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Echinococcosis/hydatidosis, Epidemiology Risk Factors, Economic and Public Health Significance in Ethiopia

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Abstract

Hydatidosis is a neglected cyclozoonotic disease caused by larval stages (hydatid cysts) of cestodes belonging to the genus *Echinococcus* and the family *Taeniidae*, affecting both humans and livestock populations.The larval stage of *Echinococcus*, is a bladder-like cyst formed in various organs and tissues following the growth of the oncospheres of an *Echninoccus* tape worm in that specific organ or tissue. The epidemiology and control of hydatidosis is often considered to be a veterinary matter since the disease can be regulated by controlling parasites in animals. However, collaboration between veterinarians and public health professionals is essential for the successful control of hydotidosis. The developmental stage of *Echinococcus* is that eggs develop to oncospheres, this oncospheres develop to hydatid cyst in the intermediate host and the hydatid cyst if consumed by final host develops to the adult *Echinococcus*. Human echinococcosis is a zoonotic infection caused by the tape worm of the genus *Echinococcus. Echinococcus granucosusgranulosis* cause cystic echinococcosis (CE), *Echinococcus multilocularis* cause alveolar echinoloccosis (AE), and *Echinococcus vogeli* and *Echinococcus oligarthus* cause polycystic echinococcosis (PE). From these *Echinococcus mulitilocularis* is rare but is the most virulent, *Echinococcus vegeli* and *Echinococcuso ligarthus* are the rarest. Hydatidosis is a zoonotic cosmopolitan parasitic disease found in almost all countries of the world. In Ethiopia, the disease causes a significant economic loss directly by causing organ or carcass condemnation and indirectly by affecting human and animal health which increase the cost for diagnosis, treatment and control of the disease. Public awareness creation about the transmission and control of the disease and its public health significance and collaboration between veterinarians and public health workers in the prevention and control of the disease is mandatory.The disease can be controlled through dosing dogs, inspecting meat and educating the public on the risk to humans and on avoiding feeding offal to dogs, as well as introducing legislative rules towards community based control.

Keywords: Animal, Cystic echinococcosis, Hydatidosis, Human, Prevalence Ethiopia

Introduction

The world human population is growing at a rate much faster than food production and this increase is mainly in developing countries which are unable to assure adequate food for their people. Developing countries have nearly two third of the world's livestock population but produce less than a third of the world meat and a fifth of its milk (FAO, 1995).Thus, the contribution from these huge livestock resources to the national income is small, owing to several factors including draught, malnutrition, management problems, lack of veterinary services, poor genetic performance and the diversified topographic conditions with prevalent livestock diseases in Ethiopia (Kebede *et al.*, 2009).

Ethiopia is an agrarian country with huge livestock population in Africa. In thecountry,there were approximately 60.39 million cattle, 31.3 million sheep, 32.74 million goats, 0.46 million camels and 56.06 million poultry (CSA. 2018). Camel is a versatile animal; it can be milked, ridden, loaded, eaten (meat), harnessed to plow, traded for goods or, exhibited in zoos or turned into sandal**s**. Despite the ecological, economic, environmental and social benefits of the camel it has remained the least studied domesticated animal. One reason is the main camel belt area is located in three poor countries, namely Ethiopia, Somalia, and Sudan accounting for 60% of the world camel population (Getahun and Belay, 2002)

Cestodes of the family Taeniidae which infect the dogs (definitive host) are transmitted to therange of intermediate host species where they cause Hydatidosis, Coenurosis, and Cysticercosis. Adult worms have been reported to be found in small intestines of dogs and wild carnivores like the wolf and fox (Gadahi *et al.*, 2009).Among them hydatidosis a disease affecting camels and cattleis a diseases with substantial economic and public health importance occurring in many countries (Lahmar *et al*., 2004) and is becoming more endemic in many African countries including Ethiopia (Azlaf and Dakkak,2006; Getaw *et al*.,2010).

Soil contaminated by dog feces and even dust containing eggs aspirated during rural activities can be major reasons for transmission of *E. granulosus*. In domestic animals Dogs arethe obligate final host of the adult tapeworm and infected by ingesting infectedoffal's (lung, liver, kidney, spleen, etc). Human and wide varieties of other animals also serve as accident intermediate hosts for the parasite (Thompson and Mcmans, 2002).

