



Prevalence of *Cysticercus Tenuicollis* and associated risk factors of small ruminants slaughtered at Jimma Municipal Abattoir, South West Ethiopia

Yitegasu Seyoum Gulilat
Dept. of CoA & VM,
School of Veterinary Medicine,
Jimma University, Jimma, Ethiopia

Nemomsa Anbesse Jiru
Dept. of CoA & VM,
School of Veterinary Medicine,
Jimma University, Jimma, Ethiopia

Article details:

Received: 18th Jan, 2019

Revision: 22nd Jan, 2019

Accepted: 27th Jan, 2019

Published: 31st Jan, 2019



ABSTRACT

This study was conducted from April 2018 to May 2018 in Jimma municipal abattoir, south west of Ethiopia. The aims of this study were to determine the prevalence of *C. Tenuicollis* in sheep and goat slaughtered at Jimma municipal abattoir and to identify risk factors that can influence the

prevalence of *C. Tenuicollis*. Ante-mortem and post-mortem inspection were conducted. Ante-mortem inspection was conducted in the lairage and abnormalities encountered were recorded, followed by post-mortem examination through their identification number to detect gross abnormalities. During the study, a total 109 goats and 275 sheep visceral organs were inspected. *C. Tenuicollis* was found in 14 goats (12.84%) and 46 sheep (16.72%), respectively. *C. Tenuicollis* had a tendency to be located more in the mesentery than other organs and this difference between infections rate of mesentery and other organs was not significantly associated ($p > 0.05$). This study also shows that *C. Tenuicollis* is more frequently detected in the mesentery of goats and sheep than any other visceral organs. Appropriate control measures need to be introduced to reduce the prevalence of these parasites in small ruminants. So as to reduce these losses, further studies should be done in different abattoirs of the country and introduce preventive measures to reduce unnecessary financial losses.

Keywords: Prevalence, *C. Tenuicollis*, sheep and goats, Jimma town Ethiopia.

1. INTRODUCTION

Ethiopia has the largest livestock population in Africa, estimated at 38 million cattle, 23 million sheep and 18 million goats, which are raised almost entirely by smallholder farmers throughout the country. Small ruminants (sheep and goats) are particularly important resources of the country as they provide more than 30% of local meat consumption and generate cash income from export of meat, live animals and skins (Anonymous, 2005).

However, a significant amount of organs and carcasses are condemned in slaughtered sheep and goat due to various diseases and pathological abnormalities and each year more than 900 million USD loss are estimated annually. *C. tenuicollis* is among those diseases results organ condemnation from slaughtered house (Jacob, 1979).

C. tenuicollis is a larva of *Taeniahydatigena* (*T. hydatigena*) is the most important parasite of sheep and goats. After the ingestion of egg the oncospheres enter the blood stream via the intestinal wall. It is thus carried to the liver where it bores its way through the liver substance. After 14 days it leaves the liver and enters the abdominal cavity where it develops to a large bladder worm, known as *C. tenuicollis*. If a sheep or goat swallows a whole tapeworm segment, which may contain 100,000 eggs, death may occur due to massive numbers of developing metacestodes known as *Cysticerci* (Radostits *et al.*, 2007).

C. tenuicollis, a metacestode of *T. hydatigena*, invades the liver and abdominal cavity of the intermediate hosts like sheep and goats causing considerable tissue damage during larval migration. Fibrous scars resulting from the

migration of the larvae lead to condemnation of the viscera and disposal of other offal's to which the mature bladder worms attached and if they fail they degenerate and become calcified (Assefa, 2005).

Various investigations have been conducted to determine the prevalence and economic importance of organs condemned in Ethiopia. According to Woinshet and Girma the prevalence of *C. tenuicollis*, in visceral organs of slaughtered sheep and goat at Addis Ababa abattoir was 40.0% and 46.6% in sheep and goat respectively. Furthermore, many researchers indicate that, there is variation in the occurrence of *C. tenuicollis* in different areas of Ethiopia. However, most of the surveys paid attention to organ condemnation due to parasites in shoats (Woinshet *et al.*, 2010).

