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Review Article

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Review on *Tania saginata* and Its Zoonotic Importance in Ethiopia

Fikadu Fola Diko[a]

[a] Department of Veterinary Public Health; Jimma university, P.O. Box 379
Corresponding Authors; Fikadu Fola Diko, *kumefikadu123@gmail.com*

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Abstract

The presence of zoonotic helminths in meat, particularly in developing countries, poses a significant public health challenge.One such parasite, *Cysticercus bovis*, comes from the flatworm *Taenia saginata*. This parasite primarily infects cattle, but it can also affect humans who consume undercooked beef that contains viable cysticerci, leading to a condition known as taeniosis. The life cycle of this tapeworm relies heavily on the interaction between humans and cattle. Infected individuals can shed up to a million eggs daily, leading to cattle infection when they graze on contaminated pastures. Despite Taenia *saginata* being a global concern, higher infection rates are common in Africa, including Ethiopia. The consumption of raw meat, traditional cattle slaughter methods, poor sanitation, and unrestricted livestock grazing trigger disease's transmission in Ethiopia. The infection treatment options include the anthelmintic like Niclosamide and Praziquantel but many people in Ethiopia also turn to traditional medicinal plantsinclude; *Hagenia abyssinica* (Kosso), *Embelia schimperi* (Enkoko), and *Glinus lotoides* (Metere or Amkint) have been used in Ethiopia. Effective control measures such as proper meat inspections, improved personal and environmental hygiene, temperature treatments for meat, and raising public awareness using a One Health approach is highly recommended.

1. Introduction

Zoonotic diseases are diseases that transmit from animal to human and one of the world's greatest health challenges, both today and in the past (Bendrey & Martin, 2022).In the past, zoonotic diseases were primarily confined to low- and middle-income countries. However, things are changing, with the expansion of international markets, better transportation systems, and shifts in demographics, the geographical reach and the populations at risk are becoming much broader. In fact, around 60.3% of emerging infectious diseases are zoonoses, which means they originate from animals and affect humans. These diseases can significantly impact public health, and they shift in their patterns and the burdens they impose(Vale, 2022). As the human population grows and socioeconomic conditions change, more people are moving into new geographical areas, which, along with alterations in farming practices, can contribute to the emergence of new diseases. Additionally, advancements in diagnostic techniques are uncovering a higher incidence of zoonoses than previously thought. Furthermore, some newly recognized health issues are now being linked to parasitic zoonoses, further increasing the overall burden of disease (Torgerson & Macpherson, 2011).

The occurrence of zoonotic helminths in meat is a significant public health issue. These are parasites that can move from animals to humans, creating health risks when contaminated meat is consumed. Unfortunately, the rates of these infections from helminth parasites are often underestimated and neglected. This lack of attention means that such infections are becoming increasingly common in various regions around the globe. One major reason for this trend is the insufficient procedures in place for routine diagnosis, monitoring, and reporting related to many zoonotic parasites(Mohamed *et al.*, 2024).

Cysticercus bovis is a global zoonotic disease caused by a type of flatworm, and its spread is influenced by various ethnic and cultural factors. It is estimated that between 50 to 77 million people around the world are affected, leading to approximately 50,000 deaths each year due to this issue. Both the larval and adult forms of the parasite pose serious health risks to their hosts, either directly or indirectly, and can lead to several secondary infections, especially in humans(Tamirat *et al.*, 2018).When the larvae of *Cysticercus bovis* infect the muscle tissue of cattle, it results in cysticercosis, while the adult worms residing in the human small intestine cause taeniasis. It is cosmopolitan in its distribution and its life cycle is entirely dependent on the link between man and cattle (Semie *et al.*, 2018).

Cysts of *Cysticercus bovis* can appear throughout a cattle carcass and its organs, but they tend to be more commonly found in certain areas, such as the masseter, tongue, heart, triceps, intercostal muscles, and diaphragm. Many of these parts are often eaten raw or only lightly cooked, which poses a significant public health risk for contracting taeniasis (Haile, 2021). This diseaseis commonly prevalent in Sub-Saharan Africa and can cause significant economic setbacks by lowering productivity levels. Taeniasis is caused by *Taenia saginata*, which not only leads to financial losses but also negatively impacts public health. This parasite is particularly prevalent where sanitary conditions are often inadequate, and people frequently consume raw, undercooked, or sun-dried meat (Abate Worku, 2014).

