Int. J. Curr. Res. Med. Sci. (2022). 8(6): 1-13

International Journal of Current Research in Medical Sciences

ISSN: 2454-5716

(A Peer Reviewed, Indexed and Open Access Journal)

www.ijcrims.com

Review Article

Volume 8, Issue 6 -2022

DOI: http://dx.doi.org/10.22192/ijcrms.2022.08.06.001

Epidemiology of *Echinococcous granulosis* in dogs with due emphasis on biology, mode of transmission and public health importance

Yacob Hailu Tolossa

Addis Ababa University, College of Veterinary Medicine and Agriculture

P.O. Box 24, Bishoftu, Ethiopia

*Corresponding author: email: *yacob.hailu@aau.edu.et*

Abstract

Echinococcosis/hydatidosis is a zoonotic parasitic disease caused by the dog tapeworm Echinococcus and its larval stage, the hydatid cyst. It is characterized by the formation of variably sized cysts in the visceral organs of the intermediate hosts and adult tapeworm in the intestine of dogs. The disease is chronic and affects all kinds of food animals, including herbivorous and omnivorous mammals. The distribution of *E. granulosus* is higher in developing countries, especially in rural communities where there is close contact between the dog, the definitive host, and various domestic animals, which may act as intermediate hosts. Echinococcosis is associated with severe morbidity and disability and is one of the world's most geographically widespread zoonotic diseases. Hydatid disease results in loss of millions of money in terms of public health each year and lowered productivity of infected animals. The objective of this seminar paper is to review the epidemiology, pathogenesis, diagnosis, control and prevention of hydatidosis and its public health and economic impact. The life cycle is complex, involving two hosts and a free-living egg stage. The dynamics of the transmission of the parasite are determined by the interaction of factors associated with these two hosts and with the external environment. Echinococcosis 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 legislation.

Keywords: Definitive host; *Echinococcus granulosus*; Hydatidosis; Intermediate host; Zoonosis

Introduction

Echinococcus granulosus is one of cestodes that caused cystic hydatid disease (cystic Echinococcosis), and this parasite is transmitted from carnivores (dogs, foxes, leopards, lions, and hyenas), which are the definitive hosts of E. granulosus and the parasite (the adult stages) lives in their intestines, to herbivores (sheep, goats, camels, cows, buffaloes, horses, donkeys, pigs and rabbits), which are intermediate hosts of the parasite where the larvae (hydatid cyst) live (Arafa,2003).

The tapeworm spends most of its adult life in the intestine of its definitive host, namely canids and in particular the dog. 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 (Ahmadi and Meshkehkar, 2011;Budke and Torgerson, 2003).

Humans can also act as aberrant intermediate hosts if they ingest infective parasite eggs either through contaminated food or directly from an in fectedcanid. A cystic larval form (metacestode) gradually develops, most commonly in the liver or lungs. However, other organs can also be affected (Deplazes and Eckert, 2004). The symptoms of echinococcosis depend on the size, number and the location of the metacestodes. Until the cysts become large enough to damage adjacent tissues and organs, they are usually asymptomatic. The clinical signs are those of a mass lesion (Kammerer and Schantz, 1993).Clinical signs typically develop as a result of this space-occupying lesion exerting pressure on surrounding tissues. Rupture of the cyst and spillage of the contents may cause anaphylactic shock and secondary CE (Deplazes and Eckert, 2004).

In herbivorous animals and in people who become infected by accidentally ingesting E. granulosus ova, the cystic larval form (hydatid cyst) develops, and can cause serious morbidity (WHO, 2001).

E.grnulosus has a worldwide geographical distribution and occurs in all countries. High prevalence is found in parts of Eurasia, Africa, Australia, and South America (Eckert *et al.*, 2001).

Cystic echinococcosis is one of the major parasitic diseases which affect the health and productivity of food animals in Ethiopia (Abebe *et al.*,2013). Losses in productivity such as reduction in carcass weight, milk production, fleece and wool value, fertility, hide value, birth rate and fecundity; delayed performance and growth; condemnation of organs, especially liver and lungs; and costs for destruction of infected viscera are the major economic impacts associated with cystic echinococcosis in food-producing animals (Otero-Abad, &Torgerson, 2013; Singh *et al.*, 2013).

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 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 (Abebe *et al.*, 2013).

The aim of this review was to bring together available data from primary research conducted so far on the epidemiology, biology of *E.granulosus* in dog, mode of transmission of *E,granulosus* and its public health importance.

Epidemiology of *Echinococcus granulosus* in dog

It is customary to consider the epdimology of as being based on two cycle, pastoral and sylvatic. In the pastoral cycle, the dog is always involved, being infected by the feeding of ruminant offal containing hydatid cysts. The domestic intermediate host will vary according to the local husbandry but the most important is the sheep, which appears to be the natural intermediate host, scolices from these animals being the most highly infective for dog. The pastoral cycle is primary source of hydatidosis in man, infection being by accidental ingestion of onchospheres from the coats of dog, or from vegetables and other foodstuffs contaminated by dog feces. The sylvatic cycle occurs in wild canids and ruminants and is based on predation or carrion feeding. It is less important as source of human infection, except in hunting communities where the

infection may be introduced to domestic dogs by feeding of viscera of wild ruminants(Duncanj and Urquhart, 1996).Complex situations of coexisting or overlapping domestic and sylvatic cycles also exist in other regions (for example, in Africa and Eurasia) and represent special problems in echinococcosis control (Jenkins, 2002; Macpherson, 2001).

The degree of infectivity and availability of egg in the environment, and the feeding behavior of the intermediate host determine the number of infective organisms entering the host (Gemmell *et al.*, 2001; Torgerson *et al*., 2002; Zanini *et al*., 2006).

