



Epidemiology Public Health Importance and Traditional Medicinal Plant of *Cysticercus bovis* in Ethiopia

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ABSTRACT

Bovine cysticercosis is a parasitic disease that affects the musculature of cattle and is caused by the metacestodes stage of human intestinal cestode. Cysts of *Cysticercus (C) bovis* is found anywhere in the carcass and viscera especially masseter, tongue, heart, triceps, inter costal muscles and the diaphragm are the most affected organs. Accordingly, this paper tried to review present status of bovine cyticercosis in Ethiopia. So that in our country except the heart, other organs are consumed at raw or under cooked. Moreover, habit of eating raw beef dishes, low level of toilet use by human population, backyard slaughter, low availability of taenicides, free access of cattle to surface water, and proximity of wastewater are important causes for transmission of bovine cysticercosis to a herd of cattle and taeniasis in human population and such practices are not uncommon in Ethiopia. Many drugs which have shown efficacy against bovine cysticercosis are used. In addition, traditional medicine is used, because herbs have nutritional elements and for treatment of tapeworm. Controlling cysticercosis is depends on reducing an animal's exposure to the eggs. Where feasible, it can be easier to control these illnesses by focusing on the definitive host.

Keywords: Beef; Control; Cysticercosis; Ethiopia; Public health; *Taenia saginata*

INTRODUCTION

Parasitic disease cause many diseases in human and animal. These are observed as being among the chief diseases of tropical countries and have threatened one quarter of the world's population [1]. Meat borne diseases are common in developing countries because of the prevailing poor food handling and sanitation practices, inadequate food safety laws, weak regulatory systems, lack of financial resources to invest in safer equipment's, and lack of education for food handlers [2].

In Sub-Saharan Africa, livestock diseases, negatively affect the public health and impede economic growth by incurring direct (morbidity, mortality) and indirect economic losses. Parasitic

diseases are highly prevalent in Sub Saharan Africa and incur severe economic losses by reducing productivity [3]. The distribution of *Taenia saginata* is wider in developing countries, where hygienic conditions is poor and where the inhabitants traditionally consume raw or insufficiently cooked or sun cured meat.

In realizing the severity of food safety problems and control of parasitic meat borne zoonosis in Africa, the Food and Agricultural Organization (FAO) and the World Health Organizations (WHO) of the United Nations (UN) passed resolutions to improve the food safety situation in Africa and inadequate health education and low availability of taenicides, are the major obstacles for the control of the disease [4].

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The variations in the epidemiological patterns of taeniasis/cysticercosis throughout Africa are a reflection of the numbers and distribution of human and cattle populations. In East African countries prevalence rates of 30% to 80% have been noted. In many developing countries, this disease constitutes a serious but sometimes less recognized public health problem.

In Ethiopia, the livestock sector contributes about 30% of the agricultural GDP and 19% to the export earnings [5]. *Taenia saginata/Cysticercus bovis* is important from the standpoint of the health of cattle because of consequences for the meat supply and, more importantly from the direct effects on the well-being of humans who, almost universally, consume beef as a source of protein and other minerals.

The distribution of *Taenia saginata* is wider in developing countries, where hygienic conditions is poor and where the inhabitants traditionally consume raw or insufficiently cooked or sun cured meat. Bovine cysticercosis and taeniasis are common where hygienic conditions are poor and the inhabitants traditionally eat raw or insufficiently cooked or sun-cured meat.

Inadequate health education and low availability of taenicides are the major obstacles for the control of such infections [6]. Due to these reasons, taeniasis is more common in developing countries including Ethiopia where meat is an important component of human diet and traditionally it is consumed raw on several occasions. About 45% of Ethiopia's domestic meat consumption comes from cattle, but this income is affected due to various unimproved animal health problems, among which, *T. saginata/C. bovis* is one [7].

Cysts of *Cysticercus bovis* can be found anywhere in the carcass and viscera, but there seems to be special affinity towards some parts which are described as sites of predilection (masseter, tongue, heart, triceps, intercostal muscles and the diaphragm). Most of these organs except the heart are consumed raw or under cooked and could be a potential public health hazard in contracting taeniasis. *T. saginata/C. bovis* life cycle is entirely dependent on the link between man and cattle so that any break in this link can result in the total elimination of the parasite [8].