The two major species of medical and public health importance in Ethiopia are *Echinococcus granulosus* and *Echinococcus multilocularis*, which cause cystic *Echinococcosis* (CE) and alveolar *echinococcosis (*AE), respectively. They are found in a large number of hosts also throughout the world. The distribution of hydatidosesis worldwide with its prevalence varies among regions due to climate difference, agro-ecology, level of education, and development condition (Mutate and Nazir, 2015). It is regarded as an emerging zoonotic disease occurring with the highest prevalence in parts of Eurasia, north and EastAfrica, Australia, and South America (Seimeni, 2003).

It's transmission is high in livestock raising regions where veterinary service is unsatisfactory and offal from slaughtered animals is accessible to dogs.The tapeworm spends most of its adult life in the intestine of its definitive host, namely canids particularly the dogs. The tapeworm eggs become voided in the canids' faeces and as a result of ingesting the eggs, infection passes to the intermediate host, commonly herbivores while grazing. However, humans can become accidentally infected and hydatid cysts may develop throughout the body (Gottstein *et al.*, 2017).

The adult form of the parasite is a minute white tapeworm,few millimeters long(3-7 mm) with three to five proglottids. Like all tapeworms, Echinococcus has no gut and all metabolic

interchange takes place across the syncytial outer covering tegument. The adult Echinococcus possesses an attachment organ, the scolex, which has four muscular suckers and two rows of hooks. The eggs are ovoid (30µm-40µm diameter), consisting of a hexacanth embryo (oncosphere or first larval stage) surrounded by several envelopes, the most noticeable one being the highly resistant keratinized embryo phore, which gives the egg a dark striated appearance, host specificity and pathogenicity (Nakao *et al.,* 2013). *Echinococcusgranulosus*was initially regarded as the causative agent of hydatidosisand it has different taxa with differences in adult morphology, host specificity and pathogenicity (Nakao*et al.,* 2013). Domestic animals such as camels, cattle, goats, and sheep which live in close contact with dogs are implicated as one of the important contributors of zoonotic diseases to humans (Gesses*et al.,* 2015)

Currently ten (G1-G10) and lion strain (E. felids) genetically, biologically and morphologically distinct strains of *E.granulosu*s have been identified from different parts of the world. Strain of *E. granulosusi*s sheep strain (G1), cattle strain (G5), camelstrain (G6) genotype distributed worldwide and occurring particularly in areas of extensive farming. It is the predominant strain infecting humans but the other genotypes are also known to be infective. The presence of other *Echinococcus strains* in humans has been confirmed in Argentina (G1), Kenya(G2), Egypt (G5,) Poland, Ukraine, the Slovak Republic, Turkey, Austria, South Africa (G7), Russia, and Mongolia (G10) (Aito *et al.,* 2014).

The different strains of the parasite were reported to have different epidemiological, socio-economical significances and geographical ranges. Among the ten different strains of *E. granulosus* so far characterized, seven of them (G1, G2, G3, G5, G6, G7, and G9) were reported to have public health importance. In Africa, six strains of *E. granulosus*, the common sheep strain (G1), Tazanian sheep strain (G2), horse strain (G4), cattle strain (G5), camel strain (G6), and lion strains *(E. felids*) were reported. From these, four of them (G1, G2, G5 and G6) were reported to infect humans in different parts of the world (Lymbery *et al*., 2015)**.**The molecular characterization of human and animal. *E.granulosus* isolates demonstrated that the 'camel' strain (G6) is also equally important source of infection to humans (Magambo *et al.*,2006; Shahnazi *et al*., 2011).

Human acquire this infection by accidental ingestion of *E. granulosus* eggs with food, water or contaminated soil. Initiative to assess the global burden of foodborne diseases, the cysts in humans develop mainly in the liver (70%), lungs (20%), and other organs like the brain, heart, and bones (Pawlowsk *et al*., 2008).Hydatidosis, caused by the larval stage of *E.granulosus*, is characterized by the formation of variably sized cysts in the visceral organs of the intermediate hosts and adult tape worm in the intestine of dogs. The cysts usually may develop asymptomatically foryears and clinical symptoms occur when the cysts press onthe surrounding tissues or organs. Hydatidosis can be life-threatening when the cysts rupture into the peritoneal cavity causinganaphylaxis. In domestic animals the hydatid cyst in the liver or lungs is usually tolerated without any clinical signs, and the majority of infections are revealed only at post mortem inspection (Urquhart *et al*., 1996).

