

A Review on Metacestode Influence in the Case of Public Health and Economic Manners in Small Ruminants

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Abstract

Small ruminants are widely reared in a crop-livestock farming systems and are distributed across different agro-ecological zones of Ethiopian. Cysticercosis, hydatidosis and coenurosis of farmed and wild animals is caused by the larval stages (metacestodes) of cestodes of the family Taeniidae (tapeworms). Cerebellar cysts may precipitate more acute and severe signs of ataxia or opisthotonus. Eggs contaminate the environment and waters then it resist for 15 days under dry conditions, or in the high level of humidity it can stay 30 days. The life cycle is indirect with sheep and goats acting as an intermediate host. Coenuruses results from ingestion of contaminated pasture with eggs. *T. hydatigena* and *T. ovis* are cosmopolitan parasites, though control programs, improved sanitation and other factors have made them uncommon in some regions. Infection by the larval stage of the tapeworm *T. multiceps* in small ruminants is common in worldwide. Tapeworms of the family Taeniidae are transmitted from the definitive hosts such as carnivores to the intermediated hosts including herbivores or omnivores and human beings *via* oral-fecal cycle. The predilection sites of positive cyst were right cerebral hemisphere, left cerebral hemisphere and cerebellum. The type and severity of the clinical signs is influenced by the number and location of the parasites. Cysticercotic encephalitis, which is most common in children and teenagers, is a particularly dangerous disease. Metacestodes causes considerable economic impacts in terms of morbidity, loss of productivity and health care costs. Different abattoir survey indicated that metazoan parasites are endemic disease of small ruminants in Ethiopia, especially in the highland where 75% of the sheep population is found. Controlling cysticercosis and coenurosis 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: Small ruminants • Ethiopia • Life cycle • Metacestode • Zoonosis

Abbreviations: CNS: Central Nervous System; CSF: Cerebrospinal Fluid; EC: Ethiopian Calender; ETB : Ethiopian Birr; US\$: United State Dollar

Introduction

Small ruminants are widely reared in a crop-livestock farming systems and are distributed across different agro-ecological zones of Ethiopian. Ethiopia's estimated livestock population is often said to be the largest in Africa. In the country, there were approximately 60.39 million cattle, 31.3 million sheep, 32.74 million goats, 0.46 million camels and 56.06 million poultry. Small ruminants are found mainly in the lowland agro-ecology, which constitutes 65% of the area, where 25% sheep and close to 100% goat's population exist. They have lower feed requirements compared to cattle because of their small body size. This allows easy integration of small ruminants into different farming systems. Economic opportunities exist for small ruminant producers to supply animals to both the export and domestic markets. Taking advantage of these opportunities requires overcoming many barriers to increase productivity. They are raised for the production of milk, meat, leather, hair, wool and manure [1].

Cestodes of the family Taeniidae infect dogs as the definitive host and are transmitted to a wide range of intermediate host species where they cause coenurosis, hydatidosis, and cysticercosis. Infestations with the larval stage of some species of *Taenia* are not only of public health importance, but also of veterinary significance because they cause economic losses due to condemnation of infected offal or meat. Coenurus cerebri, is the

metacestode or larval form of the dog tapeworm *Taenia multiceps*, causes cerebral coenurosis, also known as gid or stagger. Coenuruses due to larval stage of *Taenia multiceps* can occur in both an acute and a chronic disease form. Acute coenuruses occurs during the migratory phase of the disease, usually 10 days after ingestion of the large number of tape worm eggs. Young lambs aged 6-8 weeks are most likely to show signs of acute disease. The signs are associated with an inflammatory and allergic reaction. There is transient pyrexia and relatively mild neurological signs such as listlessness and a slight head aversion. Occasionally the signs are more severe and the animal may develop encephalitis, convulse and die within 4-5 days [2].

Cysticercus tenuicollis is the larval stage of the taeniid cestodes *T. hydatigena*. The adult worms are found in the small intestine of canines such as dogs and foxes, while the metacestodes are found in large number of domestic and wild intermediate ruminant hosts.

T. hydatigena metacestodes are found on the different visceral organs such as liver, spleen, omentum, kidney, heart etc. of sheep, goat and pig. Infection with *C. tenuicollis* favors infection and growth of pathogenic microorganisms that can cause necrotic hepatitis associated with reduced productivity among the affected animals. Size of the cysts varies from one cm up to 6-7 cm, and the scolex has a long neck [3].

Consumption of offal containing viable cyst results in infection of definitive host carnivores including dogs. The adult tapeworm in definitive host is harmless unlike the metacestodes in the intermediate host animals that is responsible for immense economic and medical importance in infected host. The disease is much more common in rural areas of Ethiopia where dogs and domestic animals live in a very close association. Additionally, where home slaughtering of small ruminants is still predominant and uncooked offal and carcass wastes are normally given for dogs.