In Ethiopia, human taeniasis is a prevalent infection, primarily associated with the local cultural habit of eating raw or undercooked beef in various communities. Many of these communities, especially in rural areas where over 80% of the population resides, struggle with inadequate access to proper sanitation facilities, resulting in widespread open defecation. Traditional livestock management practices, such as allowing cattle to roam freely, exacerbate the situation by exposing these animals to contaminated environments. Consequently, cattle may ingest *T. saginata* eggs found in contaminated pasture or water, facilitating the ongoing cycle of transmission associated with cysticercosis(Yimer & Gebrmedehan, 2019). This infection is often linked to poverty and is frequently overlooked as a significant health concern. To combat this issue, effective prevention and control strategies must consist of prompt diagnosis, appropriate treatment, and various preventive measures (Sharma & Garg, 2021). This review aims to provide insights into the etiology, life cycle, transmission, epidemiology, status in Ethiopia and control strategies related to *Taenia saginata*, as well as its implications for human health.

2. Literature review

2.1. Aetology and morphology

Bovine cysticercosis is a parasitic infection of cattle caused by the larval stage (Cysticercus) of the cestode *Taenia saginata*. This larva is meat-borne, and humansget infection by consuming raw or undercooked beef.*Taenia saginata* is known as the “beef tapeworm” because beef is the main source of infection (Fesseha & Asefa, 2023)In cattle diseaseaffect muscles and it is zoonotic , meaning it can be transmitted from cattle to humans by consuming this infected muscle. *Taenia saginata* belongs to the order Cyclophyllidea and genus Taenia (Mohamed *et al*., 2024).

The adult *Taenia saginata* tapeworm is a large, ribbon-like, flat worm that can grow to lengths of 4 to 15 meters, consisting of thousands of individual segments called proglottids arranged in a chain. Its body is divided into three main parts: the head (scolex), the neck, and the strobila. The scolex contains attachment organs that help the tapeworm latch onto the host's intestines, while the neck is short and unsegmented(Belete, 2023).The long chain of segments, known as the strobila, continuously produces new proglottids that mature as they move down the chain. Each proglottid is hermaphrodite and contains one or two sets of reproductive organs. Finally, when the proglottids are fully developed, they usually leave the host one at a time and can sometimes exit spontaneously from the anus(Shafaghi et al., 2015).

The scolex of the *Taenia saginata* tapeworm is about the size of a pinhead and is followed by a short, undivided area known as the neck. From there, a long chain of segments, called the strobila, emerges, giving the tapeworm its characteristic ribbon-like appearance with potentially over a thousand proglottids. The proglottids increase in size, with the oldest and largest segments found at the posterior end(Blate *et al.*, 2023).One of the most notable characteristics of tapeworms is the absence of a mouth and digestive system. Instead, they rely on their outer covering, called the tegument, for various essential functions like absorption, digestion, and protection. The tegument surrounds the entire worm, and its outermost layer features tiny projections known as microtriches, which resemble microvilli. These projections are coated with a thin layer of glycoproteins and mucopolysaccharides, known as the glycocalyx, helping the tapeworm interact with its environment(Tesfaye *et al.*,2025).

The neck and strobila of the *Taenia saginata* tapeworm are noticeably flattened, while the scolex exhibits a radial symmetry, making it difficult to distinguish between the dorsal and ventral surfaces. The testes are located closer to one side, which is therefore identified as the dorsal surface, while the female reproductive organs are situated nearer to what is considered the ventral surface. The only external feature of each proglottid is the genital pore or atrium. Proglottids develop in stages: those closest to the neck are immature, followed by mature segments, and the ones at the tail end are gravid, filled with eggs. The mature proglottids are hermaphroditic, containing hundreds of testes linked by delicate sperm ductules that join to form a single sperm duct or vas deferens that leads to the genital pore, culminating in a muscular structure called the cirrus. The female reproductive system features a bilobed ovary connected to an oviduct. The vagina is a slightly winding tube that connects the genital atrium to the oviduct. Additionally, the vitelline glands are also linked to the oviduct. Once the gonads and their ducts mature, the oviduct transforms into a central sac or uterus, where fertilization occurs(Tagesu, 2018).