Epidemiologically, CE occurs mostly in poor communities raising sheep and other livestock, and involving dogs in guarding as well as herding animals.*E. granulosus* is mainly transmitted in a cycle between dog definitive hosts and livestock (mainly sheep); the human behaviour also helps to perpetuate the domestic cycle of *E. granulosus* (Craig, 2007).

Certain deeply rooted traditional activities could be commonly described as factors substantiating the spread and high prevalence rates of the disease. These include the wide spread back yard animals slaughter practice, the absence of rigorous meat inspection procedure and the long standing habit of most Ethiopian people to feed their dogs with condemned offal which in effect facilitate the maintenance of the perfect life cycle of Echinococcus (Kebede,2009).

The parasite spreads almost all over the world, but it is more common in rural areas with large pastoral areas, where there are large numbers of animals that are hosts of the parasite, such as cattle, sheep, and others, with the presence of definitive hosts in these areas especially dogs (Craig, 2008).It is highly endemic in parts of Africa, Europe, Australia, Asia, and the Mediterranean countries as well as Middle Eastern countries including Iran, Saudi Arabia, Kuwait, Jordan, Palestine, Syria, Lebanon, and Iraq (McManus, 2012; Nasrieh,2003). The epidemiology of the disease depends on the economic and agricultural factors and the level of learning and health and social culture in the human society where the parasite is spread, and what helps to spread the disease is the mixing with pets, especially dogs, in the absence of appropriate health conditions (Al-Shahwani,2010).

The Life cycle

Like other cestodes, species of Echinococcus require two different host species to complete their life cycles. Definitive hosts harbouring the adult tapeworm in the small intestine are exclusively carnivores and intermediate hosts harbouring the larval stage (metacestodes) are herbivorous or omnivorous. They feed on the intestinal contents of the host without causing any symptoms as they do not invade tissues. When mature, Echinococcus worms shed the terminal proglottids containing eggs which pass with the faeces to the environment (Budke and Torgerson, 2003).

The intermediate hosts acquire the infection by accidental ingestion of the eggs with contaminated food or water. Larvae contained in the eggs (oncospheres) emerge from the eggs in the small intestine, invade blood vessels and may migrate into almost every part of the body. There, the metacestodes grow for months or years forming fluid-filled cysts or vesicles. Protoscolices are produced within the metacestode in a phase of non-sexual reproduction. Once the metacestode is eaten by a suitable definitive host, these protoscolices will grow into adult tapeworms. The occurrence of a parasite in a particular host assemblage like dog/sheep or dog/horse reflects a variable degree of host parasite adaptation (Budke and Torgerson, 2003).

The adult *E. granulosus* (sensulato) (2–7 mm long) 1) resides in the small intestine of the definitive host. Gravid proglottids release eggs 2) that are passed in the feces and are immediately infectious. After ingestion by a suitable intermediate host, eggs hatch in the small intestine and release six-hooked oncospheres3) that penetrate the intestinal wall and migrate through the circulatory system into various

organs, especially the liver and lungs. In these organs, the oncosphere develops into a thick-walled hydatid cyst 4) that enlarges gradually, producing protoscolices and daughter cysts that fill the cyst interior. The definitive host becomes infected by ingesting the cyst-containing organs of the infected intermediate host. After ingestion, the protoscolices5) evaginate, attach to the intestinal mucosa, 6) and develop into adult stages in 1)32–80 days. Humans are aberrant intermediate hosts and become infected by ingesting eggs.2) Oncospheres are released in the intestine, 3) and hydatid cysts develop in a variety of organs.4) If cysts rupture, the liberated protoscolices may create secondary cysts in other sites within the body (secondary echinococcosis).

Mode of transmission of Echinococcus granulosus

The definitive hosts become infected with the adult worm when they feed on the hydatid cysts, which are found in the organs of the intermediate host, such as infected sheep (Krauss *et al*., 2003; Moroand Schantz, 2009).In developing countries, due to lack of effective meat inspection, and also a backyard slaughter practices, the hydatid cyst infected visceras are deliberately left for home and stray dogs consumption. This type of unhygienic practice plays a major role in the maintenance and transmission of the disease in dog. This is particularly true in sub-Saharan Africa countries including Ethiopia (WHO / OIE, 2002).

Humans become exposed to the eggs of the tapeworm after close contact with an infected dog or its contaminated environment (Craig *et al.*, 2007).The infected dogs pass in their feces E. granulosus eggs that adhere to hairs on the dog, and humans become exposed to the eggs after close contact with the dog (or its contaminated environment), and (humans) infected following accidental ingestion of*E. Granulosus* eggs, or children in the course of playful and intimate contact with the infected dogs. Indirect transfer of *E. granulosus* eggs in contaminated water and uncooked food can also cause human infection. Certain human activities (e.g., the widespread rural practice of feeding dogs the viscera of home-butchered sheep) facilitate transmission of the sheep strain and consequently increase the risk of human infection (Moro *et al*., 2008).

Detection of *Echinococcoccus granulosus* and diagnosis of echinococcosis

In dog

The detection of Echinococcus infections in canines is important for epidemiological surveillance and evaluation of echinococcosis control programs. Diagnosing Echinococcus infections in dogs and other definitive hosts is problematical as the eggs of taeniidcestodes are extremely similar, and thus identification by microscopic examination of the faeces is risky and non-specific(Zhang *et al*., 2003).Recently, a PCR for specific detection of DNA from E. granulosus egg has been developed (Abbasi *et al*., 2003).

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 copro DNA (Craig *et al*., 2015).