In Ethiopian situation, hydatidosis is a serious public health problem of includes cost of hospitalization, medical, surgical, losses of income and productivity due to temporal incapacity to work, social consequences, due to disability and mortality. In livestock it causes considerable economic losses due to condemnation of affected animal organs at the slaughter house.In food animals, it has adverse effect on production causing decreased in production of meat, milk,wool,reduction in growth rate and predisposition to other diseases(Nigatu *et al*.,2011).

The important control method of the disease are to prevent dogs from ingestion of uncooked offal, keeping the dog health service, prevent backyard slaughtering and disposal of infected organs, community education about spread and causes of

disease and to giving recommendation on the epidemiology of the disease (Loomu, 2010).

The aim of this review was to bring together available data from primary research conducted so far on the epidemiology, economic and public health importance of hydatidosis.in both animals and human in Ethiopia.

Overview onhydatidosis

Zoonotic parasitic diseases are infections that are transmittedamong vertebrate animal populations and human societies(Carmena& Cardona, 2014) .There is an inextricable link among human health, animal and environmental health. This association is wellrepresentedby revitalization of infectious zoonoses such ashydatidosis, which accounts for a major worldwideburden. The two major species of medical and public health importance which cause hydatidosis are *Echinococcus granulosus* and *Echinococcus multilocularis*, which cause cystic *echinococcosis*(CE) and alveolar *echinococcosis (*AE), respectively .They are found in a large number of hosts throughout the world (Mutate and Nazir, 2015).

Etiology:species and their morphology

The cestode Echinococcus belongs to family taeniidae class Eucestoda. The adult stage of this parasite lives in intestine of dogs, fox, hyena, jackals. Different species of tapeworms occur in different vertebrates and hasthree stages of cycles i.e. eggs, larvae, and adults (Parija, 2004).

The four species of the *genus Echinococcus* are re cognized and regarded as taxonomically valid: *E. granulosus* (cystichydatidosis), *E.multilocularis* (multivesicular hydatidosis), *E. vogeli*(polycystic hydatidosis) and *E. oligarthrus*. These four species are morphologically different both the adult and the larval stages. In addition, several differentstrains of E. *granulosus*and E. *mu ltilocularis are* recognized. Adult Echinococcus is a very short tapeworm, the adult form of the parasite is a minute white tape worm, few millimeters long (3-7 mm) with three to five proglottids (segments) and it help in species diagnosis morphologically (Thompson and Mcmans, 2002).

Like all tapeworms, Echinococcus has no gut and all metabolic interchange takes place across the syncytial outer covering tegument. Interiorly, the adult Echinococcus possesses an attachment organ, the scolex, which has four muscular suckers and two rows of hooks, only large and one small, on the rostellum. The body or strobila is segmented and consists proglottids which may vary in number from two, to six. The adult worm is hermaphrodite with reproductive ducts opening at a common, lateral, genital pore, the position of which may vary depending on species and strain. There is a prominent cirrus sac, which may be horizontal or titled anteriorly and the vitellarium is globular (Parija, 2004).

The uterus dilates after fertilization, eventually occupying most of the terminal segment when the eggs are fully developed (The eggs are ovoid (30µm-40µm diameter), consisting of a hexacanth embryo (oncosphere or first larval stage) surrounded by several envelopes, the most noticeable one being the highly resistant keratinized embryo phore, which gives the egg a dark striated appearance. The eggs of Echinococcus are morphologically indistinguishable to those of other tape worms of the genusTaenia.The metacestode (second larv al stage) basically consists of a bladder with an ou ter acellular laminated layer and an inner nucleate d germinal layer which my give rise by asexual budding to brood capsules (Nakao *et al*.,2013).

Biology and Epidemiology of Hydatid Cyst/Echinococcus

The Life cycle of Echinococcus

Echinococcus spp. requires two mammalian hosts for completion of its life cycle.Thelife cycle of the parasite is complete when dogs ingest hydatid cysts containing fully develop protoscoleces, which are subsequently released and attach

themselves to the intestinal lining of the host. The protoscoleces start to develop into mature adult tapeworms.

Theadult tapeworm is found in parts of small intestine of the definitive host, from where segments containing eggs are passed with the faeces. When the eggs are ingested by intermediate hosts like cattle, sheep, goats, pigs and camel in which the metacestode develops, the onchospheres penetrates the wall of the small intestine. A hormonal secretion from the onchospheres aids the penetration in to the intestine. Upon gaining access to a venue, the onchospheres is passively transported to the liver, where some are retained, others reach the lungs, and a few may be transported further to the kidney, spleen, muscles, brain, and other visceral organs(McManus *et al*., 2003; Zhang *et al*., 2003).