Hence, there are practically no dependable and precise information with regard to organ condemnation of small ruminants especially on liver due to parasitic cases likes *C. tenuicollis*. In view of this, proper evaluation of economic loss due to liver condemnation in sheep and goats at abattoir is needed. This is of great relevance where economic realities often determine the type and scope of control. There was very few studies conducted, and hence, there is scarcity of information about *C. tenuicollis* prevalence or status at Jimma municipal abattoir. Therefore, the objectives of this paper were:

- ✓ To determine the prevalence of *C. tenuicollis* in sheep and goat slaughtered at Jimma municipal abattoir
- ✓ To identify risk factors that can influence the prevalence of *C. tenuicollis* in the study area.

2. LITERATURE SURVEY

2.1 Cysticercus Tenuicollis

Cysticercustenuicollis is larval stage (metacestode) of *Taeniahydatigena* (*T. hydatigena*). Adult worms of *T. hydatigena* have been reported to have been found in the small intestines of dogs, cats, mice and wild carnivores, like the wolf and the fox as the definitive hosts. The adult worm of *T. hydatigena* lays eggs which pass out in the feces of the host and are ingested by a wide range of herbivorous animals (intermediate hosts) during grazing. After ingestion, the egg's shell is digested and the oncospheres are liberated and migrate through the intestinal walls, reaching the liver through the hepatic portal system (Jenkinsa *et al.*, 2014).

The oncospheres may remain in the liver or migrate to the omenta, mesenteries or the peritoneal cavity. However, unusual locations like the lungs, the kidneys, brain and reproductive system organs have also been reported. Pathogenicity of adult parasites is not high for definitive hosts. However, *C. tenuicollis* have serious impacts on their intermediate hosts. The migration of these cysticerci in the liver may cause hepatitis cysticercosa leading to haemorrhagic and fibrotic tracts and serofibrinous peritonitis. In very heavy infections, the migrating larvae destroy the hepatic cells causing eosinophilic infiltration and severe inflammation that may prove to be fatal (Payan-Carreira *et al.*, 2008).

In recent years, it is becoming increasingly clear that greater priority should be given to *C. tenuicollis* because of its economic impact due to condemnation of offal's containing these larvae, particularly in resource-poor countries. Loss in quantity or quality of meat or offal will have financial implications, with reduced payments for carcass contamination or diseased or infected tissues (Bates *et al.*, 2013).

2.2 Taxonomy and Classification

More than 70 nominal species having been attributed to the genus of *Taenia* and approximately 42 valid species and three subspecies are currently recognized. *Taeniidae* consists of two genera, *Echinococcus* and *Taenia*. The genus *Taenia* includes a diversity of tapeworm species, including the larvae (metacestodes) and the cestodes (tapeworms), the adult stages of which occur in the intestine of dogs or wild canids. Species of *Taenia* are of significant human and veterinary importance. They parasitize in different hosts, including fish, reptiles and mammals. The adult stage of *T. hydatigena* (Cestoidea; Cyclophyllidea; *Taeniidae*; *Taenia*) parasitizes and matures in the small intestine of dogs, cats, mice and wild carnivores, like the wolf and the fox (Lavikainen *et al.*, 2008).

2.3 Adult Tapeworm

T. hydatigena (Synonym: *Taeniamarginata*) or thin-necked bladder worm, the adult stage of *C. tenuicollis*, is very like the *Taeniasolium*, but smaller. Its usual length is about 5 meters. The body consists of a head called scolex, followed by a narrow neck and a long strobila. The strobila is composed of linear chain of flat segments called proglottids, and each proglottid is a monoecious. The head possesses four suckers and a rostellum with 28 to 33 hooks, situated in two rows hooks. These hook and suckers enable tapeworm to remain attached to the host's

intestinal mucosa. The lengths of the large hooks of *T. hydatigena* range between 191 and 218 μm , while the small hooks range between 118 and 143 μm (OIE, 2008).