Gravid proglottids can hold between 50,000 and 80,000 eggs, which can be at various stages of maturity. These eggs are spherical, measuring between 20 and 50 micrometers in diameter. When viewed under light microscopy, they exhibit a radial pattern due to the embryophore that surrounds the oncosphere, which is made up of blocks formed by a keratin-like protein that are closely packed together. The eggs can survive for several weeks or even months in environments like sewage, water, or on pasture. When cattle ingest these eggs, the embryos hatch and become active due to the effects of gastric and intestinal juices. They then penetrate the intestinal lining to enter the bloodstream. The oncospheres migrate to the skeletal and cardiac muscles, and occasionally to fat and internal organs. However, they begin to deteriorate within a few months following infection, with a significant number becoming dead and calcified by the nine-month mark. The cysticerci, which are the larval forms, become capable of infecting humans approximately ten weeks after they form in the cattle(WHO/FAO/OIE, 2005).

Figure 1: Mature *Taenia saginata* discharged from humans (Liu et al., 2025).

2.2. Life cycleand modes of transmission

The life cycle of the tapeworm is completely dependent on the connection between humans and cattle. Any disruption in this connection could lead to the complete eradication of the parasite(Haile, 2021).Humans are the primary source of the parasites, and certain behaviors contribute to the spread of bovine cysticercosis. In regions with transhumant or nomadic lifestyles, these behaviors are influenced by cultural practices that can expose animals to infected feces. Cattle become infected primarily through the improper disposal of human feces by infected individuals or indirectly through the use of human sewage as fertilizer on grazing land(Tagesu, 2018).In this relationship, cattle serve as intermediate hosts where the larvae develop, while humans are the definitive hosts for the adult tapeworms(Mohamed *et al.*, 2024).

After eggs are laid in the soil or on grass, they can be ingested by cattle and other herbivores. In these animals, the tough outer layer of the eggs remains intact as they travel through the first three stomach chambers. When they reach the abomasum, the eggs are exposed to pepsin, which breaks down the substance holding them together. As they move into the duodenum, the eggs are further acted upon by pancreatic secretions, leading to their disintegration and the release of the onchosphere, which is still enclosed in a protective membrane. The onchosphere then secretes enzymes that help it invade the intestinal lining and enter the bloodstream. From there, it travels to muscle tissues in the hind limbs, diaphragm, and tongue, where it becomes trapped and transforms into a cyst, known as a bladder worm or Cysticercus, over a period of about 3 to 4 months. When a person eats raw or undercooked beef containing this cyst, the parasite continues its development into an adult worm in the small intestine, completing its life cycle. After ingestion, it takes roughly two months for the adult worm to mature and establish itself in the human intestine(Talu, 2012).

An infected individual can release up to one million eggs daily. When cattle consume contaminated pasture, they can become infected with the parasite. The tapeworm lives in the small intestine of humans, where it matures and generates segments, each containing around 100,000 eggs. These segments can detach and exit the body through feces or by migrating out through the anus. In cattle, the cysts mainly develop in the heart and skeletal muscles, but they can also appear in other areas such as the liver, lungs, kidneys, and lymph nodes(Begidu *et al.,* 2025).

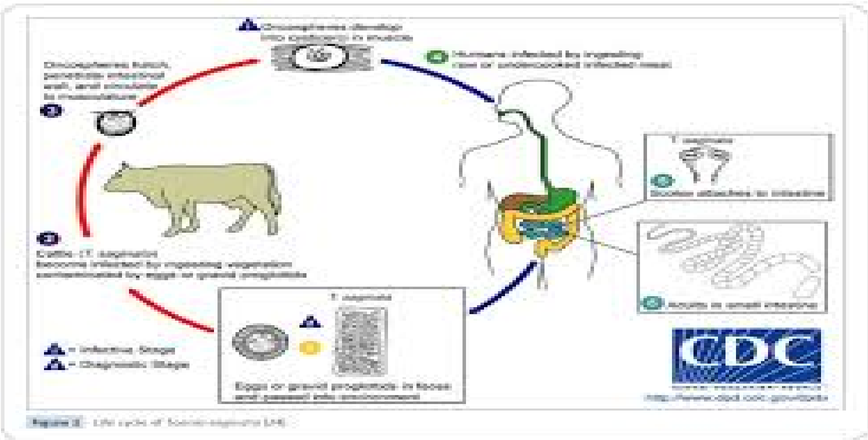

Figure 2:life cycle of *T.saginata*(Alemneh T *et al.*, 2017).