Epidemiology

Hydatidosis to commonly prevalent in sheep-raising areas of the Mediterranean, Australia, New Zealand, South Africa, South America and the Middle East including Saudi Arabia. In Africa, the disease is reported more commonly in cattle raised in a free range associated intimately with dogs and has a cosmopolitan distribution with major public health problem in the world (Deplazes *et al.,* 2004).

The prevalence of hydatidosis in Ethiopia is high this is due to frequent contact betweenthe infected intermediate and final hosts.It could also be associated to slaughtering of aged animals which have considerable chance of exposure to the parasitic ova,backyard slaughteringof animals, giving of infected offal'sto pet animals, poor public awareness about the diseases as well as small number of slaughter houses in the countries could have contributed to such a higher prevalence rate (Esatgil and Tuzer, 2007).

Host range in animals

It is likely that *granulosus* originally completed its life cycle among wild animals in a sylvatic cycle that involved, for example, wolves and in a mammal of the deer family,cervids or lions and warthogs. It has now adapted into a domestic cycle, however, commonly involving dogs and sheep. As *granulosus* has little host specificity with regard to intermediate hosts, hydatid cysts have been seen in a wide range of mammals, including domestic ruminants, camels, giraffes' pigs, equines, elephants, hippopotamuses, marsupials and different types of deer, as well as humans (Roming *et al*., 2017).

Echinococcus *granulosus* has two biotypes (*E. Granulosus granulosus* and *E.* granulosus *equines*) that are host adaptive. Dog, red fox, and many wild canids are the common definitive hosts. The intermediate stage of *E. g. granulosus* is found in domestic ruminants, man, pigs, and wild ruminants, whereas horse and donkey are resistant. The larval stage of *E. granulosus equines* is found in horses and donkeys but not in humans (Urqhart *et al*., 1995).

Foxes serve as the principal definitive hosts for the adult of *E. multilocularis*, but dogs, cats, and coyotes can also serve that function. Larval forms occur in various rodents, chiefly voles, field mice, shrews, and ground squirrels. Humans can also be infected. *Echinococcus vogeli* is a parasite of the bush dog and occasionally domestic dogs, with an intermediate stage in pacas and other rodents, and on occasion, humans (Roming *et al*., 2017).

Wild felids like the cougar, jaguar, and cerot are important definitive hosts of *Echinococcus oligarthus* and the larval stage found in agoutis, rodents, spiny rat, paca, and man can be an accidental host (Taylor and Coop, 2007).

Mode of transmission to intermediate hosts

The eggs enter into the intermediate hosts by the ingestion of contaminated grass, water, vegetables, and others. It has been shown that flies and possibly other insects contaminated during feeding may mechanically transport the eggs over considerable distance. The definitive hosts are infected by the ingestion of offal's contaminated by fertile and viable hydatidcysts

(Carmena and Cardon, 2013). Unhygienic practice plays a major role in the maintenance and transmission of the disease in domestic ruminants and humans. This is particularly true in sub-Saharan Africa countries including Ethiopia. In developing countries, due to lack of effective meat inspection, and a backyard slaughter practices, the hydatid cyst infected viscera are deliberately left for home and stray dog's consumption. In these areas, the infection rate with *E. granulosus* in dogs was reported to be between endemic and hyper endemic (Dakak, 2010).

Clinical manifestations and diagnosis

The clinical manifestations of echonococcosis/ hydatidosis are different in different hosts. Infection of adult tapeworm in the definitive host is harmless unlike the hydatid cyst in the intermediate host. Clinical manifestations in intermediate hosts are typically asymptomatic except for a small number of cases with chronic and heavy infection and the effect of hydatid cyst largely depends on the size and location of the cyst. If large cyst is located in an area of the body, with rigid bounders, it creates sufficient pressure on the tissue or organs (Ibrahim, 2010). Fever and generalized purities are systemic symptoms often associated with hydatid disease. Rupture of cysts, particularly into serosal cavities, may cause acute and sometimes fatal anaphylactic reactionand. The adult Echinococcus is considered to be rather harmless to the definitive host when it occurs in large numbers which may cause severe enteritis (Azlaf and Dakkak, 2006; Ibrahim, 2010).

