ISSN 2475-529X

Review Article

Journal of Nursing & Healthcare

Epidemiology of Hydatidosis in Ethiopia

Abebe Garoma Gichile

Ministry of Agriculture Animal Healthy Institute

***Corresponding author**

Abebe Garoma Gichile,
Ministry of Agriculture Animal Healthy Institute.

Submitted: 25 Jun 2022; **Accepted**: 02 July 2022; **Published**: 09 July 2022

Citation: *ABEBE GAROMA (2022) Epidemiology of Hydatidosis In Ethiopia. Journal of Nursing & Health care 7(3): 01-06.*

Abstract

Hydatidosis is a neglected cyclozoonotic disease affecting both humans and livestock populatio. The objective of the paper was to review the hydatidosis disease. The overall prevalence of the hydatidosi was reported in the country: 4.9%, 6.8%, 8.02%, 9.7%, 11.3%,11.78%, 16.79%, 17.4%, 27.64%, 35.15% and 49.5% respectively. The most common source of infection: contamination of water and feed by dogs feces. The main Reservoir, risk factors for distribution of the disease are forage, water, and host, pathogenic risk factors respectively. All domestic animal are the people at risk for thedisease. The major clinical forms of hydatidosis are rup-ture of cysts, particularly into serosal cavities, may cause acute and sometimes fatal anaphylactic reaction. Effective control and prevention measures should be introduced to minimize the risk of public health hazard and economic losses can be controlled through preventive mea¬sures that break the life cycle between the definitive and inter¬mediate hosts. They must be improving hygienic management for animals and health educations for peoples about the disease for reduceinfection.

Keywords: dogs, hydatidosis, public health.

1. Introduction

1.1. Background of Study

Ethiopia is naturally endowed with different agro ecological zones and environmental conditions suitable for livestock production. The country is considered to have numerous 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 [1].

Cattle are distributed throughout the country, with the greatest concentration in the highlands serving as a source of draught power for the rural farming population and also provide meat, milk, cash income , manure, and serve as a capital asset against risk. In the semi-arid low lands, cattle are the most important species because they supply milk for the subsistence pastoral families (Tonamo, 2016).

In the more arid areas, however, camels is the dominant species reared. Camel is a versatile animal; it can be milked, ridden, loaded, eaten (meat), harnessed to plow, traded for goods, exhibited in zoos or turned into sandals. Despite the ecological, economic, environmental and social benefits of the camel, it has remained the least studied domesticated animals. 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 [2].

However, the contribution from these huge livestock resources particularly cattle and camel 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 [3].

Among many prevalent diseases,parasitosis represents a major health problem hampering livestock productivity in tropics including Ethiopia [4]. Hydatidosisor cystic echinococcosis caused by *Echinococcusgranulosus* among the major parasitic diseases that has reduced meat production due to carcass or organ condemnation in abattoirs [5].

Echnococcus species are castode parasites belonging to of the family Taeniidae. Morphologically the adult parasite is a minute white tapeworm, 3-7 mm millimeters long with three proglottids. The eggs are ovoid (30µm-40µm diameter), consisting of a hexacanth embryo (oncosphere or first larval stage) surrounded by several

envelopes, which gives the egg a dark striated appearance, host specificity, and pathogencity [6].

The two major species are *Echinococcusgranulosus* and *Echinococcus multilocularis*, which cause cystic *echinococcosis* (CE) and alveolar *echinococcosis* (AE), respectively. The distribution of hydatidosis is worldwide with its prevalence varies among regions due to climate difference, agro-ecology, level of education and development condition [7].

The adult worm infects the dogs and wild carnivores like the wolf and fox (definitive host). The intermediate host species include cattle, camel and other domestic and wild ruminates including pigs that cause hydatidosis. In domestic animals, dog's are the obligate final host of the adult tapeworm and are infected by ingesting infected offal's (lung, liver, kidney, spleen, etc.). The tapeworm eggs voided from the intestine of the canids'throughfeces and because of ingesting the eggs, infection passes to the intermediate host, commonly herbivores while grazing [8].

In the intermediate hosts, hydatid cyst, 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. The cysts usually may develop asymptomatically and clinical symptoms occur when the cysts press on the surrounding tissues or organs. Hydatidosis can be life threatening when the cysts rupture into the peritoneal cavity causing anaphylaxis. 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 [9].

The disease is also known to cause public health problems as humans also serve as accident intermediate hosts for the parasite. Humans are infected by accidental ingestion of parasite eggs/larvae passed into the environment with feces from definitive hosts [10, 11].