Cattle serve as the main intermediate hosts for *T. saginata*, while humans are the only final hosts of this parasite. All age groups of cattle can be infected, but younger cattle tend to be more vulnerable. Occasionally, other ruminants like sheep, goats, antelopes, gazelles, and buffaloes may also host this parasite(Abdo *et al*., 2009).

2.3. Epidemiologyand risk factor

2.3.1.Epidemiology

Taenia saginata is found worldwide, affecting both developed and developing nations. However, Africa reports a significantly higher number of cases compared to other regions of the globe(Meku, 2022). Moderate prevalence levels are also seen in Southern Asia. High prevalence rates occur in Sub-Saharan Africa, especially in Eastern Africa where it causes an important economic loss due to condemnation of meat.

Highly endemic regions for *Taenia saginata* include countries in Central and East Africa, such as Ethiopia, Kenya, and Zaire, as well as Argentina, the Caucasus region, and South-Central Asian republics of the former USSR. The Mediterranean area, including Syria, Lebanon, and parts of the former Yugoslavia, also shows high levels of infection. In certain areas of Serbia and Montenegro, reports indicate that as many as 65% of children may be affected by *T.saginata*. Moderate prevalence rates are observed in Southeast Asian countries like Thailand, India, Vietnam, and the Philippines, as well as in Japan and various nations in Western Europe and South America(Fahmy *et al.*, 2015). In contrast, Canada, the USA, Australia, and some countries in the Western Pacific experience low rates of infection(Abate Worku, 2014).In Ethiopia, reported prevalence rates of bovine cysticercosis in cattle ranged from 2.2% to 3.2%(Kebede *et al.*, 2009).

2.3.2. Risk factor

In Cattle:Several factors can increase the risk of bovine cysticercosis on farms. One major risk is having tapeworm carriers among the farm staff. Poor hygiene practices among workersfor example, not washing hands properly after handling animal feed or during hand milkingcan also contribute to the spread of the disease, especially if hands come into contact with eggs. Defecating in areas where cattle gather or in places where cattle feed is produced can further heighten the risk. Additionally, using human sewage as fertilizer on pastures or applying it to soils that easily allow water to seep through can lead to the contamination of nearby water sources. Even treated wastewater from sewage treatment plants can pose a risk if it contains Taenia eggs(European Commission, 2000).In Human: the primary risk factor for taeniosis is consuming undercooked beef that contains viable cysticerci. This can occur when meat has not undergone thorough inspection or when current meat inspection methods fail to identify contamination. Individuals eat this contaminated meat, they can become infected with the tapeworm(Aziz, 2024).

2.4. Zoonotic and economic importance

Taenia saginata cysticercosis is zoonotic and poses a serious threat to public health(Firew & Moges, 2018). The larval stage of the tapeworm family Taeniidae, known as the Cysticercus, leads to a condition called cysticercosis. These cysticerci can be found in various tissues of infected animals, and the rate at which they are recovered varies based on the amount of infecting material introduced. Cysticercosis is a parasitic disease that can be transmitted from animals to humans and has been identified by the World Health Organization (WHO) as a top priority within the list of Neglected Tropical Diseases (NTDs)(Sitali *et al.*, 2022). It is estimated that there are approximately 50 to 77 million cases each year, leading to around 50,000 deaths annually(Tamirat *et al.*, 2018).

Human taeniasis is one of the most important food-borne parasitic diseases, but it is preventable and treatable(Iza *et al.*, 2020). The practice of consuming raw beef, poor sanitation facilities, backyard slaughtering, limited access to effective medications for treatment, unrestricted access of cattle to surface water, and the proximity of livestock to wastewater all contribute significantly to the transmission of bovine cysticercosis within cattle herds. These factors make taeniasis more prevalent in developing countries, such as Ethiopia, where meat holds a central place in the diet and is often eaten raw on various occasions(Kumar & Tadesse, 2011).

In Ethiopia, nearly 45% of the meat consumed by households comes from cattle, highlighting the importance of livestock to the nation's diet and economy. However, the income generated from this vital resource is impacted by a range of animal health issues, with *T. saginata* parasitic infections being among the significant concerns(Sendafa, 2024).