The diagnosis of depends on the detection of the l arvalcyst form which can occur in almost any org an particularly in the liver and lungs.The diagnost ic includes imaging techniques,mainly ultrasound (US),computed tomography (CT) and immune diagnostic tests (Pawlowski *et al.*, 2001). The diagnosis of hydatid cyst in the dog or other carnivores requires the demonstration of the adult cestodes of Echinococcus spp. in their faeces or the small intestine and the detection of specific copro-antigens or copro DNA (OIE, 2008). Post-mortem examination is the most reliable method of diagnosis. Up on post mortem examination liver and lung was shown to harbour a greater number of small calcified cysts neither spleen nor kidney show observable cyst but the presence of cyst in lung and liver indicates a relatively higher population of reticulo-endothelial cells and abundant connective tissue reaction in this organ (Kumsa and Mohammedzein, 2012).

There is usually no early parasitological evidence for the presence of cysts in organs or tissues and in most cases the early stage of infections are asymptomatic. Over the last decade diagnosis of hydatid disease was improved due to the use of imaging techniques including ultrasonography, computed tomography (CT scanning) and magnetic resonance imaging (MRI) supported by immunological assays for confirmation of clinical diagnosis. Recently, a PCR for specific detection of DNA from *E. granulosus* egg has been developed (Cabrera et al., 2002).

Immuno-diagnosis involves the detection of parasite antigens in feces (copro-antigens) and serum antibody detection. ELISA has been described for several groups for the detection of coproantigens released by cestodes, including taenia species of dogs, and humans. Serologic tests are usually positive at high titers purified *E. multilocularis* antigens are highly specific and permit serologic discrimination between infections with *E. multilocularis* and *E. granulosus*. Needle biopsies of the liver can confirm the diagnosis if larval elements are demonstrated. Exploratory laparotomy is often performed for diagnosis as well as determination of the size and extent of invasion (Moro and Schantz, 2013).

Risk factors

Certain deep-rooted traditional activities have been described as a factor associated with the spread and high prevalence of the disease in some areas of the world. These can include the wide spread backyard slaughter of animals, absence of rigorous meat inspection procedures, the long-standing habit of feeding domesticated dogs with

condemned offal's. Agricultural or stock-raising lifestyle, low socio-economic status, climate, poor hygienic practices, as well as uncontrolled dog populations have all been reported to be risk factors (Cetinkaya *et al*., 2005; King and Fairley, 2010).Muslim families who have the religious practice of keeping dogs away from homes and avoiding direct contact are reported to be at low risk of being infected with CE (Akalin *et al*., 2014).

Public Health Significance

Hydatidosis caused by larval stages of *Echino-coccus granulosus* one of the most common zoonotic diseases associated with severe economic losses and great public health significance worldwide. Echinococcus infections are estimated to affect approximately two to three million people worldwide Echinococcus infections are estimated to affect approximately two to three million people worldwide, with Africa amongst the primarily endemic regions (Cummings *et al*., 2009). In humans hydatidosis has frequently been reported from different regions of the world. The disease is more common in rural areas, where dogs and domestic animals live in very close association. Most cases in humans are caused by the sheep cattle and camel strain. In Libya, most human cases are caused by sheep strain G1; cattle strain G5 and camel strain G6. These intermediate hosts are the most common reared animals in the country (Abushhiwa *et al*., 2010).

Hydatidosis has the greatest economic and public health impacts in rural communities of 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 (Fikireet al., 2011).

Economic Significance

Hydatid disease wide spread parasitic diseases infecting a large number of domestic animals, wild and humans are considered as one of the major causes of economic losses and productivity of livestock in both the developing and industrialized world (Oryan *et al*., 2012). In livestock it causes considerable economic losses due to condemnation of affected animal organs at the slaughter house, production losses due to reduction in live weight gain, yield of milk, fertility rates, value of hide and skin (Roming *et al*., 2011).

It is implicated as the economic burden on the global livestock industry alone has been estimated to be over $2 billion per annum, such lo sses are of particular importance in Ethiopia with low economic output with a per capita income of less than one US dollar per day, (Scala *et al.*, 2006)

Hydatid disease not only results in loss of millions of money it also worsens the protein deficiency for human consumption in terms of condemned organ and lowered productivity of infected animals. The difference in economic losses agreed with the variation in the prevalence of the disease, mean annual slaughter rate in different abattoirs and variation in retail, market price of organs. In humans, hydatidosis is responsible for direct monetary costs such as those incurred by diagnosis, hospitalization, surgical or percutaneous treatments, therapy, post treatment care, travel for patients and family members. Indirect costs include mortality, suffering and social consequences of disability, loss of working day (Gottstein, 2012).