The public health importance of hydatidosisincludes 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 slaughterhouse. In food animals, it has adverse effect on production causing decrease productionof meat,milk,wool,reduction in growth reate and predisposition to other diseases [12].The important control method of the disease are to prevent dogs from ingestion of uncooked offal, giving for dogs 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 [13].

2. Literature Review

2.1. Overview of hydatidosis

Zoonotic parasitic diseases are infections that are transmitted among vertebrate animal populations and human societies [14]. There is an inextricable link among human health, animal and environmental health. This association is well represented by revitalization of infectious zoonoses such as hydatidosis, which accounts for a major worldwide burden. The two major species of medical and public health importance, which cause hydatidosis, are *Echinococcusgranulosusis an dEchinococcus multilocularis,* which cause cystic *echinococcosis* (CE) and alveolar *echinococcosis* (AE), respectively.They are found in a large number of hosts throughout the world [7].

2.2. Species and 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 has three stages of cycles i.e. eggs, larvae, and adults [15].

The four species of the *genus Echinococcus* are recognized and egarded as taxonomically valid: *E.granulosus*(cystichydatidosis), *E.multilocularis*(multivesicular hyadatidosis),*E.vogeli*(polycystichydatidosis) *E. oligarthrus*. These four species are morphologically different both the adult and the larval stages. In addition, several different strains of *E. granulosusis* and *E. multilocularis* 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 proglottids (segments) and it help in species diagnosis morphologically [16].

Like all tapeworms, Echinococ¬cushas no gut and all metabolic interchange takes place across the syncytial outer covering tegument. Interiorly, the adult Echi¬nococcus 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 strobilais segment¬ed and consistsproglottids, 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 [17].

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 genus Taenia. The metacestode (second larval stage) basically consists of a bladder with an outer acellular laminated layer and an inner nucleated germinal layer which my give rise by asexual budding to brood capsules [6].

2.3. Life cycle

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 theintestinal lining of the host. The protoscoleces start to develop into mature adult tapeworms within 32 80days depending on the species and the parasite strain.Humans are described as dead end'hosts for the parasite, since the life cycle is usually completed when carnivores eat infected herbivore [18].

The life cycle of Echinococcus, which shows in the figure below, (Fig.1), discussed as follows. The adult tapeworm is found in parts of small intestine of the definitive host, from where segments containing eggs are passed with the faeces. When intermediate hosts like cattle, sheep, goats, pigs, ingest the eggs and camel in which the metacestode de¬velops, the onchospherespenetrates the wall of the small intes¬tine. A hormonal secretion from the onchospheres aids the pen¬etration 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 transport¬ed further to the kidney, spleen, muscles, brain, and other viscer¬al organs [19, 20].

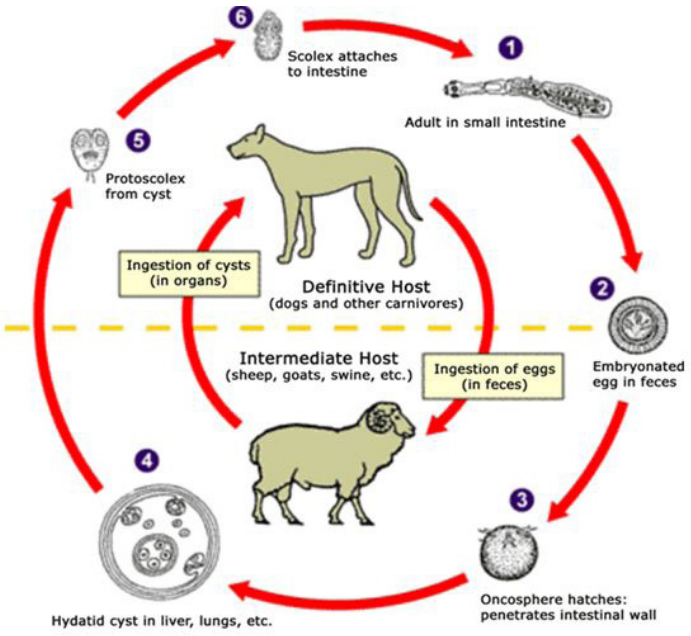

Figure 1: Life cycle of hydatidosis [18].

2.4. 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 [21].

