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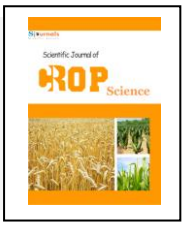

Review article

Cystic hydatidosis in Ethiopia: a review

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ABSTRACT

Cystic echinococcosis is a cestode infection caused by the larval stage of *Echinococcoccus granulosus*. It is an important zonoses, as humans get infected by ingesting eggs passed in the feces of dogs, and important cause of economic loss mainly due to organ condemnation and reducing the quality of meat, milk, and wool production. Hydatidosis is prevalent in cattle and small ruminant population of Ethiopia in a range of 3.1% to 72.44%. The prevalence rate reaches up to 30.8% in camels and 25% in dogs. Very few retrospective and case reports of cystic human hydatidosis also indicated the relevance of the disease in the human population of the country. Besides to the scarcity of reports the slow growing nature of disease development may result in underestimation of the situation. Economic losses in a range of 3201 to 1,167,512 USD have been reported in the country. Diagnosis of the larvae in the intermediate hosts, especially in humans, is mainly by imaging and immunology techniques. During post mortem examination the cyst can be diagnosed during meat inspection procedures in lungs, liver, heart, spleen, kidneys, muscle bones and other tissues of intermediate hosts. In the definitive host diagnosis can be by demonstration of the parasite from there faces or the small intestine or the detection of specific coproantigens or coproDNA. The role of holistic and systematic interventions approaches involving the public, veterinarians and public health professional for the action to be simultaneous and effectual along with prevalence of hydatidosis are highlighted in the present review.

1. Introduction

Cystic echinococcosis (CE) (Hydatidosis), caused by the larval stage of *Echinococcus granulosus*, is recognized as being one of the world's major zoonoses (Torgerson and Budke, 2003). This cyclozoonosis requires two vertebrate hosts to uphold the life cycle (Eckert and Deplazes, 2004).Dogs are the primary definitive hosts for the parasite where as livestock acting as intermediate hosts and humans can accidentally become intermediate hosts (Budke *et al*., 2006). Hydatidosis is still endemic in sheepherding areas of the world and is inflicting public health problems in the Mediterranean, Middle East, Asia, South America and Africa, including Ethiopia (Beltrán, 1988, Kevin *et al*., 1991, Shambesh *et al*., 1999, Magambo *et al*., 2006). It also imposes enormous economic losses in the livestock industry due to condemnation of edible organs and lowering the quality of meat, milk and wool production (Craig *et al*., 2007).

Humans become infected by ingestion of egg passed in the feces of dogs (Budke *et al*., 2006) and infection with *Echinococcus granulosus* typically result in a slowly growing parasitic disease most frequently seen in the liver, in 52-77% of cases (Morris and Richards, 1992, Timothy *et al.,* 2001). The pathogencity of hydatidosis depends on the extent and severity of infection and the organs on which it is situated. Occasional rupture of hydatid cysts often leads to sudden death due to anaphylaxis, hemorrhage and metastasis (White *et al*., 2004). The adult *Echinococcus* is considered to be harmless to the definitive host, except when it occurs in large numbers, which may cause severe enteritis. There are few available data on the clinical effects of the cystic hydatid disease in animals since the cyst is slow in growing and animals are often slaughtered before it manages to create sufficient pressure on the tissue or organs.

When undertaking surveillance work with *E.granulosus* in intermediate hosts, it is vitally important that data are stratified and reported according to the age of the animal slaughtered, prevalence rates are strongly age dependant (Torgerson and Heath, 2003). Older animals may be heavily infected even if when animals have very few larvae (OIE, 2008).However, studies by Gebretsadik *et al*., (2010), Jemere and Berhanu (2011), Fufa *et al*., (2011) and Melaku *et al*., (2012), in Ethiopia reported insignificant associations among different age groups whereas as Endrias *et al*., (2010), Feyesa *et al*., (2010), Terefe *et al*., (2012) reported significant increase in prevalence as age increases.