In the case of Cerebral coenurosis the clinical sign of the disease circling of animals is often confused with other nervous diseases. To bring the metacestodes of family taeniidae under control, it is essential to break the

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Received: 27 January, 2024, Manuscript No. jvst-24-126146; Editor Assigned: 29 January, 2024, PreQC No. P-126146; Reviewed: 14 February, 2024, QC No. Q-126146; Revised: 13 March, 2024, Manuscript No. R-126146; Published: 20 March, 2024, DOI: 10.37421/2157-7579.2024.15.224

transmission cycle, which occurs between dogs and sheep and goats. Dogs are the definitive or main carriers of the disease, and while the effects are relatively benign for them, in sheep and goat infection can be deadly [4].

Now a days the demand of eating raw or under cooked meat of small ruminants increasing particularly in developing country. Backyard slaughter houses buying the diseased animals from markets in low costs and selling the head and offals for customer who need for his or her pets increasing the transmission and risk factors. So, awareness development of the community on cause, mode of transmission, and prevention and control measures of the disease.

Therefore, the objective of this paper is

- To review the general aspects of metacestodes and its public health and economic significance in small ruminants

Literature Review

Etiology

Cestode parasites are segmented, parasitic tapeworms; belong to the kingdom of Animalia, phylum of Platyhelminthes, order of Cyclophyllidea. Cysticercosis, hydatidosis and coenurosis of farmed and wild animals is caused by the larval stages (metacestodes) of cestodes of the family Taeniidae (tapeworms), the adult stages of which occur in the intestine of domestic carnivores, wild Canidae and man. Cysticercosis of sheep and goats, with the cysts occurring in several organs are caused by larval stages of *Taenia ovis* and *T. hydatigena*, while hydatidosis and coenurosis are caused by larval stage of *Echinococcus granulosus* and *T. multiceps* respectively. *Coenurus cerebralis* the larval stage of *Taenia multiceps* a tapeworm that infests the small intestine of carnivores. Contamination of pastures grazed by sheep by dog faeces can result in larval invasion of the central nervous system and clinical disease. The life cycle is completed when the carnivorous definitive host ingests infested sheep's brain. Foxes are much less efficient than farm dogs in transmitting infection [5].

Predilection site and identification

The parasites have a predilection site for the brain and spinal cord. Early migrating parasites can cause reddish haemorrhagic and later grey purulent tracks in the brain, and in heavy infections, the sheep may have a meningoencephalitis. Clinical signs caused by the mature cyst relate to pressure atrophy of adjacent nervous tissue and vary according to location in the brain. There may be impaired vision or locomotion if cysts are in the cerebral hemispheres and the sheep gradually may be unable to feed and will become emaciated. Cerebellar cysts may precipitate more acute and severe signs of ataxia or opisthotonus. In heavy infections, parasites migrate and begin development in other tissues, but they die early.

These produce small lesions, 1 mm or so in size, that first contain an encapsulated cyst, then eosinophilic, caseous material that later may calcify. Adults, up to a metre long in the intestine of canids, have an armed rostellum. The metacestodes (*Coenurus cerebralis*) are large, white fluid-filled cysts that may have up to several hundred scoleces invaginated on the wall in clusters. *Coenuri* grow to 5 cm or more in size in the brain of sheep, the brain and intermuscular tissues of goats, and also the brain of cattle, wild ruminants and occasionally humans. The cysts induce neurological signs that in sheep are called 'gid', 'sturdy', etc.

Risk factor

Certain deep-rooted traditional activities have been described as factors associated with the spread and high prevalence of the disease in some areas. These factors include; the wide spread backyard slaughter of animals, the corresponding absence of rigorous meat inspection procedures, the long standing habit of feeding domesticated dogs with condemned offal and the subsequent contamination of pasture and grazing fields. The presence of shepherd (dog used as sheep keeper) dogs on grazing land as well as in paddocks, greatly contributes to the existence of the disease. Dogs are

frequently fed on viscera, trimmings, and heads of butchered animals, and they are not treated for parasitic diseases, thus maintaining *C. cerebralis* – *T. multiceps* life cycle. Introduction of dog or sheep with taenia multiceps or coenurus cerebralis in to an area where the disease is less prevalent, could pose a considerable risk for the introduction of coenurus into the new area.

Eggs contaminate the environment and waters then it resist for 15 days under dry conditions, or in the high level of humidity it can stay 30 days. At high temperatures, they died in a few hours. The cyst takes approximately eight months to mature, during which it becomes progressively larger, as the volume of the fluid increases. When mature cyst is eaten by definitive host scolex evaginate and attached to small intestinal wall of definitive host turn into adult parasite and the cycle continue.