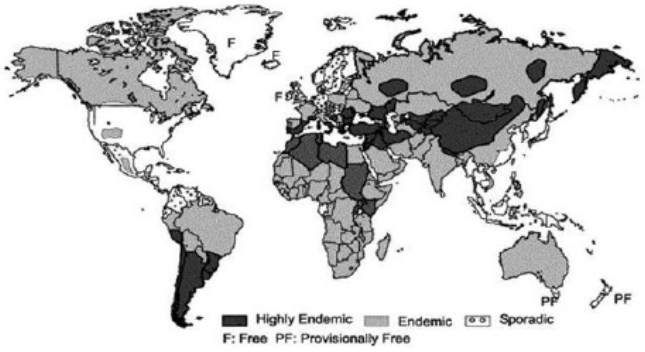

Figure 2: Worldwide distribution of E. granulosus [4].

2.4.1. Mode of transmission to intermediate hosts

The eggs en¬ter into the intermediate hosts by the ingestion of contaminat¬ed 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 contami¬nated by fertile and viable hydatidcysts [22]. 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 inspec¬tion, and a backyard slaughter practices, the hydatid cyst infected visceraare 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 [23].

2.4.2. Host range

It is likely that *E. granulosuso* rigi¬nally completed its life cycle among wild animals in a sylvatic cycle that involved, for example, wolves and cervids or lions and warthogs. It has now adapted into a domestic cycle, however, commonly involving dogs and sheep. As *E. granulose* has little host specificity with regard to intermediate hosts, hydatid cysts have been seen in a wide range of mammals, in¬cluding domestic ruminants, camels, giraffes' pigs, equines, ele¬phants, hippopotamuses, marsupials and different types of deer, as well as humans [24].

2.4.3. Risk factor

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 [25].

2.5. Clinical manifestations and diagnosis

The clinical manifestations of hydatid cyst 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 intermedi¬ate hosts are typically asymptomatic except for a small number of cases with chronic and heavy infection. The effect of hydatid cyst on the intermediate host 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 pres¬sure on the tissue or organs [26].

Fever and generalized purities are systemic symptoms often associated with hydatid disease. Rup-ture 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 [26].

The diagnosis of depends on the detection of the larvalcyst form which can occur in almost any organ particularly in the liver and lungs.The diagnostic includes imaging techniques,mainly ultrasound (US),computed tomography (CT) and immune diagnostic tests [27].The diagnosis of hydatid cyst in the dog or other carnivores requires the demonstration of the adult cestodes of Echinococcusspecies.The small intestine and the detection of specific copro antigens (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 arelatively higher population of reticulo-endothelial cells and abundant connective tissue reaction in this organ [28].

2.6. 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 mea¬sures 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 hydratidcystis 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 [29]. The key to success is health educations that elicit community partic¬ipation and Further control meth¬ods include introduction of appropriate meat inspection, estab¬lishment 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 [30]. Specific control measures including stray dogs' control, registration of all owned dogs, spaying of bitches. Prevention can be achieved also by strict hygiene measures like hand washing, after animals handling, in particular dogs, control of move¬ments 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 [31].

2.7. 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 [32]. In livestock, it causes considerable eco¬nomic losses due to condemnation of affected animal organs at the slaughterhouse, production losses due to reduction in live weight gain, yield of milk, fertility rates, value of hide and skin [33]. It is implicated the eco¬nomic burden on the global livestock industry alone has been estimated to be over $2 billion per annum, such losses are of particular importance in Ethiopia with low economic output with a per capita income of less than one USA dollar per day [34].

Hydatid disease not only results in loss of millions of mon¬ey it also worsens the protein deficiency for human consumption in terms of con¬demned 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 [35].

2.8. Public Health Significance

Hydatidosis caused by larval stages of *Echinococcusgranulosusis* one of the most common zoonotic diseases associated with severe economic losses and great public health significance worldwide. Echinococcus infections are esti¬mated to affect approximately two to three million people world¬wide Echinococcusinfections 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. The sheep cattle and camel strain cause most cases in humans. In Libya, most human cases are caused by sheep strain G1; cattle strain G5 and camel strain G6. These intermediate sts are the most common reared animals in the country [36]. 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 [37].

Conclusion and Recommendations

Hydatidosis is an important zoonotic disease that causes serious public health as well as economic problem throughout the world. The distribution of the diseases is higher in developing countries than developed countries, especially in rural communities where there is close contact between the definitive host and various domestic animals, which may act as intermediate hosts. Hydtidosis caused substancial financial loss from both cattle and camel in the

studied abattoir through condemnation of infected organs.Backyardslaughtering system being practiced can enhance the continuation of the life cycle between the intermediate and final host.