2.4 Eggs

Taeniid species eggs are spherical or oval 26-34 μm in the diameter and consist of a delicate outer layer (yolk sac), being removed prior to the expulsion of the egg within the proglottid. The second layer, a thick embryophore (polygonal keratin blocks), which gives the egg its radial appearance. On the inside of the embryophore layer is a thin oncospherical membrane and the oncosphere (hexacanth embryo), which contains six hooks and a pair of glands (Murrell *et al.*, 2005).

The eggs of *Taenia* species are morphologically indistinguishable by light microscopy, limiting the diagnosis by fecal examination. Adult stage of *T. hydatigena* in dogs produce proglottids which mature, become gravid, detach from the tapeworm, and migrate to the anus or are passed in the stool (approximately 2 per day, each containing about 50,000 eggs). Although each *T. hydatigena* may produce over 100,000 eggs per day, many of them hatch in the small intestine and become inactive (Rostami *et al.*, 2013).

2.5 Metacestode (*Cysticercus tenuicollis*)

C. tenuicollis is the larval stage of *T. hydatigena* tapeworm that considered as the most important parasite of sheep and goats. The adult *T. hydatigena* lives in the small intestines of dogs and other carnivores, segments containing numerous eggs passed in the feces. After the ingestion of eggs, oncosphere within egg hatches under the influence of gastric juices and bile that break down the embryophore and activate the oncosphere. The oncosphere penetrates the intestinal epithelium, presumably using its hooks and secreted enzymes. The gland secretions act as host-cell lysing agent, thus they assist passage of hooks through the tissues (Jabbar *et al.*, 2010).

The penetration in the intestinal mucosa takes around 30-120 minutes of entering the lumen of the small intestine. Once through the epithelium, some oncospheres enter subepithelial capillaries and are carried to the liver via the portal system, where they are transformed to cysticerci. Cysticerci, which arise from the liver, will continue to grow in size and can reach a maximum length of 10mm in length. The oncospheres which enter the peritoneal cavity become attached to the peritoneum, mature therein, the abdominal (peritoneal) cavity of the sheep and can reach 10mm to 60mm in diameter. Cysts contain a clear, jelly-like fluid surrounding a single, immature tapeworm head (scolex) bearing hooks that act as an attachment device for the larvae with the epithelial cells in the host (Bayu *et al.*, 2012).

Usually, liver damage heals, forming fibrotic tracts, which leads to condemnation at meat inspection. If a sheep swallows a whole proglottid, which may contain 100,000 eggs death may occur due to massive numbers of developing metacestodes known as cysticercosis hepatica as reported. *C. tenuicollis* are infective for about two to three months after entering the sheep host. Some cysticerci may survive the lifetime of the host. Cysticerci that die at predilection sites are calcified (Guadu *et al.*, 2012).

2.3 General life cycles

2.3.1 Basic life-cycle pattern

Life cycle of *T. hydatigena* involves intermediate (a wide range of herbivorous animals) and definitive (dogs or wild Canids) host species; and three distinct stages: eggs in environment, cysticerci in the intermediate host and adult tapeworms in the small intestine of definitive host (Torgerson *et al.*, 2003).

2.3.2 Egg survival and dispersion

Eggs of *T. hydatigena* are highly resistant to environmental factors and can remain infective for a long period of time in a suitable environment. Their survival is dependent on temperature and relative humidity. However, the viability of the eggs declined more rapidly under high temperatures, lower humidity, direct exposure to intense sunshine and the presence of tapeworm debris. Heating to 60°C-80°C killed eggs of *T. hydatigena* in less than 5 minutes. On the other hand, *T. hydatigena* eggs can survive freezing conditions (Buttaret *et al.*, 2013).

Taeniid eggs disperse at least 80 meters within 10-19 days from deposition. The potential for dispersion of *T. hydatigena* eggs was recorded by the discovery of *C. tenuicollis* in a population of undomesticated sheep on a remote Scottish Island despite the fact that the nearest definitive hosts were located at a distance of 40 km away. In a pasture, the sheep themselves may be involved in the dispersal of the eggs as they walk through them, but the transfer of eggs over longer distances requires alternative dispersal mechanisms. Flies may be involved in the

transport of *T.hydatigena* eggs. *T. hydatigena* eggs which had been ingested by flies in field experiments were reported to be viable and caused infection when ingested by lambs (Deplazes *et al.*, 2011).

