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# Review on the Prevalence and Associated Risk Factors of Parasitic Zoonosis in Ethiopia: Taeniasis

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## Abstract

Parasitic foodborne infections of humans may involve both protozoan and helminth species of internal parasites. The route of infection is normally consumption of the parasite's natural hosts as a human food item. Taeniasis is a parasitic zoonotic disease caused by the adult stage of large tapeworms that live in the intestines of human hosts. Bovine cysticercosis is a food borne disease caused by *Taenia saginata* with humans as the final host and cattle as the intermediate host. Infection of human by *Taenia saginata* occurs through ingestion of raw or undercooked meat containing *Cysticercus bovis* while; infection of cattle with *Cysticercus bovis* occurs through ingestion of *Taenia saginata* eggs. The parasite population of these species consists of three distinct sub populations: adult Tapeworms in the definitive host (man), larvae (Cysticercus or metacestodes) in the intermediate host (pigs or cattle), and eggs in the environment. The most common causative agent in Ethiopia is the beef tapeworm, *Taenia saginata*, which has the cow as its intermediate host. The other tapeworm that can cause taeniasis (*Taenia solium)* has pigs as its intermediate host, but they are not so common in Ethiopia. Taeniasis due to beef tapeworm is highly prevalent in Ethiopia due to the widespread habit of eating raw beef (*kitfo* in Amharic, Figure 38.5) and poor sanitary conditions. Defaecation in open fields in grazing lands, disposal of raw human sewage in rivers and its use as a fertiliser, facilitate the spread of taeniasis. The highest cases of taeniasis are found in the towns of Northern and Eastern Ethiopia.

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## Introduction

Humans suffer from several foodborne helminth zoonotic diseases, some of which can be deadly (e.g. trichinellosis, cerebral cysticercosis) while others are chronic and cause only mild illness (e.g. intestinal taeniosis). The route of infection is normally consumption of the parasite's natural host as a human food item (e.g. meat). The risk for infection with these parasites is highest wherever people have an inadequate knowledge of infection and hygiene, poor animal husbandry practices, and unsafe management and disposal of human and animal waste products. The design of surveillance and control strategies for the various foodborne parasite species, and the involvement of veterinary and public health agencies, vary considerably because of the different life cycles of these parasites, and epidemiological features (CDC, 2011;

WHO, 2013; Uygur-Bayramiçli *et al.,* 2012). Parasitic foodborne infections of humans may involve both protozoan and helminth species of internal parasites. The route of infection is normally consumption of the parasite's natural hosts as a human food item (CDC, 2017). Taeniasis, a disease in humans, is food-borne and caused by consuming raw or uncooked meat containing viable cysticercus (Gracey *et al.,* 2015). In humans, cysticercus develops into a tapeworm and most of the time, patients are asymptomatic. Nevertheless, symptoms can include nausea, abdominal discomfort, flatulence, epigastric pain, diarrhea, vitamin deficiency, excessive loss of appetite, weakness and loss of weight, digestive disturbances, and intestinal blockage (CDC, 2017).

Some parasites, such as the protozoan parasites Toxoplasma, Cryptosporidia and Cyclospora, and fish-borne parasites such as liver and intestinal flukes, are generally not controlled, although, in the trade of marine fish, inspection may be required and/ the fish may be subjected to treatment to inactivate helminth parasites. In this paper a selection of foodborne helminth species of nematode and cestode parasites are discussed, chosen for their public health and economic importance and the demands they place upon Veterinary Services. The examples *Trichinella spiralis* (trichinellosis) and Taeniaspp. (cysticercosis and taeniosis) all share the common epidemiological feature of being meat-borne and they illustrate well the challenges faced in implementing (CDC, 2017; Galán-Puchades and Fuentes, 2013).

*Trichinella spiralis*, which causes most human trichinellosis, is acquired from the consumption of pork, although increasingly cases occur from eating wild game. For cysticercosis, however, the only sources for human infection are pork (*Taenia solium*) or beef (*T. saginata*). The chief risk factor for infection of humans with these parasites is the consumption of meat that has been inadequately prepared. For the pig or cow, however, the risk factors are quite different between Trichinella and Taenia. For *T. spiralis* the major source of infection of pigs is exposure to infected animal meat (which carries the infective larval stage), while for both Taenia species it is human faecal material contaminated with parasite eggs shed by the adult intestinal stage of the tapeworm.

Consequently, the means for preventing exposure of pigs and cattle to infective stages of *T. spiralis, T. solium*, and *T. saginata* vary markedly, especially the requirements for ensuring the biosecurity of these animals at the farm. The surveillance strategies and methods required for these parasites in livestock are discussed, including the required policy-level actions and the necessary collaborations between the veterinary and medical sectors to achieve a national reporting and control programme (Garcia *et al.,* 2014; CDC, 2017).