2.5. Disease in Ethiopia

Parasitic zoonotic diseases encompass a diverse group of infectious diseases characterized by varying host ranges and methods of transmission. Their spread, prevalence, and transmission patterns are influenced by a combination of factors, including human activities, animal health, and environmental conditions(Komba, 2017).Poor coordination between human and animal health sectors and insufficient resources leads toineffective surveillance systems and delayed responses to public health threats(Fenta *et al.*, 2025).Additionally, foodborne parasitic zoonoses are further complicated by inadequate inspections at critical points in slaughterhouses, a lack of awareness about how these diseases spread, and the widespread practice of consuming raw meat in both rural and urban settings(Rodarte et al., 2023).

The prevalence of *Cysticercus bovis* in Ethiopia, revealing significant differences in reported rates across various abattoirs and notable portion of the population has reported issues with taeniasis(Tamirat *et al*., 2018).The cultural habit of eating raw meat, such as "Kurt" (cubed meat) and "Kitfo" (minced meat), is believed to play a significant role in the transmission of this disease in Ethiopia(Fesseha & Asefa, 2023).

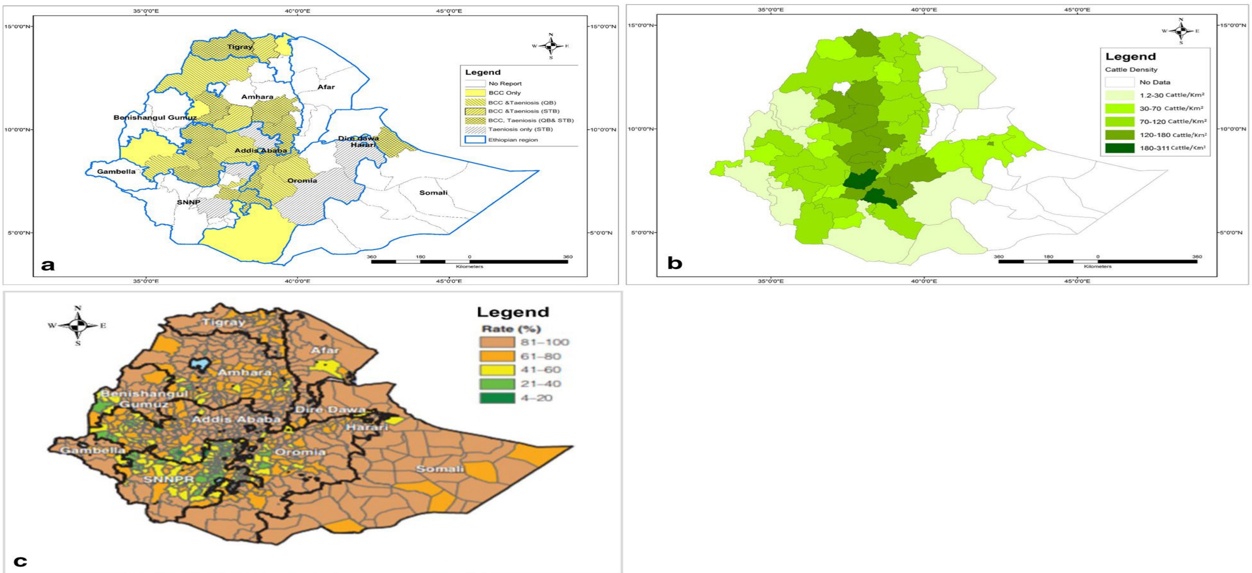

Figure 3: Map of Ethiopia showing regions and zones. where; a, bovine cysticercosis and taeniosis were reported. b Cattle population density reported. c open defecation areas reported(Jorga et al., 2020).

2.6. Clinical sign and pathogenesis

2.6.1. In humans

Taeniosis is generally not fatal and most individuals with this infection do not exhibit significant symptoms, but some may experience issues such as abdominal pain, nausea, fatigue, weight loss, bloating, and changes in bowel habits, including either diarrhea or constipation. While many people may have one or several symptoms, a high percentage report gastric hyposecretion as well(Wiktoria *et al*., 2025). Reactions to the infection can vary greatly among individuals and might be influenced by psychological factors, particularly when symptoms are more common after seeing the proglottids,the segments of the tapeworm(Weledsenbet & Deresso, 2023).