2.3.3 Hatching and activation

Hatching refers to removal of the thick embryophore of *Taenia* eggs caused by gastric juices and activation refers to discharge of the oncosphere from the oncospherical membrane by the action of bile (Radfa *et al.*, 2005).

2.4 Clinical features

The presence of *C. tenuicollis* in ruminants is generally not clinically apparent. However, death may occur due to massive infections of numerous *C. tenuicollis* known as cysticercosis. Deaths can follow due to hepatic hemorrhage, mainly in young animals. Economic loss is mainly due to condemnation of livers and other organs at slaughterhouse. Moderate to heavy infections can result in loss of appetite, diarrhea, jaundice, anemia, and decrease in growth rate leading to increase feed costs. Sheep may also become weak, leaving them susceptible to other infections. On the other hand, liver damages caused by the migration of young *C. tenuicollis*, can create favorable conditions for local growth of some pathogenic microorganisms (Popova *et al.*, 2013).

The most frequent locations for *C. tenuicollis* are the omenta, the mesenteries or the liver. However, unusual locations of *C.tenuicollis* cysts, like the lungs, the kidneys, brain and even the reproductive system had been reported. An aberrant location of *C. tenuicollis* inside the chorion-allantoic membrane of a goat's foetus was reported in Portugal's northeast. On the other hand, the existence of *C. tenuicollis* cysts attached to the broad ligament and to the uterine tubes also was reported in an abattoir survey on acquired reproductive abnormalities in the ewes. In a certain number of these cases, calcified cysticerci occluded the uterine tubes (Mekuria *et al.*, 2013).

2.5 Economic impact

The importance of *C. tenuicollis* is the resultant losses encountered during meat inspection when infected carcasses are condemned. The loss due to condemnation of organs by *C. tenuicollis*, particularly liver is of special significance in countries of low economic output, where sheep and goat production is of particular importance. The estimated annual loss due to the rejection of carcass and organs from small ruminants slaughtered in Ethiopia to be 65,269 USD or 1,044,317 Ethiopian birr (Oryan *et al.*, 2012).

2.6 Detection and diagnosis

2.6.1 Meat inspection —the main diagnostic procedure

Meat inspection at slaughterhouses usually was performed to detect the presence of *C. tenuicollis* cysts in the infected intermediate hosts, although such procedure is insensitive, particularly for lightly infected carcasses. Slaughterhouse meat inspection provides useful information and is an initial indicator for the prevalence of *C. tenuicollis* in an area, but active surveillance is needed to gather more valid epidemiological information and for surveillance of control programs (El-Hallawany *et al.*, 2012).

In addition, meat inspection of *C. tenuicollis* is more difficult if cysts are small or degenerate early, thus allowing more infected carcasses to pass unnoticed. In general, meat inspection procedures detect only about 20–50% of the animals that are actually infected. Meat inspection depends on finding one or several *C. tenuicollis* cysts at necropsy, the presence of only one scolex in the bladder worm and rostellar hook characters, particularly large and small hook lengths (Jibat *et al.*, 2008).

2.7 Prevention and control of *C. tenuicollis*

C. tenuicollis do not have serious impact on sheep health. However, they influence on the carcass value at slaughter and cause considerable losses in the sheep industry and thus, restrict market access. *C. tenuicollis* in the internal organs of intermediate hosts are difficult to eliminate with drugs. Therefore, treatment for *C. tenuicollis* in intermediate hosts is not included in any control programme. All control strategies rely on an integrated control programme involving both sheep farmers and dog owners to break the life cycle of *T. hydatigena* (Goussanou *et al.*, 2014).