Coproscopic method

This is a concentration method in which a saturated solution is used to separate *E.granulosus* eggs from feces (Nonaka *et al.*, 2008).A modification of the formalin-ether sedimentation technique was used for the taeniid egg detection in fecal samples. Briefly, about 1 g of stool was collected with a spatula and emulsified in 3 mL of 10% formalin in a mortar using a pestle for proper emulsification. The stool emulsion was poured through a fine mesh of 250 µm into a 15 mLcentrifuge tube. The stool was washed through the gauze using 2 mL of 10% formalin. About 3 mL of ethyl acetate, in substitution of diethyl ether of the original method was added to the content of the centrifuge tube and mixed. The mixture was centrifuged at 448 g for 5 min. After centrifuging, four layers were formed in the tube; an ethyl acetate layer, plug of debris, formalin layer and the sediment. The top three layers were discarded and the sediment was mixed thoroughly. Two drops of sediment were placed on a glass slide with one drop of iodine solution

and a cover slip was applied. The entire cover slip was then examined under an optical microscope (Rojekittikhun *et al*., 2015).

The eggs are ovoid (30µm-40µm diameter) consisting of hexacanth (six hooks onchospheres) they have highly resistant keratinized embryophore which gives the eggs dark striated appearances, the outer capsule quickly disappear once the egg is liberated (Thompson, 1986).

Adult parasites detection and identification

Necropsy

Post-mortem examination (necropsy) of the entire small intestine (SI) for the presence of the small (3–7 mm) adult tapeworms is the gold standard for the detection of canine echinococcosis(Craig, 1997; Eckert *et al*., 2001).Necropsy is an inexpensive method for determining the prevalence in a population and the best way to determine worm burden (Duscher *et al.*, 2005).

The small intestine is removed as soon as possible after death, and tied at both ends. If the material is not frozen or formalin fixed (4–10%), it should be examined quickly, as the parasite can be digested within 24 hours. Formalin does not kill eggs. The fresh intestine is divided into several sections and immersed in 0.9% saline at 38±1°C for examination. Worms adhering to the intestinal wall may be observed and counted by means of a hand lens. *E.granulosus* is usually found in the first third of the small intestine of dogs.(Duscher *et al.*, 2005).

Arecoline purging

Arecoline is a parasympathomimetic drug that, when given to dogs in tablet or liquid form at doses between 1 .75-3.5 mg/kg body weight, purges the entire intestinal contents, increases intestinal peristaltic movements, and paralyses the tapeworms. These can then be collected and identified.(Eckert *et al*., 2001). The dogs should ideally be starved for 12 hr prior to dosing and usually produce purge within 30 min to 1 hr (Craig, 1997).

Arecoline purgation is time consuming, can bebiohazardous hazardous to the operator and occasionally produces severe reactions in the dogs (Torgerson and Budke, 2003). Although the technique is 100% specific, it has low sensitivity as not every dog will purge (up to 25%), and a significant number of carriers are not detected (Craig, 1997; Schantz *et al*., 1995). Purged material is examined using a magnifying glass, although further examination with a dissecting microscope is recommended (Craig, 1997). Purging remains the only quantitative technique that can be used in the living dog and continues to play an important role in epidemiological studies (Torgerson *et al.*, 2003).

Coproantigen detection by ELISA

A specific and sensitive laboratory test for antigen detection in canidfaecal samples (coproantigen) was considered to have the potential to replace arecoline purgation and to have the advantage over serology for detection of current infection (Allan *et al*., 1992; Deplazes *et al*., 1992).

Coproantigen ELISA or coproELISA provides an alternative method for diagnosing canine echinococcosis, and both polyclonal and monoclonal antibodies have been used: directed against either somatic or excretory/secretory (ES) antigens (Benito and Carmena, 2005).

Canineechinococcosis due to *E. granulosus* most authors report reasonable sensitivity (78–100%) and good genus specificity from 85% to greater than 95% (Benito and Carmena, 2005; Buishi*et al*., 2005), as well as a degree of pre-patent detection (Jenkins *et al*., 2000).

Copro ELISA sensitivity broadly correlates with worm burden of *E. granulosus*, however some low intensity infections (worm burdens <50–100) may give false negatives in copro ELISA. Copro ELISAs offer several logistical advantages over purgation: not least due to the fact that faecal samples can be collected from the ground by one person, thus avoiding difficulties associated with restraining and purging dogs by multiple trained personnel (as well as the reduced biohazard risk associated with the process).Coproantigens are

rich in carbohydrate/glycoprotein and thus generally very stable, can be detected in ground faecal samples after days of environmental exposure, and can be preserved in a 5–10% formalin solution for several months without refrigeration (Allan and Craig, 2006).This is a great advantage for field-based studies, especially as echinococcosis often affects rural and relatively remote communities (Craig *et al*., 2007).

Detection of copro-DNA by PCR

Copro- DNA has proven to be of value for the diagnosis of echinococcosis in animal definitive hosts. DNA isolation from the feces, however, is laborious .PCR is technically demanding and expensive technique. It is currently used mainly for confirmatory testing of coproantigen positive samples or for identification of taenid eggs recovered from feces (Bretagne *et al*., 1993).

Serological tests

Serodiagnostic tests for canine echinococcosis were considered to have good potential for practical testing of dogs for *E. granulosus* infection and, initially, as a potential substitute for arecoline purgation. Diagnostic specificity was good (>90%) but sensitivity was generally poor (35–40%) with natural infections, and was much lower when compared directly with coproantigen detection (Jenkins *et al*., 1990).