Therefore this review is having the following objectives:

- To review about bovine cysticercosis and its public health importance.
- To overview public health and economic significance of the disease.

LITERATURE REVIEW

Taxonomy

It is a flatworm class-cestoda, order-cyclophyllidea, family-taeniidae) with a two-stage life cycle: Adult (in the definitive host) and larval (in the intermediate host). *Taenia saginata* and its metacestode *Cysticercus bovis* the unarmed beef tapeworm and genus *Taenia*.

Morphology

Adult parasite: It is the largest tapeworm inhabiting the small intestine of man. The adult parasite is ribbon shaped, multi-segmented and hermaphroditic flatworm its body divided into three distinct parts consisting of scolex (head), neck and strobili. The scolex, measuring 1 mm to 2 mm in diameter, has four strong hemispherical suckers [9]. *Taenia saginata*, the beef tapeworm, is a large worm measuring 3-10 meters in length rarely the adult measures up to 15 m. It resides in the small intestine of humans where it attaches using its scolex and can survive for many years. The adult is ribbon shaped, multi-segmented and hermaphroditic flatworm its body divided into three distinct parts consisting of scolex (head), neck and neck and strobili [10].

Self and cross fertilization between and among proglottids is possible. The gravid proglottids are 15 mm to 35 mm long and 5 mm to 7 mm wide and filled with eggs which detach from the strobila singly and leave the host via anus. This implies that coproscopic examination has a limited value in the diagnosis of *Taenia saginata* infection. The gravid segments, each containing branched uterus, are filled with thousands of eggs [11]. The number of segments increase constantly as the tapeworm grows, forming long chains. The segments, which are formed first, are pushed towards the end leaving space for the new ones. The segments, which are found at the rear, are the oldest. These old segments periodically detached from the worms and discharged from the host's body with feces or independent of defecations [12].

Egg stage: Eggs passed in feces or discharged from ruptured gravid segments are sub spherical to spherical in shape as indicated in [Figure 1](#). The egg consists of the hexacanth (6-hooked) embryo (oncosphere), thick dark brown to yellow in color. There is an outer oval membranous coat, the true egg shell, which is lost in fecal eggs. It measures 30-41 micrometers in diameter and 46 to 50 micrometers in length. The eggs survive up to 200 days in moist manure, 33 days in river water, 154 days on pasture and are resistant to moderate desiccation, disinfectants and low temperature (4°C to 5°C).



Figure 1: The egg of *Taenia saginata*.

Metacestodes or cysticercosis: It's the infective stage to man, while eggs are infective to cattle. Adult worm lives in the small intestine of man. The gravid segments from the adult worm break away and are expelled singly. They actively force their way out through the anal sphincter. The larval stages, or metacestodes also referred to as "beef measles", are found in all striated muscles of the intermediate host. *C. bovis* is a small (pea sized) oval in shape.

Semi-translucent cyst filled with dense white fluid containing an invaginated scolex. The metacestode is morphologically similar to the future adult tapeworm. It measures about 10 mm in diameter and 6 mm in length [13]. When incised, the cyst may be viable containing a thin fibrinous capsule or degenerate showing cream or green colored calcification. The cysticercosis formed over a period of 3-4 months after the egg is ingested. This form may remain viable in the intermediate host for up to 9 months or even up to the entire life of the host.

In the carcass *C. bovis* can survive for about 15 days at 5°C, 9 days at 10°C and 6 days at 15°C to 30°C. If a carcass is found to contain cysts, it is required to be frozen at 10°C for 10 days, or if the lesions are extensive, the entire carcass is condemned [14].

It is a disease that affects the musculature of cattle and is caused by the metacestode stage of human intestinal cestode as indicated in **Figure 2**.

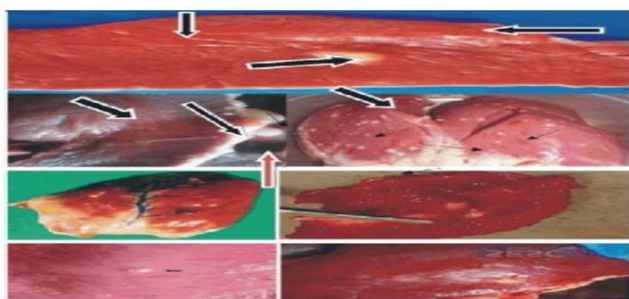


Figure 2: *Cysticercus bovis* cyst distribution in different organs.

