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Review Article

Cerebral Coenurosis in Small Ruminants: A Comprehensive Review

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Summary

Small ruminants are the major source of economy in the world, especially in developing countries, like Ethiopia. However, there are various parasitic diseases that affect small ruminants. One of the serious nervous diseases of livestock is *cerebral coenurosis* which cause high economic losses in the sheep and goat herds. Therefore; this paper is designed with objective to review the current information on the characteristics of the disease and its economic and public health importance. *Cerebral Coenurosis* is caused by larval stage of *Taenia multiceps* known as *Coenurus cerebralis*. The disease has worldwide distribution. The larval stage of *Taenia multiceps*, a global cestode, encysts in the central nervous system of sheep and other livestock. *Taenia multiceps* also causes zoonotic infections in humans, when man is ingested the contaminated food or water with the parasitic egg accidentally. The life cycle is commonly happening between dog and small ruminants. The adult stage of this parasite inhabits the small intestine of dogs, foxes; while larvae are found in the brain and spinal cord of intermediate hosts. Diagnosis is mostly done by history, clinical signs and post mortem examination. In conclusion, *cerebral coenurosis* is a major problem of small ruminants throughout the world including Ethiopia which causes considerable economic loss and public health significance. The zoonotic importance of the disease might exacerbate due to less awareness of community about disease transmission and hygienic problem. Community awareness about the public health importance and transmission way of the disease should be increased.

Keywords: Brain; Coenurus cerebralis; Small ruminants; Taenia multiceps; Zoonosis

Introduction

Small ruminants (sheep and goats) are important domestic animals in the animal production systems of the world. Especially within the African society they comprise a greater proportion of the total wealth of poor families because of low input requirements such as small initial capital, fewer resources and maintenance cost, and ability to produce milk and meat using marginal lands and poor pasture. Furthermore, they need only short periods to reconstitute flocks after disaster and respond quickly to the demand. Leather industry derives most of the raw materials in the form of skin from small ruminants. However, a significant amount of organs and carcasses are condemned in the abattoir due to various diseases and pathological abnormalities (Jibat *et al.*,2008)

Nowadays small ruminant production enterprises are very attractive in the world market, this is due to small ruminants are sources of food such as milk and meat for consumption, generate cash income from export of meat, live animal and skin; are adaptable to abroad range of ruminant population and profitability of small animal environments; have short generation cycles and high production rate. The sheep and goat's population of Ethiopia, including expert estimates of the pastoral areas, is 66 million head of which some 35 million are sheep (Negassa *et al.*,2011). In spite of the presence of large number of small ruminant, as one of the largest resources of sheep and goats among African countries, Ethiopia fails to optimally utilize this resource as the sector is suffering from lower productivity. Among many factors which limit the economic return from small ruminant's parasite is the known and danger one. It is known fact that parasitized animals perform less efficiently, reduced reproductive performance, wool yield declines and consequent economic losses are significant (CSA, 2009).

While their extensive use, the productivity of small ruminants is mainly constrained by diseases, poor nutrition, poor management and poor breeding policies. Helminthes parasite is the main diseases affecting sheep and goat productivity in the world. Among helminth parasites larvae of *Tinea multiceps* known as *coenurus cerebralis* is the major disease affecting sheep and goat production. Coenurosis constitutes, as other well-known metacestodosis, an important parasitic disease that could cause important losses in ovine breeding and a not negligible zoonotic risk to human health (Sabbatani *et al.*, 2004). The major economic losses associated to *coenuruses* of small ruminants for the export are abattoir brain condemnation, time and loss of energy to dissect the brain of small ruminants for export purpose (Adane *et al.*,2015). Therefore, it causes great economic losses in sheep and goat production by killing the animals or reducing the productivity of the animal or by condemnation of the organs.

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Recently, in Ethiopia there is gap of Knwoledge in society about disease transmission, Economic impact and zoonotic significances of *Coenuruses.*

Therefore, the main objective of this senior seminar is to:

- Review on lifecycle, epidemiology and method of control of coenuruses and look at the economic and zoonotic importance of coenuruses

Literature Review

Historical Background

Wepfer was the first man who started in the year 1675 that "gid "condition occurs in sheep due to presence of bladder or larvae of *t.multiceps* or tapeworm known as *taenia multiceps* (Mandal,2006). Authentic records of coenurosis began to appear in literature during the 17thcentury, although references to the disease with nervous symptoms have been found in texts from the time of Hippocrates (Gicik *et al.,*2007). The parasitic nature of *coenurus cerebralis* was recognized for the first time by describing multiple buds with four suckers and a double circle of hooks at the inner surface of the bladder removed from sheep brains by Goeze and Leske in 1780 (Varcasia *et al.*,2012; Schuster *et al.*,2010).

Coenurosis (gid or sturdy) is an economically important disease caused by *coenurus cerebralis* which is the larvael stage or the metacestode of *Taenia multiceps*. This parasite usually inhabits the central nervous system, especially the left and right cerebral hemisphere (Desouky *et al.*, 2011; Veronesi *et al.*, 2008; Varcasia *et al.*, 2009).

Coenurus cerebralis infection has been observed as a common and worldwide problem of small ruminants. Dog being definitive host of *Taenia multiceps* plays an important role in spreading the disease. Nervous lesions, due to presence of cysts, lead to neurological symptoms that are quite discrete in nature and may be fatal. Domestic and wild canids constitute the definitive hosts, while a wide range of herbivores including sheep, goats, cattle, buffaloes, camels, yak and equines are the intermediate hosts. Coenurosis is quite common in sheep compared to the other animals (Sharma and Chauhan, 2006). The clinical signs of the disease develop when the central nervous system (CNS) of the sheep/goat is invaded by *C. cerebralis* cyst. Signs are paralysis, blindness, nystagmus, lethargy and lack of response to stimuli. Infected animals tend to move away from the herd and press their head against objects (Miran,2015)

Etiology:

Coenurosis is caused by *coenurus cerebralis*, which is a bladder worm stage or larval stage of tapeworm of *Taenia multiceps*, genus taenia, family taeniidae, order cyclophyliidea, class cestoda, phylum platyhelminthes and it is a commonly occurring parasitic disease that affects various livestock species in the worldwide (Sharma and Chauhan,2005; Scala *et al.*,2007; Varcasia *et al.*,2012).