The terms 'cysticercosis' and 'taeniosis' refer to foodborne zoonotic infections with larval and adult tapeworms, respectively, of the genus Taenia. The important feature of these tapeworms is that the larvae are meat-borne (beef or pork) and the adult stage is an obligate parasite of the human intestine (Galán-Puchades and Fuentes, 2013). *Taenia solium* (pork tapeworm), *T. saginata* (beef tapeworm), and *T. asiatica* ('Taiwan Taenia') are the most important causes of taeniosis in humans (Uygur-Bayramiçli *et al.,* 2012). When humans ingest meat with a cysticercus, the cyst evaginates in the gastrointestinal tract and grows a large series of reproductive segments or proglottids, each of which produces a large number of eggs that reach the environment in the faeces. Cysticercosis is the term for the tissue infection in pigs and cattle. In the case of *T. solium*, however, humans are unique in that they may also serve as an intermediate host in which the larval or cysticercus stage can also develop. When a pig or cow, or humans in the case of *T. solium*, ingests an egg, an onchosphere is released which penetrates the intestinal tissue and enters the bloodstream, where it circulates until filtering out into striated and cardiac muscle; *T. soliumcysticerci* may also invade the eye or the central nervous system (CNS). When cysticerci invade the CNS, neurocysticercosis may result; this zoonosis is now receiving greater attention in sub-Saharan Africa because of the growing recognition of the importance of neurocysticercosis as a cause of epilepsy (CDC, 2011; Assefa and Bihon, 2015).

*Taenia solium* has a cosmopolitan distribution and is highly endemic in Latin America, Africa and Asia, where poverty, poor sanitation, and close contact between humans and livestock are commonplace. It has been estimated that 2.5 million people worldwide are infected with adult *T. solium* (carriers) and that 20 million are infected with cysticerci (Galán-Puchades and Fuentes, 2013). Human carriers (egg shedders) are major targets of control efforts. The rapid expansion of smallholder pig production in Africa and elsewhere has led to a significant increase in cysticercosis in pigs and humans, presenting governments with an important challenge as they seek to increase livestock production and rural incomes (WHO, 2013). The other two species,

*T. saginata* and *T. asiatica*, cause only taeniosis (adult tapeworm tage) in humans and the clinical problems are mainly minor. Human carriers are also, however, responsible for infections in cattle (bovine cysticercosis), which can have an economic impact because of meat condemnations at slaughterhouse inspections (Galán-Puchades and Fuentes, 2009).

In Ethiopia, the prevalence of cysticercosis was reported to be 7% at the national level by meta-analysis of previous studies (Assefa and Bihon, 2015). Spatiotemporal analysis based on previous studies conducted by Hiko and Seifu (2019) indicated that the prevalence of *C. bovis* had high variability that ranged from 8 to 90% geographically. Furthermore, a more recent systematic review (Jorga *et al.,* 2020) also showed huge regional variation ranging from 2 to 25%. In some studies, the average prevalence reaches upto30% from different abattoirs in the country (Adugna *et al.,* 2013) and 30.7% at Eastern Shoa of Oromia (Abdela and Lemi Korso, 2019). *Taenia saginata* taeniasis/cysticercosis has high economic and public health impacts; as a result control and prevention of the disease has great importance. One of the prerequisite for implementing control and prevention of taeniasis is investigation of detail information on the prevalence and associated risk factors in the country.

## Etiology

Taeniasis in humans is a parasitic infection caused by the tapeworm species *Taenia saginata* (beef tapeworm), *Taenia solium* (pork tapeworm), and *Taenia asiatica* (Asian tapeworm). Humans can become infected with these tapeworms by eating raw or undercooked beef (*T. saginata*) or pork (*T. solium* and *T. asiatica*). People with taeniasis typically have mild gastrointestinal symptoms or may be asymptomatic (Liao *et al.,* 2007; McManus and Donald, 2008).

Humans become infected by eating raw or undercooked infected beef or pork. Once ingested, cysticerci attach to the small intestine and develop into adult tapeworms over the course of 2 months. The adult tapeworms produce proglottids that mature, detach, and migrate to the anus and are then passed in the feces. *T. saginata* tapeworms are usually 4-12 m in length, but can grow to be 25 m; the adult tapeworms produce 1,000 to 2,000 proglottids/ worm and may produce up to 100,000 eggs per worm. *T. solium* (pork) tapeworms are smaller, 2-8 m in length, produce an average of 1,000 proglottids/worm, and may produce 50,000 eggs per worm. *T. asiatica* tapeworms range in size from 4-8 m, produce 700 proglottids/worm and may produce 80,000 eggs per proglottid (Uygur-Bayramiçli *et al.,* 2012; Galán-Puchades *et al.,* 2013).

## Epidemiology

The tapeworms that cause taeniasis (*Taenia saginata*, *T. solium*, and *T. asiatica*) are found worldwide. Eating raw or undercooked beef or pork is the primary risk factor for acquiring taeniasis. Persons who don't eat raw or undercooked beef or pork are not likely to get taeniasis.

Infections with *T. saginata* occur wherever contaminated raw beef is eaten, particularly in Eastern Europe, Russia, eastern Africa and Latin America. Taeniasis due to *T. saginata* is rare in the United States, except in places where cattle and people are concentrated and sanitation is poor, such as around feed lots when cattle can be exposed to human feces. Tapeworm infections due to *T. solium* are more prevalent in under-developed communities with poor sanitation and where people eat raw or undercooked pork (Galán-Puchades and Fuentes, 2013; Galán-Puchades and Fuentes, 2009). Higher rates of illness have been seen in people in Latin America, Eastern Europe, sub-Saharan Africa, India, and Asia.

*Taenia solium* taeniasis is seen in the United States, typically among Latin American immigrants. *Taenia asiatica* is limited to Asia and is seen mostly in the Republic of Korea, China, Taiwan, Indonesia, and Thailand (WHO, 2013; González *et al.,* 2000; Ooi *et al.,* 2013).