Taenia saginata and its metacestode or *Cysticercus bovis*, the unarmed beef tapeworm, is classified under the kingdom of animalia, phylum of platyhelminthes, class of cestoda, order of cyclophylidea, family of Taeniidae, genus of *Taenia* and species of *T. saginata*. The adult tapeworm, *Taenia saginata*, is a large ribbon shaped, multi segmented, white flat worm usually 4-15 m long consisting of thousands of segments (proglottids) arranged in a chain.

In the world there are 77 million bovine Taeniasis patients of which 32 million are in Africa, 11 million in Asia (excluding the former USSR) and about 3 million in the new world. Its prevalence could be classified into three groups [15].

- High prevalence with taeniasis exceeding 10%.
- Moderate infection rates (0.1%-10%).
- Low infection rate less than 0.1%.

Etiology

The etiological agent of bovine cysticercosis is metacestode stage of human intestinal cestode *T. saginata* which affects the musculature of cattle. *Taenia saginata* and its metacestode, *Cysticercus bovis*, the unarmed beef tapeworm is classified under the kingdom of animalia, phylum of platyhelminthes, class of cestoda, order of cyclophylidea, family of taeniidae, genus of *Taenia* and species of *T. saginata*.

Taenia eggs passed in the faeces or discharge from ruptured segments are sub spherical to spherical in shape and very resistant, remaining viable for 6 months in pasture and vegetables, 5 weeks in water, 10 weeks in stool or hay and 12 weeks in silage sludge.

The infestation in the intermediate host with the larval stage is referred to as bovine cysticercosis. The cysticerci or larval stage is formed over a period of 3-4 months, after egg is ingested by intermediate host and may remain viable in the intermediate host for up to 9 months or even up to the entire life of the host.

Epidemiology

Source of infection: For cattle, the only source of the hazard is infected humans spreading the embryophores in the environment. Up to 500,000 eggs can be released per day, and are likely to remain viable for weeks or even months in the external environment. The embryophores found in sewage sludge are in principle inactivated by the various treatment processes as man is the source of parasites, human habits are responsible for the spread of bovine cysticercosis [16].

In areas with transhumant human or nomadic systems, these habits are conditioned by the way of life and animals are exposed to infected feces. Infection of cattle is associated with directly to the non-hygienic disposal of stool by infected humans or indirectly by the use of human sewage on pasture as fertilizer. Man's customs and traditions of consuming raw, sun cured and inadequately cooked beef dishes like raw, sun cured and inadequately cooked beef dishes like cysticerci perpetuate human infection.

In developing countries like Ethiopia, cattle are reared on extensive scale, human sanitation is poorly developed which makes the incidence of *T. saginata* infection in humans very high. Calves are infected usually in early life, often within the first few days after birth from infected stockmen whose hands are contaminated with *Taenia* eggs.

Risk factors of taeniasis

Environmental risk factors: The environmental risk therefore comes from the lack or poor quality of sanitation, dispersion of septic tank sludge on pastures or fields, or defecation of hikers or campers.

- Human faecal contamination.
- Overflowing domestic sewage systems.
- Irrigation with inadequately treated reclaimed sewage water.
- Bird movements to and from a nearby sewage treatment works.

Water birds such as ibis can pick up tapeworm eggs from the sewage treatment works and transfer them to a nearby property. The prevalence of taeniasis is associated with different risk factors. The potential risk factors of taeniasis are: Habit of raw meat consumption, age, gender, religion, educational level and presence and usage of sanitary facilities

especially toilets [17]. Different scholars have controversies regarding to disease prevalence in association with such risk factors.

Host risk factors: Cattle of all ages are susceptible however young age groups are more susceptible. Parasitism is sometimes observed in other ruminants (sheep, goats, antelops, gazelles, buffaloes) but cysticercus development is unlikely. Man cannot spread taeniasis to his own species. Management of animals in their natural environment predisposes them to infection. In Africa inadequate education of population and low accessibility to safe taenicides has favored the spread of *Taenia saginata*.