Morphology

The larval stages of the cysts are evaluated and identified morphologically, according to a combination of criteria (cysts are large, white, have translucent structures and numerous protoscoleces

Figure 1: A large number of scolices as white clusters attached to the internal layer of the cyct.
Source: Nourani and Kheirabadi. (2009).

attached to the wall; scolex had a double ring of rostellar hooks (Avcioglu *et al.,* 2012). (*Coenurus cerebralis*), are round or oval, large and bladder-like, filled with fluid and have several protoscolices attached to inner side of cyst wall (Desouky *et al.*, 2011; Miran, 2013). Cysts are approximately 0.8-6.5cm in diameter and are filled with large amount of fluid. In addition, they contain numerous macroscopic invaginated scolices. Microscopically the scolices shows the C-shaped suckers and a rostellum armed with typical taeniid hooks arranged in double rows (Shibiru, 2012) (Figure 1).

The length of the adult *T. multiceps*is up to100 cm. The scolex has four cup shaped suckers and bears a rostellum which has two rows of hooks. The number of hooks in each scolex is variable, ranging from 22 to 32. The length of the large hooks is recorded from 180 to 198 µm and the length of the small hooks ranges 108 to 126 µm (Oryan *et al.*,2014). The eggs of *taenia multiceps* are 29 to 37micrometer in diameter and contain single oncosphere with three pairs of hooks (Mandal, 2005).

Site of Development

Taenia multiceps of adult parasite is a worldwide parasite which inhabits the small intestine of dogs, foxes, coyotes and jackals or mostly the small intestine of canids. The larval stage, known as gid or sturdy and may also affect other animal species such as domestic and wild ruminants including human. In humans, these larvae are usually found in the brain (neurocoenurosis), eye or subcutaneous tissues (Scala *et al.*, 2007).

The cystic larvae are mainly found in the brain and in some instances in the spinal cord of small ruminants and to a lesser extent in cattle, resulting in neurological signs, such as gid, ataxia, head deviation and blindness. Such neurological signs, in the majority of cases, result in the death of the affected animals (Avcioglu *et al.,* 2011, 2012).

Life Cycle

In the small intestine of the final host, *Taenia multiceps* reaches maturity after 40-42 days. After this prepatent period, the dog starts to disseminate daily 3-4 proglottids, which could contain almost 37,000 eggs each. *T. multiceps* eggs are usually released from the proglottids before these are voided in the faeces. Eggs contaminate the

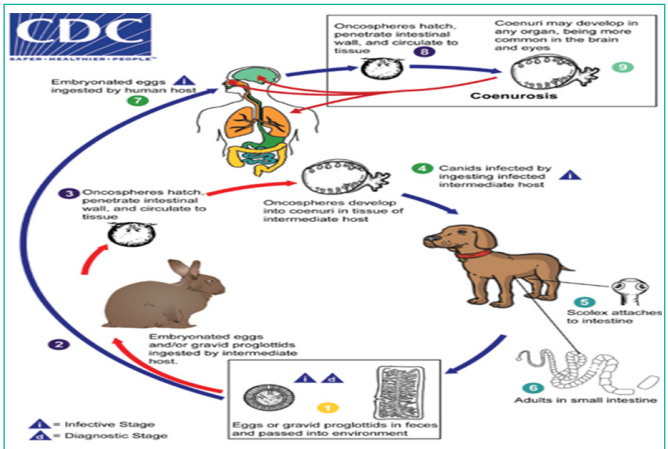

Figure 2: *Coenurus cerebralis* life cycle involving in definitive and intermediate hosts.
Source: (McDermott *et al.,* 2012).

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 onconspheres spread from eggs and through the blood circulation they reach various locations, but only in the CNS they could develop into mature *Coenurus* cysts (Scala and Varcasia, 2006). The life-cycle is indirect with sheep and goats acting as an intermediate host (McDermott *et al.,* 2012) (Figure 2).

Epidemiology:

Geographic Distribution

Infection by the larval stage of the tapeworm *T. multiceps* in small ruminants is common worldwide (Oryan *et al.*,2010). It has been documented in scattered foci throughout the world, including the Americas and parts of Europe and is probably distributed worldwide (Abo-Shehada *et al.,* 2002; Sharma and Chauhan, 2006). In Africa, the disease (coenurosis) has been documented in Ethiopia, Ghana, Mozambique, Uganda, Egypt (Desouky*et al.*, 2011), Democratic Republic of Congo, Senegal, Sudan, Chad, Angola, Kenya and Southern Africa (Afonso *et al.*, 2011).

It has been reported that 2.9% sheep in Jordan (Abo-Shehada *et al.,* 2002), 18.65 % in Uramia abattoir, Iran (Tavassoli *et al.* ,2011), 14.8 % in Tete municipal abattoir, Mozambique (Afonso *et al,* 2011), 44.4 % Ngorongoro district, Tanzania (Miran *et al,2015), and* 3.1–28.5% in Kars Province of Turkey (Gicik *et al.,* 2007; Uslu & Guclu, 2007) have been infected with the cerebral form of the *C. cerebralis*. There are many reports regarding the cerebral form of the coenurosis in Europe, including Greece (Christodoulopoulos, 2007, Christodoulopoulos *et al.,* 2008). The disease has also been reported in sheep, almost in all 31 provinces of Iran. Prevalence of18.65% in West Azarbaijan Province, northwestern Iran (Tavassoli *et al.,* 2011),0.007% in Kerman Province eastern Iran. So thus all indicates the disease is worldwide in distribution (Kheirandish *et al.,* 2012).