Farmer or the owner often facilitate the contamination of the environment by opening the skull of infected sheep leaving the *Coenurus* cyst free to be eaten by dogs or, feeding them directly with the definitive host. The higher percentages of ecological variables (rainfall, relative humidity and air temperature) are considered to be the influencing factors for coenurosis. In rainy season, rain causes spread of feces of dog, fox (Final host) over the grasses and these contaminates are responsible for the increased occurrence of gid during rainy season [6].

According to Geremew, revealed in the study area interviewed respondents of Modjo and Bishoftu towns had dogs that shared their house with them, and the potential predisposing factors associated with the metacestodes infection are; dogs fed raw offal, scavenging dogs, dogs left free all-time, lack of worm control in sheep, goats and dogs. . Similarly the risk factors related to sheep and goats are: free grazing animals, offal thrown into environment and offal thrown raw to dog(s) after slaughtering or when the animal died.

Life cycle

Life cycle of *C. coenurosis*: The life cycle is indirect with sheep and goats acting as an intermediate host. *Coenurus* results from ingestion of contaminated pasture with eggs. After ingestion of the eggs, the gastric and intestinal juices digest the embryo and the onchosphere is activated. After penetrating the gastric and intestinal mucosa, it passes into the blood and lymphatic circulation. Only those which reach the CNS develop to form metacestodes in 2-8 months and induce nervous symptoms and death. The rest, which reach other tissues, will die. The onchosphere of *Taenia multiceps* has a specific affinity for nervous tissue and eventually lodges in two predilection sites (Brain or spinal cord). This is due to the CSF is required for the differentiation, nourishment and growth of the metacestode and the scolices develop from the base of the invaginated outer surface of the metacestode wall.

In the small intestine of the final host, *Taenia multiceps* reach maturity after 40-42 days. After the prepatent period, the dog starts to disseminate daily 3-4 proglottids, which contain approximately 37,000 eggs each. *T. multiceps* eggs are usually released from the proglottids before they are voided in the faeces. Eggs contaminate the environment and waters and resist for 15 days under dry conditions, or 30 days with high level of humidity. At high temperatures, they died in a few hours. When ingested by ruminants, in the small intestine the oncospheres spread from eggs and through the blood circulation they reach various locations, but only in the CNS they could develop into mature *Coenurus* cysts [6].

The presence of a cyst in the cerebral cortex causes loss of the menace response in the contralateral eye, thus blindness in the right eye indicates that the lesion is in the left hemisphere. Blindness can also be investigated by unilateral blindfolding. Unilateral proprioceptive deficits suggest a contralateral cerebral cyst, whereas bilateral deficits more likely indicate a cerebellar cyst. Blindfolding may exacerbate these deficits. Compulsive circling behaviour is commonly observed in sheep with coenurosis. Narrow diameter circles (1-2 m) suggest involvement of the basal nuclei at a deep location within the forebrain whereas wide circles are suggestive of a more superficial location of the cerebral cyst. There is the tendency for sheep to circle towards the side of superficial cysts and away from the side of more deeply sited cysts. Depression and head-pressing behaviour occur with cysts involving the frontal lobe of the

cerebrum. A head tilt towards the affected side may result if the cyst involves either the vestibular or cerebello-vestibular pathways. Cerebellar lesions are characterized by dysmetria, ataxia but with preservation of strength, and wide-based stance. Bilateral postural deficits and lack of menace response are usually also present with a cerebellar cyst. Deterioration of the clinical condition occurs more rapidly with a cerebellar cyst (Figure 1).

The adult *T. multiceps* (1) reside in the small intestine of the definitive host. Eggs or gravid proglottids are shed in the feces of the definitive host into the environment (2). After ingestion, the eggs hatch in the small intestine of the intermediate host (3) and release the oncospheres (4a) that penetrate the intestinal wall and migrate through the bloodstream to the central nervous system (CNS) (4b), and eventually, in non-cerebral forms, to subcutaneous and intramuscular tissues (4c). In these locations, the oncosphere encysts and develops over several months into a mature infective coenurus, Coenurus cerebri (4a, 4b). Definitive hosts (5) are infected by ingesting the tissue of an infected intermediate host containing the mature coenurus [7].

Life cycle of *C. tenuicollis*: Dogs and wild canids are infested by consuming the cysticercus in the intermediate host. If untreated, the final host can harbour tapeworms from several months to a year or more. The intermediate host is infected through the ingestion of tapeworm eggs that hatch in the intestine. The oncospheres, infective to sheep, cattle and pigs, are carried in the blood to the liver in which metacestode migrate through the hepatic parenchyma to the peritoneal cavity for about 4 weeks before they emerge on the surface of this organ [8]. It matures over a period of five to eight weeks each develops into the characteristically large metacestode and it is then found attached as a bladder worm called *C. tenuicollis* to the mesentery, serosal surface of the abdominal organs, and omentum (Figure 2).