Diagnostic methods in human

In humans, cycticechinococcosis is diagnosed mainly with imaging techniques such as ultrasonography, radiology, magnetic resonance imaging (MRI) or computed axial tomography (CT scanning), supported by serology (Pal, 2007). Serological tests used in humans include enzyme-linked immunosorbent assays (ELISAs), indirect immunofluorescence, indirect hemagglutination, immunoblotting and latex agglutination. Complement fixation is now rarely used. Some people with cysts do not develop detectable antibodies. False positives, which include cross-reactions with other taeniidcestodes, are also possible (Ito, 2002).

Biopsies can also be used in diagnosis, but there is risk of cyst leakage or rupture, and antiparasitic drugs must be given concurrently. Ultrasonography-guided fine-needle puncture can distinguish cysts from tumors, abscesses and other lesions. The cyst fluid recovered with this technique can be examined for protoscolices and other evidence of the parasites. It may also be tested for Echinococcus antigens with an antigen-detection ELISA, or for parasite DNA using polymerase chain reaction (PCR) assays. When the lungs are affected, protoscolices might be found in sputum or bronchial washings (Zhang *et al*., 2003).

Public health importance of the diseases

Cystic echinococcosis (CE) caused by larval stages of *Echinococcus granulosus* is one of the most common zoonotic diseases associated with great public health significance worldwide (Romig *et al.*, 2011). Echinococcus infections are estimated to affect approximately two to three million people worldwide, with Africa amongst the primarily endemic regions (Cummings *et al*.,2009). CE in humans has frequently been reported from different regions of the country (Erbeto*et al*.,2010).The disease is more common in rural areas, where dogs and domestic animals live in very close association(Fromsa and Jobre,2011). In humans the cyst may reside and grow in liver, lung and other visceral organs. Occasional rupture of the cysts often leads to sudden death because of anaphylaxis, hemorrhage and metastasis(Getaw*et al*., 2010).

Echinococcosis due to Echinococcusgranulosus which occurs at high prevalence in both dogs and livestock and also accounts for the highest number of condemned lungs in slaughterhouses is of major public health concern in Ethiopia (Meresie, 2006). Dogs are the most successful canids adapted to human habitation world-wide. They have contributed to physical, social and emotional well-being of their owners, particularly children who are often at greatest risk of exposure (Ugbomoiko *et al*., 2008).

The occurrence of the disease in humans in Ethiopia was described earlier by Graber. However, the situation of the disease in humans is not well documented and explored so far in the country. In the northern part of the country of the regional state of Tigray all the six hospitals pretending to this area had disclosed diagnosing one active clinical case in Mekelle hospital during the study period of 2008 (Kebede *et al*., 2009). Similarly in the southern part of Ethiopia, the existence of human hydatidosis was confirmed in south Omo region(Teketay *et al*., 2009).

The impact of hydatidosis varies with the location(s) of the cysts. When the cyst occurs in the liver, common symptoms include abdominal pain, nausea, vomiting and indigestion. If the cyst obstructs the biliary system, it can mimic gallstones and cause pain or cholestasis jaundice. Hepatomegaly, anemia, pleural pain, ascites and portal hypertension can also be seen.

Cysts in the lungs are more likely to be clinically apparent while they are still small, compared to those in the liver. In the lungs, cysts can cause respiratory signs including chronic cough, chest pain, dyspnea and hemoptysis, particularly if they rupture. Abscess formation (from secondary bacterial infection of the cyst) and pneumothorax can also occur, and fragments of the capsulemay cause arterial embolism. Neurologic signs, including blindness and seizures, may be seen if the brain or spinal cord is affected. Cysts in the bones can destroy the structure of the bone and result in spontaneous fractures. In the heart, a cyst can result in pericardial effusion, heart block or other arrhythmias, and sudden death. Cysts in any location may become secondarily infected by bacteria. *Echinococcosis granulosus* cysts can also be asymptomatic throughout the individual's life, and may be incidental findings at surgery or autopsy. Some cysts may die and not develop further (Moro *et al*., 2008).

In retrospective study, 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 (Abiyot*et al*., 2011; W. Kebede*et al*., 2009). Besides, during 1995 and 2005, 234 patients were operated for hydatid disease at TikurAnbessa Hospital in Addis Ababa 137 patients during1994-2006 was treated for hepatic hydatidosis). Overall this few findings show huge magnitude of the problem (Hagos*et al*., 2006; Minas *et al*., 2007).

Treatment

Adult hydatid tapeworms in dogs can be eliminated from the animal's intestines using tapeworm'sspecific anticestodal medications such as praziquantel. Praziquantel is the anti cestodal drug most commonly included in commercially available dog(Ajioum*et al*., 1994). praziquantel is found effective against both juvenile and adult Echinococcus Parasites (Krauss *et al*., 2003).When an adequate dose of an appropriate anti tapeworm drug is administered to the dog ,the tapeworms die and are voided in the host animal's feces. The single treatment is usually curative, however, several dose may be needed to completely rid an animals of very large hydatid tapeworm burden (Ajioum *et al*., 1994).

CE treatment centers on cyst type according to the WHO-IWGE US classification depend on size, location, and presence/absence of complications (Brunetti *et al*., 2010). Four treatment options are currently available. They are surgery, PAIR and chemotherapy with albendazole, mebendazole or other anthelmintic drugs (Junghanss *et al*., 2008). Medical treatment is used for reducing cysts, decreasing infectivity and avoiding relapses. Besides, drugs are useful in disseminated or inoperable CE as the sole modality of treatment. To date, the medical treatment of CE is based on drugs of the benzimidazolefamily; usually albendazole (Alvela-Suárez *et al*., 2014; Stojkovic*et al*., 2009).Over the last few years, praziquantel has been associated with albendazole (Cobo *et al., 1998;* Mohamed et *al*., 1198). In addition, other drugs like nitazoxanide have also been used in disseminated CE (Pérez Molina *et al*., 2011).