Based on the above conclusion the following recommendations are forwarded:

- Public education should be required to avoid the consumption of contaminated food by dog's feces, keep their self-hygiene, prohibition of backyard slaughter, proper disposal of condemned offal's.
- In endemic areas of hydatidosis, the subspecies and strain identification of E. granulosusis, followed by immunological study of infected animals should be carried out to promote the production of vaccines against the adult parasite in the dogs.
- Close collaboration and coordination between veterinary and medical authorities at all level is required.

References

1. Central Statistical Agency (CSA).(2018) Federal Democratic Republic of Ethiopia Agriculture sample survey, Addis Ababa, Staticallbulletin 2: 583.
2. Getahun,T. and Belay,K.(2002) Camel husbandry practices in Eastern Ethiopia the case of Jigjig a and Shinile zone .Nomadic people.,6: 155-176.
3. Kebede, N., Mitku, A., Tilahun, G. (2009) Hydatidosis of slaughtered animals in Bahir Dar Abattoir, Northwestern Ethiopia. Trop. Anim. Health Prod. 41: 43-50.
4. Johannes Eckert and Peter Deplazes (2004) Biological, epidemiological, and clinical aspects of echinococcosis, a zoonosis of increasing concern. Clin Microbiol Rev. 2004 Jan;17(1):107-35. doi: 10.1128/CMR.17.1.107-135.2004.
5. Regassa, F., Molla ,A. , Bekele,J.(2010) Study on prevalence of cystic Hydatidosis and its economic significance in cattle slaughtered at Hawassa municipal abattoir, Ethiopia. Tropical Animal Healthand Production, 42: 977-984.
6. Nakao, M., Lavikainen, A., Yanagida, T.,Ito, A. (2013) Phylogenetic systematic of the genus Echinococcus (Cestoda: Taeniidae). Int. JournalParasitol., 43: 1017-1029.
7. Mulate, B. and Nazir, S. (2015) Major metacestodes in small ruminants slaughtered at Dessie municipal abattoir, Eastern Ethiopia: Prevalence, cyst viability,organ distribution and economic implications. Comp. Clin.Pathol.,24(3): 659-668.
8. Gottstein, B., Saucy, F., Deplazes, P., Reichen, J., Zuercher, C., Harandi, M., Budke, M. and Rostami, S. (2017) The monetary burden of cystic echinococcosis in Iran.Negl. Trop. Dis., 8(4): 1915.
9. Urquhart.G.,Armour,J.,Duncan,A.,Jenning,W.(1996) Vet parasitology 2 nd edition .Black well science Ltd UK,122: 128-129.
10. Thompson, R.C., McManus, D.P., 2002. Towards a taxonomic revision of the genus Echinococcus. Trends in Parasitology 18 (10), 452-457.
11. Jenkinsa, D.,Romig, T., Thompson, R. (2005) Emergence/ re-emergence of Echinococcus species, a global update. Int. Journal of Parasitology, 35: 1205–1219.
12. NigatuK,AbebeM.,Getachew, T.(2009) Hydatidosis of slaughtered animals in Bahir Dar abattoir ,North Western Ethiopia .Trop Anim Health prod 42: 323-325
13. Loomu, M. (2010) Trans-boundary Animal Disease Surveillance in Ngorongoro District: Thecase of Peste des Petits Ruminants. Research paper for award of MPVM at SokoineUniversity of Agriculture, Morogoro, Tanzania, Pp: 37.
14. Carmena, D. and Cardona, G.A. (2014) Echinococcosis in wild carnivorous species: epidemiology, genotypic diversity and implications for veterinary public health.Veterinary Parasitology 202: 69–94.
15. Sharma, D. and Chauhan, P. (2006) Coenurosis status in Afro-Asian region: A review Small Ruminants Research 64: 197 – 202
16. Thompson, R. (1995) Biology and systematics of Echinococcus. In: Thompson RCA,Lymbery, A., Jenkins, E., Schurer, J. and Thompson, R. (2015) Echinococcuscanadensis,Echinococcusborealis,and Echinococcus intermedius.TrendsParasitol., 31: 23–29.
17. Parija, S.(2004) Text book of medical parasitology, Protozoology and helmenthology. (2ndedition). India Publishers and Distributors , India, New Delhi.
18. EC kert, J., and Thompson, R. (2017) Historical aspects of echinococcosis. 95: Pp. 31-54.
19. McManus, D., Zhang, J. and Bartley, P.. (2003) Echinococcosis.Lanc. 362: 1295-1304.
20. Zhang, W., You, J., Zhang, G., Turson, H., Aili, J., Wang., McManus, P. (2003) Immunoglobulin profiles in a murine intermediate host modelof resistance for Echinococcusgranulosusinfection. Parasite Immunol. 25: 161–168.
21. Deplazes, P., Rinaldi, L., Alvarez Rojas, C., Torgerson, P., Harandi,M., Romig,T.,Antolova,D., Schurer, J., Lahmar, S., Cringoli, G., Magambo, J., Thompson, A.,Jenkins, E.,(2016) Global distribution of alveolar and cystic echinococcosis diversity. ActaTropica 128: 441–460.
22. Carmena, D. and Cardona, G.(2013) Canine echinococcosis: global epidemiology and genotypic diversisity. Acta Trop. 128: 441-460.
23. Dakak, A. (2010) Echinococcosis/hydatidosis. A severe threat in Mediterranean countries.VeterinaryParasitol, 174: 2-11.
24. ChristianRominger,Johannes Reitinger,Clemens Seyfried,Eva Schneckenleitner,Andreas Fink (2017) The Reflecting Brain: Reflection Competence in an Educational Setting Is Associated With Increased Electroencephalogram Activity in the Alpha BandMind, Brain, and Educationhttps://doi.org/10.1111/mbe.12140
25. Cetinkaya, Z, Ciftci, I, Demirel, R, Altindis, M, Ayaz, E. (2005): Asero epidemiologic study on cystic echinococcosis in Midwestern Region of Turkey. Saudi Med. J., 26:350.
26. Ibrahim, M. (2010) 'Study of cystic echinococcosis in slaughtered animals in Al Baha region, Saudi Arabia: Interaction b/n some biotic and abiotic factors, ActaTropica 113: 26–33.
27. Pawlowski J., Holzmann M., Fahrni J. F., Hallock P. (2001). Molecular identification of algal endosymbionts in large miliolid foraminifera: 1. Chlorophytes. J. Eukaryot. Microbiol. 48 362–367. 10.1111/j.1550-7408.2001.tb00325.x