Transmission

Coenurus cerebralis is the larval form of *Multiceps multiceps* which is seen in the small intestines of carnivores (Güçlü *et al.*,2006; Christodoulopoulos, 2007). Infection occurs as a result of the oral intake of eggs spreading via fecal dumps of those animals during grazing from pasture, by intermediate hosts (Sharma and Chauhan, 2006). The presence of freely roaming dogs on grazing land greatly contributes to the existence of the disease. Dogs are routinely fed on offal, including sheep and goats head, thus after infected are not dewormed. Thus maintaining the *C.cerebralis Taenia multiceps* cycle. Human infection can also occur if eggs are accidentally ingested as result of poor personal hygiene after being shed in the faces of the dog. (Adane *et al.*, 2015).

Host Range

Domestic and wild canids constitute the definitive hosts, while a wide range of herbivores including sheep, goats, cattle, buffaloes, camels, yak and equines are the intermediate hosts. Coenuruses is quite common in sheep and goat compared to the other animals. Human can also get infected with this parasite if accidentally ingest the egg of the parasite (Sharma and Chauhan, 2006; Oryan *et al., 2015*).

Risk Factor

The presence of shepherd 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 *coenorus cerebralis* in to an area where the disease is less prevalent, could pose a considerable risk for the introduction of coenuruses into the new area. Breed and sex had no statistical impact on the prevalence of *C.cerebralis* infection. The prevalence of the metacestodes among the different age groups of sheep is Statistically significant (Gicik *et al.,*2007; Jibat *et al., 2008*). Farmer or the owner often facilitate the contamination of the environment by opening the skull of infected sheep for curiosity or to confirm his own "diagnosis", leaving the Coenurus cyst free to be eaten by dogs or, feeding them direct1y with it (Scala and Varcasia,2006). 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 (Rashid, *et al.,* 2000).

Pathogenesis

Coenurosis results from ingestion of contaminated pasture with eggs. The embryos penetrate the intestinal mucosa and migrate all over the body. 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. 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 (El-Din, 2010).

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. The onchosphere of *Taenia multiceps* has a specific affinity for nervous tissue and eventually lodges in two predilection sites (Brain or spinal cord). Here it develops into the metacestode. This is

a fluid filled cyst containing clusters of numerous invaginated scolices attached to its inner wall. The *Coenurus* has unusual power of asexual division giving rise to 400-500 of protoscolices invaginated from the inner cysts wall so that large number of scolices which appear as white clusters are attached to the internal layer of the wall of the superficial cyst (Nourani & Pirali Kheirabadi, 2009; Oryan *et al*., 2014).

The cyst takes approximately eight months to mature, during which it becomes progressively larger, as the volume of the fluid increases. At maturity, it can reach a diameter of five centimeter or more in which will result in the onset of clinical signs due to increased intracranial pressure causes deviation of the head, headache, stumbling and paralysis (Adane *et al., 2015)*.

Clinical Manifestation

Clinical syndrome is based on location and size of the *Coenurus* cyst in the brain or spinal cord (Avcioglu *et al*.,2012). The time taken for the larvae to hatch, migrate and grow large enough to present nervous dysfunction varies from 2 to 6 months (Giadinis *et al.*, 2012). The cerebral form of the coenurosis is referred to as acute or chronic gid or sturdy; while the chronic form is more common than acute one. Acute coenurosis occurs as the result of larval migration in the central nervous system when several viable eggs are ingested by an herbivore animal. The signs are associated with an inflammatory and allergic reaction. Usually there is transient pyrexia, and relatively mild neurological signs such as listlessness and a slight head aversion. In rare cases the signs are more severe and the animal may develop encephalitis, convulse and die within 4 - 5 days (Miran, 2013).

Chronic coenurosis mostly occurs in older animals of more than 6 months' age, where it presents as a consequence of cyst development and slowly create local lesion in the cerebrum, cerebellum and spinal cord. However, it typically involves one cerebral hemisphere and to a lesser extent the cerebellum (Oryan., *et al*,2014). An acute meningoencephalitis may develop if a large number of immature stages migrate in the brain and young lambs/kids aged 6-8 weeks are most likely to show signs of acute disease (Özkan *et al.,* 2011).

Both acute and chronic forms of coenurosis have been described, although chronic disease is more readily identified and more frequently reported. Acute coenurosis has been reported in a flock of sheep introduced in a pasture heavily contaminated by dog faeces. Clinical signs appeared within 10 days, which ranged from mild to severe with death occurring within 3–5 days after onset of neurological dysfunction. Acute coenurosis has also been reported in 6–8 week-old lambs, where clinical signs ranged from pyrexia, listlessness and head aversion to convulsions and death within 4–5 days. Chronic coenurosis is more commonly reported in growing sheep aged 6–18 months, where it presents as a slowly progressive focal lesion of the brain, typically involving one cerebral hemisphere. Chronic coenurosis has rarely been reported in sheep older than 3 years. The time taken from larval hatching, migration to the brain and evidence of neurological dysfunction varies between 2 and6 months (Scott, 2012).

The main clinical signs in goats and sheep include dullness, circling, torticollis, loss of appetite, frequent bleating, separation from the flock, visual impairment, muscle tremors, pain response on pressure over the cystic area and sometimes unilateral partial blindness correlated cystic presence in cerebrum with depression, tilting of the head either towards right or left, head pressing, feet stamping or walking in straight line (Sharma and Chauhan, 2006; Gicik *et al*., 2007).