Epidemiology

Geographical distribution: *T. hydatigena* and *T. ovis* are cosmopolitan parasites, though control programs, improved sanitation and other factors have made them uncommon in some regions. Infection by the larval stage of the tapeworm *T. multiceps* in small ruminants is common worldwide. It has been documented in scattered foci throughout the world, including the Americas and parts of Europe and Africa. It appears to be more common in temperate regions. Some countries (e.g., the U.S., Australia, New Zealand) report that this organism is no longer found in domestic animals. The disease

(coenurosis) has been documented in Ethiopia, Ghana, Mozambique, Uganda, Egypt, Democratic Republic of Congo, Senegal, Sudan, Chad, Angola, Kenya and Southern Africa.

Mode of transmission: Tapeworms of the family Taeniidae are transmitted from the definitive hosts such as carnivores to the intermediated hosts including herbivores or omnivores and human beings via oral-fecal cycle [9]. This family includes two major genera namely Taenia and Echinococcus. In many endemic areas the diseases caused by the genus Taenia in humans are often categorized as neglected tropical diseases. In general, the larval stages or metacestodes belonging to these tapeworms include hydatid cysts, cysticerci and coenuri. All Taenia species except for *T. hydatigena* (*C. tenuicollis*), *T. ovis* (*Cysticercus ovis*) and *T. pisiformis* (*C. pisiformis*), cause zoonotic parasitic diseases and thereby are of public health importance.

Humans acquire infection by inadvertent consumption of ova or larval stages (metacestode) present in undercooked meat. The transmission cycle of infection by *T. multiceps* takes place between dogs and domestic herbivores. Man is an accidental host and does not play any role in the epidemiology of the disease. The main factor in maintaining the parasitosis in nature is access by dogs to the brains of dead or slaughtered domestic herbivores that were infected with coenuri. Taenia eggs expelled in the feces of infected dogs or other canids are the source of infection for man and for the other intermediate hosts. In general, the eggs are eliminated by the definitive host in the proglottids. Since these dry out rapidly and are destroyed outside the host, the eggs are released and dispersed by the wind, rain, irrigation, and waterways.

After 10 days, radial dispersion up to 80 m from the place the feces were deposited has been confirmed for eggs of other taeniids; they may be able to disperse even greater distances with the aid of mechanical vectors such as carrion birds and arthropods. The physical composition of the soil, its porosity, and the kind of vegetation cover also help determine the length of time that the eggs survive.

According to Ermias said, man is an accidental host, and his direct contact with dogs is important. The gravid proglottids are found primarily on the surface of fecal matter, and they can accumulate in the perianal region, where they disintegrate and release the eggs. The dog carries the eggs on its tongue and snout to different parts of its body, and a person's hands can become contaminated by touching the animal. Close contact with dogs and deficient personal hygiene practices, such as failure to wash the hands before eating,