Mode of transmission: Tapeworm eggs are spread through food, water or surfaces contaminated with feces. This can happen by drinking contaminated water or food or by putting a contaminated finger into your mouth. Importantly a human tapeworm carrier can infect him or herself with tapeworm eggs, resulting in cystercosis (autoinfection), and can contaminate others in the family. In the central nervous system or the eye rather than when develop in voluntary muscles [18].

Cattle grazing commonly have a higher risk of picking up *T. saginata* eggs as they are frequently in contact with the human feces compared to commercial herds. The risk of cattle coming into contact with *T. saginata* eggs is much higher when cattle are at pasture.

Status of cysticercosis in Ethiopia: In Ethiopia, 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. prevalence of 2% in Nekemte 3.1% in Central Ethiopia, 7.5% in Addis Ababa, 9.7% at gonder meat factory.

Some area reported higher prevalence like 17.5% in East Shoa, 18.49% at North Western Ethiopia, 21% at Tigray, 26.25% at, 27.6% at East Showa and 30% from Hawassa. Therefore, it is alarming issue in our country to focus on taeniasis and it must be further study area (**Table 1**).

Table 1: Status of cysticercosis in Ethiopia.

Location	Prevalence in %	Source
Eastern Ethiopia	5.6	Adinew and Geremew, et al.
Central Oromia		Abshir, et al.
Nekemte	60.6	Abdela and Lemi K, et al.
Dale Wabera	8.1-17.6	Kibruyesfa and Tariku, et al.
Dessie	6.8	Getachew, et al.
EasternTigray	11.85	Tewodros, et al.
Kombolcha	31.6	Haylegebriel and Alembrhan A, et al.
Hawassa	30	Fikire, et al.
WolaitaSoddo	11.3	Alemayehu, et al.
Tigray	21	Berhe, et al.
Hawassa	26.25	Abunna, et al.
North western Ethiopia	18.49	Kebede, et al.
East Shoa	17.5	Hailu, et al.
Addis Ababa	7.5	Nigatu, et al.

Life Cycle

Tapeworms have an indirect life cycle and are relatively host specific for both larval and adult stages. Humans are the only natural definitive hosts of the adult tapeworm [19]. The adult is fully developed and reproductively mature as early as 10-12 weeks (depending on species) after infection of the host.

Once mature, the tapeworm regularly sheds its most posterior segments, called gravid proglottids, which are discharged from infected humans spontaneously or with defecation. These proglottids contain thousands of

immediately infective eggs that can remain in the proglottid or be expelled free into the surrounding fecal matrix or environment. On average, a single *T. saginata* tapeworm releases six to nine proglottids daily.

Although multiple and mixed species infections can occur, most taeniosis infections involve a single tapeworm. Upon ingestion by a suitable intermediate host, a hexacanth embryo, or oncosphere, hatches from the egg and uses its six hooklets to penetrate the intestinal mucosal within a few hours to enter the circulatory or lymphatic system. It eventually reaches the tissue site (such as the lymphatic space

in skeletal muscle) where it eventually develops into acysticercus which is infective to a human final host after about 10-12 weeks. *T. saginata* have also proven suitable intermediate hosts for *Cysticercus bovis*.

In cattle, cysticercosis are found predominantly in cardiac and skeletal musculature, and occasionally in other sites including liver, lung, kidneys and lymph nodes (Figure 3).

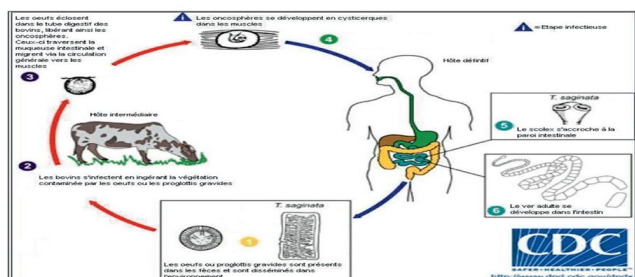


Figure 3: Life cycle of *Taenia saginata*, presented by CDC.