Curative treatment is achieved by the complete removal of the cyst, regardless of location. If the cyst with all its layers (including adventitia) cannot be removed totally, which is the case with sub-total cystectomy and all types of partial

cystectomy and with the percutaneous "PAIR" (puncture, aspiration, injection, and reaspiration) technique, the therapeutic procedure should be complemented with the use of protoscolecidal agents. Intraoperative dissemination of protoscolex-rich fluid during surgery and insufficient killing of protoscoleces and germinal membrane during the percutaneous procedures are major causes of CE recurrence (Brunetti *et al*., 2010).

Prevention and control methods

Echinococcosis can be controlled through preventive measures that break the life cycle of between the definitive and intermediate hosts. These measures include a complete deprivation of dogs from the access of infected raw offals by proper disposal of hydatid cysts possessing condemned offals at abattoirs, local slaughterhouses, back yards and on farms. Further control methods include introduction of appropriate meat inspection, establishment of local slaughterhouses, education of the people, effective implementation of legislative measures, burning or burial of condemned offals and sterilization of offals, if it is going to be used as dog food (Craig *et al*., 2007).

Specific control measures including stray dogs control, registration of all owned dogs, spaying of bitches, and treatment of all (or most) dogs with praziquantel at predetermined intervals for example every 6-8 weeks (Craig *et al*., 2007; Pedro and Peter, 2009).

Deworming of dogs is based on the regular treatment of dogs to eliminate the adult tapeworm and on the prevention of infection in dogs by exclusion from their diet of animal material containing hydatids. This is achieved by denying dogs access to abattoirs, and where possible, by proper disposal of carcasses. Proper disposal of the carcass is by deep burial or incineration (Coop *et al*., 2007).Transmission to humans can be controlled by eating vegetables by washing properly, keeping foods closed, personal hygiene, and avoiding kissing dogs, preventing the egg from being transferred to humans (Paniker, 2007).Prevention of cystic echinococcosis measures also includes restricting home slaughter of sheep and other livestock, not consuming any food or water that may have been contaminated by fecal matter from dogs, washing hands with soap and warm water after handling dogs and before handling food, and teaching children the importance of washing hands to prevent infection(CDC,2012).

Prevention can be achieved by strict hygiene measures like hand washing after animals handling, in particular dogs (Parija, 2004). 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).

A regular examination and programmed treatment of dogs, particularly sheep-dogs, can decrease echinococcosis in domestic animals (Craig *et al*., 2007). One time treatment of definitive host is not adequate for the questions of reinfection. Eradication or control of *E. granulosus* had been successfully achieved by breaking sheep/dog cycle in Iceland, New Zealand and Tasmania. This programs have targeted to the parasite in domesticated dogs by regular surveillance, and if necessary, treatment. Education campaigns have also been used, either alone or in conjunction with programs aimed at dogs. The elimination of farm slaughter of sheep reduces the risk that dogs will be infected from this source (Craig *et al*., 2007).

Application of an effective vaccine to reduce hydatid infection in livestock would be likely to have a substantial impact on the rate of transmission of the disease to humans (Lighttowlers, 2006).

In conclusion, 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 pet.
- Backyard, open air and road side slaughteringpractice should be prevented by implementing the law and regulation of meat inspection.
- Meat should be properly inspected bysufficient number inspectors at the abattoir.

References

Arafa MI. Hydatids vesicular disease in humans and animals, the growing disease in the spread. Assiut Journal of Environmental Studies.2003 ;(**12**):181-188.

WHO, 2001.WHO/OIE Manual on Echinococcosis in Humans and Animals, a Public Health Problem of Global Concern. Eckert J, Gemmel MA, Meslin FX, Pawlowski ZS, eds. Geneva: World Health Organization.

J. Eckert, P. M. Schantz, R. B. Gasses et al., "Geographic distribution and prevalence of echinoccosis," in WHO/OIE Manual on Echinococcosis in Humans and Animals: A Public Health Problem of Global Concern, J. Eckert, M. A. Gemmell, F. X. Meslin, and Z. S. Pawlowsk, Eds., pp. 101-102, WHO,Geneva, Switzerland, 2001.

Kammerer,W.S. and Schantz, P.M. 1993. Echinococcal disease. Infectious Disease of Clinics of North America 7: 605-609.

Abebe, A., Beyene, D., &Kumsa, B. (2013). Cystic echinococcosis in cattle slaughtered at Gondar Elfora export Abattoir, Northwest, Ethiopia. Journal of Parasitic Diseases, 107,229–234.

Otero-Abad, B., &Torgerson, P. R. (2013).A systematic review of the epidemiology of echinococcosis in domestic and wild animals.PLoS Neglected Tropical Diseases, 7(6), e2249.

Singh, B. B., Dhand, N. D., Ghatak, S., & Gill, J. P. S. (2013). Economic losses due to cystic echinococcosis in India: Need for urgent action to control the disease. Preventive Veterinary Medicine, 113(1), 1–12.

Ibrahim, M. M. (2010). Study of cystic echinococcosis in slaughtered animals in Al Baha region, Saudi Arabia: Interaction between some biotic and abiotic factors. ActaTropica, 113, 26–33.

Romig, T., Omer, R. A., Zeyhle, E. T., Hüttnera, M., Dinkela, A., Siefert, L., et al. (2011).Echinococcosis in sub-Saharan Africa: Emerging complexity. Veterinary Parasitology, 181, 43–47.

Abebe, A., Beyene, D., &Kumsa, B. (2013). Cystic echinococcosis in cattle slaughtered a Gondar Elfora export Abattoir, Northwest, Ethiopia. Journal of Parasitic Diseases, 107, 229–234.