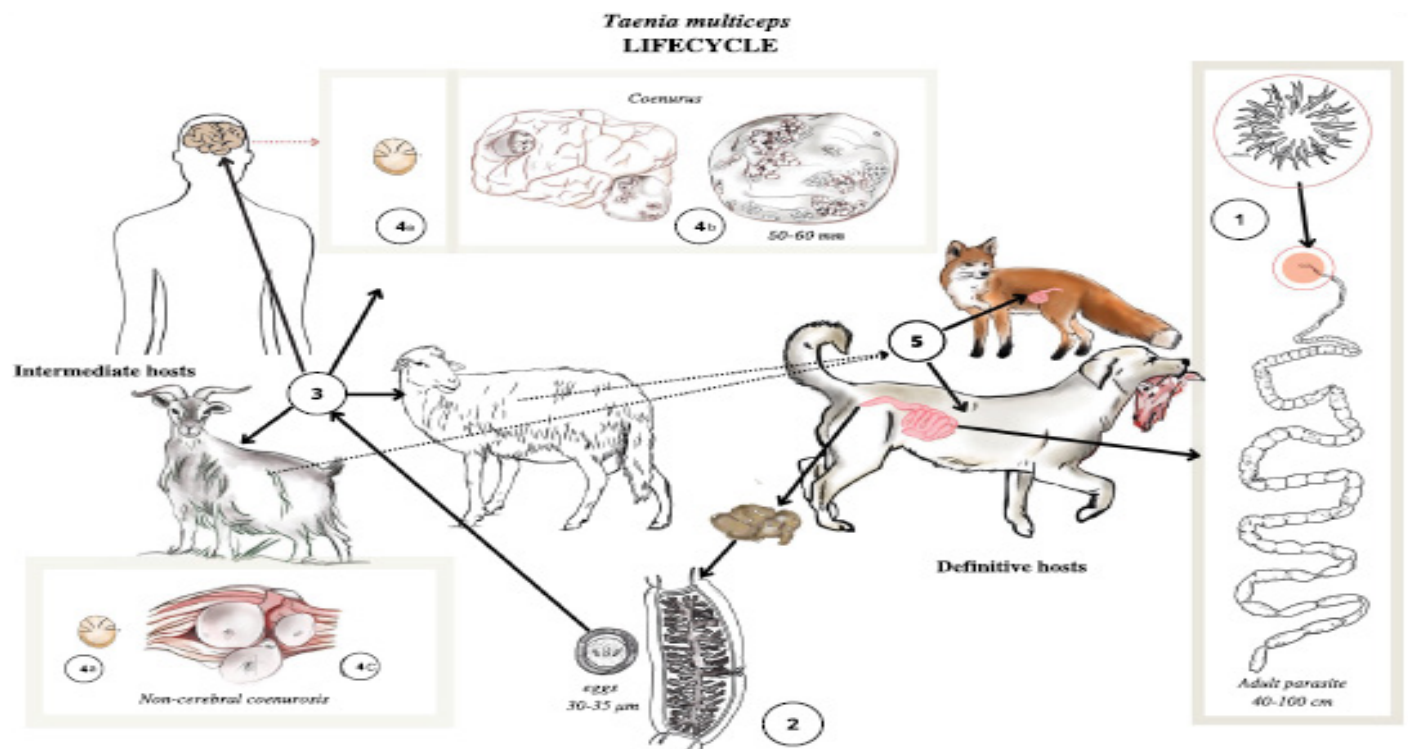


Figure 1. Graphical representation of the life cycle of *Taenia multiceps*.

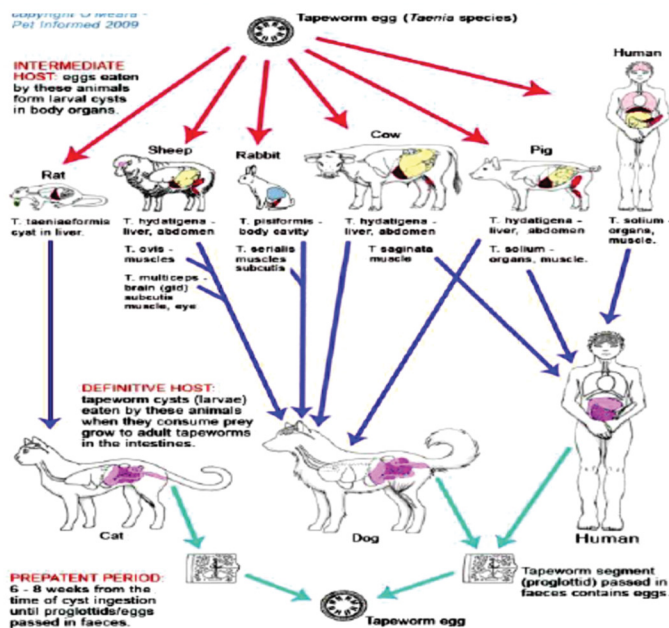


Figure 2. The life cycle of Taenia tapeworm.

are important factors in the transmission of the infection from dogs to humans. Another important source of human infection can be vegetables and water contaminated with infected dog feces. Coprophagic flies may also serve as mechanical vectors of the eggs.

Pathogenesis

According to Diba and Garoma, studies revealed the predilection sites of positive cyst were 16.7%, 66.6% and 16.7% right cerebral hemisphere, left cerebral hemisphere and cerebellum respectively. The number of cyst(s) per examined brain ranged from one to three (1–3) and the heads infested by one cyst accounted for 60% of the total heads. 33% and 7% were infested by two and three cysts respectively. Similarly from total forty five positive cysts were recovered, 46.7%, 42.2% and 11.1% small, medium and large size respectively. Out of 45 positive cysts were examined to identify cyst calcified, fertility and viability, 17.8%, 68.9% and 13.3% calcified, sterile and fertile respectively

According to Dayana, studies revealed that the most prevalent abdominal locations for *C. tenuicollis* were similar in goats and sheep: the omentum [41.8% (64/153) and 44% (29/66), respectively], the mesentery [37.3% (57/153) and 28.8% (19/66), respectively] and the abomasum [7.2% (11/153) and 9.1% (6/66), respectively]. The average weights of cysticerci presented in the positive animals were 27 g ± 5.8 g in goats and 41.3 g ± 23 g in sheep. The intensity of *C. tenuicollis*, estimated from the number of vesicles presented in the carcass, was wider in goats than in sheep. In goats, 21% (16/76) of positive carcasses presented one vesicle, 59.2% (45/76) presented two vesicles, 17.1% (13/76) three vesicles, and 2.7% (2/76) four vesicles. In sheep, 29.4% (10/34) of the positive carcasses presented one vesicle, 47% (16/34) two vesicles, and 23.6% (8/34), three vesicles. In only one goat the liver presented a major granulomatous lesion that received full condemnation. In the infested viscera of other animals, the lesions were caused by the parasite attachment and received partial condemnation.

