Original article

Occurrence of bovine hydatidosis and evaluation of its risk to humans in traditional communities of Southern Region of Ethiopia

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Abstract

Background: Cystic Echinococcosis/ Hydatid Disease, is an infection caused by the larval stage of the tapeworm *Echinococcus granulosus*, one of the most widespread parasitic zoonoses.
Objective: To determine the occurrence, localization and fertility/sterility rates of hydatid cyst in cattle, to determine the prevalence of adult *E. granulosus* in dogs and asses the risk for human infection in traditional communities.
Methods: Postmortem examination, hydatid cyst characterization, questionnaire survey and dog stool sample examination were carried out.
Results: Of the total 320 ruminants examined at backyard slaughtering, 151 (47.2%) were found harboring hydatid cysts. The liver and lungs were the two main infected organs, 34.4% and 52.3%, respectively. The majority of the cysts found were small, 54.3%, and medium, 37.7%. From the total number of cysts found, 70.2% were sterile, while 29.8% were fertile. A questionnaire survey revealed that local people were unaware of the life cycle of *E. granulosus* and the perpetuation of its life cycle by their cultural and traditional practices. Dogs have intimate contact with humans and other domestic animals, share the same house and also dogs do not have access for veterinary care. Stool samples of 62 dogs were collected and analyzed with a 30% prevalence of taenia infection confirmed to be *E. granulosus*.
Conclusion: Because of the high prevalence of *E. granulosus* infection in dogs and hydatidosis in cattle as well as common practice of backyard slaughtering, the risk of human infection in traditional communities is suspected to be high and requires immediate attention to study the status of cystic ehinococcosis in the human population of the study area. [*Ethiop. J. Health Dev.* 2012;26(1):43-48]

Introduction

Ecchinococcosis is a zoonotic infection caused by adult or larval (metacestode) stages of cestodes belonging to the genus Echinococcus and the family Taeniidae. Hydatidosis/Cystic Echinococcosis (CE), also known as Hydatid Disease, is an infection caused by the larval stage of the flatworm *Echinococcus granulosus*. *E. granulosus* has a cosmopolitan distribution and is one of the most widespread parasitic zoonoses. Hydatidosis is of importance since humans serve as incidental intermediate host for the larvae stage of *E. granulosus* and infection can lead to serious health problems. Hydatidosis is a global health problem in Africa, and Asia, the Mediterranean, and South America, due to immigration the prevalence of the disease has increased in North America and Europe in recent years (1-5).

Echinococcus species require two hosts to complete their life cycle. The definite hosts of *E. granulosus* include dogs, wolves, and other canines and carry the adult form of the flatworm while intermediate hosts, which consist of cattle, sheep, goats, camels and other ruminants, carry their larval stage. Since humans are accidental hosts, they do not complete the life cycle of the parasite (6).

Adult *E. granulosus* releases ova in the small intestine of the canid host and passes with the fecal matter, where it can survive for an extended period of time (up to one year outside the host body). The eggs can adhere to the paws, muzzle and hair of the animal so intimate contact with the animal can lead to ingestion by humans or transfer to grazing areas of ruminants (7). Close contact between dogs and intermediate hosts and dog fecal contamination of water and pasture leads to ingestion of the eggs by the intermediate host. Dogs must ingest raw offal in order to complete the life cycle of *E. granulosus* as protoscolices develop into adult flatworms in the duodenum of the dog.

The wide variety of animal species, both domestic and wild, which act as intermediate hosts, have contributed to the distribution of *E. granulosus* across the globe and at least 10 different genetically distinct populations exist within the complex *E. granulosus* (8, 9).

In regions of Africa, including Kenya and Libya, the prevalence of CE is found between the age group of 21 and 30 (10). In Ethiopia, previous studies suggest hydatidosis is the major cause of organ condemnation (11-14), causing huge economic losses in animals. Before contemplating a rationale on control programs, a collection of baseline data is required. Therefore, the aim of this study was to determine the occurrence of bovine hydatidosis, study the localization and fertility/sterility rates of hydatid cyst in cattle slaughtered in the backyard, to determine the prevalence of adult *E. granulosus* in

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dogs and assess the risk for human infection in traditional communities of southern region of Ethiopia.