Pathogenesis

The adult worm, in spite of its large size, causes surprisingly little inconvenience to the patient. When the infection is symptomatic, vague abdominal discomfort, indigestion, nausea, and diarrhea and weightless may be present [20]. Occasional cases of acute intestinal obstruction, acute appendicitis and pancreatitis have also been reported. Under natural condition the presence of cysticercosis in the muscle of cattle is not associated with clinical signs checked although experiments that calves given massive infection of *T. saginata* eggs developed with severe myocarditis and heart failure associated with developing cysticerci in the heart and cause of death between 14 to 16 days. Heavy infection in cattle may

results in fever, gastroenteritis, muscle stiffness and weight loss particularly in young animals.

Clinical Manifestations

In man: Taeniosis is a non-fatal infection in man caused by the adult meat tapeworm of *T. saginata*. Humans seldom show symptoms, but in some cases suffer, clinical manifestations in humans include abdominal pain, nausea, debility, weight loss, flatulence and diarrhea or constipation. A patient may have one or several of these symptoms and a high percentage of patients experience gastric hyposecretion. Individual reactions to the infection differ and may be influenced by psychogenic factors, since patients often notice symptoms only after they see proglottids.

In animals: In cattle: *C. bovis* not pathogenic for cattle and usually the infection causes no clinical signs, unless a vital organ (e.g. the heart) is massively infected, which is very unusual. In case of massive infections muscle stiffness has been reported. However, heavy infestation by the larvae may cause myocarditis or heart failure.

Light or moderate cysticercosis in cattle is not usually associated with any defined clinical picture. Heavy infections, those induced experimentally by 200,000 to 1,000,000. As indicated in Table 2, *T. saginata* eggs, may give rise to fever, weakness, profuse salivation, anorexia, increase heart and respiratory rate and a dose of one million or more eggs may cause death between 14 to 16 days due to a degenerative myocarditis. Light or moderate cysticercosis in cattle is not usually associated with any defined clinical picture.

Table 2: Traditional anticestodial drugs.

Botanical name	Vernacular name	Plant part used	No. of name used vendors selling drug
Hageniaablssinica	Kosso	Flowers	10
Myrsine Africana	Ketchemo	Seeds	9
CrotQDmacrostachys	Bissana	Bark	8
Embeliaschimperi	Enkoko	Seeds	4
Lepidiumsativum	Feto	Seeds	2
Brassica nigra	Senafich	Seeds	7
CurcubitaRgQQ	Dubbafirie	Seeds	3
GlinulotoideMettere	Addes	Seed	9
Myrtuscommunis	Addes	Leaves	

Diagnosis

In cattle: Postmortem inspection is the most common method in use to detect bovine cysticercosis. *C. bovis* is round or oval in shape and when fully developed consists of scolex invaginated into small fluid filled vesicle.

The cystic stage is infective in about 10 weeks post-infection and can remain viable for up to 9 month. The routine meat inspection is the only diagnostic procedure in use in Ethiopia for the diagnosis of bovine cysticercosis. This method is insensitive and inaccurate and thus the reported prevalence of this infection in different regions of country may be an

underestimate. To effectively improve meat, there is a need to increase the area and number of predilection sites observed during inspection procedures.

Metacestodes (*Cysticercus bovis*) of *T. saginata* usually occur in the striated muscles of cattle (beef measles), but also buffalo, reindeer and deer. Meat inspection relies exclusively on visual examination of the intact and cut surfaces of the carcass (eye-and knife method) in the slaughterhouse by meat inspectors who follow officially laid-down procedures. Adult cestodes can be expelled from human using an anthelmintic followed by a saline purgative and are identified based on scolex and proglottid morphology.

In man: Diagnosis is based on symptoms, faecal examination and rectal swabs, although it is difficult to discover the disease during the first 3 months. A person should not be considered uninfected before having three negative tests completed over a 2-3 day intervals. As indicated in **Figure 4**, confirmatory diagnosis is made by examination of the scolex or those proglottids that show typical morphological characteristics. Eggs are distinguishable by morphological feature on examination should be repeated if the results are negative. Recently researchers are suggesting PCR standardization that can be applied on human stool samples for taeniosis diagnosis by the extraction of Deoxyribonucleic Acid (DNA) from the sample.



Figure 4: Standing *Hagenia abyssinica* tree and its flower.