2. Prevalence of hydatidosis in Ethiopia

Despite the large efforts that have been put into the research and control of echinococcosis, it still remains a disease of worldwide significance (Torgerson and Budke, 2003). It remains persistent and re-emerging problem in countries of low economic status where a resource for an intensive control program is limited (Schaniz *et al*., 2003). In Ethiopia prevalence rate changing between 13.7 to 72.44% in cattle and 9.9 to 35% in sheep was described (Jobre *et al*., 1996; Kebebe *et al*., 2009c). High prevalence of *Echinococcus* could be due to slaughtering of small ruminants in backyard without inspection, provision of infected offal's and dead animals to dogs; that may harbor fertile cysts (Fikire *et al*., 2012). Moreover, poor public awareness about the disease and presence of few slaughter houses could have contributed to such a higher prevalence rate (Abiyot *et al*., 2011). Ethiopia is divided in to nine ethnically-based administrative regions and three chartered cities and hydatidosis has been reported from different parts of the country (Table 1 and 2).

Metacestodes were found through different organs of cattle slaughtered including lung, liver, spleen, heart and kidney (Tolosa *et al*., 2009; Kebede *et al*., 2009c; Feyesa *et al*., 2010; Endrias *et al*., 2010; Endrias *et al*., 2010; Jemere and Berhanu, 2011; Fikire *et al*., 2012). Fikire *et al*., (2012) reported relatively higher proportion in kidneys 16.3% as compared to that of spleen 1.7% and heart 2.4%. A cyst prevalence of 53.51% in lungs, 16.67% in liver, 22.81% in lung and liver, 2.63% in spleen, 1.75% in lung, liver and spleen, 1.75% in lung and spleen, 0.88% in Heart and 0% in kidenys reported by Endrias *et al*., (2010). Most of the large fertile and viable cysts were found residing in lungs (Endrias *et al*., 2010; Fikire *et al*., 2012; Melaku *et al*., 2012). Abiyot *et al*., (2011) reported hydatid cyst in muscle tissue of sheep. Higher prevalence of the cyst in liver 56.7% followed by lungs 41.7% in sheep was also reported by Fikire *el al*., (2012).

Table 1
Bovine hydatidosis in different parts of Ethiopia.

Place	Percent prevalence	Reference
Ambo, West Shoa	29.69%	Endrias *et al*., 2010
Mekelle, Tigray	32.11%	Gebretsadik *et al*., 2010
Assela	72%	Fromsa and Jobre, 2011
Addis Ababa	19.7%	Fikire *et al*., 2012
Addis Ababa	40.5%	Terefe *et al*., 2012
Nekemte, Western Ethiopia	23.17%	Fufa *et al*., 2011
Hawasa	52.69%	Feyesa *et al*., 2010
Wolayita Sodo	16.85%	Jemere and Berhanu, 2011
Bahir Dar	34.05%	Kebede *et al*., 2009c
Birre-Sheleko and Dangila Debre	15.2%	Kebede N. *et al*., 2011
Markos	48.9%	Kebede *et al*., 2009a
Dessie	13.61%	Melaku *et al*., 2012
Jimma	31.44%	Tolosa *et al*., 2009
Adama	46.8%	Getaw *et al*., 2010

Table 2
Prevalence of small ruminant hydatidosis in different parts of Ethiopia.

Place	Species	Percent Prevalence	Reference
Harar, Dire Dawa and Jijiga	Sheep	68%	Sissay *et al*., 2008
(Eastern Ethiopia)	Goat	65%	Menkir *et al*., 2008
Addis Ababa	Sheep	13.9%	Ermias *et al*., 2011
	Goat	3.1%	
Modjo	Sheep	8.05%	Abiyot *et al*., 2011
	Goat	8.99%	
Bahir Dar	Sheep	10.6%	Kebede *et al*., 2009c
Adama	Sheep	29.3%	Getaw *et al*., 2010
	Goat	6.7%	