Methods

Study area

Wondo Genet is known for its hot springs and is surrounded by primary Ethiopian forests. Located southeast of Shashemene in the Sidama Zone of the Southern Nations, Nationalities and Peoples' Region, with a latitude and longitude of 7°1′N, 38°35′E and an elevation of 1723 meters. Wondo Genet has an estimated total population of 5,792 consisting of 2,857 men and 2,935 women and is one of the most highly populated areas in the country. The inhabitants consist of Sidama, Oromo Guji, Kembata, Hadiya and Wolaita communities living in cluster villages (15). In the area, animal husbandry is the main production system where cattle, sheep, goats and equines are the species of animals found.

Study design

Postmortem examination: A total of 320 cattle slaughtered in the backyard at Wondo Genet were considered in this study. The liver, lung, spleen, and heart of slaughtered cattle were examined for the presence of hydatid cysts. Each organ was accessed macroscopically either by visual inspection or palpation and where necessary, one or more incisions were made in order to detect small hydatid cysts. Cystic organs were taken to Aklilu Lemma Institute of Pathobiology Laboratory, Addis Ababa University, fluid removed, contents examined for presence of protoscolices, and fertility tests were carried out.

Hydatid cyst characterization: The infected organs from each positive animal were collected and recorded. The size of the diameter of collected hydatid cysts was measured and classified as small (diameter less than 5 cm), medium (diameter between 5 cm and 10 cm) and large (diameter greater than 10 cm) (16).

Of the collected hydatid cysts, individual cysts were carefully incised and examined for protoscolices, which was spatially expressed on the germinal epithelium; such cysts were characterized as fertile cysts. Fertile cysts were subjected to viability test. A drop of the sediment containing the protoscolices were placed on the microscope glass slide and covered with cover slip and observed for amoeboid like peristaltic movements, with X40 objective. For clearer vision, a drop of 0.1% aqueous eosin solution was added to equal volume of protoscolices in hydatid fluid on microscope slide with the principle that viable protoscolices should completely or partially exclude the dye, while the non viable protoscolices absorb the stain (17). Furthermore, infertile cysts were further classified as sterile or calcified. Sterile hydatid cysts were characterized by their smooth inner lining usually with slightly turbid fluid in its content. Typical calcified cysts produce a gritty sound feeling up on incision (18).

Questionnaire survey: A total of 50 household heads of the community participated in the questionnaire survey to assess their knowledge of *E. granulosus* and the causes of infection. A structured questionnaire was prepared in the local language and a pilot test to assay the questionnaire was performed. The questionnaire was designed to gather information on dog ownership, treatment for dogs, the extent of awareness on CE and control measures taken. Observations were also taken of the prevalence of stray dogs in the community and the access they have to slaughtered carcass remains and offals. The participants were selected based on simple random sampling.

Examination of dog stool samples: Arecoline hydrobromide purgation at dose of 4 mg/kg was administered orally as previously described (19) and 30 minutes later stool samples were collected from 62 dogs found at the slaughtering sites and areas in the local community. The stool samples were collected in vials containing 10% formalin solution, for preservation of the sample until microscopic examination. Standard procedures for identification of taenia eggs using the floatation method with zinc sulphate solution were carried out for microscopic examination of the samples.

Results

Postmortem examination: Of 320 heads of cattle examined at various backyard slaughter sites in Wondo Genet, 151 (47.2%) were found with hydated cysts. Occurrence and number of infected organs were described (Table 1). Infection of the lung and liver accounted for 52.3% and 34.5%, respectively.

Table 1: **Distribution and number of organs with hydatid cysts in infected cattle slaughtered in Wondo Genet, Southern Ethiopia**

Organ	No. of infected organs	Relative Prevalence (%)
Lung	79	52.3
Liver	52	34.4
Heart	12	7.9
Spleen	5	3.
Kidney	3	1.9
Total	151	100

Hydatid cyst characterization: The total number of cysts with respect to size is presented in Table 2. The viability of the hydatid cysts was examined and the findings showed that the sterility of cysts was significantly higher (72.4%) than fertile cysts (27.6%) (Table 3).

Table 2: **Cyst Size and Counts in Relation with Organ Involvements in Infected Cattle Slaughtered in Wondo Genet, Southern Ethiopia**

Cyst Size	No.	Relative Prevalence (%)
Small	82	54.3
Medium	57	37.7
Large	12	7.9
Total	**151**	**100**

Table 3: **Characterization of Hydatid Cyst (sterile, fertile and calcified) in Different Organs of Infected Cattle Slaughtered in Wondo Genet, Southern Ethiopia**