Torgerson, P.R. and Budke, C.M., 2003. Echinococcosis – an international public health challenge. Res. Vet. Sci., **74**, 191–202.

Ahmadi, N.A. and Meshkehkar, M., 2011.An abattoir-based study on the prevalence and economic losses due to cystic echinococcosis in slaughtered herbivores in Ahwaz, south-western Iran. J. Helminthol. 85, 33–39.

Eckert J, Deplazes P (2004) Biological, epidemiological, and clinical aspects of echinococcosis, a zoonosis of increasing concern.ClinMicrobiol Rev 17: 107–135.

Craig PS, McManus DP, Lightowlers MW, Chabalgoity JA, Garcia HH, Gavidia CM,

et al. Prevention and control of cystic echinococcosis. Lancet Infect Dis 2007; 7: 385-394.

Jenkins, D. J. 2002. Echinococcus in Australia: the role of wildlife in transmission, with particular reference to South Eastern Australia, p. 327–332. In P. Craig and Z. Pawlowski (ed.), Cestodezoononoses: echinococcosis and cysticercosis, an emergent and global problem. IOS Press, Amsterdam, The Netherlands.

Macpherson, C. N. L. 2001. Epidemiology of Echinococcusgranulosus in transhumant situations, p. 156–163. In J. Eckert, M. A. Gemmell, F.-X. Meslin, and Z. S. Pawlowski (ed.), WHO/OIE manual on echinococcosis in humans and animals: a public health problem of global concern. World Organisation for Animal Health, Paris, France.

Kebede, W., A. Hagos, Z. Girma and F. Lobago, 2009.Echinococcosis: Its prevalence, economic and public health significance in Tigray region, northern Ethiopia. Tropical Animal Health and Production, 41: 865-871.

Urquhart, G.M and Duncanj, L,(1996):Veterinary parasitology,2nd edition ,UK, Pp 350-370

Torgerson P.R., &Budke C.M.(2003). Echinococcosis-an international public health challenge. Res. Vet. Science. 74, 191-202.

[Figure] Higuita NIA, Brunetti E, McCloskey C. Cystic echinococcosis (Review). Journal of Clinical Microbiology. 2016;54(3):518-523

Craig PS, Li T, Qiu J, Zhen R, Wang Q , Giraudoux P, et al. Echinococcosis and Tibetan communities. Emerging Infectious Disease.2008;14(10):1674-1675

McManus DP, Gray DJ, Zhang W, Yang Y. Diagnosis, treatment, and management of Echinococcosis.British Medical Journal. 2012; 344(7861):39-44

Nasrieh MA, Abdel-Hafez SK, Kamhawi SA. Cystic echinococcosis in Jorden: Socioeconomic evaluation and risk factors. Parasitology Research. 2003; 90:456-466

Al-Shahwani TA. The effect of some plant extracts on the vitality of protoscoleces of E. granulosus of sheep origin and its growth within vivo [master thesis]. University of Mosul; 2010. 160 p

Craig PS, McManus DP, Lightowlers MW, ChabalgoityJA,Garcia HH, Gavidia CM, et al. Prevention and control of cystic echinococcosis. Lancet Infect Dis 2007; 7: 385-394.

Moro PL, Cavero CA, Tambini M, Briceno Y, Jimenez R, Cabrera L. Identification of risk factors for cystic echinococcosis in a periurban population of Peru. Trans RylSoc Trop Med Hyg 2008; 102: 75-78.

CRAIG P.S., MASTIN A., VAN KESTERIN F. & BOUFANA B. (2015). Echinococcusgranulosus: Epidemiology and state-of-the-art of diagnostics in animals. Vet. Parasitol, 213, 132–148.

Zhang W, Li J & McManus DP (2003) Concepts in immunology and diagnosis of hydatid disease. ClinMicrobiol Rev 16: 18–36

Abbasi, I., Branzburg, A., Campos, P.M., Abdel Hafez, S.K., Roul, F., Craig, P.S. and Hamburger, J., (2003): Copro-diagnosisis of Echinococcusgranulosus infection in dogs by amplification of newly identified repeated DNA sequence. Am. J. Trop. Med. Hyg, 69: 3254-3360.

Rojekittikhun, W.; Mahittikorn, A.; Prummongkol, S.; Puangsa-Art, S.; Chaisiri, K.; Kusolsuk, T. Evaluation of Sugar Flotation and Formalin-Ether Concentration Techniques in the Examination of GI Parasites of Refuge Dogs and Cats in Kanchanaburi Province, Thailand. J. Trop. Med. Parasitol. 2015, 38, 17–24

Nonakan, N, Okam, H, Kamiya, M and Okuy,y,(2008):Alatex agglutination test for the detection of Echinococcusmultiloculariscoproantigen in the definitive hosts Vet.parasitol of pediatric,755:87-89.

Thompson, R.C.A. (1986): Biology and systematics of Echinococcusgranulosus. In: The biology of Echinococcus and hydatid disease. (RCA. Thompson ed.).

London. George Allen and Unwin. pp. 5-6.

Duscher G., Prosl H. & Joachim A. (2005).Scraping or shaking—a comparison of methods for the quantitative determination of Echinococcusmultilocularis in fox intestines.Parasitol.Res, 95: 40-42.

DuscherG,Prosl H, & Joachim A(2005). hand scraping or shaking – a compassion of methods for the quantitative determination of Echinococcusmultiocularis in fox intestine,parasitol,Res,95:40-42.