Humans typically become infected by consuming improperly prepared beef containing viable cysts. Often, just one cyst is enough to start an infection, although multiple cysts can lead to co-infections(Hotez & Kamath, 2009). It is estimated that a single infected bovine carcass could potentially infect 8 to 20 people on average. Once ingested, the adult tapeworm develops in the human small intestine, reaching full maturity within two to three months and can grow impressively large(Cabaret *et al*. 2002). Without treatment, these tapeworms can reside in the intestines for 20 to 25 years, releasing gravid proglottids that contain between 30,000 and 50,000 eggs; typically, three to seven proglottids are expelled daily. These segments can exit the host's body either actively through the anus or alongside stool, often found on the surface of feces (Kumera, 2021).

2.6.2.In cattle

Diseases arise when eggs are released in human feces into the environment, allowing cattle to become infected by grazing on contaminated pastures or consuming contaminated food or water. Once inside the cattle's body, the eggs hatch and penetrate the intestinal wall, allowing the oncospheres to enter the bloodstream. From there, it spreads to various parts of the body, where it develops into cysticerci. These cysts tend to form in certain areas, such as the heart and masseter muscles (Dermauw *et al*., 2018). Maturecysticercus of *Cysticercus bovis* appears as a grayish-white structure about 1 cm in diameter, filled with fluid in which the scolex (the head of the larva) is typically visible. When the cyst is cut open, it may still be viable, encased in a thin fibrinous capsule, or it may have degenerated, presenting with a cream or greenish color due to calcification. These cysticerci develop over a span of 3 to 4 months after the host ingests the eggs. Remarkably, they can remain viable within the intermediate host for up to 9 months or even throughout the animal's entire life(Blate *et al.*, 2023).

Cysticercus bovis does not pose a significant health threat to cattle, and most infections do not lead to noticeable clinical signs, unless there is a severe infestation of a vital organ like the heart, which is rare. In cases of substantial infection, muscle stiffness may occur, and heavy infestations can lead to more serious conditions like myocarditis or heart failure. Light to moderate cases of cysticercosis in cattle typically do not present a defined clinical picture. However, intense infections such as those induced experimentally with 200,000 to 1,000,000 *T. saginata* eggs can lead to symptoms like fever, weakness, excessive salivation, loss of appetite, and increased heart and respiratory rates. In extreme cases, administering a million or more eggs may result in death within 14 to 16 days due to degenerative myocarditis. Overall, mild or average cysticercosis in cattle is not usually linked with any specific clinical signs(Weledsenbet & Deresso, 2023).

2.7. Diagnosis

2.7.1. In Cattle

Enzyme-linked immunosorbent assays (ELISA) that detect antibodies are not very effective for diagnosing individual cysticercotic animals. One limitation of these tests is that they cannot differentiate between new infections involving live metacestodes and older infections with degenerated metacestodes that are no longer capable of causing infection. In contrast, diagnostic techniques that detect circulating antigens have the advantage of specifically identifying the presence of living cysts. a study by Brandt et al. (1992), developed IgM monoclonal antibodies (MoAbs) targeting excretory-secretory antigens from the metacestode stage of *Taenia saginata*, which were then used in a sandwich ELISA format. This method was subsequently improved by incorporating IgG isotype MoAbs and applying heat to the serum samples to break up immune complexes. The enhanced technique boasts a specificity of 98.7%, meaning it accurately identifies infected animals most of the time. Its sensitivity is 92.3% for cattle with more than 50 live cysticerci, but it drops to only 12.8% for cattle with fewer than 50 cysticerci present. This illustrates the challenges in accurately diagnosing infections, especially when the number of cysts is low(Dorny et al., 2000).

In Ethiopia, the standard method for diagnosing bovine cysticercosis is routine meat inspection, which 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. However, this approach is not very sensitive or accurate, which likely leads to an underreporting of the infection's prevalence across various regions(Kumar & Tadesse, 2011).

