Cystic echinococcosis is a cestode infection caused by the larval stage of *Echinococcus granulosus*. It is an important zoonoses, 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 cyclozoanosis 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 shepherding 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 pathogenicity 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 dependent (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 kidney's 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 et al., (2012).
Table 1

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

Table 2

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

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 revealed 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 during 1994-2006 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 (Pawlowski 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>
<thead>
<tr>
<th>Estimated Economic loss</th>
<th>References</th>
</tr>
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<tbody>
<tr>
<td>19847704.5 * /1,167,512 **</td>
<td>Terefe et al., 2012</td>
</tr>
<tr>
<td>681,331.87 */19157.12 **</td>
<td>Melaku et al., 2012</td>
</tr>
<tr>
<td>160032.32 *</td>
<td>Endrias et al., 2010</td>
</tr>
<tr>
<td>3201 **</td>
<td>Kebede N. et al., 2009</td>
</tr>
<tr>
<td>410,755.90 <em>/30,202.64 USD</em>*</td>
<td>Jemere and Berhanu, 2011</td>
</tr>
<tr>
<td>25,608*</td>
<td>W. Kebede et al., 2009</td>
</tr>
<tr>
<td>18911.6. **</td>
<td>Kebede et al., 2011</td>
</tr>
<tr>
<td>52,828*</td>
<td>Getaw et al., 2010</td>
</tr>
</tbody>
</table>

*Ethiopian Birr; **United States Dollar

6. Treatment of hydatidosis

Today, treatment options for CE include: surgery, PAIR (puncture, aspiration, injection, reaspiration) and chemotherapy (Pawlowski 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 carba mates 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 (Gl) 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) revealed 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).

References


