. However, in our study, there was no statistical significance when sex was considered as a risk factor.

In the present study, it has been established that hydatid cysts occur predominantly in the liver and lung with the prevalence rate of 60.87 and 37.68% respectively. This is explained by the fact that lung and livers possess the first great capillaries sites encountered by the migrating *E. granulosus* 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 (Alula, 2010). The higher yield of calcified cysts in liver could be attributed to relatively higher reticulo-endothelial cells an abundant connective tissue reaction of the organ (Permin and Hansen, 1994). In examining the condition of cyst fertility and viability, the fertility rate was higher. The findings of 15.2% sterile, 48.1% fertile and 36.7% calcified cysts may generally imply that most of the cysts are fertile. In comparison of the fertility rate among organs, it was higher in liver. The variation between tissue resistance of the infected organs may also influence the fertility rate of the cyst in the liver and host reaction may limit fertility rate of hydatid cyst.

Hydatidosis is not currently a well-known medical condition, nor is it considered being a public health importance; it is not a notifiable disease and there are limited surveillance data available about humans in the country. However, in this research, retrospective hospital and clinic survey data on human hydatidcyst gave an

estimate of the prevalence of hydatidosis 0.044% in the study area among the total ultrasound examined patients in a selected clinics and Hospital. In community-based surveys conducted in Southern Ethiopia in 1987 and 1996, 1.6% ($n=1997$) and 0.5 % ($n=3224$) were respectively screened with ultrasound (Eckert et al., 2002). The average annual incidence in humans per 100,000 has been reported in a number of studies from different countries. For example, it was reported as 2.2 in Portugal (Battelli, 2003), 3.3 in Bulgaria (Todorov and Boeva, 1997), 3.4 in Greece (Economides and Thrasou, 1999), 3.6 to 15.8 in Morocco (El-Idrissi et al., 1997), 3.4 to 4.6 in Algeria (Shambesh, 1997). Similarly, our current finding showed that CE has a zoonotic importance. This may be because of the low public awareness, backyard slaughtering practices, poor control measures and presence of a large number of stray dogs that contributed to human infection. The study area is lacking modern diagnostic facilities, and there is inability to offer treatment by the most vulnerable sections of the society. However, despite such limitations, careful examination of hospital/clinic records provided a useful indication of infection rates.

CONCLUSION AND RECOMMENDATION

The overall prevalence of this study in sheep (15%) and humans (0.044%) indicated that the disease has important public health significance. Therefore, serious attention must be given to the disease by various stakeholders in order to safeguard the public health. Body condition score and age groups are also concluded from the study as statistically risk factors in the study area. According to anatomical distribution of hydatid cysts, examined liver is the most affected organ and sex group has no significance. The actual natural, cultural and behavioral situations of the study area are conducive for maintenance of high level of infection and spread of the disease between animals and humans. Hence, we recommended that there should be strict routine meat inspection so that infected organs and carcasses can be condemned accordingly. Proper disposal of condemned organs to mitigate the effect of the disease on public health, ensuring sanitary condition for slaughtering done on ranches and preventing dogs from free access to raw viscera, reducing the number of stray dogs and treating them for echinococcus on regular bases and there should be public education to create awareness so that all individuals in the society avoids giving infected offals to dogs.

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