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Review Article

Epidemiology of Cystic Bovine Hydatidosis: Emphasis on Abattoir Findings in Ethiopia

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Abstract

Hydatidosis is an important livestock disease which has zoonotic importance and is frequently reported from abattoirs in Ethiopia. This disease is imposing huge economic loss to the country through affecting production efficiency of livestock and resulting condemnation of organs and carcasses in abattoirs. Based on abattoir survey hydatidosis was reported with prevalence ranging from 11.3% (Harar) to 62.38% (Assela). As a consequence of under-reporting of zoonotic diseases resulted in underestimation of the real public health and economic burden that downgrades their relevance and attention given to control the diseases is very poor. To satisfy increasing demand for milk and milk product of the country, milk productivity and production should be improved through transformation of dairy industry from extensive farming system to intensive modern farming system. This can be achieved through establishing effective disease control system particularly zoonotics like hydatidosis. Veterinary extension service should be strengthened to assist farmers and there should be integration and collaboration of concerned bodies (veterinarians, public health professionals and political leaders) to control zoonoses. To show real damage incurred due to zoonoses, nationwide studies should be conducted on public health and economic impact, transmission, reservoirs, geographic distribution, control and prevention measures of zoonoses. Strengthening of veterinary facilities and extension systems, expansion of abattoir facilities, creation of community awareness, regular deworming of dogs and appropriate disposal of infected organs are recommendations forwarded in order to help zoonoses control.

ABBREVIATIONS

CFSPH: The Center for Food Security and Public Health; WHO: World Health Organization; AGP: Agricultural Growth Project

INTRODUCTION

Zoonoses have been recognized for many centuries, and over 200 have been described. They are caused by all types of pathogenic agents, including bacteria, parasites, fungi, and viruses [1]. Hydatidosis is one of parasitic zoonotic disease caused by larval stages of *Echinococcus granulosus* and associated with severe economic losses and has great public health significance worldwide. *Echinococci,* in addition to cause livestock infections, are estimated to affect approximately two to three million people worldwide, with Africa amongst the primarily endemic regions [2].

In Ethiopia, abattoir reports from different regions of the country indicated that hydatidosis is highly prevalent disease incurring economic loss and affecting public health [3-6,7,8]. Abattoir based studies conducted in various parts of the country showed that prevalence of hydatidosis in cattle ranges from 11.3% to 62.38% at Harar and Assela respectively [3,6,8-12] and contributing a big role in lowering the amount and quality of exported commodities [13,14].

However, abattoir based information or findings from different part of the country indicating the present damage and warning alarm of the future economic and public health consequences, in Ethiopia there is no preparedness to implement integrated control measures. Veterinary and abattoir facilities are poor and unable to support huge livestock health demand. Weak veterinary extension system and lack of integration of concerned bodies to fight zoonotic diseases may worsen the problems associated with zoonoses. Therefore, the objective of this paper is to show status of hydatidosis in Ethiopia based on abattoir survey studies conducted previously at different parts of the country.

Etiology

Echinococcosis is a zoonotic infection caused by adult or larval (metacestode) stages of cestodes belonging to the genus *Echinococcus* and the family *Taeniidae*. At present, four species of *Echinococcus* are recognised, namely *Echinococcus granulosus, E. multilocularis, E. oligarthrus* and *E. vogeli.* Hydatid disease in

people is mainly caused by infection with the larval stage of the dog tapeworm, *Echinococcus granulosus [1].*

E.granulosus causes a type of echinococcosis known as cystic echinococcosis, unilocular echinococcosis or cystic hydatid disease. This species has traditionally been divided into strains, named G1 to G10, which have a degree of host adaptation, and may be maintained in distinct cycles. These strains have generally been named after the intermediate host thought to be most important in perpetuating the life cycle. In some cases, other species may also maintain the strain. Strains may differ in their morphology, rate of development, virulence, geographic range and other factors [2]. The strains include two sheep strains (G1 and G2), two bovid strains (G3 and G5), a horse strain (G4), a camelid strain (G6), a pig strain (G7), and a cervid strain (G8). A ninth genotype (G9) has been described in swine in Poland2 and a tenth strain (G10) in reindeer in Eurasia. The sheep strain (G1) is the most cosmopolitan form and is that most commonly associated with human infections [15].