Judgments for Bovine Cysticercosis

Cysts count 1-5 should be retained, frozen at 10°C for at least 10 days and released “unconditionally”, 6-20 cysts should be similarly treated as above but released conditionally to schools/institutions where proper cooking is expected to be practiced, those with over 20 cysts should be totally condemned. Developed countries are stricter than developing countries in putting the judgment for bovine cysticercosis. There is a recommendation of total condemnation of carcass if the infestation is extensive (cysts are found in at least two of the sites *viz.* heart, tongue, muscles of mastication, diaphragm and its pillars, esophagus and musculature that is exposed during dressing operations and in at least two of the sites exposed by incision into the rounds and forelimbs) during routine primary inspection while slightly infested carcass (infestation lesser than extensive infestation) may be passed for human food after removal and condemnation of the lesions with surrounding tissues.

From less infested carcasses, the cysts and surrounding tissues shall be removed and condemned while the carcass or the meat derived there from shall be held in a freezer under inspectional control at a temperature not exceeding 10°C for not less than 10 days or the meat is heated throughout, under inspectional control, to a temperature of at least 60°C. Edible viscera and offal shall be disposed of in the same manner as the rest of the carcass from which they were derived, unless any lesion of *C. bovis* is found in these by products, in which case they shall be condemned.

DISCUSSION

Public Health and Economic Importance

Public health importance: Human taeniasis is caused by infection with the adult stage of the tapeworms, *T. saginata* and *T. solium*, while human cysticercosis results from infection with the larvae (cysticerci) of the latter species. Both of these parasites occur in Africa as zoonosis because the usual hosts for the cysticerci are cattle and swine respectively, from which humans become infected with the adult tapeworm. About 100 million people worldwide may be infected with either *T. saginata* or *T. solium*. Man is the only final host where the adult *Taenia saginata* resides in the small intestine. The size reached by the adult worm is related to the number of worms present.

In a single worm infection, a worm can develop longer and produce large number of proglottids. Multiple infections up to 20 tapeworms in one host are often occurring in developing countries. Bovine cysticercosis is food-borne parasitic zoonosis caused by the larval stage of the tapeworm *Taenia saginata* commonly referred to as the beef tapeworm. This larva is meat borne and human infection results from the ingestion of raw or undercooked beef.

Taenia saginata the small intestine of man absorbs digested food and its proglottids migrate to different organs causing different signs. Adult *Taenia saginata* can live up to 30 to 40 years in the small intestine of its human host. Most humans who carry an adult tapeworm are asymptomatic. Patients may intermittently pass proglottids with spontaneously (*T. saginata*).

Economic importance: The financial loss to commercial meat producers can be significant. Meat and offal infested with *Taenia* cyst of any species (even those species not infective to man) will most likely to be rejected from the commercial food chain (will not be able to be sold) because of people will not buy it (people are unlikely to eat meat or organs with cyst in them), the economic losses due to bovine cysticercosis are associated with total condemnation of carcasses with generalized infestation.

Evaluation of the economic impact of taeniasis/cysticercosis is very difficult particularly in developing countries like Ethiopia, where necessary information is so scant and considerable proportions of infected people treat themselves with traditional herbal drugs like “kosso” and others.

However, countries have high cattle population poor hygiene, and common occurrence of bovine cysticercosis reflect heavy miss the economic impact of the disease in the cost implication scan be broken down in to those involved in treating human taeniosis and cattle carcasses (cost of freezing, boiling) or condemned, as well as the costs involved in the inspection procedures amount to millions of dollars.

Treatment

Traditional medicinal plant in Ethiopia: Indigenous medicine is used in ways that differ from the ways conventional pharmacologic drugs are used. Because herbs have nutritional elements but pharmaceutical elements interact with one another polyvalent, the clinical effects may have greater depth and breadth than those seen in drug therapy.

In Ethiopia the dried female flowers are traditionally used as an anthelmintic remedy, especially for tapeworm. Infections with *Taenia saginata* Goeze are common in this region due to the regular traditional consumption of raw beef. Historically it was one of the most famous African plants that were included in the European pharmacopoeia based on the description of a Portuguese priest in 1645 of the usage as vermifuge by Ethiopians.

Hagenia abyssinica (Kosso): In 1870 Merck produced the first crystalline compound from Kosso, which was named "kosin". Later, it was demonstrated that kosins is an artifact generated through the alkaline extraction of the etheric crude extract of the female flowers. Several investigators proposed different structures for the active principles in Kosso. The active pharmacological constituents are one, two and tricyclic phloroglucinol derivatives bearing isobutyryl, isovaleryl and 2-methylbutyryl sidechains, for historical reasons further named kosins. These compounds are similar to filix acid, the main characterization of constituents and anthelmintic properties of *Hagenia abyssinica*.