A disease called cysticercosis can occur when *T. solium* tapeworm eggs are ingested. For example, people with poor hygiene who have taeniasis -- with or without symptoms -- will shed tapeworm eggs in their feces and might accidentally contaminate their environment. This can lead to transmission of cysticercosis to themselves or others (Galán-Puchades and Fuentes, 2009; Ortega and Ynes, 2006).

Taeniasis is an intestinal infection caused by 2 species of tapeworms. The most important human *Taenia* tapeworm infections are caused by *Taenia solium* (pork tapeworm) and *T. saginata* (beef tapeworm). Humans become infected with *T. saginata* when they consume beef which has not been adequately cooked. Taeniasis due to *T. saginata* has no major impact on human health. Infection also occurs in humans when they eat raw or undercooked pork (*Taenia solium*) (Zarlenga, 1991).

Humans can also become infected with *T. solium* eggs by ingesting contaminated food or water (human cysticercosis) or as a result of poor hygiene. Tapeworm larvae (cysticerci) develop in the muscles, skin, eyes and the central nervous system. When cysts develop in the brain, neurocysticercosis may result. Symptoms include epilepsy, severe headache and blindness, and be can be fatal. Neurocysticercosis is the most frequent preventable cause of epilepsy worldwide.

Cysticercosis mainly affects the health and livelihoods of subsistence farming communities in developing countries of Africa, Asia and Latin America. It also reduces the market value of pigs and cattle, and makes especially pork unsafe to eat. *T. solium* cysticercosis remains a neglected disease, and was added by WHO to the list of major neglected tropical diseases in 2010 (WHO, 2013; WHO, 1983).

## Mode of Transmission

Taeniasis is acquired by humans through the inadvertent ingestion of their cysticerci in undercooked pork or beef. Once in the human body, cysticerci develop into adult tapeworms that live in the intestine and release egg-bearing gravid proglottids (segments) which are passed out with faeces. Cysticercosis is acquired when proglottids or eggs are ingested. It is a natural infection of pigs and cattle but, in the case of *T. solium*, it can also affect humans, usually when they swallow *T. solium* egg-contaminated soil, water or food (mainly vegetables). Taeniasis and cysticercosis are common in areas where animal husbandry practices are such that pigs and cattle come into contact with human faeces. Taeniasis and cysticercosis are common in areas where animal husbandry practices do not prevent pigs and cattle from coming into contact with human faeces.

Taeniasis is predominantly found in Asia, Africa, Latin America, particularly on farms in which pigs are exposed to human excrement. It occurs everywhere though where beef and pork are eaten, even in countries such as the United States, with strict federal sanitation policies. *Taenia saginata* is relatively common in Africa, some parts of Eastern Europe, the Philippines, and Latin America. (Somers *et al.*, 2010) It is most prevalent in Sub-Saharan Africa and the Middle East. (Ortega and Ynes, 2006) *Taenia asiatica* is retricted to East Asia, including Taiwan, Korea, Indonesia, Nepal, Thailand and China. (Eom *et al.*, 2009; Ale *et al.*, 2014)

Classified biologically as protozoa and helminths (but better known as tapeworms, flatworms and roundworms), it is difficult to know how widespread parasites are globally because in many countries it is not compulsory to notify public health authorities of their presence.

- In Europe, more than 2,500 people are affected by food borne parasitic infections each year. In 2011 there were 268 cases of trichinellosis and 781 cases of echinococcosis recorded in the EU.
- In Asia, there is no precise national data but parasitic diseases are known to be widely spread and are recognized as major public health problems in many countries.
- In most African nations there is no data at all on the prevalence of food borne parasites in humans because there of a general lack of surveillance systems.
- In the United States, *Neurocysticercosis*, caused by *Taenia solium*, is the single most common infectious cause of seizures in some areas of the US where 2 000 people are diagnosed with *neurocysticercosis* every year. *Toxoplasmosis* is a leading cause of food-borne illness and death (6, 33).

## Life Cycle

Human taeniasis is a parasitic infection caused by three tapeworm species, *T. saginata* (known as the beef tapeworm), *T. solium* (pork tapeworm), and *T. asiatica* (the Asian tapeworm). Humans are the only hosts for these *Taenia* tapeworms. Humans pass the tapeworm segments and/or eggs in feces and contaminate the soil in areas where sanitation is poor. *Taenia* eggs can survive in a moist environment and remain infective for days to months. Cows and pigs become infected after feeding in areas that are contaminated with *Taenia* eggs from human feces. Once inside the cow or pig, the *Taenia* eggs hatch in the animal's intestine and migrate to striated muscle to develop into cysticerci, causing a disease known as cysticercosis.

Cysticerci can survive for several years in animal muscle. Humans become infected with tapeworms when they eat raw or undercooked beef or pork containing infective cysticerci. Once inside humans, *Taenia* cysticerci migrate to the small intestine and mature to adult tapeworms, which produce segments and eggs that are passed in feces (WHO, 2013; Hiko and Seifu, 2019; Eckert, 2005).