Cyst viability	Cyst No.	%
Fertile	45	29.8
Sterile	106	70.2
Total	**151**	**100**

Results of the questionnaire survey: The households interviewed in the study area owned on average 7 livestock and 2 dogs. The animals were for milk, meat, draught power and as a source of cash income. The animals grazed at community commons where livestock and humans have frequent contact with dogs and their excreta. The questionnaire revealed that the sample population knew general helminth parasites, locally referred to as "yewusha koso" (literally "dog tapeworm"). The sample population also recognized that humans contract tapeworms, as well. The traditional communities mostly practiced backyard slaughter; during slaughtering, meat inspection is not conducted and the offal is often given to pets or disposed in the backyard. Because of cultural practices dogs, are fed abandoned offal's of slaughtered animals. Only 7% of the households treat their dog with traditional preparations at their puppy stage, otherwise treatment of dogs with commercial drugs was not practiced at all. The dogs were kept for guarding the homestead and hunting.

Dog stool examination: Of the 62 stool samples of dogs examined, 30% were found infected with taenia species confirmed of *E. granulosus*.

Discussion

In the present study, the occurrence of hydatidosis in cattle was found to be 47.2% during the study period. It was established that hydatid cysts were localized predominately in the lung and liver with prevalence rates of 52.3% and 34.4% in cattle, respectively. The high disease rates of the lung and liver fall in line with previous studies (11-14) because of the mode of transport that the cysts follow in the intermediate host. These organs posses the first great capillaries sites encountered by the migrating echinococcus 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. The lungs have a relatively softer tissue consistency which leads to a higher prevalence of cysts and an increase in fertility rates with the age of the host (20).

Higher numbers of medium sized cysts were found in lungs, while the liver harbored higher number of small sized cysts. The reason for the higher percentage of medium cysts in the lungs is due to softer consistency of the lung, while the higher yield of small cysts in liver may be due to immunological response of the host which might preclude expansion of cyst size (21-24). In examining the condition of cyst viability, the finding of 72.4% sterile and 27.6% fertile cysts in cattle may generally imply that most of the cysts in cattle are infertile, which is consistent with the studies conducted by Dalimi et al. (25). Of the viable cysts, higher numbers were found in the lung.

The wide spread tradition of offering uncooked infected offals to pet animals around the homestead, poor public awareness about the disease, the absence of slaughterhouses and the common practice of backyard slaughter (readily accessible to dogs and other carnivores), and the habit of improper disposal of dead wild or domestic animals (unburied and left open for scavenging carnivores) creates favorable conditions for environmental contamination by maintaining the life cycle of *E. granulosus* in stray dogs and wild carnivores, the definite hosts.

The respondents of the questionnaire were aware of the existence of tapeworm parasites in their animals; however, the particular mode of transmission and life cycle was unknown to them. This was clearly observed in the community as people distributed condemned offals to their dogs (Figure 1). Observations at backyard slaughtering sites in Wondo Genet also revealed that stray dogs wait outside to be given any meat deemed unsuitable for human consumption by the butcher (Figure 2). Stray dogs freely roam around the villages and thus having human contact and with their fecal matter were prevalent. With 80% of the stool samples analyzed containing parasitic infections and 30% of the samples containing taenia species, *E. granulosus* infection. The perpetuation of the life cycle of these parasites is maintained as ruminants graze on the same land that is open to with dog defecation.

The stool samples exhibited a high prevalence of *E. granulosus*, in addition to the presence of other infectious parasites that are transferable to humans there by posing health risks. Children especially have close contact with the fecal matter of dogs, because of walking barefoot or their normal play around being areas with dog feces. The

Figure 1: **Two stray dogs eat various organs that have been left over after a slaughter. Unused carcasses and organs are left out in the open when communities are finished slaughtering ungulates.**

Figure 2: **This photograph shows dogs eating the stomach contents of slaughtered ruminants which may contain various zoonotic helminth larvae, such as *E. granulosus.***

correlation between the high prevalence of hydatidosis found among slaughtered cattle (47.2%) and the high infestation of dogs, points to the successful proliferation of the life cycle of *E. granulosus* as a result of traditional practices and socio-economic conditions of the area. Previous studies on human CE reported prevalence of 2.2-5.6% in Nyangatom and Dassanetch (26, 27), 0.5-0.7% in Hamar (26, 28) and 1.8% in Borena (26) tribes of south-west Ethiopia.

In conclusion, the occurrence of hydatidosis in slaughtered cattle and the prevalence of *E. granulosus* infection in dogs is an indication of perpetuation of the life cycle. Therefore, this high infection rate in the definitive host, cattle, together with the common practice of backyard slaughtering poses higher risk of human infection in the traditional communities and requires immediate attention to create better awareness and study the status of cystic echinococcosis in the human population of the study area.

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