So, many Ethiopians indeed have to expel the tapeworm every one to three months, and the most used medicine for it is obtained from the dried female flowers of the kosso tree. The inflorescences are collected and dried and can be used the whole year. Some people however think that fresh flowers are strongest and that old flowers lose strength.

Myrsine africana: This medicinal plant *M. Africana* are reported from Ethiopia: The fruits are a common medicine against tapeworm and roundworm. Fruits are dried and powdered and drunk with water or eaten with food 2-3 handfuls or 15 g-20 g per treatment. No food or drink is taken for 12 hours after a worm treatment. Sometime after the medicine has been taken the patient has a burning feeling in his throat (Figure 5). The worms are evacuated with the faeces.



Figure 5: *Myrsine africana* plant.

Medical Treatment

Chemotherapy of cattle for bovine cysticercosis is not common in Ethiopia. However, such treatment has been tried in other countries and treatment with a drug was suggested to be economical where prevalence of bovine cysticercosis is very high.

Abenzimidazole: Is widely used against common nematode invasions such as ascariasis, trichiurosis and hookworm infections.

Praziquantel: Anaclyate disoquinoline-pyrazine, well absorbed from the intestine thus active against tissue parasites such as cysticerci, liver flukes and schistosomes. Both albendazole appear to be effective against adult stages and praziquantelopensmembrane calcium channels of the worm causing its paralysis, aiding the body in expelling the parasite through peristalsis.

Prevention and Control

The development of improved sanitation and hygiene practices has had a major impact on the occurrence of cysticercosis and also amongst urban populations in developing countries. Because of their effect on the transmission of taeniid eggs. Ensure there is no human faecal contamination of pasture or other cattle foodstuffs. If cattle graze land that is irrigated with reclaimed sewage water, ensure the reclaimed water is adequately treated.

Cook beef to a temperature of at least 57 degrees Celsius to kill the cysts. Meat carcass inspection to prevent human infection (taeniosis), improved farm livestock management to ensure that cattle are protected from ingesting feed or water contaminated with human faeces to prevent cysticercosis in these animals. Screening and treatment of farm workers or regular (3 monthly), controlled deworming of all staff on large farming enterprises, Proper treatment of sewage effluent and sludge to kill taeniid eggs, and avoid the use of effluent and sludge for agricultural purposes.

Deep-freezing of meat will kill all cysticerci in 24 h but a whole carcass has to be frozen for about 21 days before all parts reach the correct temperature as a meat is a good insulator. Control of cattle and pig marketing systems to prevent clandestine marketing and slaughter practices that bypass certified official, inspected channels. These should include the

provision of incentives to ensure owner compliance. Health education of both farmers/livestock owners and the general public/consumers, especially on the risks associated with eating raw undercooked meat. Effective programmers target meat inspectors, primary health care workers, school teachers, pharmacists, butchers and food handlers, people involved in ritual/cultural/informal slaughter, campers, tourists and hunters.

Washing hands with soap and warm water after using toilet teach children the importance of washing hands to prevent infection wash peel all raw vegetables and fruits before eating and use good food and water safety.

CONCLUSION

Cysticercus bovis, is an infectious parasitic disease that affects the musculature of cattle and is caused by the metacestode stage of human intestinal cestode of *Taenia saginata*. It is one of the major problems that affect livestock productivity and neglected zoonotic, human are definitive hosts. Culture of eating raw meat, Habit of defecating in open field, traditional grazing system of cattle is the main risk factor of transmission. The zoonotic importance and food borne nature of the parasite makes *Taenia saginata* a relevant public, animal health and the socio-economic impact concern of worldwide. Because highly complex process the versatility of *Cysticercus bovis* and its epidemiology, it is not possible to direct strategies for control or prevention of disease that are effectively worldwide.

Since most published studies in Ethiopia are so old that it have not indicated the current status of the problem. Therefore, it is better to undertake further studies.