Systematic clinical examination of the animal demonstrated symptoms like inertia, incoordination, irregular gait, failure to hold the head straight, left ward head tilt and circling abnormal clinical sign is observed (Özkan *et al.,* 2011).

Pathological Findings

Systematic necropsy revealed no pathological findings in the internal organs. Dissection of the cranium exhibited a cyst of 9x7 cm size over the caudal portion of the left cerebral hemisphere. Owing to the drainage of the cystic fluid during removal of the brain, the cerebral tissue in this area is tend to collapse (Özkan *et al*., 2011).

During the acute phase of coenurosis, pale yellow tracts are visible on the surface of the brain, and in cut sections of brainstem and cerebellum. In chronic coenurosis, the increased intracranial pressure from the cyst compresses surrounding brain tissue and may result in softening of an area of the skull, but such changes may not occur in bone immediately overlying the cyst. Hydrocephalus may result from a coenurus cyst in a ventricle or the cerebral aqueduct. Increased intracranial pressure may cause herniation of the vermis of the cerebellum through the foramen magnum or the cerebrum may become herniated beneath the tentorium. (Scott., 2012; Miran, 2013) Coenuri in the brain caused damage to surrounding tissues, including thinning of the cerebral grey and white matter owing to focal pressure atrophy and liquefactive necrosis. The meninges were hyperaemic and oedematous, and microscopically there were degenerative and necrotic lesions in the brain. Within the brain, sections of coenuri of various shapes were surrounded by marked eosinophilic necrotic tissues, degenerated neutrophils and mononuclear cells (Kheirandish *et al*.,2012)

Diagnosis

The disease can be diagnosed on the basis of history, clinical signs and on the basis of the postmortem examinations in the animals died due to this disease (Uphadhayas,2005). Diagnosis of the *cerebral coenurosis* is dependent on the clinical manifestations, neurological examination, ultrasound examination and post-mortem examination (Godara *et al.,* 2011b; Biswas, 2013).

Post mortem examination for the diagnosis of coenuruses is as the following: The heads of slaughtered sheep and goats collected, followed by skin removal and careful opening of the skull using a machete or other instrument without damaging the brain. Meninges incised using a scalpel blade to expose brain tissue. The whole brain of each individual animal collected and examined for visible evidence of cyst *C. cerebralis.* The number and location of cysts seen (described as right hemisphere, left hemisphere or cerebellum) recorded (Miran *et al*,2013).

Animal *cerebral coenurosis* is usually diagnosed based on a clinical examination protocol and seldom includes imaging methods like radiology, ultrasonography and CT which are mainly used in experimental situations. Immunodiagnosis tests such as skin test for immediate hypersensitivity, indirect haemaglutination antibody

(IHA) test, immuno-electrophoresis (IEP), gel double diffusion (GDD), immunoblot and enzyme linked immune-assay (ELISA) tests have been used experimentally. Despite the availability of these tests which have their own practical challenges, post mortem findings of a thin walled cyst filled with transparent fluid and with numerous scoleces in the wall remain the definitive diagnosis (Afonso *et al*.,2011)

Molecular characterization by PCR shows positive result for cerebral cysts in the naturally and experimentally infected sheep and goats, by producing the expected fragments for COX-1 and NAD1 genes. Sequence analysis showed that the sheep and goats samples examined in the naturally and experimentally infected samples were 100% identical to each other and were 100% similar to adult worms recovered from dogs based on both mitochondrial markers (Oryan *et al* 2015).

Based on histopathological findings, the affected cerebral hemisphere shows multiple scolices growing inside the cyst, leading to increased intracranial pressure. This growth also results in thinning of the cerebral grey and white matter and, in some cases, the skull. The surrounding cerebral tissues exhibit various degenerative changes, including neuronal degeneration, demyelination, necrosis, hyperemia, perivascular cuffing, diffuse astrocytosis, and microgliosis. These changes lead to the formation of microglial nodules and pressure atrophy in the skull. Liquifactive necrosis, characterized by degenerative changes, is present around the cerebral cysts, along with satellitosis, neuronophagia, and diffuse gliosis. The meninges of the infected animals show hyperemia and edema. However, no fibrous connective tissue capsule encloses the cerebral form of Coenurus. Examination of H&E stained sections reveals granulomatous encephalitis with caseation, encephalomalacia, and Langhans giant cells. Consistent findings include necrosis and dissociation of ependymal cells with subventricular edema. Additionally, there is degeneration and necrosis of oligodendroglial cells, as well as axonal swelling and demyelination (Oryan *et al*., 2014; Hamed *et al.,* 2015).

Differential Diagnosis

Listeriosis, nasal bot's syndrome, louping ill, scrapie, sarcocystosis, brain abscessation, polioencephalomalacia and cerebral echinococcosis should be considered as the differential diagnosis of the *cerebral coenurosis* (Godara *et al.,* 2011b; Scott, 2012; Uphadhay,2005).

Scrapie would typically affect sheep older than three years, polioencephalomalacia causes diffuse bilateral cerebral signs, listeriosis results in multiple unilateral cranial nerve deficits, while focal symmetrical encephalomalacia results in rapid death. A thorough neurological examination should therefore permit an accurate diagnosis of coenurosis (Scott, 2012). *Coenurus cerebralis* may be found upon necropsy in the brain of sheep and goat but the condition needs to be differentiated from other local space occupying lesions of the cranial cavity and spinal cord including abscess and tumor. Hemorrhage in the early stage may be confused with encephalitis because of signs of brain irritation (Adane *et al.,2015)*