3. MATERIALS AND METHODS

3.1 Study area

The study was conducted at Jimma Municipal Abattoir to determine the prevalence of *C. tenuicollis* in sheep and goat slaughtered at Jimma municipal abattoir and to identify risk factors that can influence the prevalence of *C. tenuicollis* in the study area. Jimma town is located in Oromia region, south west of Ethiopia, at a distance of about 352 km from Addis Ababa. Geographically, Jimma is located at 7°13' and 8°56' N latitude and 35°52' and 37°37'E longitude. The climatic condition of the area is 'midland with altitude ranging between 1720 to 2110 m above sea level and receives annual rainfall which ranges between 1200 to 2000 mm. There are two rain seasons, short rainy season (November to April) and long rainy season (July to October). The annual mean temperature ranges from about 12.1°C to 28°C (JZARDO, 2009). Jimma zone has a poultry population of about 1,139,735 (CSA, 2015).

3.2 Study Population

The study population constituted of local breeds of sheep and goats coming from different market of Jimma zone slaughtered at Jimma municipal abattoir. All slaughtered animals, were males and females. In this study, small ruminants were categorized into two age groups, young and adult and two species, sheep and goats. Sheep and goats with the first pair of permanent incisor teeth were considered as young and those with two and more pair of permanent incisors were regarded as adults (Steele, 1996).

3.3 Study design

The study was cross-sectional study whereby the study animals were selected from the slaughter line using systematic random sampling technique. List of the animals to be slaughtered, from which study animals were selected, was prepared while the animals were kept in lairage.

3.4. Sample Size Determination

The required sample size was determined based on expected prevalence of 50% and the formula given by Thrusfield (2005). The study considered 95% confidence interval and 5% precision level. Accordingly a total of 384 animals (that is, 275 sheep and 109 goats) were selected and studied. For this study sex, age, species, breed of animals and body condition were considered as risk factors.

3.5. Study methodology

3.5.1. Ante-Mortem Inspection

The date and the species, origin, breed, sex, age and body condition of animals were recorded prior to slaughter. During ante-mortem examination underweight animals were detained less than 14 kg and 12 kg for sheep and goat respectively in Lairage. Animals were clinically examined for any sign of illness while standing and moving and following the judgments passed by FAO. Animal were examined after evisceration serially numbered different paper tickets with different plastic tickets were placed on the liver (FAO, 1994).

3.5.2. Post-Mortem Inspection

During post mortem inspection the livers were thoroughly inspected by visualization, palpation and systemic incisions for the presence of parasites and other abnormalities. Cyst characterization (fertility and viability): the cyst collected was transported to the parasitology laboratory at the Faculty of Veterinary Medicine for confirmation and viability study on the cysts. To determine the viability, the cysts were incubated at 37°C in 40% sheep bile solution diluted in normal saline for 2 hours (Mc Cool, 1979).

Cysts were considered viable if the head evaginated within 2 hours, then the identification of the cysts was done based on the morphological parameters set for the metacystodes. *C. tenuicollis* was differentiated from *C. ovis* on the basis of its relatively larger size, less number of hooks, the position of the head and neck in relation to caudal bladder and also the location of the cyst in the body of the host (Urquhart *et al.*, 1996).

3.6. Data Analysis

The species, age, origin, body condition and visceral organs were collected. The raw data generated during post mortem inspection was entered into a Microsoft Excel spread sheet and the statistical analysis was performed using a SPSS Technologies. Descriptive statistics were used to determine the prevalence. The variation between infection rates of specific organs, age, species and origin of animals were evaluated by Pearson's chi-square test and P values of less than 0.05 were regarded as significant.

4. METHODOLOGY

During the study period, a total of 384 sheep and goats were slaughtered and inspected for the presence of *C. tenuicollis*. The overall prevalence of *C. tenuicollis* was 60 (15.6%) and the prevalence in sheep and goats were 16.72% and 12.84%, respectively with no a significant statistical difference ($P > 0.05$) between the two species (Table 1).