REFERENCES

- Korso AE (2019) Prevalence of *Cysticercosis bovis* in Eastern Shoa of Oromia, Ethiopia. J Bio, Agr Health. 9:2224-3208.
- Abunna F, Tilahun G, Megersa B, Regassa A, Kumsa B (2008) Bovine cysticercosis in cattle slaughtered at Awassa municipal abattoir, Ethiopia: Prevalence, cyst viability, distribution and its public health implication. Zoonoses Public Health. 55(2):82-88.
- Abunna F, Tilahun G, Megersa B, Regassa A (2007) Taeniasis and its socio-economic implication in Awassa town and its surroundings, Southern Ethiopia. East Afr J Public Health. 4(2):73-79.
- Ashwani K, Gebretsadik B (2008) Occurrence of cysticercosis in cattle of parts of Tigray region of Ethiopia. Haryana Vet. 3:88-90.
- Asaava LL, Kitala PM, Gathura PB, Nanyingi MO, Muchemi G, et al. A survey of bovine cysticercosis/human taeniosis in Northern Turkana district, Kenya. Prev Vet Med. 89(3-4):197-204.
- Berhe G (2009) Abattoir survey on cattle hydatidosis in Tigray region of Ethiopia. Trop Anim Health Prod. 41(7): 1347-1352.
- Boone I, Thys E, Marcotty T, de Borchgrave J, Ducheyne E, et al. (2007) Distribution and risk factors of bovine cysticercosis in Belgian dairy and mixed herds. Prev Vet Med. 82(1-2):1-11.
- Dorny P, Phiri I, Gabriel S, Speybroeck N, Vercruyse J (2002) A sero-epidemiological study of bovine cysticercosis in Zambia. Vet Parasitol. 104(3):211-215.
- Endris J, Negussie H (2011) Bovine cysticercosis: Prevalence, cyst viability and distribution in cattle slaughtered at Kombolcha Elfora Meat factory, Ethiopia. Am Eurasian J Agric Environ Sci. 11:173-176.
- Fikire Z, Tolosa T, Nigussie Z, Macias C, Kebede N (2012) Prevalence and characterization of hydatidosis in animals slaughtered at Addis Ababa abattoir, Ethiopia. J Parasitol Vector Biol. 4(1):1-6.
- Gizaw M, Timotiwo W (2022) Prevalence of *Cysticercus bovis* in cattle in case of Wolaita Sodo municipal Abattoir, Southern Ethiopia. A Peer Reviewed, Referred, Indexed and Open Access J. 9:2348-8069.
- Yigizaw G, Tefera Y, Tintagu T (2017) Prevalence of *Cysticercus bovis* at Dessie municipal abattoir, North East Ethiopia. Abyssinia J Sci Techno. 2(1):25-29.
- Gupta PK, Varshney RK (2000) The development and use of microsatellite markers for genetic analysis and plant breeding with emphasis on bread wheat. Euphytica. 113(3):163-185.
- Tesfay H, Assefa A (2014) *Cysticercosis bovis* in Eastern Tigray, Northern Ethiopia. Int J Innov Sci Res. 10:522-526.
- Jeon HK, Eom KS (2006) *Taenia asiatica* and *Taenia saginata*: Genetic divergence estimated from their mitochondrial genomes. Exp Parasitol. 113(1):58-61.
- Kebede N (2008) Cysticercosis of slaughtered cattle in Northwestern Ethiopia. Res Vet Sci. 85(3):522-526.
- Kebede N, Tilahun G, Hailu A (2009) Current status of bovine cysticercosis of slaughtered cattle in Addis Ababa Abattoir, Ethiopia. Trop Anim Health Prod. 41(3): 291-294.
- Minozzo JC, Gusso RL, Castro EA, Lago O, Soccol VT (2002) Experimental bovine infection with *Taenia saginata* eggs: Recovery rates and cysticerci location. Braz Arch Biol Technol. 451-455.
- Nunes CM, Biondi GF, Heinemann MB, Richtzenhain LJ (2000) Comparative evaluation of an indirect ELISA test for diagnosis of swine cysticercosis employing antigen from *Taenia solium* and *Taenia crassiceps* metacestodes. Vet Parasitol. 93(2):135-140.
- Hunter A (2000) OIE manual of standards for diagnostic tests and vaccines. Cysticercosis. 423-428.