Listeriosis is an infection caused by the bacterium *Listeria monocytogenes.* The disease can affect sheep, goats and cattle. Symptoms include depression, decreased appetite, fever, stumbling or moving in one direction only, head pulled to flank with rigid neck, facial paralysis on one side, slack jaw, and abortions. The disease is curable by use of antibiotics such as procaine penicillin (Miran,2013) Scrapie is an infectious transmissible fatal degenerative disease affecting the central nervous system of sheep and goats. The disease is caused by a prion (protein particle similar to a virus but lacking nucleic acid) and is usually observed in animals older than 2 years. Early signs include subtle changes in behavior or temperament. These changes may be followed by scratching and rubbing against fixed objects, loss of coordination, weakness, weight loss despite retention of appetite, biting of feet and limbs, lip smacking, and gait abnormalities, (high–stepping of the forelegs, hopping like a rabbit, and swaying of the back end) and the disease is often accompanied by pruritus (Miran,2013)

Treatment

Treatment is by surgical removal of the cyst or by aspiration of the cyst fluid through the softened skull. This treatment is usually reserved for valuable animals, although the method described are fairly straight forward and non-specialized equipment or techniques are required. Indeed, the determination of the localization is the most problematic factor in the successful treatment of coenurosis. there is no proved drug therapy to the disease (Upadhayay,2005). Treatment based on surgical removal of the coenurus cyst after general anaesthesia of the animal, achieves a very good success rate, especially after accurate anatomic localization of the lesion within the brain (P.R. Scott, 2012). 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 MRI or ultrasonography (Manunta *et al*.,2012)

Combination of fenbendazole together with praziquantel and albendazole is effective against the *cerebral coenurosis*. He shown that praziquantel administration with dosage rates of 50 to 500 mg/kg resulted in successful treatment of this metacestode. Chemotherapy could be applied only in migration stages of the parasite. The efficacy of the antiparasitic drugs such as albendazole, fenbendazole, and praziquantel against *cerebral coenurosis* was supported by other studies too (Ghazaei, 2007)

Goat infected orally with approximately 3000 T. multiceps hatching eggs in a cellulose and amide bolus, and then assigned randomly to groups. Albendazole suspension administered orally for treatment. After 2 months' post infection, the animals of group 1 (G1) treated with albendazole at doses of 10 mg/kg/3 days; group 2 (G2) received a single dose of 10 mg/kg; group 3(G3) animals were administered a single dose of 20 mg/kg and group 4 (G4) was the control group. After 5 months' post infection, group 5 (G5) was treated with ABZ at a dose of 10 mg/kg/3 days and group 6 (G6) was used as control.

Recovered cysts from each group, found in different muscles and tissue, with different sizes, varied from 11 to 44. In all treated groups, non-viable cysts are significantly higher than in the control group, after 2 months' post-infection ABZ at a dose of 10 mg/kg for 3 days is effective in treating early infection of T. multiceps larva in goats. Nevertheless, with 5-month old cysts the number of non-viable cysts in treated group is similar to that of the non-treated goats (Afonso *et al;*2014).

This Taeniasis in the definitive host can be treated with praziquantel, epsiprantel, mebendazole, febantel and fenbendazole (Scala and Varcasia, 2006) (Table 1).

Table 1: prevalence of coenuruses in Ethiopia.

Study area	Study year	Prevalence (%)	Author/s
Yabello and surrounding areas	2012	13.5	(Shibiru, 2012).
Lega Hida district of Bale zone	2015	12.6	(Aliye, 2015).
Addis Abeba	2012	4.7	Deresse *et al.,* 2012
Atsbi Womberta Woreda	2007	7.5	(Abraha, 2007).

Control and Prevention

Control of coenurosis can be controlled by regular anthelmintic treatment of dogs at 6–8-week intervals, by using an effective taenicide, and correct disposal of all sheep carcasses to prevent scavenging by dogs belonging to the general public, which may not receive regular anthelmintic treatment. (P.R. Scott, 2012). Effective control measures must be taken, such as prohibition of backyard slaughtering, disposal of heads, and public awareness of the epidemiology of the C. cerebralis (Gicik *et al.,2007*).

Communities and governments can make sure their water supply remains sanitary and free of dog feces. Communities can control wild dog populations and vaccinate dogs for tapeworm infection, thus preventing infection of the definitive host. Individuals should wash all fruits and vegetables thoroughly before eating and make sure their dogs are not infected with tapeworm (Bechelli, 2005).

Zoonotic Importance of Coenurus Cerbrallis

Coenurus cerbrallis in human beings diagnosed for the first time in 1913 in Paris, when a man presented symptoms of CNS nerve degeneration. He had convulsions and trouble speaking/ understanding speech. During his autopsy, two coenuri were found in his brain (Euzeby, J.; 1966). Recently (within the last 25 years), human cases have been recorded in Uganda, Kenya, Ghana, South Africa, Rwanda, Nigeria, Italy, Israel, Mexico, Canada and the United States, and animal cases have been found in many other countries as well. In 1983, a 4-year-old girl in the USA was admitted to the hospital with progressive, generalized muscle weakness, inability to walk, rash, abdominal pain and deteriorating neurological ability.

When the doctors did a CT scan, they saw fluid filled lumps in her brain and decided to operate. While operating, coenuri were found and the patient was immediately given chemotherapy with praziquantel. Unfortunately, the coenurosis had already done too much damage in the CNS and the little girl did not survive. The most recent North American case took place in 1994 in Los Angeles, Ca when a 39-year-old man presented an enlarging mass on his back. When doctors tried to operate a large intramuscular capsule was found. The man was treated with praziquantel. The drug successfully killed the larvae and his infection never returned (Acha *et al*., 2003). The most recent case on record to date took place in Israel in 2006. A 4-year-old girl had *T. multiceps* in her subcutaneous tissue. She received proper treatment and made a full recovery. In all of these recent cases, the infected individuals had been exposed to wild dogs in regions where canid tapeworm is considered endemic, and probably ingested the parasite accidently through contact with contaminated food or water (Bechelli,2005) Coenuruses is a relatively rare zoonotic disease of humans, caused by the larval stage (Coenuruses) of a dog tape worm *Taenia* (Multiceps) *multiceps*. Human infection occurs if eggs are accidentally ingested as result of poor personal hygiene after being shed in the faces of the dog. After ingestion of the eggs, larvae hatch, penetrate the intestinal wall and migrate to various tissues, where they develop in to large, cystic larvae. Symptoms are secondary to the presence of a cyst in a vital structure. Patients with coenuruses present with headache and papillae edema. The cysts have been responsible for epilepsy, hemiplegia, monoplegia and cerebral ataxia. When the spinal cord is affected there may be spastic paraplesia, lymphadenopathy, fever and malaise can occur, raising the suspicion of lymphoma. Cysts are found in the liver, muscle and brain (*Adane et al.,2015)*.