Metacestodes, or larva, of *Taenia saginata* are typically found in the striated muscles of cattle, which is commonly referred to as beef measles. These metacestodes can also be present in other animals, such as buffalo, reindeer, and deer. Individual countries have different regulations regarding the inspection of carcasses. In Ethiopia, meat inspection primarily involves a visual examination of both intact and cut surfaces of the carcass by trained inspectors in slaughterhouses, following officially established protocols(Talu, 2012).Additionally, deep incisions into both the external and internal muscles of the masseter, which run parallel to the jaw. Visual inspection and longitudinal incision through the myocardium, starting from the base and extending to the apex of the heart are performed (Juta *et al.*, 2012). According to the Ethiopian Meat Inspection Regulation Notice Number 428 of 1972, the standard procedure for inspecting carcasses includes several steps. Inspectors perform a visual check and palpate the carcass surfaces. For instance, longitudinal incision along the ventral side of the tongue, from the tip to the root, and a deep incision into the triceps muscles on both sides of the shoulder(Ministry of Agriculture (MoA), 2021).

2.7.2. In human

Adult tapeworms can be expelled using anthelmintic medications, followed by a saline purgative. The worms can then be identified by examining the morphology of their scolex (head) and proglottids (body segments). Diagnosis typically involves checking stool samples for eggs or visually inspecting any proglottids or segments that are passed. It is important to note that diagnosing the infection can be challenging within the first three months of exposure. To be certain that someone is not infected, they should have three negative test results over a span of 2 to 3 days(Alemneh T *et al.*, 2017). Diagnosing *Taenia*eggs in human stool samples using a microscopeis a traditional method and often misses cases and is not very reliable. One challenge is that the eggs of different *Taenia species* look the same and have identical morphological characteristics and are difficult to differentiate by microscopy. To improve diagnosis, researchers have developed alternative techniques, like copro-Ag-ELISAs, which search for specific antigens in feces. Moreover, a range of molecular tests such as PCR has also been introduced, offering a more accurate way to identify human taeniasis. These advancements aim to enhance the accuracy and reliability of human taeniasis (Naqvi *et al.*, 2026).

2.8. Treatment

In Ethiopia, the most commonly used medications for treating *T. saginata* infections are niclosamide and praziquantel. Niclosamide, commercially known as Niclocide or Yomesan, is considered the primary treatment for taeniasis(Zhang *et al.*, 2019). An adult dose of 2000 mg is effective in damaging the tapeworm enough that a purge after treatment often reveals the scolex (the head of the worm). Praziquantel, marketed as Biltricide, is another effective option, typically administered at a dose of 5 to 10 mg per kg; however, it may lead to partial digestion of the scolex, making it less likely to be recovered(Tesfaye *et al.*,, 2025).In addition to these pharmaceutical treatments, several traditional medicinal plants have also been found to be effective against taeniasis in humans. These include widely used plants in various regions of Ethiopia, such as the flowers of *Hagenia abyssinica* (known locally as Kosso), the fruit of *Embelia schimperi* (referred to as Enkoko), and the seeds of *Glinus lottoides* (locally called Metere or Amkint(Talu, 2012).

2.9. Prevention and control

Control measures for *T. saginata* after slaughter mainly involve meat inspections. When necessary and feasible, a sample of suspicious cysts should be examined through histopathology to confirm whether the cysts are viable, following recognized methods approved by the relevant national authorities. Any laboratory tests utilized should have clearly defined performance metrics, such as sensitivity and specificity, to ensure a risk-based approach to food safety is effectively implemented. The sensitivity of standard post-mortem meat inspections for *T. saginata* is quite low, especially in animals with light infections. As a result, many carcasses that contain *T. saginata* cysts may go unnoticed. Additionally, only a fraction of these undetected cysts will be viable, and this percentage can vary based on the extent and cycle of infection within the originating herd. The procedures for post-mortem inspections can differ significantly from one country to another (CAC, 2014).

Temperature treatments, such as heating and freezing, are effective regular preventive measures to ensure the lethality of *T. saginata*. To achieve this, it is recommended to freeze meat at -10°C for a minimum of 10 days or to heat it to a core temperature of 60°C.Heat treatment is also applied to meat from carcasses that are suspected or confirmed to be infected with *T. saginata*, as well as those from the same herd. It is important that these treatments are validated according to the relevant national guidelines. Additionally, salting and irradiation can be alternative methods for ensuring safety, but they must also be validated and approved by the competent authority to confirm their effectiveness against *T. saginata*. For guidance on irradiation practices, refer to the General Standard on Irradiated Food (CODEX STAN 106-1983) and the Code of Practice for Radiation Processing of Food(CAC/RCP 19-1979)(CAC, 2014).