Sheep and goats appear to be the most common domestic intermediate hosts in sub-Saharan Africa, but recent studies suggest that camels are equally important intermediate host, especially in Sudan and Turkana (Japhet *et al*., 2006). However, the status of camel hydatidosis is not well documented in Ethiopia so far. A study conducted by Bekele and Samuel, (2008) in Eastern Ethiopia shows an overall prevalence of 30.80% and another report from the capital city, Addis Ababa, of the country by Muskin *et al*., (2011) indicated 22.6% prevalence. 25.7% prevalence in Borana area of the country by Bekele (2010) also supports the important role that camel's has in the epidemiology of the disease. Since Cystic echinococcosis (CE) is highly endemic among the nomadic pastoral tribes of East Africa, but is rare amongst the agriculturally based communities as reported by (Japhet *et al*., 2006) it will be an area of investigation for concerned individuals. A 25% prevalence rate in dogs by Endrias *et al*., (2011) in Ambo also strengthens the role of different animal species in the country for the spread of the disease.

3. Public health impacts of hydatidosis in Ethiopia

The occurrence of the disease in humans in Ethiopia was described earlier by Graber, (1978). However, the situation of cystic echinococcosis in humans is not well documented and explored so far in the country. clinical and serologic tests conducted among the Dassanetch and Nyangatom pastoralist tribes of the southern western part of the country reveled the prevalence of 4.8% palpable abdominal cysts, 15% hepatomegally and 31.7% positive hydatid skin test (Fuller and Diane, 1981). In Hamar pastoralist tribes of southwest Ethiopia a prevalence of 0.5%-0.7% was reported (Macpherson et al., 1989; Klungsøyr, 1993). Prevalence rates of 1.6% and 0.5% have been reported, in southern parts of Ethiopia (Eckert J *et al*., 2002). A mean annual incidence rate of approximately 2.3 cases per 100 000 per year was also reported in Bahir Dar by Kebede *et al*., (2010),4 year retrospective study. In another retrospective study, by W. Kebede *et al*., (2009), of the six zonal hospitals in Tigray Region diagnoses of

eight cases of human hydatidosis since 2000 were reported. 3 cases of cerebral hydatidosis were also reported by Asefa *et al*., (2011). Besides, during 1995 and 2005, 234 patients were operated for hydatid disease at Tikur Anbessa Hospital in Adis Ababa (Minas *et al*., 2007) of which 137 patients during1994-2006 was treated for hepatic hydatidosis Hagos *et al*., (2006). Overall this few findings show huge magnitude of the problem.

4. Diagnosis of hydatidosis

In the intermediate host, diagnosis depends on the detection of the larval cyst form, which can occur in almost any organ, but particularly in the liver and lungs The diagnostic repertoire includes imaging techniques, mainly ultrasound (US) and computed tomography (CT) examination for abdominal echinococcosis and X-ray for lung echinococcosis, and immunodiagnostic tests (Pawłowski *et al*., 2001). The diagnosis of echinococcosis in dogs or other carnivores requires the demonstration of the adult cestodes of *Echinococcus* spp. in their faeces or the small intestine or the detection of specific coproantigens or coproDNA (OIE, 2008).

According to FAO manual for meat inspection for developing countries Herenda, (2000) ante mortem diagnosis for hydatidosis doesn't have significant value rather it relies on postmortem inspection of carcass and decision has to be in the following manner: carcass showing emaciation, edema and muscular involvement is *condemned* and destroyed. Otherwise the carcass is *approved*. Affected viscera and any other tissue are also *condemned* and destroyed. Burying of carcass is not sufficient, since dogs may retrieve the affected organs. Moreover hydatid cyst needs to be differentiated from retention cysts in kidneys, cysts in liver, granulomatous lesions, Cysticercus tenuicolis and tuberculosis (Herenda, 2000).

5. Economic importance of bovine hydatidosis in Ethiopia

Economic losses due to the disease hydatidosis were estimated in studies conducted in different parts of the country (Table 3).