Economic Importance of Coenurosis

Small ruminants are the major source of economy in the world, especially in the rural area due to low input requirements but they can be affected by the disease due to management problem (Dejene *et al.,* 2013). In developing countries like Ethiopia there is close contact between dogs and small ruminants, lack of knowledge of the population about how coenurosis occurs, free access of dogs to the head of ruminants, containing coenurosis vesicles, the absence of regular deworming of dogs are the most important drivers for perpetuation of *T. multiceps* cycle and the persistence of cerebral coenurosis that leads to high economic losses of the country (Miran *et al*., 2015).

Cerebral coenurosis is an economically important disease as it causes serious problems especially in the sheep industry and breeding. Economic losses result from prolonged disease course, low productive performance, cost of treatment, death of untreated sheep and goats (Kheirandish *et al*., 2012). Some researchers stated that *cerebral coenurosis* is highly prevalence in turkey and Tanizania that causes major economic losses due to mortality of sheep and goats (Gicik *et al*., 2007).

In Ethiopia the total annual financial loss due to brain/animal condemnation was estimated as 8330 Ethiopian Birr (490 US$). The main causes of brain condemnation were due to brain with a higher *C.cerebralis* cyst. In addition to the above report another study done on *C. cerebralis* in sheep and goat in and around Yabello district of Borana zone in Ethiopia shows that economic implication of coenurus presented with the direct losses due to death of sheep and goat and reduction in market prices due to aesthetic values (Deresa *et al*., 2012).

Status of Coenurus Cerebrallis in Ethiopia

Coenurosis is endemic in Ethiopia, especially in the highland sheep where 75% of the population is found. The presence of freely roaming dogs on grazing land greatly contributes to the existence of the disease. Dogs are routinely fed on offal, including sheep and goats head, and are not dewormed. Thus maintaining the *C.cerebralis,* Taenia multiceps cycle (Adane *et al., 2015).* The total 445 sheep heads Examined, 21(4.7%) were found to be affected by coenurosis. Postmortem examination showed that *coenurus cerebralis* occurred with a range of 1 to 5 cysts in each animal. One cyst occurred most frequently (61.9%) followed by 3, 4, and 5 cysts. The great majority of the cysts (94.4%) were located in the cerebral hemisphere where as 5.4% of cysts were localized on both sides of the middle cerebellar hemisphere Out of 21 infected brains, 15 (71.4 %) and 6 (28.6%) were trimmed and rejected, respectively. From the total of 6 rejected (total

condemned) brain, all of the 6 (100.0%) brains had deep lesions. His studies concluded that coenurosis is one of the most important livestock parasitic diseases especially in sheep in Ethiopia which results great economic loss at national level and therefore, appropriate control measure should be taken (Deressa *et al; 2012)* (Table1). The total 339 examined sheep and goats 46 0f them were found with counurus cerebralis in different part of the brain. Clinical signs were seen in 41 of these positive animals and 5 of apparently healthy examined animals were proved to be infested with the coenurus cerebralis, those animals were from different areas of Yabello and surrounding areas (Shibiru ;2012).

This result indicates us counurus is also prevalent in Ethipia. Coenurosis is the major health problem in Atsbi Womberta Woreda in Tigrai (Abraha, 2007).

The total of 412 sheep and goats examined for *C.cerebrallis* in and around Lega Hida district of Bale zone,52 of them were found with *coenurus cerebrallis* cyst in one or different parts of the brains (Aliye, 2015).

Based on above table appeared information, there is prevalence of coenureses in Ethiopia,but study not done most part of our country that make us not to say there is such amount of distribution currently.

Conclusion and Recommendations

Coenurosis (gids, or circling disease) is a disease of nervous system in sheep and goats, being intermediate host for the parasite *Coenurus cerebralis*. *Coenurus cerebrallis* is the larval stage of *Taenia multiceps*, the parasite which inhibits the small intestine of domestitic dogs and other canid. The disease is common in worldwide. Coenurosis causes enormous economic loss in husbandry production of sheep and goat due to its direct effect of its high mortality and morbidity such as decreased production. The life-cycle of the parasite is usually circulated between the dog and sheep. Foxes and other wild canids could also be infected if they get access to the cyst. Infection of dogs should be interrupted by regular deworming of dogs. Feeding the head of slaughtered shoat to the dog are the most common risks associated with parasite transmission. Human can be infected if eggs are accidentally ingested as result of poor personal hygiene after being shed in the faces of the dog. The treatment of the disease in sheep and goat is not satisfactory, except surgical removal of the cyst that is not economical, so the most effective method is prevention of the disease by controlling dog contact with pasture, community awareness regarding the transmission way of the disease and the like; therefore based on the above conclusion, the following recommendations are forwarded:

- ✓ Head of sheep and goats after slaughter should be disposed properly
- ✓ Brains of the sheep and goats should never give to dogs nor left for wild carnivores.
- ✓ Public education programs should convey the messages that dogs infected with tapeworms present a danger to both the human population and livestock.
- ✓ Dog contact with pasture should be controlled
- ✓ Population of stray dog should be controlled