**Fig.1**

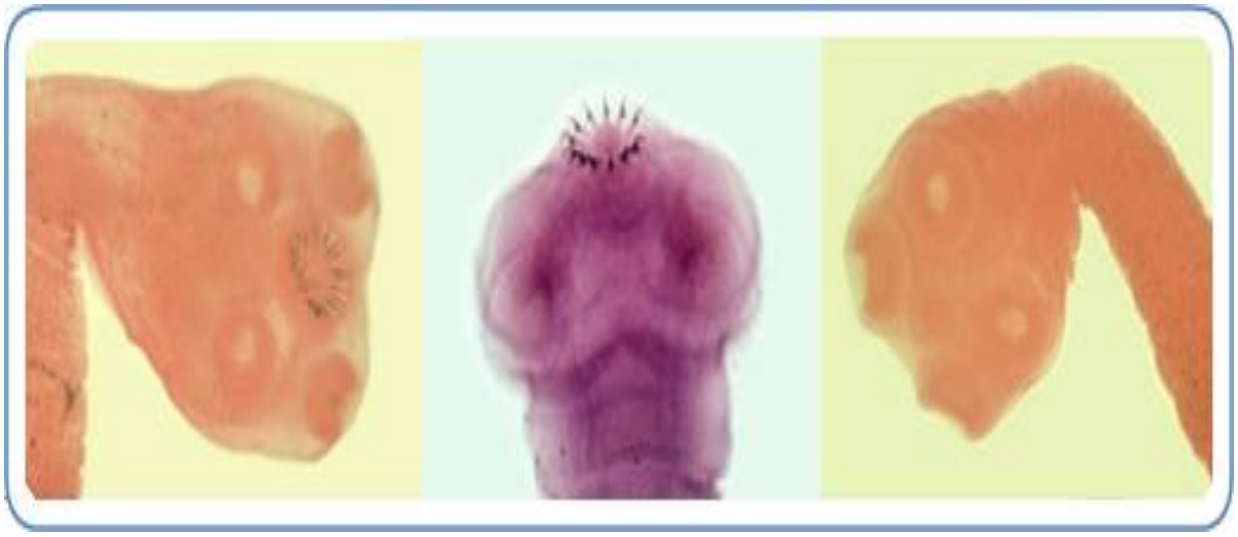
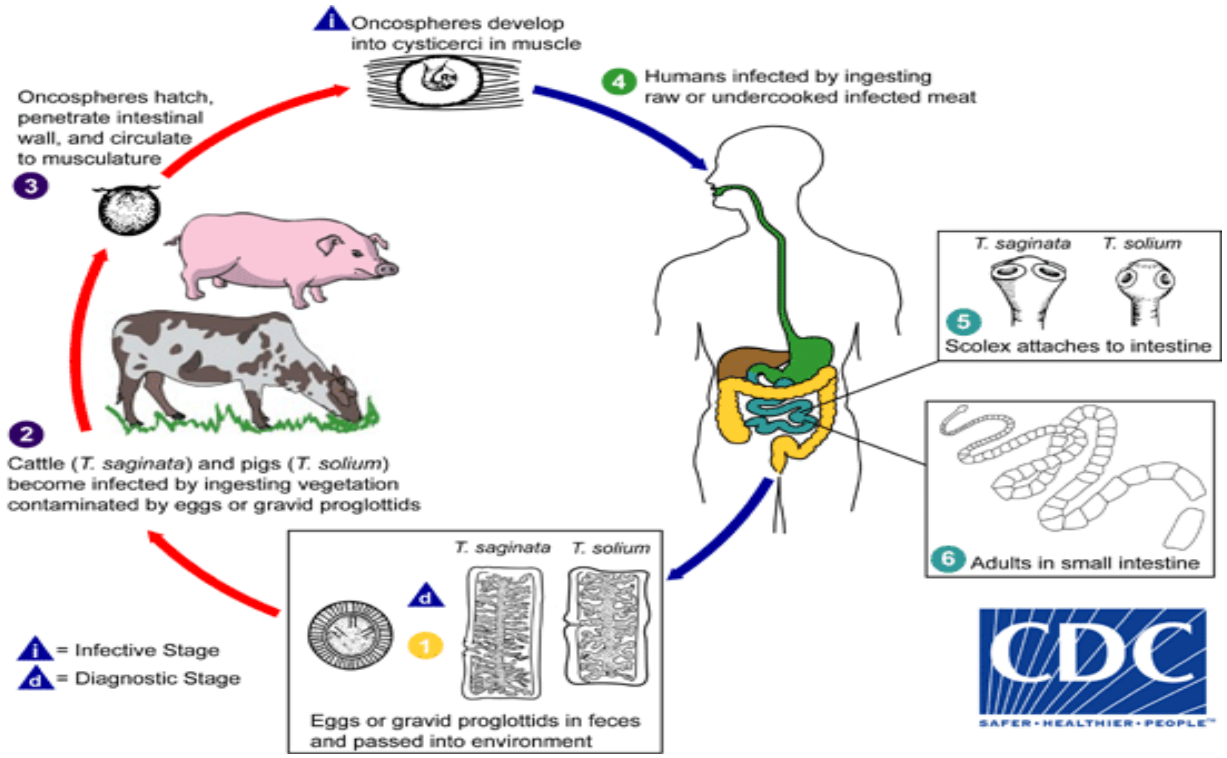