According to Geremew studies revealed that a total of 436 cysts comprising 34 *C. ovis*, 239 *C. tenuicollis* and 163 hydatid cysts were counted in the total small ruminants harbouring metacestodes. 189 total cysts were counted in total infected goats while 247 cysts in total infected sheep. *Cysticercus ovis* was detected only in the heart of both goats and sheep. The result showed *C. tenuicollis* had more tendencies to be located in omentum followed by mesentery, liver, lungs and peritoneum of both goats and sheep while the lungs showed the highest rate of infestation for hydatid cyst followed by liver and kidney.

Clinical signs

The type and severity of the clinical signs is influenced by the number

and location of the parasites. Many organisms, including some in the CNS, are carried subclinically and only observed as incidental findings at necropsy. Clinical signs mainly result from inflammation associated with degenerating cysticerci and coenuri or the mechanical effects of the parasites, though large numbers of migrating, immature larvae can occasionally cause illness. *T. multiceps* cause a neurological condition called gid, staggers or sturdy in sheep and goats. Acute signs from immature, migrating *T. multiceps* larvae are seen mainly in young lambs, though they may also occur in older sheep introduced to a heavily contaminated pasture. Many animals have only a transient fever, listlessness and mild neurological signs such as a slight head tilt; however, large numbers of parasites can cause acute meningoencephalitis and may be fatal. Migrating larvae of other organisms have been reported to affect tissues outside the CNS.

In case of *T. hydatigena* the most clinical signs appeared are loss of condition, emaciation and ascites may be present and also caused an outbreak in lambs with elevated mortality and damage to the liver. It also affected the liver and/or lungs in a few other reports. CNS signs from established cysticerci or coenuri develop gradually, and often sporadically, in older animals. Most animals have focal signs related to the location of the cyst(s), but multifocal signs are possible, especially when cysts in the Cerebrospinal Fluid (CSF) block its flow and cause elevated intracerebral pressure. *T. multiceps* coenuri in sheep have been associated with behavioral abnormalities, circling, head pressing, ataxia, hypermetria, blindness, deviation of the head, paralysis, convulsions and hyper excitability, as well as prostration and emaciation. Increased intracranial pressure may result in softening of the frontal bone.

Chronic coenurosis is more commonly reported in sheep aged 6–18 months in which it presents as an insidious onset and slowly progressive focal lesion of the brain. Only rarely has chronic coenurosis been reported in sheep over 3 years of age. The time taken from larval hatching, migration to the brain and evidence of neurological dysfunction varies from 2 to 6 months. The cyst is located in one cerebral hemisphere in 80 per cent of cases, the cerebellum in approximately 10 percent, and affecting multiple locations in 8 per cent. Individual cases of gid cyst within the spinal cord have been reported.

Diagnosis

Abscessation should be included in the differential diagnosis list but the clinical signs tend to remain static and do not deteriorate as occurs in chronic coenurosis. Listeriosis, louping-ill and poliоencephalomalacia should be considered when formulating a diagnosis of acute coenurosis. Sheep with listeriosis present with depression, multiple cranial nerve deficits, and in many cases circling behaviour and head tilt. Poliоencephalomalacia has an acute presentation with bilateral loss of menace response, hyperaesthesia to auditory and tactile stimuli, and, without appropriate treatment, rapid progression to opisthotonus. In certain situations an outbreak of ovine pregnancy toxemia may present with some of the clinical features of acute gid. Ancillary tests, such as the intradermal injection of coenurus cyst fluid, do not give consistent results and false positive results are common [10].

Mostly in *C. tenuicollis* chronic infection in sheep is usually confirmed at meat inspection where the large larval cysts are observed on the mesentery, omentum and abdominal organs. The liver of animals that have died as a result of acute infestation may contain haemorrhagic tracts and developing metacestodes.

Treatment

Treatment of the cerebral coenurosis includes chemotherapy with antiparasitic drugs and surgery. Chemotherapy could be applied only in migration stages of the parasite, because when the *C. cerebralis* is formed rupture of the cyst after treatment could be very dangerous. Combination of fenbendazole together with praziquantel and albendazole is effective against the coenurosis. The most effective treatment to cure it is surgical removal of cyst. The surgical treatment of coenurosis in small ruminants is limited and is not recommendable in field conditions.

Surgical removal of the coenurus cyst Economic Importance of Cerebral Coenurosis: Small after general anaesthesia of the animal, achieves a very

good success rate, especially after accurate anatomic localization of the lesion within the brain. Surgery of the skulls and brains of sheep with cerebral coenurosis would be effective up to 90%, if the brain and skull are first tested by magnetic resonance imaging or ultrasonography. Tapeworms can be removed from dogs through the administration of an effective cestocidal anthelmintic, such as niclosamide, praziquantel, nitroscanate or multiple doses of mebendazole or fenbendazole. Larval stage of *T. hydatigena* (*C. tenuicollis*) there is no practical treatment is available for the intermediate host.