Back yard slaughtering or illegal butcheries should be prohibited by the law

Reference

1. Abo-Shehada, M.N., Jebreen, E., Arab, B., Mukbel, R. and Torgerson, P.R., (2002). Prevalence of Taenia multiceps in sheep in northern Jordan. Preventive veterinary medicine, 55(3), Pp.201-207.
2. Abraha, G. (2007): Major animal health problems of market oriented livestock development in Atsbi woreda womberta in Tigrai regional state, DVM thesis, faculty of veterinary medine, Addis Ababa University, Pp25.
3. Acha, P., & Szyfres, B. (2003). Coenurosis. In: Parasitoses. Third ed. In: Pan American Health Organization (Eds.), Zoonoses and Communicable Diseases Common to Man and Animals, Washington, Pan American Health Organization, 3:162–165.
4. Adane, P., Kumsa, B., Hiko, A., & Afera, B. (2015). Prevalence of Coenurus cerebralis in Small Ruminants Slaughtered at Hashim Export Abattoir, Debre Zeit, Central Oromia.European Applied Sciences,7:56-63.
5. Afonso, S., Mukaratirwa, S., Hajovska, K., Capece, B., Crist`ofol, C., Afonso, S., Nevesa L., Pondjaa A., Macuamule C., Mukaratirwa S., Arboix,M., Cristòfol,C.,Capecea,B.,(2014). Efficacy of albendazole against Taenia multiceps larvae in experimentally infected goats, Veterinary Parasitology206: 304–307.
6. Aliye, J. (2015). DVM thesis, study on prevalence, associated factors, farmer's perceptionand economic importance of coenurus cerebrallis in sheep and goats in and around Lega Hida district of Bale zone, south eastern Ethiopia, Jimma University, P. 34.
7. Avcioglu, H.,Terim,K., &Yildirim, A. (2012). Clinical, morphological and histopathological features of bovine coenurosis: case reports. Revue de Medicine Veterinaire 163: 295-298.
8. Avcioglu, H., Yildirim, A., Duzlu, O., Inci, A., Terim, K., & Balkaya, I. (2011). Prevalence and molecular characterization of bovine coenurosis from Eastern Anatolian region of Turkey. Veterinary Parasitology 28: 59-64.
9. Batista, F., Pizzigatti, D., Martins, C., Nunes, M., Megda, T., Ribeiro, O., & Paiva,F., (2010). First report of coenurosis in sheep in the State of Mato Grossodo Sul, Brazil. Revista Brasileirade Parasitologia Veterinária,19:265-267. Bechelli.k., (2005). Parasite.
10. Project,http://web.stanford.edu/group/parasites/ParaSites2010/Kelly,Bechelli/Parasite Info.htm: accessed on March 23, 2016.
11. Biswas, D. (2013). Ultrasound diagnosis and surgical treatment of coenurosis (GID) in bengal goat (Capra hircus) at chittagong metropolitan area, Chittagong, Bangladesh. Scientific Journal of Veterinary Advances 2: 68-75.
12. Central statistical Authority CSA, (2009). Federal democratic republic of Ethiopia, centralstatistical agency, agricultural sample survey 2008/9 (2001 E.C), report on livestock and livestock characteristics, statistical bulletin, P. 446.
13. Christodoulopoulos G, (2007). Two rare clinical manifestations of coenurosis in sheep. Vet Parasitol,143: 368-370.
14. Christodoulopoulos, G., Theodoropoulos, G. & Petrakos, G. (2008). Epidemilogical survey of cestode – larva disease in Greek sheep flocks. Veterinary Parasitology,153: 368-373.
15. Dejene, S., Abebe, B., and Degefu,. H;(2013). Study on the major health problems that causes carcass and organs condemnation at hashim's export abattoir, debrezeit, Ethiopia. Global Veterinary, 11(4): 362-371.
16. Deressa, A., Tilahun, T., Tadesse, A., Beyene, M., Gebrewold, G. & (2012) Assessment of Coenurus cerebralis and its economic impact in sheep brain harvested at Ethiopian Health and Nutrition Research Institute, Ethiopia. Int. J. Livest. Res., 2:217-226.
17. Desouky, E. Badawy, A. and Refaat, R. (2011): Survey on coenurosis in sheep and goats in Egypt. Veterinaria Italiana, 47: 333-340.
18. El-Din, M. (2010). The significance of subarachnoid cerebrospinal fluids (CSF) in the development of metacestode of Coenurus cerebralis in sheep with reference to its pathological effect.Global Veterinaria, 4: 343-348.

19. Euzeby, J. (1966). Les maladies vermineuses des animaux domestiqu esetleursincidencessur la pathologie humaine.Tomell: Maladies duesaux plathelminthes. Fascicule I. Vigot frères(Ed), Paris.

20. Ghazaei, C. (2007). Evaluation therapeutic effects of antihelminthic agents.

21. Giadinis, N. Psychas, V., Polizopoulou, Z., Papadopoulos, E., Papaioannou, N., Komnenou, A.T., Thomas, A. L., Petridou, E. J., Kritsepi-Konstantinou, M., Lafi, S. Q. and Brellou, G. D. (2012). Acute coenurosis of dairy sheep from 11 flocks in Greece. New Zealand Veterinary Journal, 60: 247 – 253.

22. Gicik, Y., Kara, M. & Arsalan, M.O., (2007). Prevalence of Coenurus cerebralis in sheep in Kars Province, Turkey. Bulletin of The Veterinary Institute in Pulawy, 51: 379-382.

23. Godara, R., Katoch, R., Yadav, A., Khajuria,J.K. & Borkataki, S. (2011b). Coenurosis in small ruminants: an overview. Veterinary Practitioner, 12: 102-105.