**Fig.2**




## Symptoms

Most people with tapeworm infections have no symptoms or mild symptoms. Patients with *T. saginata* taeniasis often experience more symptoms that those with *T. solium* because the *T. saginata* tapeworm is larger in size (up to 10 meters (m)) than *T. solium* (usually 3 m). Tapeworms can cause digestive problems including abdominal pain, loss of appetite, weight loss, and upset stomach. The most visible symptom of taeniasis is the active passing of proglottids (tapeworm segments) through the anus and in the feces. In rare cases, tapeworm segments become lodged in the appendix, or the bile and pancreatic ducts. Infection with *T. solium* tapeworms can result in human cysticercosis, which can be a very serious disease that can cause

seizures and muscle or eye damage (Roberts *et al.*, 2009; Somers *et al.*, 2010). Taeniasis due to *T. solium* or *T. saginata* is usually characterized by mild and non-specific symptoms. Abdominal pain, nausea, diarrhoea or constipation may arise 6–8 weeks after ingestion of the cysticerci when the tapeworms become fully developed. These symptoms may continue until the tapeworm dies following treatment, otherwise it may live for many years. In the case of cysticercosis due to *T. solium*, the incubation period is variable, and infected people may remain asymptomatic for years. In some endemic regions (particularly in Asia), infected people may develop visible or palpable nodules (a small bump or node which is solid that can be detected by touch) beneath the skin (subcutaneous). When cysts are recognized by the host following spontaneous degeneration or after treatment, an inflammatory reaction may occur.

Neurocysticercosis is associated with a variety of symptoms and signs depending on the number, size, stage and location of the pathological changes as well as the host's immune response and the parasite's genotype, but it can also be clinically asymptomatic. Symptoms may include chronic headaches, blindness, seizures (epilepsy if they are recurrent), hydrocephalus, meningitis, dementia and symptoms caused by lesions occupying spaces of the central nervous system (WHO, 2013; Galán-Puchades *et al.*, 2013; Nkouawa *et al.*, 2010).

## Diagnosis

Diagnosis of *Taenia* tapeworm infections is made by examination of stool samples; individuals should also be asked if they have passed tapeworm segments. Stool specimens should be collected on three different days and examined in the lab for *Taenia* eggs using a microscope. Tapeworm eggs can be detected in the stool 2 to 3 months after the tapeworm infection is established. Tapeworm eggs of *T. solium* can also infect humans, causing cysticercosis. It is important to diagnose and treat all tapeworm infections (Galán-Puchades and Fuentes, 2009; Ale *et al.*, 2014).

## Treatment

Taenaisis can be treated with praziquantel (5–10 mg/kg, single-administration) or niclosamide (adults and children over 6 years: 2 g, single-administration after a light breakfast, followed after 2 hours by a laxative; children aged 2–6 years: 1 g; children under 2 years: 500 mg). Currently there are no standard treatment guidelines for neurocysticercosis and treatment has to be tailored to the individual case. Since the destruction of cysts may lead to an inflammatory response, treatment of active disease may include long courses with praziquantel and/or albendazole, as well as supporting therapy with corticosteroids and/or anti-epileptic drugs, and possibly surgery. The dosage and the duration of treatment can vary greatly and depend mainly on the number, size, location and developmental stage of the cysts, their surrounding inflammatory edema, acuteness and severity of clinical symptoms or signs (Gemmell *et al.*, 2005).

## Prevention and Control

Infections with *T. saginata* can be managed through an individual clinical approach due to its low pathogenicity (low ability to spread from host to host). In contrast, infections due to *T. solium* require proper public health interventions aimed at their prevention, control and possibly elimination (Flisser *et al.*, 2010; Ortega and Ynes, 2006). Eight interventions for the control of *T. solium* can be used in different combinations designed on the basis of the context in the countries:

Health education; identification and treatment of taeniasis cases; access to preventive chemotherapy; improved sanitation; improved pig husbandry; anthelmintic treatment of pigs; vaccination of pigs; improved meat inspection, and processing of meat products.

Drink water only from treated municipal water supplies.

Do not eat undercooked pork or meat.

When traveling to countries where the water supply may be unsafe, either avoid the water or boil it for 1 minute to kill parasite eggs. Avoid ice in those same areas. Drinking bottled beverages or hot coffee and tea are safe alternatives.

Do not swallow water while swimming. Do not swim in community swimming pools if you or your child are infected with tapeworms.

Wash, peel, or cook raw fruits and vegetables before eating.

Make sure that infected individuals wash their hands frequently to reduce the spread of infection (Galán-Puchades and Fuentes, 2008; Gemmell *et al.*, 2005).

Reliable epidemiological data on geographical distribution of *T. solium* taeniasis/cysticercosis in people and pigs is still scarce. Appropriate surveillance mechanisms should enable new cases of human or porcine cysticercosis to be recorded in order to help

identify communities at high risk and focus prevention and control measures in these areas. One way to prevent taeniasis is to cook meat to safe temperatures. A food thermometer should be used to measure the internal temperature of cooked meat. Do not sample meat until it is cooked. USDA recommends the following for meat preparation (Nkouawa *et al.*, 2010; Gemmell *et al.*, 2005)

### For Whole Cuts of Meat (excluding poultry)

Cook to at least 145° F (63° C) as measured with a food thermometer placed in the thickest part of the meat, then allow the meat to rest* for three minutes before carving or consuming.

### For Ground Meat (excluding poultry)

Cook to at least 160° F (71° C); ground meats do not require a rest* time.