Craig, P.S. (1997).Immunodiagnosis of Echinococcusgranulosus and a comparison of techniques for diagnosis of canine echinococcosis In: Compendium on Cystic Echinococcosis in Africa and in Middle Eastern Countries with special reference to Morocco, eds. Andersen, F.L., Ouhelli, H. and Kachani, M. Brigham Young University, Provo, Utah, 84602, pp. 85-118.

Torgerson, P.R. and Budke, C.M. (2003).Echinococcosis – an international public health challenge. Research in Veterinary Science, 74: pp. 191-202.

Schantz, P.M., Chai, J., Craig, P.S., Eckert, J., Jenkins, D.J., Macpherson, C.N.L. and Thakur, A. (1995).Epidemiology and control of hydatid. In: Echinococcus and Hydatid disease, eds. Thompson, R.C.A. and Lymbery, A.L. CAB International, Wallingford, Oxon, pp. 233-331.

Torgerson, P.R. and Heath, D.D. (2003).Transmission dynamics and control options for Echinococcusgranulosus. In: Echinococcosis: Transmission: Biology and epidemiology, Eds Craig, P.S. and McManus, D.P. Cambridge University Press.Parasitology (supplement), 127: pp. 143-158.

Eckert J, Gemmell MA, Meslin FX, Pawlowski ZS (2001).WHO/OIE Manual on Echinococcosis in Humans and Animals: a Public Health Problem of Global Concerno World Health Organization, Paris, France, 265 pp.

Allan, J.C., Craig, P.S., Garcia Noval, J., Mencos, F., Liu, D., Wang, Y., Wen, H., Zhou, P.,Stringer, R., Rogan, M.T., Zeyhle, E., 1992. Coproantigen detection for immunodiagnosis of echinococcosis and taeniasis in dogs and humans.Parasitology 104, 347–355.

Deplazes, P., Gottstein, B., Eckert, J., Jenkins, D.J., Ewald, D., Jimenez-Palacios, S., 1992.Detection of Echinococcuscoproantigens by enzyme-linked immunosorbent assay in dogs, dingoes and foxes.Parasitol. Res. 78, 303–308.

Benito, A., Carmena, D., 2005. Double-antibody sandwich ELISA using biotinylated antibodies for the detection of Echinococcusgranulosuscoproantigens in dogs. Acta Trop. 95, 9–15.

Buishi, I.E., Njoroge, E.M., Bouamra, O., Craig, P.S., 2005. Canine echinococcosis in northwest Libya: assessment of coproantigen ELISA, and a survey of infection with analysis of risk-factors. Vet. Parasitol. 130, 223–232.

Jenkins, D.J., Fraser, A., Bradshaw, H., Craig, P.S., 2000. Detection of Echinococcusgranulosuscoproantigen in Australian canids with natural and experimental infection. J. Parasitol. 86, 140–145.

Allan, J.C., Craig, P.S., 2006. Coproantigens in taeniasis and echinococcosis.Parasitol.Int. 55, S75–S80.

Craig, P.S., Budke, C., Schantz, P.M., Li, T., Qiu, J., Yang, Y., Zehyle, E., Rogan, M.T., Ito, A., 2007.Human echinococcosis—a neglected disease? Trop. Med. Hyg. 35, 283–292.

JENKINS D.J., GASSER R.B., ZEYHLE E., ROMIG T. & MACPHERSON C.N.L. (1990).Assessment of a serological test for the detection of Echinococcusgranulosus infection in dogs in Kenya.Acta Trop., 47, 245–248.

Bretagne, S.,Guiloum, JP, Morand,M. and Houin,R. (1993): detection of Echinococcusmultilocularis: DNA in fox feces using DNA hybridaization. Parasitology, 106:193-199.

Pal, M. 2007. Zoonoses.Second Edition, Satyam Publishers, Jaipur, India. Pp. 234-235.

Ito, A. 2002.Serologic and molecular diagnosis of zoonotic larval cestode infections. Parasitology International 51: 221–35.

Zhang, W., Li, J. and McManus D.P. 2003.Concepts in immunology and diagnosis of hydatid disease. Clinical Microbiology Review 16: 18–36.

Brunetti E, Kern P, Vuitton DA. 2010. Expert consensus for the diagnosis and treatment of cystic and alveolar echinococcosis in humans. Acta Trop 114:1–16.

Junghanss T, da Silva AM, Horton J, Chiodini PL, Brunetti E. Clinical management of cystic echinococcosis: state of the art, problems, and perspectives. Am J Trop Med Hyg.2008; 79:301–1.

Stojkovic M, Zwahlen M, Teggi A, Vutova K, Cretu CM, Virdone R, et al.Treatment response of cystic echinococcosis to benzimidazoles: a systematic review. PLoSNegl Trop Dis. 2009; 3:e524.

Alvela-Suárez L, Velasco-Tirado V, Belhassen-Garcia M, Novo-Veleiro I, Pardo-Lledías J, Romero-Alegría A, Pérez del Villar L, Valverde-Merino MP,Cordero-Sánchez M. Safety of the combined use of praziquantel and albendazole in the treatment of human hydatid disease. Am J Trop Med Hyg.2014; 90:819–22.

Mohamed AE, Yasawy MI, al MA K. Combined albendazole and praziquantel versus albendazole alone in the treatment of hydatid disease. Hepato-Gastroenterology.1998; 45:1690–4.

Cobo F, Yarnoz C, Sesma B, Fraile P, Aizcorbe M, Trujillo R, et al. Albendazole plus praziquantel versus albendazole alone as a pre-operative treatment in intra-abdominal hydatisosis caused by Echinococcusgranulosus. Trop Med Int Health.1998; 3:462–6.