Zoonotic and economic importance of metacestodes

Only a limited number of taeniids are known to infect people, though some organisms might be missed. The larvae of *T. multiceps* have also been found occasionally in people. There is one report of *T. ovis* in the CNS (spinal cord) of a person in the Soviet Union, a single report of *T. hydatigena* in the liver. The larval (metacestode) stage causes hydatidosis (cystic hydatid disease; cystic echinococcosis), a chronic cyst-forming disease in the human host. In some areas, 10% of the population has detectable hydatid cysts by abdominal ultrasound and chest X-ray. Cysticercotic encephalitis, which is most common in children and teenagers, is a particularly dangerous disease. Although it is rare, it is often fatal. Cysticercosis has also been suggested to be a major contributor to epilepsy in endemic regions, though this is controversial.

Metacestodes causes considerable economic impacts in terms of morbidity, loss of productivity and health care costs. They causes economic loss through condemnation of infected meat and offal. Infection with the parasites favours infection and growth of pathogenic microorganisms that can cause inflammation in affected organs, which gives rise to economic losses due to condemnation of damaged organs. They also produce cystic lesions in the skeletal and cardiac muscle of infected animals which, if numerous, will result in the condemnation of an entire carcass [3]. Many parasitic diseases are prevalent in Ethiopia, which are responsible for the low productivity of livestock besides contributing to reduced meat production due to carcass or organ condemnation. In Ethiopia, parasitic diseases including *C. tenuicollis* in small ruminants were implicated as cause of organ condemnation in Abattoir enterprise leading to significant economic loss.

In Ethiopia, abattoir survey indicated the economic importance of metacestode in small ruminants. Study by Abiyot, calculated the annual financial of loss of 69,139.77 ETB due to small ruminants hydatidosis at Modjo export abattoir. Similarly the annual loss due to small ruminant's hydatidosis at Gindebirit was estimate as 58,755.1ETB. According to Deressa, total annual financial loss due to brain/animal condemnation was estimated at 8330 Ethiopian Birr (490 US\$). Main causes of brain condemned are due to brain with a higher *C. cerebralis* cyst. Current study at Elfora export abattoir indicated the total annual financial loss of 18,127.2 USD (335,353.2 ETB) from brain condemnation due to *C. coenurus*. Though brain is not a common dish for Ethiopians, there is a higher demand in the Middle East countries [11].

Similarly study by Anteneh, the annual local market monetary loss of 1,044,317.79 ETB per year was calculated due to rejection of organs and tissue by *C. tenuicollis* alone. Current study at Elfora export abattoir annual economic losses due to a single organ condemnation (liver) from sheep and goats infested by *C. tenuicollis* was estimated to be:1,836,100 ETB. According to Geremew, the total annual monetary losses both partially and totally condemned organs due to *C. ovis*, *C. tenuicollis* and hydatid cysts at each abattoirs was estimated to be 1,036,505 ETB.

According to Diba and Garoma, studies revealed that the average retail market price of sheep and goats brain was 5.75\$ from international market. Based on these data, average number of animals slaughtered per annum in five year and percentage of brain/animal condemnation per annum were 324,000 and 6.67%, respectively. Therefore, based on the above information, total financial losses due to coenurosis 124,821\$USD (3,994,272 Ethiopia birr). According to Yacob, studies revealed that direct economic losses associated with disposed organs are significantly high. The annual monetary loss due to rejection of organs were also calculated and found to be 51,428.57 USD per year in export and local market loss.

Extent of metacestodes in Ethiopia

Different abattoir survey indicated that metazoan parasites are endemic

disease of small ruminants in Ethiopia, especially in the highland where 75% of the sheep population is found. The presence of freely roaming dogs in grazing land greatly contributes to the existence of the disease. Dogs are routinely fed on sheep and goat's offal such as lungs, liver and head thus maintaining the parasite cycle. Certain deeply rooted traditional activities could be commonly described as factors substantiating the spread and high prevalence rates of the disease. These include the wide spread back yard animals slaughter practice, the absence of rigorous meat inspection procedure and the long standing habit of most Ethiopian people to feed their dogs with condemned offal which in effect facilitate the maintenance of the life cycle of the parasites.