### Status of Taeniasis in Ethiopia

*Taenia saginata* is a cosmopolitan parasitic disease found in industrialized countries as well as in developing countries. It is also more common in populations/age groups that consume raw or undercooked beef (Getachew, 1990). In Eastern African countries like Ethiopia up to 70% of the population reports to have been infected with a tapeworm (WHO, 1983) while in developed western countries much lower prevalence (0.01% to 10%) were recorded (Regassa *et al.*, 2008).

Similarly, bovine cysticercosis, the source of infection for human beings, is highly prevalent in developing like Ethiopia. The prevalence of bovine cysticercosis in Ethiopia reported so far varies from relatively lower prevalence of 3.1% in central Ethiopia (Dawit, 2004) to as high as 26.2% at Awassa (Nigatu, 2004) whereas in Europe it ranges from 0.007% to 6.8% (WHO, 2013). Differences in geographical isolates of the parasite and in the breed and age of cattle have been suggested as possible factors affecting the distribution of *Cysticercus bovis* (Dawit, 2004).

Economic losses due to bovine cysticercosis are associated with total condemnation of carcasses with generalized infestation and downgrading of carcasses which are subjected to refrigeration, in addition to the cost of refrigeration and extra handling and transport (WHO, 1983). The treatment cost for human and costs of manufacturing of drugs have significant contribution in estimation of economic losses (Abunna *et al.*, 2008)

Taeniasis caused by *T. saginata* is a well-known disease in Ethiopia with prevalence ranging from 10% to 70%. The prevalence reports of cysticercosis in Ethiopia showed variable results with localities. Relatively lower prevalence of 3.1% in Central Ethiopia, 4.9% at Gonder (34) and 7.5% in Addis Ababa (Nigatu, 2004) were reported, while others reported as high as 17.5% in East Shoa (36), 21% at Nekemt, 26.25% at Awassa (Abunna *et al.*, 2008) and 30% from different abattoirs in the country. Hence, bovine Cysticercosis is an important public health and economic problems caused by its consequence on public health, nutrition and economy of some countries.

In Ethiopia, the rural communities mainly raise cattle under extensive husbandry practices. Existence of higher population density, raw meat consumption, low awareness, poor hygiene and sanitary infrastructures may facilitate transmission of the disease between animals and human beings in the rural areas. The prevalence reports of cysticercosis in Ethiopia showed variable results with localities. Relatively lower prevalence of 3.1% in Central Ethiopia, 4.9% at Gondor (Dawit, 2004) and 7.5% in Addis Ababa (Nigatu, 2004) were reported.

A prevalence of 5.9% out of 996 examined animals at slaughter at Asmara; 9.7% out of 1168 at Gonder meat factory have been recorded; while others reported as high as 17.5% in East Shoa (Hailu, 2005), 21% at Nekemt, 26.25% at Awassa (Abunna *et al.*, 2008) and 30% from different abattoirs in the country (Regassa *et al.*, 2008).

The common traditional animal husbandry practices in Ethiopia (free grazing in cattle) mainly allow free access of cattle to the contaminated environment and perpetuate transmission of Cysticercosis, due to the fact that cattle become infected by ingestion of pasture/feed or water contaminated with *T. saginata* eggs (Kifle, 2015). It is associated with poor hygiene and local factors including cultural background, such as eating meat without proper cooking (raw), economic condition and religious beliefs, close proximity of humans to cattle kept with little or no distinction between companion or utility functions (Fralova, 2014). As reported in Ethiopia from several authors, prevalence the average 30% from different abattoirs in the country (Adugna *et al.*, 2013) and 30.7% at Eastern Shoa of Oromia (Abdela and Lemi Korso, 2019).

Most of the positive respondents witnessed infection once per lifetime in their stool and underwear. Respondents confirmed that they do not consume pork meat due to religious purposes, so the proglottids observed were doubtless to be of *T. saginata* and also, *T. saginata* is known for its more frequent anal expulsion than *Theridion solium* (Gemmell *et al.*, 2005).

In the present study, self-medication was higher than consulting health professionals to treat the infection they observed, which have to be prohibited to avoid the development of drug resistance. Even though half of positive respondents were aware of human taeniasis and its transmission mode, they still consume raw beef dishes like *kurt* and *kitfo*, which contributed to the higher burden of the disease in the country. *Taenia saginata* taeniasis/cysticercosis is high economic and public health impacts in Ethiopia; as a result control and prevention of the disease has great importance.

The prevalence of *C. bovis* in cattle and *T. saginata* in humans is high in Ethiopia. The widespread distribution of *Taenia saginata*/ *Cysticercus bovis* is associated with several factors. The prevalence of *C. bovis* is associated with age, body condition and site, while the prevalence of *T. saginata* in humans was associated with occupation, educational status, marital status and raw beef consumption habits, bush defecation and poor waste disposal practice, low level of public awareness and presence of backyard (village) slaughtering practices. Poor meat inspection procedures and raw and undercooked meat consumption is common in Ethiopia.

Slaughter rooms are small, government enforcements are weak and backyard slaughtering is practiced. Besides, large numbers of animals were inspected with one meat inspector. The practice of self-medication was high in positive respondents than consulting health professionals for treatment complicating the disease's impact further to drug resistance. To reduce the impact of the disease, a coordinated one health intervention is highly advised. Behavioral change in human consumers and also limiting human sewage reaching cattle to breaking the life cycle of *T. Saginata* is necessary to lower the impact of the disease in the country. Finally, the present review reflects the zoonotic and economic impact of the disease.