Pérez Molina JA, Díaz-Menéndez M, Gallego JI, Norman F, Monge-MailloB,Ayala AP, et al. Evaluation of nitazoxanide for the treatment of disseminated cystic echinococcosis: report of five cases and literature review. Am J Trop Med Hyg.2011; 84:351.

Craig, P. S., McManus, D.P., Lightowlers, M.W., Chabalgoity, J.A., Garcia, H.H., Gavidia, C.M., Gilman, R.H., Gonzalez, A.E., Lorca, M, Naquira, C. Nieto, A. and Schantz, P.M. (2007): Prevention and control of cystic echinococcosis. Lancet. Infect. Dis. 7: 385-394.

Pedro, M. and Peter, M.S. (2009): Division of Parasitic Diseases, Coordinating Center for Infectious Diseases, Atlanta, Georgia, and USA. Cent Dis Cont Prev. 13: 125-133.

M. A. Taylor, R. l. Coop, and R. L. Wall, Veterinary Parasitology, pp. 337–339, Blackwell publishing, Ames, IA,USA, 3rd edition, 2007.

C. K. Paniker, Text Book of Medical Parasitology, pp. 1150–155, Jayple Brothers Medical Publishers, New Delhi, India, 6th edition, 2007.

Centers for disease control and prevention, “Echinococcosis prevention and control,” Global Health, Division of Parasitic Diseases and Malaria, Atlanta, GA, USA, 2012.

Parija, S.C. (2004): Text book of Medicine and Parasitology, Protozology and Helmentology. 2nd edition.India publishers and Distributors, India, New Delhi. pp. 5-39.

Vuitton, D.A., Economides, P. and WHO-IWGE EurEchinoReg Network 2011.

Lightowlers, M.W. (2006): Cestode vaccines: origins, current status and future prospects. Parasitol; 133: 27-42.

Romig T, Omer RA, Zeyhle E, Hüttner M, Dinkel A, et al. (2011) Echinococcosis in sub-Saharan Africa: Emerging complexity. Veterinary Parasitology 181: 43-47.

Cummings H, Rodriguez-Sosa M, Sat Oskar AR (2009) Hydatid disease. In Sat Oskar AR, Simon GL, Hotez PJ, Tsuji M (Eds.), Medical parasitology pp.146-152.

Erbeto K, Zewde G, Kumsa B (2010) Hydatidosis of sheep and goats slaughtered at Addis Ababa Abattoir: Prevalence and risk factors.Tropical Animal Health and Production 42: 803-805.

Fromsa A, Jobre Y (2011) Infection prevalence of hydatidosis (Echinococcus granulosus Batsch, 1786) in domestic animals in Ethiopia: A synthesis report of previous

surveys. Ethiopian Veterinary Journal 15: 11-33.

Getaw A, Beyena D, Ayana D, Megersa B, Abunna F (2010) Hydatidosis: Prevalence and its economic importance in ruminants slaughtered at Adama municipal abattoir, Central Oromia, Ethiopia. Acta Tropica113: 221-225.

Kebede N, Abuhay A, Tilahun G, Wossene A (2009) Financial loss estimation,prevalence and characterization of hydatidosis of cattle slaughtered at DebreMarkos Municipality abattoir, Ethiopia. Trop Anim Health Prod 41: 1787-1789.

Teketay W, Asmare M, Muluken M, Mingistu M (2009) Prevalence of economic and public health importance of Echinococcushydatidosis in Bahir Dar slaughter house. Ethiopia.

Moro,Pedro, MSchantz, Peter (2008) Echinococcosis: A Review. International Journal of Infectious Diseases 13: 125-33.

Kebede, W., Hagos, A., Girma, Z., Lobago, F., 2009.Echinococcosis/hydatidosis: its prevalence, economic and public health significance in Tigray region, North Ethiopia. Trop. Anim. Heal. 41, 865-871.

Abiyot, J., Beyene, D., Abunna, F., 2011.Prevalence of hydatidosis in small ruminants and its economic significance in Modjo Modern Export Abattoir, Ethiopia. J. Public Heal. Epidimol. 3(10), 454-461.

Minas, M., Biluts, H., Bekele, A., Alemie, M., 2007. Surgical Management of 234 patients with hydatid disease: the TikurAnbessa Hospital experience. Ethiop.Med. J. 45, 257-65.

Hagos, B., Mesfin, M., Abebe, B., 2006.Hydatid disease of the liver: A 12 year experience of surgical management. East and Central Afri. J. Surg. 11(2), 54-6.

Krauss H, Weber A, Appel M, Enders B, Isenberg H, Schiefer HG,et al. Parasitic zoonoses. In: Zoonoses: Infectious Diseases Transmissible from Animals to Humans. 3rd ed. Washington, DC: ASM Press; 2003. pp. 334-343.

Moro P, Schantz PM. Echinococcosis: A review. International Journal of Infectious Diseases. 2009; 13(2):125-133.

Ajiouni, A, Q, Saliba, B, K., and Disi, A.M (1994).Intetinalcestodes of stray dog in jordan, 70:203-210.

WHO/OIE, (2002): by Eckert, J; Gemmell. M.A.; Meslin. F-X and Pawlowski, eds: Manual on echinococcosis in humans and animals: a Public Health Problem of Global Concern. pp. 77-78.

Access this Article in Online

Website: www.ijcrims.com

Subject: Veterinary Sciences

Quick Response Code

How to cite this article:
Yacob Hailu Tolossa. (2022). Epidemiology of *Echinococcous granulosis* in dogs with due emphasis on biology, mode of transmission and public health importance. Int. J. Curr. Res. Med. Sci. 8(6): 1-13. DOI: http://dx.doi.org/10.22192/ijcrms.2022.08.06.001