Table 1: Prevalence of *Cysticercustenuicollis* in sheep and goats based on their Species, sex, body condition and age

Risk Factor	No. examined	Infected number	Prevalence (%)	χ^2 -value	P-value
Species				0.893	0.345
Sheep	275	46	16.72		
Goat	109	14	12.84		
Sex				1.275	0.259
Male	230	32	13.9		
Female	154	28	18.2		
Age				0.234	0.628
Young	181	30	16.57		
Adult	203	30	14.77		
Body condition				3.356	0.187
Poor	129	14	10.85		
Medium	133	24	18.04		
Good	122	22	18.03		

Out of 275 sheep inspected, *C. tenuicollis* was detected in 27 (16.26%) and 19 (17.43%) male and female sheep, respectively. *C. tenuicollis* was found more in young sheep 26 (19.5%) than in adult sheep 20 (14.1%) with no significant statistical difference in infection rates between the two age groups ($P > 0.05$). The prevalence of *C. tenuicollis* was higher in females than in male sheep with no significant statistical difference in prevalence ($P > 0.05$). Small ruminant with poor body conditions 21(21%) were the most affected compared to the medium 8(9.9%) and good 17(19.5%) body conditions. When animals suffer from shortage or scarcity of nutrition, and infected with gastrointestinal internal parasites their immunity compromised. Hence, possibly this can be accounted for the higher prevalence of the cyst in poor body condition animals.

Table 2: Prevalence of *C. tenuicollis* versus the considered risk factors in sheep

Risk Factor	No. examined	Infected number	Prevalence (%)	χ^2	P-value
Sex				0.064	0.800
Male	166	27	16.26		
Female	109	19	17.43		
Age				1.472	0.225
Young	133	26	19.5		
Adult	142	20	14.1		
Body condition				5.489	0.064
Poor	100	21	21		
Medium	88	8	9.09		
Good	87	17	19.5		

Out of 109 goat inspected, *C. tenuicollis* was detected in 5 (7.9%) and 9 (19.56%) male and female sheep, respectively. *C. tenuicollis* was found more in adult goat 10 (16.7%) than in young goat 4 (8.16%) with no significant statistical difference in infection rates between the two age groups ($P > 0.05$). The prevalence of *C. tenuicollis* was higher in females 9 (19.56%) than in male goat 5 (7.9%) with no significant statistical difference in prevalence ($P > 0.05$). Sheep and goats with poor body conditions 6(14.3%) were the most affected compared to the medium 3(9.4%) and good 5(14.2%) body conditions. When animals suffer from shortage or scarcity of nutrition, and infected with gastrointestinal internal parasites their immunity compromised. Hence, possibly this can be accounted for the higher prevalence of the cyst in poor body condition animals (Table 3).

Table 3: Prevalence of *C. Tenuicollis* versus the considered risk factors in goats

Factor	No. examined	Infected number	Prevalence (%)	χ^2	P-value
Sex				3.212	0.073
Male	63	5	7.9		
Female	46	9	19.56		
Age				1.742	0.187
Young	49	4	8.16		
Adult	60	10	16.7		
Body condition					

Poor	42	6	14.3	0.487	0.784
Medium	32	3	9.4		
Good	35	5	14.2		

Table 4 indicates the infection rate of *C. Tenuicollis* in different organ of sheep and goats. The cysts in sheep and goats had a tendency to be located more in the mesentery, and it was lower in other organs. The infection rate in goats and sheep were comparable. Out of a total of 384 cysts counted in different internal organs of sheep and goats, 9 (30%), 13 (19.7%), 11 (17.18%), 17 (15.17%) and 10(8.9) were found in the mesentery, lung, omentum, peritonium and liver, respectively. More cysts were found in each of the above visceral organs of goats and sheep (Table 4).

Table 4: Over all infected organs among the totally examined sheep and goats

Organ	Infected organs	Prevalence (%)	Non infected organs	Total	X ²	P-value
Liver	10	8.9	102	112	9.477	0.050
Peritoneum	17	15.17	95	112		
Omentum	11	17.18	53	64		
Lung	13	19.7	53	66		
Mesentery	9	30	21	30		