Therefore, serious attention should be given to the public awareness, detailed meat inspection to be safe to public health, consumption of well-cooked cattle meat should be implemented for breaking the cycle of the diseases and promote meat industry in the country.

## References


Abdela, & Lemi Korso. (2019). Prevalence of *Cysticercosis bovis* in Eastern Shoa of Oromia, Ethiopia.

Abunna F, Tilahun G, Megersa B, Regassa A (2008) Bovine cysticercosis in cattle slaughtered at Awassa municipal abattoir, Ethiopia: Prevalence, cyst viability, distribution and its public health implication Zoonoses and Public Health 55: 82–88.

Adugna, Yacob, H., Dinka, A., & and Getachew, T. (2013). Bovine cysticercosis and human taeniasis in South-West Shoa zone of Oromia Region, Ethiopia. Ethiopian Veterinary Journal, 17: 121133.

Ale, Anita; Victor, Bjorn; Praet, Nicolas; Gabriël, Sarah; Speybroeck, Niko; Dorny, Pierre; Devleesschauwer, Brecht (2014). "Epidemiology and genetic diversity of *Taenia asiatica*: a systematic review". Parasites & Vectors 7 (1): 45. doi:10.1186/1756-3305-7-45. PMC 3900737.PMID 24450957.

Assefa, A. Bihon. (2015). Bovine cysticercosis in Ethiopia: a systematic review and meta-analysis of prevalence from abattoir-based surveys. Prev. Vet. Med., 169 (2019), Article 104707

CDC, (2011) "Neglected Tropical Diseases". cdc.gov. June 6, 2011.

CDC, (2017). Laboratory identification of parasites of public health concern.

Dawit S (2004) Epidemiology of *Taenia saginata* taeniasis and cysticercosis in North Gondar zone, Northwestern Ethiopia. DVM Thesis. Faculty of Veterinary Medicine, Addis Ababa University: DebreZeit, Ethiopia.

Eckert, J. (2005). "Helminths". In Kayser, F. H., Bienz, K. A., Eckert, J., Zinkernagel, R. M. Medical Microbiology. Stuttgart: Thieme. pp. 560–562. ISBN 9781588902450.

Eom, Keeseon S.; Jeon, Hyeong-Kyu; Rim, Han-Jong (2009). "Geographical distribution of *Taenia asiatica* and related species". The Korean Journal of Parasitology 47 (Suppl): S115–24. doi:10.3347/kjp.2009.47.S.S115. PMC 2769216.PMID 19885327.

Flisser, A.; Avila G; Maravilla P; Mendlovic F; León-Cabrera S; Cruz-Rivera M; Garza A; Gómez B; Aguilar L; Terán N; Velasco S; Benítez M; Jimenez-Gonzalez DE (2010). "*Taenia solium*: current understanding of laboratory animal models of taeniosis". Parasitology 137 (03):

347–57. doi:10.1017/S0031182010000272. PMID 20188011.

Fralova. (2014). Taeniasis. In: Zoonotic control.,. Lysenko A (end), UNEP Publication, Moscow, pp.: 192-192.

Galán-Puchades, M. T.; Fuentes, M. V. (2009). "Diagnosis of Human Cysticercosis and *Taenia asiatica*". American Journal of Tropical Medicine and Hygiene 81 (6): 1165–1165. doi:10.4269/ajtmh.2009.09-0398a.

Galán-Puchades, M. Teresa; Fuentes, Mario V. (2013). "*Taenia asiatica*: the most neglected human Taenia and the possibility of cysticercosis". The Korean Journal of Parasitology 51 (1): 51–4. doi:10.3347/kjp.2013.51.1.51. PMC 3587749.PMID 23467406.

Galán-Puchades, M.T.; Fuentes, M.V. (2008). "*Taenia asiatica* and pig cysticercosis". Veterinary Parasitology 157 (1-2): 160–161. doi:10.1016/j.vetpar.2008.07.008. PMID 18752896.

Galán-Puchades, MT; Fuentes, MV (2013). "Lights and shadows of the *Taenia asiatica* life cycle and pathogenicity". Tropical Parasitology 3 (2): 114–9. doi:10.4103/2229-5070.122114. PMC 3889087.PMID 24470994.

Garcia, Oscar H. Del Brutto, Hector H. (2014). "*Taenia solium*: Biological Characteristics and Life Cycle". Cysticercosis of the Human Nervous System. (1., 2014 ed.). Berlin: Springer-Verlag Berlin and Heidelberg GmbH & Co. KG. pp. 11–21. ISBN 978-3-642-39021-0.

Gemmell, M, Z. Matyas, Z. Pawlowski, Soulsby (Eds.), (2005). Guidelines for surveillance, prevention and control of taeniasis/cysticercosis World Health Organization Handbook of Transdisciplinary Research (2005), pp. 134-139

Getachew B (1990) Prevalence and significance of *Cysticercus bovis* among cattle slaughtered at Debrezeit abattoir. Addis Ababa University, Faculty of Veterinary Medicine, DebreZeit, Ethiopia.

González L M, Montero E, Harrison L J, Parkhouse R M, Garate T. (2000). "Differential diagnosis of *Taenia saginata* and *Taenia solium* infection by PCR.".J ClinMicrobiol. 38 (2): 737–744. PMC 86191.PMID 10655377.