Life cycle

Echinococcus species have an indirect life cycle, and must develop in both an intermediate and a definitive host. Adult worms live in the small intestine of the definitive host and they reproduce releasing eggs into the environment in the faeces of the host animal. In many cases, the parasite cycles through specific predators or scavengers, and their prey [2]. Segments containing eggs (gravid proglottids) or free eggs are passed in the faeces of the definitive host, a carnivore. The eggs are ingested by an intermediate host, in which the metacestode stage and protoscoleces develop. The cycle is completed if such an intermediate host is eaten by a suitable carnivore [1,2].

The intermediate host ingests the eggs incidentally while grazing, foraging or drinking. The eggs hatch in the small intestine, become larvae which penetrate the gut wall, and are carried in the circulatory system to various organs. Liver and lungs are the two commonest sites for larval development; but occasionally oncospheres escape into the general systemic circulation and develop in other organs and tissues. There the cysts, called hydatid cysts or metacestodes, are formed. The cysts, which contain larvae, either comprise fluid filled bladders, which contain larval pre-tapeworms (protoscoleces), and cause the disease cystic echinococcos due to *E. granulosus* or alternatively, for *E. multilocularis* a multivesiculated lesion or mass containing protoscoleces that grows rapidly by exogenous budding and causes alveolar echinococcosis in rodents and other small mammals. Though slow growing in humans and long-lived animals (e.g. camels or horses) cysts of *E. granulosus* can reach a size of 10-20 centimetres, but in sheep are usually 2-6 cms [2,16,17,18,19].

Geographic distribution

E. granulosus occurs worldwide, with the exception of a few countries such as Iceland and Greenland. Within an area, its distribution may be focal. Each strain/ species has a distinct geographic range. The G1 sheep strain is cosmopolitan; it has been reported in Europe, the Middle East, Africa, parts of Asia, Australian, New Zealand, and North and South America [9]. But

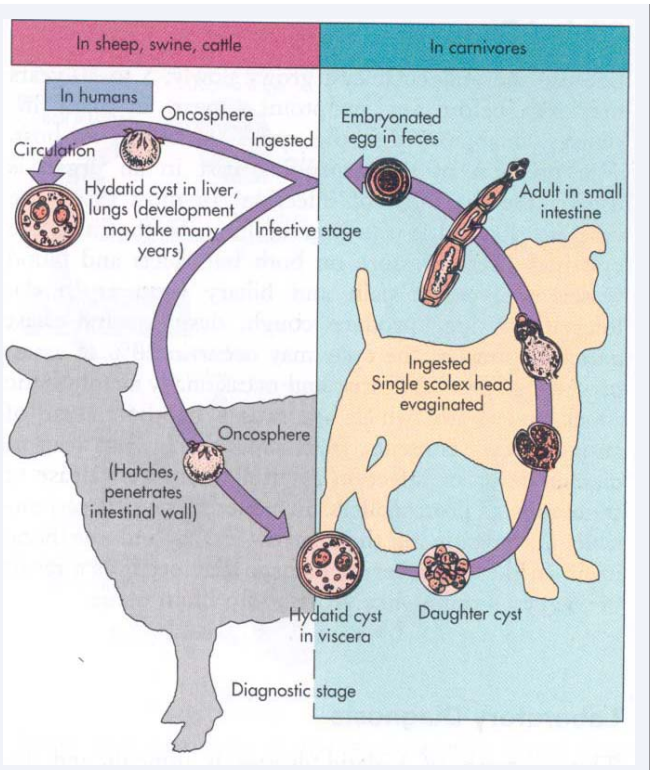

Figure 1 Life cycle of *Echinococcus granulosus* (Assefa et al., 2004)

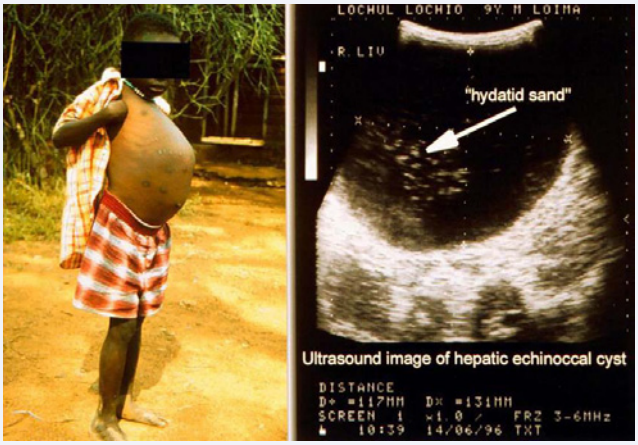

Figure 2 Boy with abdominal distention due to cystic echinococcosis of the liver as shown by ultrasound imaging (Moro&Schantz, 2009).