Current status of Echinococcosis/Hydatidosis in Ethiopia

In Ethiopia,Cystic echinococcosis, mainly caused by the metacestode of *Echinococcusgranulosus*, is one of the most common zoonotic diseases associated with huge economic losses and great public health significance worldwide (Romig *et al*., 2011). The adult tapeworm in the definitive dog host is harmless unlike the hydatid cyst in the intermediate host animals that is responsible for immense economic and medical importance in infected hosts (Ibrahim, 2010).

The prevalence, economic and public health impact of cystic echinococcosis is higher in rural communities of developing countries where there is close contact between dogs, intermediate host species and man (Ibrahim, 2010; Romig *et al*., 2011). In Ethiopia cystic echinococcosis is an endemic disease and has enormous medical and veterinary importance due to suitable factors such as predominant home slaughtering of cattle, sheep, goats and camels with improper disposal of affected organs. Moreover, uncooked carcass wastes and offals are traditionally fed to dogs and cats in the country. As a result cystic echinococcosis is implicated as one of the major causes of organ condemnation and carcass weight loss in slaughtered animals in Ethiopia. Cystic echinococcosis in cattle has been reported from some parts of the country (Abebe, Beyene, & Kumsa, 2013; Kumsa & Mohammedzein, 2012; Negash, Beyene, &Kumsa, 2013). Higher prevalence of hydatidosis were reported (84.3% in Gondar, 68.9% in Injibara, 73.4% in Finoteselam by Kebede (2010) and 49.5% at Shashemanne Municipal abattoir in Oromia (Negash et al., 2013).Research findings from abattoir surveys conducted in Ethiopia have been also reviewed, which revealed the prevalence of cystic bovine hydatidosis, ranging from 6.51% (Debre-brhan) to 62.38% (Assela) and annual economic loss ranging from 8,798.50 (Arsi) to 19,847,704.00 (Addis Ababa Abattoir Enterprise) Ethiopian Birr. However, still the real public health and economic burden of the disease have been under-estimated due to poor reporting, and that is why, the disease lacks to bring the attention that it deserves (Melese *et al.*, 2019).

This variation in prevalence of cystic echinococcosis could be attributed to factors including differences in agroecology, the times at which studies took place, stocking rates and movements of animals, animal husbandry systems, awareness, culture and religion of the society, and attitude to dogs in different regions of the Country (Abebe *et al.,* 2013; Kumsa, 1994; Romig *et al.,* 2011). Thus, comprehensive and up-to-date information is needed for the effective control and prevention of cystic echinococcosis in the country (Jobre *et al*., 1996; Magambo, Njoroge, & Zeyhle, 2006).

Prevention and Control

Effective control and prevention measures should be introduced to minimize the risk of public health hazard and economic losses can be controlled through preventive measures that break the life cycle between the definitive and inter-mediate hosts. These measures include a complete deprivation of dogs from the access of infected raw offal's by proper disposal of cysts at abattoirs, local slaughterhouses, backyards and on farms. 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).

The key to success is health educations that elicit community participation and Further control methods include introduction of appropriate meat inspection, establishment of local slaughter houses, effective implementation of legislative measures, burning or burial of condemned offal's and sterilization of offal's if it is going to be used for dog food. Control of hydatidosis is less effective without the support of dog-owners and this can only be achieved through increasing education and raising community awareness of the diseases (Heath *et al*., 2006).Specific control measures including stray dogs' control, registration of all owned dogs, spaying of bitches and Prevention can be achieved also by strict hygiene measures like hand washing, after animals handling, in particular dogs, control of movements of food animals and dogs from the infected areas to the "clean" ones marking and control of movements of animals from infected flocks or herds (Vuitton *et al*., 2011).

Conclusion and Recommendations

Hydatidosis is a zoonotic cosmopolitan parasitic disease found in almost all countries of the world, including Ethiopia. This disease causes a significant economic loss directly by causing organ or carcass condemnation and indirectly by

affecting human and animal health, which increases the cost for diagnosis, treatment, and control of the disease. Improper disposal of the carcass (organ), increased population of stray dogs, and lack of appropriate legislation for the control of the disease are the most important factors that increase the transmission of the disease.

Based on the above conclusive points, the following recommendations are forwarded:

- Regular deworming of pet dogs and control of stray dogs
- Public awareness creation about the transmission and control of the disease and its public health significance
- Proper disposal of carcass either by burning or burring and avoiding the habit of giving offal to dogs
- Collaboration between veterinarians and public health workers in the prevention and control of the disease is mandatory
- Proper food hygiene and personal hygiene especially, those having close contact with pets.

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