Gracey, J., S. Collins, R. Huey, (2015). Meat Hygiene 11th ed.W.B.Saunderscompany Ltd., London (2015), pp. 198-215

Hailu D (2005) Prevalence and risk factors for *T. Saginata* cysticercosis in three selected areas of eastern Shoa. M.Sc Thesis, Addis Ababa University, Faculty of Veterinary Medicine, DebreZeit, Ethiopia.

Hiko, A., B. Seifu. (2019). Spatiotemporal distribution and economic loss associated with bovine cysticercosis and human taeniasis in Ethiopia. Parasite Epidemiology and Control, 4 (2019), Article e00078, 10.1016/j.parepi.2018.e00078

Jeon, Hyeong-Kyu; Eom, Keeseon S. (2009). "Immunoblot Patterns of *Taenia asiatica* Taeniasis". The Korean Journal of Parasitology 47 (1): 73–7. doi:10.3347/kjp.2009.47.1.73. PMC 2655338.PMID 19290097.

Jorga, E, I. van Damme, B. Mideksa, S. Gabriël. (2020). Identification of risk areas and practices for *Taenia saginata* taeniosis/cysticercosis in Ethiopia: a systematic review and meta-analysis. Parasit. Vectors, 13 (1) (2020), pp. 1-17, 10.1186/s13071-020-04222-y

Jr, Larry S. Roberts, John Janovy, (2009). Gerald D. Schmidt & Larry S. Roberts' Foundations of parasitology (8th ed.). Boston: McGraw-Hill. ISBN 0-07-128458-3.

Juan A. Jimenez, Silvia Rodriguez, Luz M. Moyano, Yesenia Castillo, Héctor H. García (2010). "Differentiating Taenia eggs found in human stools - Does ZiehlNeelsen staining help?". Tropical Medicine & International Health 15 (9): 1077–1081. doi:10.1111/j.1365-3156.2010.02579.x.

Kifle, & B, S. (2015). Prevalence and Public Health Significance of Cyst cercus bovis in and Around DebreBerhan City. European J App Sci, 7:199-208.

Liao, Wen-Shen; Bair, Ming Jong (2007). "Taenia in the Gastrointestinal Tract". New England Journal of Medicine 357 (10): 1028–1028. doi:10.1056/NEJMicm067761. PMID 17804847.

McManus, Donald P. (2008). "Taenia in the Gastrointestinal Tract". New England Journal of Medicine 358 (3): 311–311. doi:10.1056/NEJMc072882. PMID 18199875.

Nigatu K (2004) *C. bovis*: Development and evaluation of serological tests and prevalence at Addis Ababa Abattoir. MSc Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debrezeit, Ethiopia.

Nkouawa, A; Sako, Y; Li, T; Chen, X; Wandra, T; Swastika, I K; Nakao, M; Yanagida, T; Nakaya, K; Qiu, D; Ito, A (2010). "Evaluation of a loop-mediated isothermal amplification method using fecal specimens for differential detection of

Taenia species from humans". Journal of Clinical Microbiology 48 (9): 3350–2. doi:10.1128/JCM.00697-10. PMC 2937673.PMID 20631114.

Ooi, Hong Kean; Ho, Chau-Mei; Chung, Wen-Cheng (2013). "Historical overview of *Taenia asiatica* in Taiwan". The Korean Journal of Parasitology 51 (1): 31–6. doi:10.3347/kjp.2013.51.1.31. PMC 3587746.PMID 23467308.

Ortega, Ynes R. (2006). Foodborne parasites. New York: Springer. pp. 207–210. ISBN 9780387311975.

Regassa A, Abunna F, Mulugeta A, Megersa B (2008) Major metacestodes in cattle Slaughtered at olaitaSoddo Municipal abattoir, Southern Ethiopia: Prevalence, cyst Viability, organ distribution and socioeconomic implications. Trop Anim Health and Prod 41: 1495–1502

Roberts, Larry S.; Janovy, Jr., John (2009). Gerald D. Schmidt & Larry S. Roberts' Foundations of Parasitology (8 ed.). Boston: McGraw-Hill Higher Education. pp. 348–351. ISBN 978-0-07-302827-9.

Somers, Kenneth D.; Morse, Stephen A. (2010). Lange Microbiology and Infectious Diseases Flash Cards (2nd ed.). New York: Lange Medical Books/ McGraw-Hill. pp. 184–186. ISBN 9780071628792.

Uygur-Bayramiçli, O; Ak, O; Dabak, R; Demirhan, G; Ozer, S (2012). "*Taenia saginata* a rare cause of acute cholangitis: a case report". ActaClinicaBelgica 67 (6): 436–7. doi:10.1179/ACB.67.6.2062709. PMID 23340150.

WHO (1983) Guidelines for Survellience, Prevention and Control of Taeniasis/Cysticercosis. In Gemmel M, Matyas Z, Pawlowiski Z, Suolsby EJL, VPH/83.49: 207-238.

World Health Organization, (2013). "Taeniasis/Cysticercosis".WHO Fact sheet N°376.

Zarlenga D S. (1991). "The differentiation of a newly described Asian taeniid from *Taenia saginata* using enzymatically amplified non-transcribed ribosomal DNA repeat sequences.".Southeast Asian J Trop Med Public Health. 22 (suppl): 251–255. PMID 1822899.

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