Alveolar echinococcosis is confined to the northern hemisphere, in particular to regions of China, the Russian Federation and countries in continental Europe and North America [20].

The life cycle of *Echinococcus* species is complex involving two hosts and a free-living egg stage. The dynamics of transmission of the parasite are determined by the interaction of factors associated with these two hosts and with the external environment. An understanding of these interrelationships and the way in which they influence the dynamics of the system, in particular its stability in the face of perturbation, is central for the planning and assessment of control programme [21].

In endemic regions, human incidence rates for cystic echinococcosis can reach greater than 50 per 100 000 person-years, and prevalence levels as high as 5%–10% may occur in parts of Argentina, Peru, East Africa, Central Asia and China. In livestock, the prevalence of cystic echinococcosis found in slaughterhouses in hyperendemic areas of South America varies from 20%–95% of slaughtered animals. The highest prevalence is found in rural areas where older animals are slaughtered. Depending on the infected species involved, livestock production losses attributable to cystic echinococcosis stem from liver condemnation, reduction in carcass weight, decrease in hide value, decrease of milk production, and reduced fertility [20].

Status of hydatidosis in ethiopia

In Ethiopia E.granulosus is frequently reported in domestic animals and there are also few report of human cases [3,6,8-12]. The disease is highly distributed with prevalence ranges from 11.3% to 62.38% in cattle and is cause of economic loss due to condemnation of organs (Table 1&2).

Small-scale studies conducted at different part of Ethiopia indicated that hydatidosis is endemic, although the epidemiology and zoonotic importance of the diseases are not well known due to lack of nation-wide investigation [22-24].

Anatomical organ distributions of cysts showed that 64.2%, 32.4%,0.93%,2.16%,and 0.308% in lung, liver, kidney, spleen and heart respectively [25]. Other Studies conducted showed that 53.7% of the cysts were detected in the lung and liver. The infection rate of lung, liver, spleen, heart and kidney was found to be 50.5%, 40.6%,1.98%,4.95% and 1.98% respectively. The rate of cyst calcification was higher in the liver than in the lung while fertility rate was higher among the cysts of the lung [26,27].

Annual losses in the abattoirs due to carcass/ organ condemnation, ranges from minimum of 54,679 birr at Shire abattoir to maximum of 19847704 birr in Addis Ababa Abattoirs Enterprise. This is summation of the carcass weight loss and loss due to organ condemnation. But these losses and infection prevalence do not show the real estimates because these estimates are made by meat inspection in abattoirs only and many animals slaughtered at backyard are not been included [6,8,28].

Human hydatidosis infection was reported from different part of the country such as Nekemte and Bahir Dar hospitals [6,29]. Study conducted in 2006 at Bahir Dar indicated that human infection with hydatidosis is estimated to be 2.3 cases per 100000 [29]. But after four years (2011) similar study at the same town showed that incidence rate increased by 10 cases per 100000 [35] and this is due to high population of dogs, poor community awareness on risk of cystic echinococcosis and backyard slaughter practice [29]. Moreover, study conducted at Jimma Zone also indicated that there is high risk of zoonoses due to co-residing in the same house with animals, mixing different species of animals, backyard slaughtering, improper management of condemned organs, slaughter wastes and body of dead animals were frequent [30].

Moreover, studies conducted in and around Addis Ababa to assess public awareness on zoonotic diseases showed that public awareness found at low level. The habit of eating uninspected backyard slaughtered meat was also seen to be very high [31]. Other study at Jimma indicated that only 20.65% of interviewed members of community are aware of about hydatidosis and 18.5% of the respondents knew as the disease was zoonotic disease and the rest 81.5% of the participants do not know whether the disease is zoonotic or not [4].