Table 3
Estimated economic loss incurred by hydatidosis in Ethiopia

Estimated Economic loss	References
19847704.5 * /1,167,512 **	Terefe *et al*., 2012
681,331.87 */19157.12 **	Melaku *et al*., 2012
160032.32 *	Endrias *et al*., 2010
3201 **	Kebede N. *et al*.,2009
410,755.90 */30,202.64 USD**	Jemere and Berhanu, 2011
25,608*	W. Kebede *et al*., 2009
18911.6. **	Kebede *et al*., 2011
52,828*	Getaw *et al*., 2010

*Ethiopian Birr; **United States Dollar

6. Treatment of hydatidosis

Today, treatment options for CE include: surgery, PAIR (puncture, aspiration, injection, reaspiration) and chemotherapy (Pawłowski *et al*., 2001). Percutaneous drainage has been increasingly used as an alternative to surgery in the treatment of hydatid cysts (Yorganci and Sayek, 2002). Surgical procedures ordinarily involve inactivation of the cyst contents, then the removal of all cyst components (Yorganci and Sayek, 2002, Menezes da Silva, 2003). Percutaneous drainage has many advantages; however, hydatid cyst membranes, which are composed of a laminar layer and a germinative layer, cannot be removed by this method. Percutaneous drainage may be performed by puncture, aspiration of cyst contents, injection of scolicidal agents, and reaspiration of fluid, as described by Ben Amor *et al* (1986), or by catheterization, as described by Akhan and Özmen (1999). Regardless of which method is used, 5–10 years of follow-up is advocated because of the potential for recurrence or infection (Akhan and Özmen 1999).

Chemotherapy of cystic echinococcosis became a treatment option 25 years ago, when new anthelminthic drugs were introduced. Benzimidazole carbamates were shown to kill the entire metacestode stage of the parasite, inhibit the assembly of tubulin into microtubules, thus impairing uptake of glucose and interfering with the homeostasis of the parasite (Lacey, 1990). Since their introduction in the 1970s, benzimidazoles have proved effective against the larval stages of *E. granulosus,* first in vitro, then in animals, and later in humans and praziquantel exhibited an effect on protoscoleces (Heath, 1974; Schantz *et al*., 1982). Continuous or intermittent treatment with albendazole is recommended for a period of up to 6 months, and praziquantel may enhance the effect, in particular in the case of cyst spillage (Teggi *et al*., 1993).

7. **Control and prevention of hydatidosis**

At least five of ten *E. granulosus* genotypes are infective to humans in sub-Saharan African. Most human cases of CE are caused by the sheep strain (GI) and camel strain (G6) of *E. granulosus*. Other strains occurring in the sub-Saharan Africa may include a lion strain, the horse strain (G4 or *Echinococcus equinus*) and the cattle strain (G5 or *Echinococcus ortleppi*) (Japhet *et al*., 2006). Cystic hydatidosis continues to be a substantial cause of morbidity and mortality in many parts of the world. Elimination is difficult to obtain and it is estimated that, using current control options, achieving such a goal will take around 20 years of sustained efforts (Craig *et al*., 2007).

Dogs are pivotal in *Echinococcus granulosus* transmission to humans, and dog vaccination provides a very practical and cost-effective prevention strategy. A study conducted by Wenbao *et al*., (2006) reveled that vaccination of dogs with soluble native proteins isolated from protoscoleces of *E. granulosus* will induced significant suppression of worm growth and egg production. Besides to vaccination, control strategies needs to focus on careful analysis of the local situations (particularly concerning the particularities of the cycle, ecology, and ethology of the animal hosts, and behavioral characteristics of the population at risk), the use of newly developed tools both in animals and human (immunology, molecular biology, and imaging), and the association of the traditional control measures (control of slaughtering, antiparasitic treatment and control of the definitive hosts, and health education) with more recent developments such as vaccination of the intermediate hosts (Akira *et al*., 2003).

Control of hydatidosis is less effective without the support of dog-owners, and this support can only be obtained if the people have a clear understanding of the disease (David *et al*., 2006). In an area where home slaughter is practiced, dosing of dogs with a suitable taeniacide will be an important component in the hydatid control programme (Watson-Jones and Macpherson, 1988). In developing countries effective west disposal and prohibition of entrance of animals like dogs, cats, birds and other wild animals to abattoirs will play a crucial role in reducing the incidence of the disease (Fikire *et al*., 2011).

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