According to study by Geremew, Out of the 384 goats and 384 sheeps, inspected for visceral organs, *C. ovis*, *C. tenuicollis* and hydatid cysts was found in 22.1% of Goats (n=85) and 36.2% of Sheeps (n=139), respectively were detected at the three selected export abattoirs with total annual economic losses of 1,036,505 ETB. Current study by Ermias, in Elfora export abattoir indicated that small ruminant's metacestodes were prevalent in Ethiopia. Accordingly Out of the total 785 small ruminants examined for the presence of hydatid cysts and *C. cerebralis* an overall prevalence of 7.39% and 3.8% was recorded, respectively. Similarly the latest study by Yacob, in visceral organs of small ruminants slaughtered at modjo export abattoir indicated that small ruminant's metacestodes were widespread in Ethiopia. Accordingly Out of the total 400 small ruminants examined for the presence of *C. tenuicollis* an overall prevalence of 34.8% was recorded.

Study also indicated the presence of human taeniosis in Ethiopia. During 1995 and 2005, 234 patients were operated for hydatid disease at Tikur Anbessa Hospital in Addis Ababa. In addition, a retrospective survey conducted between 2002 and 2006 revealed the registration of 24 hydatidosis cases out of the total of 36,402 patients, giving a mean annual incidence of 2.3 human hydatid cases per 100,000 people per year in North-western Ethiopia. According to the current study by Ermias, a total of 74,684 patients admitted in private clinics and referral hospitals in Bishoftu town, 495 (0.61%) human taeniosis cases were registered between September 2005–August 2007 E.C.

Control and prevention

Controlling cysticercosis and coenurosis 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. Control programs for *T. ovis*, which is an economically important parasite in some sheep-raising areas, have included regular deworming of farm dogs and bans on feeding these dogs tissues from sheep unless the larvae are first destroyed by cooking or freezing. Dead stock should not be left to be eaten by other canids. Although the surgical treatment of coenurosis is frequently successful, the use of surgery in animals, especially in small ruminants, is limited and restricted to economically viable and genetically superior and valued animals, and it is not practiced commonly under field conditions.

Control of metacestodes in livestock relies on regular anthelmintic treatment, by using an effective taenicide, and correct disposal of infected sheep and goat offal after slaughtering or death of animals to prevent scavenging by dogs. Effective control measures can also be taken by methods such as prohibition of backyard slaughtering and public awareness of the epidemiology of the parasites [12].

Specific control measures include stray-dog control, registration of all owned dogs, spaying of bitches, and treatment of all (or most) dogs with praziquantel at predetermined intervals, for example every 6 or 8 weeks. These measures are complemented by upgrading of meat inspection, slaughter hygiene, slaughter offal disposal, public health education, and other measures. Control programs in various countries have shown that the attack phase can be successfully concluded in less than 15 years if the necessary measures can be performed without major constraints and financial restrictions.

Therefore, dogs should be considered as the main source of infection and the major risk factor. The big problem for control of these diseases is reducing the risk factors including access of the stray dogs and other wild carnivores to the infected carcass wastes, consumption of raw meat and unwashed vegetables, poor sanitation, use of human feces as fertilizer, and inadequate meat inspection.

Conclusions and Recommendations

Metacestode is the larval stages of different genus taenia in the small ruminant that occurs in an intermediate hosts. This review revealed that metacestode in small ruminants due to the main problems particularly in small ruminants throughout the world and it is highly prevalent in Ethiopia, which exposed for economic loss and public health risk. Economic losses happened as a result of condemnations of different organs at abattoir and hinder small ruminant meats to spread into another parts of the world. Dog is the most common animal that plays lions share for continuation of lifecycle of the parasite. Feeding heads and different organs of small ruminants to the final host means dog play major role for transmission and it's have zoonotic importance as well. Know a day's not satisfactory treatment develops for intermediate host. So, lack of community knowledge on transmission, zoonosis, treatment and control of metacestodes were potential factors for public health risk.

Therefore, based on the above facts the following recommendations are forwarded:

- To prevent the infection dog must deworming regularly.
- Restricting the relation between dog and small ruminants.
- Public awareness regarding the disease transmission by veterinarian s.
- Persons who have contact with dog faeces should wash their hands with soap after work and have to keep their self-hygiene.
- Society should keep their water sources and vegetable gardens out of rich of dog faeces.
- Raw vegetables and fruits should be washed thoroughly before eating.
- Dog contact with pasture should be controlled.
- Population of stray dog should be reduced.
- Offal of the infected sheep and goats after slaughter should be disposed properly.
- Back yard slaughtering or illegal butchereries should be prohibited the law.

Acknowledgement

First and for most I would like to praise my almighty ALLAH who prolonged my life, helped and will help me throughout my life.

Furthermore, especial thanks for especial persons who will always be in my heart, my family especially my wife never get on my life because she is my every things in this world then for her support and encouragement throughout my life, until now.

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How to cite this article: Yusuf, Kedir. "A Review on Metacestode Influence in the Case of Public Health and Economic Manners in Small Ruminants." *J Vet Sci Technol* 15 (2024): 224.