Similarly, study conducted at central Ethiopia indicated that about 46% of farmers keep their animals in their living houses at night, 81%of farmers did not boil the drinking milk, and 74% of farmers ate raw meat [32].

Even though there is no well done study showing the rate of slaughter in abattoir (slaughter house) and backyard; it is expected to be very high in backyard system and contributing a big role in continuation of hydatidosis life cycle. In Addis Ababa nearly 76% of sheep and 82% of goats are slaughtered in the

Table 1: Prevalence of hydatidosis based on abattoir findings.

Site	Year	Type of disease	Spp of animals	Prevalence	Reference
Dire Dawa	2011	hydatidosis	Bovine	20.1%	[12]
Shire	2010	hydatidosis	Bovine	25.92%	[8]
Harar	2014	hydatidosis	Bovine	11.3%	[10]
W/Sodo	2013	hydatidosis	Bovine	15.7%	[9]
Nekemte	2014	Hydatidosis	Bovine	17.1%	[6]
Adigrat	2014	Hydatidosis	Bovine	32%	[3]
Kombolcha/ Elfora	2012	Hydatidosis	Bovine	17%	[27]
Jimma	2014	Hydatidosis	Bovine	30.7%	[4]
Bako	2012	Hydatidosis	Bovine	11.88%	[5]
Asella	2012	Hydatidosis	Bovine	62.38%	[11]
Arbaminch	2010	Hydatidosis	Bovine	20.5%	[26]
Addis Ababa Abattoirs Enterprise	2012	Hydatidosis	Bovine	40.5%	[28]

Table 2: Estimated losses due to organ/carcass condemnation at different abattoirs.

Abattoir	Year	Type of animals	Loss due to condemnation (birr)	Reference
HELMEX	2006	Shoats	2.7 million	[14]
Dire Dawa	2011	Cattle	165876	[12]
Shire	2010	Cattle	54679	[8]
Harar	2014	Cattle	96315	[10]
HELMEX	2008	Shoat	3.2 million	[13]
Nekemte	2014	Cattle	4.00 million	[6]
Jimma	2014	Cattle	94485	[4]
Addis Ababa Abattoirs Enterprise	2012	Cattle	19847704	[28]

backyard, and there are a number of factors that discourage slaughtering in slaughter houses in favor of backyard slaughter. There are very few slaughtering facilities available in the country compared to the populations. In rural area there is only one slaughter facility for about 1 million in population [33].

Even though, zoonotic disease control and prevention strategies necessitate integration and collaboration of both veterinary and human health professionals, in Ethiopia there is no satisfactory progress in this aspect. There is no participation of veterinarians in public health departments to create awareness and to train community in zoonotic diseases. No collaboration between veterinarians, medical professionals and other concerned bodies [31].

CONCLUSION

Zoonotic diseases including hydatidosis are significant public health burden in Ethiopia. Human infection with hydatidosis is reported from various part of the country. This disease is imposing huge economic loss to the country through affecting production efficiency of livestock and resulting condemnation of organs and carcases in abattoirs. Based on abattoir survey hydatidosis is reported with prevalence ranging from 11.3% to 62.38% in bovine.

Since zoonotic diseases are circulating among humans, domestic animals, wild animals and environment; it needs integration of veterinarians, public health professionals and other concerned bodies to eliminate the diseases. But there is no participation of veterinarians in public health departments to create awareness and to train community in zoonotic diseases in general and in hydatidosis in particular. No collaboration between veterinarians, medical professionals and other concerned bodies. In addition, awareness level of community about zoonotics, impact, way of transmission, methods of control and prevention is poor. Thus, in rural areas, farmers keep their animals in dwelling houses.

Therefore, based on problems identified during the review of articles, the following recommendations are forwarded:

- There should be integration of veterinarians and public health workers in order to control and prevent zoonoses
- Nationwide studies should be conducted on public health and economic impact, transmission, reservoirs, geographic distribution, control and prevention of zoonoses
- Veterinary facilities and extension system should be strengthened
- Expansion of abattoir facilities
- Creation of community awareness
- Regular deworming of dogs
- Appropriate disposal of infected organs
- Disease control strategies should be supported by legislation

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