24. Güçlü, F., Uslu, U. and Özdemir, Ö., 2006. Bilateral bone perforation caused by Coenuruscerebralis in a sheep: case report. T ParazitolDerg, 30: 282-284.

25. Hamed, M.F., Abbas, E.A.I., Amin, F.A., Elbeskawy, M.A., Al-Araby, M.A. (2015). Histopathological and ultrastructural alterations of neurons and glial cells of infected sheep brain with Coenurus cerebralis, International Journal of Advanced Research 3: 428-433

26. Jibat, T., Ejeta, G., Asfaw, Y.And Wudie, A. (2008). Causes of abattoir condemnation in apparently healthy slaughtered sheep and goats at HELMEX abattoir, DebreZeit, Ethiopia, Revue Méd. Vét.,159:305-311

27. Kheirandish, R., Sami, M., Azizi, S.H. &Mirzaei, M. (2012). Prevalence, predilection sites and pathological findings of Taenia multiceps coenuri in slaughtered goats from south-east Iran. Onderstepoort Journal of Veterinary Research DOI 10.4102/ojvr. v79i1. 436.

28. Mandal,S. (2006).veterinary parasitology at glance, first edition 2006, Pp:151-152.

29. Manunta, M., Evangelisti, M., Burrai, G.P., Columbano, N., Ligios, C., Varcasia, A.,Scala, A. &Passino, E.S. (2012). Magnetic resonance imaging of the brain and skull of sheep with cerebral coenurosis.American Journal of Veterinary Research 73:1913-1918.

30. McDermott, A., and Norton, J., (2012). Centers for Disease Control and Prevention. 1600 Clifton Rd., Atlanta, GA 30333, CDC. gov, Retrieved April 1, 2012, from http://www. cdc. gov.

31. Miran B. M.,2013, Msc thesis, coenurosis in slab-slaughtered sheep and goats in ngorongoro district: prevalence and predisposing factors of the disease, a dissertation submitted in partial fulfilment of the requirements for the degree of master of science in parasitology of sokoine university of agriculture. morogoro, tanzania. p 58.

32. Miran, M., Nzalawahe,J., Kassuku, A.A., Swai, E.S.(2015) Prevalence of coenurosis in sheep and goats at three slaughter slabs in Ngorongoro District, Tanzania, Trop Anim Health Prod 47:1591–1597.

33. Negassa, N., Shahidur, R. and Gebremedhin, B. 2011. Livestock production and marketing. ESSP Working Paper 26. Washington, DC, USA: IFPRI.

34. Nourani, H. & Pirali Kheirabadi, K. (2009). Cerebral coenurosis in a goat: Pathological findings and literature review. Comparative Clinical Pathology 18: 85-87.

35. Oryan, A., Moazeni, M., Amrabadi, O., Akbari, M., & Sharifiyazdi, H. (2015). Comparison of distribution pattern, pathogenesis and molecular characteristics of larval stages of Taenia multiceps in sheep and goats. Small Ruminant Research, 132:44-49.

36. Özkan, C., Yildirim, S., & Kaya, A. (2011). Clinical coenurosis (Coenurus cerebralis) and associated pathological findings in a calf. Pakistan Veterinary Journal, 31:263-266.

37. Rashid, M.H., Nooruddin, M., and Hashim, M.A. (2000). Extraneural coenuriasis in Bengal goats: 2. Clinical Propaedeutics Progress. Agric. 11:147-152.

38. Sabbatani,S., Zucchelli, M., Calbucci, F., Roncaroli, F., Chiodo, F.,(2004). A case of cerebral Coenurosis -Infez Med 12: 205-210.

39. Scala, A., & Varcasia, A. (2006). Updates on morphobiology, epidemiology and molecular characterization of coenurosis in sheep. Parassitologia, 48:61-63.

40. Schuster, R. K., Sivakumar, S., & Wieckowsky, T. (2010). Non-cerebral coenurosis in goats. Parasitology research, 107:721-726.

41. Scott, P.R. (2012), Diagnosis and treatment of coenurosis in sheep, University of Edinburgh, Easter Bush Veterinary Centre, Roslin, Midlothian, Scotland, United Kingdom.Veterinary Parasitology, 189: 75– 78.

42. Shibiru,N. (2012). study on the prevalence and economic implication of coenurus cerbrallis in sheep and goat in and around Yabello district of Borena zone, DVM thesis, college of Agriculture and veterinary Medicine, Jimma university, Ethipia, Pp31.

43. Tavassoli, M., Malekifard, F., Soleimanzadeh, A. & Tajik, H. (2011). Prevalence of Coenurus cerebralis in sheep in Northwest of Iran.Veterinary Research Forum, 2: 274-276.

44. Upadhayay, A.K. (2005). Text book of preventive medicine, first edition, Pp 452-454.

45. Uslu, U. & Guclu, F. (2007). Prevalence of Coenurus cerebralis in sheep in Turkey. Medycyna Weterynarina ,63: 678-680.

46. Varcasia, A., Jia, W. Z., Yan, H. (Abraha, 2007). (Abraha, 2007). B., Manunta, M. L., Pipia, A. P., Garippa, G. &Schuster, R. K. (2012). Molecular characterization of subcutaneous and muscular coenurosis of goats in United Arab Emirates.Veterinary parasitology, 190: 604-607.

47. Varcasia, A., Tosciri, G. Coccone, G., Pipia, A., Garippa, G., Scala, A., Damien, V., Vural, G., Gauci, C., Lightowlers, M. (2009). Preliminary field trial of a vaccine against coenurosis caused by Taenia multiceps. Vet. Pathol, 162: 285–289.

48. Veronesi, F., Lepri, E., Marchesi, M., Fillippini, G., Mandara, M. (2008). A focus of brain coenurosis in sheep coming from an Italian Umbrian stock farm. Large Anim. Rev. 14: 217–222.Veterinarie (SISVet) 14: 195-196.