To enhance an effective control program for *T. saginata*, it is essential to implement actions that address multiple stages of the parasite's life cycle. This calls for a collaborative effort among all involved parties, including consumers, healthcare professionals, pharmacists, sewage treatment plant managers, meat inspectors, veterinarians, and farmers.These stakeholders can help ensure a more comprehensive approach to managing and preventing *T. saginata* infections(Riyadi1 et al., 2025).

Despite decades of research and millions of dollars invested, vaccination against parasitic infections has not been particularly successful. One key reason for this is that parasitic infections are often chronic, unlike those caused by bacteria or viruses. Parasites tend to provoke inappropriate and ineffective immune responses from the host or can suppress the host’s immune system, preventing a strong and effective reaction.Furthermore, parasites employ various strategies to evade the immune system, such as changing their surface proteins, mimicking host molecules, and hiding within the host's tissues. Their complex life cycles and unique biological characteristics also make it challenging to develop effective vaccines(Herron, 2024).

However, it’s worth noting that most parasitic infections do provide some level of immunity against subsequent infections with the same parasite in the host. This highlights the potential for developing effective vaccine strategies. Efforts have been made to vaccinate cattle against *T. saginata*, with the TSA9/TSA18 vaccine demonstrating encouraging results in providing protection against the infection(Harrison *et al*., 2005). However, despite these advancements, there are no current initiatives in place for widespread vaccination, as the evidence does not support it being financially viable at this time (Okello and Thomas, 2017).

Generally,Controlling *T. saginata* infections requires a comprehensive One Health approach that brings together public health, veterinary care, and environmental actions. Meat inspection and certification play a crucial role in decreasing bovine cysticercosis. However, the success of these measures relies heavily on the training of inspectors and strict adherence to safety standards. Furthermore, educational campaigns that raise awareness about the dangers of consuming raw beef, along with improvements in sanitation infrastructure in areas where the disease is common, have demonstrated effectiveness in reducing human taeniasis (Aziz, 2024).

2.10. One health approach to control beef tapeworm

One Health is an integrated approach that highlights the deep connections between human health, animal health, and the health of our environment. It emphasizes that the well-being of people, animals, and ecosystems are intertwined and that tackling health challenges requires teamwork across different fields(Calistri et al., 2013). This approach is crucial in managing the risks linked to beef tapeworm infections. By understanding how human, animal, and environmental health are related, various stakeholders can come together to develop effective strategies. These strategies can improve disease tracking, enhance food safety, raise public awareness, and encourage sustainable practices, ultimately helping to lessen the impact of this zoonotic infection (Sudewi *et al.*, 2024). Accordingly, several developments have been made to pioneer One Health schemes in Ethiopia. Among these, the establishment of the National One Health Steering Committee and Technical Working Groups, prioritization of zoonotic diseases based on their impact on human and livestock, the development of prevention and control working documents(Fetensa et al., 2025). It also prioritized zoonotic diseases, joint disease surveillance and outbreak investigation, prioritization of zoonotic diseases, capacity building and other One Health promotions in the country(Erkyihun et al., 2022).

3. Conclusion and Recommendation

This review highlights *Taenia saginata* infections in humans and cattle, driven by interconnected risk factors. It is an infection of public health significance as eating of raw or undercooked beef results taeniasis in human population and an important cause of economic loss mainly due to condemnation, refrigeration and downgrading of infected carcasses. The disease is common in Ethiopia and affect human health and cause significant food safety problem and causes economic loss in food production.The disease can be controlled by proper hygiene, regular meat inspection, use of appropriate antihelminth and one health approaches. Based on the above conclusion, the following recommendations are forwarded:

- ✓ Public Awareness Campaigns: Increase awareness about *Taenia saginata*, its transmission, and preventive measures.
- ✓ One Health Approach: Foster collaboration among human health professionals, veterinarians and environmental scientists to create a comprehensive strategy for the prevention and control
- ✓ Strict routine meat inspection of slaughtered animals should be carried out
- ✓ The community should use latrines to improve personal as well as environmental hygiene and Untreated human feces should not be used as fertilizers.

Appendix

List of abbreviation

CAC……Codex Alimentarius Commission
ELISA-----Enzyme Linked immunosorbent Assay
NTD--------Neglected Tropical Disease
PCR…… Polymerase Chain reaction
WHO-------World Health Organization
MoA………Ministry of agriculture

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