28. Kumsa B, Mohammedzein A. Prevalence, organ distribution, risk factors, and financial losses of hydatid cysts in sheep and goats slaughtered in restaurants in Jimma, south western Oromia. Comp Clin Pathol. 2012 [Google Scholar]
29. Torgerson, P. and Budke, C. (2003) Echinococcosis an international public health challenge.Res. Veterinary sci., 74: 191-202.
30. Heath, D., Yang, W., Xiao, Y., Chen, X., Huang, Y., Yang, Y., Wang, Q. Qiu, J. (2006): Control of hydatidosis.Parasitol. Int. 55: 247-252
31. Vuitton, D., Economides P, WHO-IWGE and EurEchinoReg Network. (2011) Echinococcosis in Europe Web site, Echinococcosis in Western Europe, a risk assessment ,risk management approach; Parasitol.100: 703-14
32. Oryan A, Goorgipour S, MoazeniM, Shirian S (2012) Abattoir prevalence, organ distribution, public health and economic importance of major metacestodes in sheep, goats and cattle in Fars, southern Iran. Trop. Biomed. J., 29(3): 349-359.
33. Romig, T, Omer, R ., Zeyhle E. (2011) Echinococcosis in sub-Saharan Africa: emerging complexity. Vet Parasitol.181: 43–47.
34. Scala, A., Garippa, G., Varcasia, A., Tranquillo, V. & Genchi, C., (2006) 'Cysticechinococcosis in slaughtered sheep in Sardinia (Italy)', Veterinary Parasitology 135(1): 33–38.
35. Gottstein, B., Saucy, F., Deplazes, P., Reichen, J., Demierre, G., Busato, A., Zuercher, C., Harandi, M., Budke, C. and Rostami, S. (2012) The monetary burden of cystic echinococcosis in Iran.Negl.Trop.Dis., 6(11): 1915.
36. Abushhiwa,M.,Nolan,M.,Jex,A.,Campbell,B.,Jabbar,A.,-Gasser, R.(2010) http://dx.doi.org/10.1016/j.actatropica.2009.08.029.
37. Fikire, A., Yilma, J. (2011) Infection prevalence of hydatidosis (Echinococcus granulosus,Batsc in domestic animals in Ethiopia:A synthesis report of previous surveys. Ethiop.Veterinary Journal,15 (2): 11-33.