5. DISCUSSION

During the study period, a total of 384 sheep and goats were examined from April 2018- May 2018 to determine the prevalence of *C. Tenuicollis* in sheep and goat and to identify risk factors that can influence the prevalence of *C. Tenuicollis*. The prevalence of 16.72% and 12.84% was found in sheep and goats, respectively. The prevalence of *C. tenuicollis* by species was higher in sheep when compared with that of goat and this difference was found to be statistically not significant. But, the present study was not similar with other observation made by Samuel (2008) and (Abdulikadir *et al.*, 2015) who found out that goats were more infected with *C. Tenuicollis* than sheep and also in According to (Torgersan *et al.*, 1998) under condition of high infestation with *C. Tenuicollis*, most sheep develop protective immunity early in life and the density dependent constrains regulates the parasite population, whereas goats develop the immunity more slowly. This considerable degree of immunity against *C. Tenuicollis* infection in goat may be the reason for the low prevalence of the parasite in goat. High prevalence was reported in East Ethiopia by (Sisay *et al.*, 2007). The overall prevalence was higher in sheep than in goats with anon significant statistical difference ($p > 0.05$).

The prevalence of *C. Tenuicollis* in sheep and goats in our study was relatively lower when compared with the results attained by Samuel (2008) and (Abdulikadir *et al.*, 2015) who recorded the prevalence of 40% and 45% in sheep and 46.6% and 53.9% in goats in central Ethiopia and in Bishoftu, Elfora Export Abattoir, Ethiopia respectively.

But this finding is compared to the report of (Endale *et al.*, 2013) the prevalence of *C. Tenuicollis* in sheep and goats in this study is relatively higher. Different investigators have also reported from other part of the world on the prevalence of *C. Tenuicollis*. The prevalence of 37.03% and 27.29% have been reported in sheep and in goats, respectively in India (Pathak and Gaur, 1982) and in Nigeria, a prevalence of 21.4% in sheep and 34.2% in goats have been reported by (Dada and Bellino, 1978). In Germany, Hasslinger and Weber-Werrinhen (1988) recorded a prevalence of 16.7% in sheep. The prevalence of 21.4% in sheep and 34.2% in goats was reported in Iran (Solaymani *et al.*, 2003), and also similar results were obtained in Iran by (Radfar *et al.*, 2005) who described a prevalence of 12.84% in sheep and 18.04%

An important function of meat inspection is to assist in monitoring diseases in the national herd and flock by providing feedback information to the veterinary service to control or eradicate diseases and to produce whole some products and to protect the public from zoonotic hazards (Pathake *et al.*, 2002). Diseased animals that show signs of abnormality during ante-mortem inspection should not be allowed to enter the abattoir for slaughter (Teka, 1997).

All animals that undergo post-mortem examination were those which passed ante -mortem inspection. Both ante-mortem and postmortem examinations were done by veterinarians working in Jimma municipal abattoir. During the study, from the total sheep and goats slaughtered, parasite like *C. Tenuicollis* was found to be the major causes that rendered mesentery rejection from human consumption. The spreading of infection is an indication of environmental contamination with the eggs of the adult dog tapeworms. *C. Tenuicollis* is the most important and widely prevalent of the four metacestodes recording in small ruminants slaughtered in the study abattoir. Up to 15.6% of the slaughtered sheep and goats were found to be infected with the *C. tenuicollis*. The prevalence of *C. Tenuicollis* by

species was slightly higher in sheep (16.72%) as compared to goats (12.84%). However, this difference was not found statistically significant.

The results of this study are lower than that reported by other workers (Pathake *et al.*, 1982). The relative prevalence of *C. Tenuicollis* recorded in the study could be due to the variations in temperature, environmental condition, the degree of pasture contamination and the way of rising and grazing of these animals which may favour the transmission cycle between ruminants and dogs. The age of the animals could also be another factor in these variations. The prevalence of *C. Tenuicollis* found in sheep in this study (16.72%) is lower than that reported by (Tekleye *et al.*, 1988) (Pathak and Gaur 1982). However; the findings of this study in sheep are lower than other reports by Dada and Belino, (Dada *et al.*, 1978).

According to (Torgerson *et al.*, 2008), under condition of high infestation with *C. Tenuicollis*, most goats develop protective immunity early in life, whereas sheep develop protective immunity more slowly. This considerable degree of immunity against *C. Tenuicollis* in goats may be the reason for low prevalence of the parasite in sheep. The infection rate of *C. Tenuicollis* in the mesentery of adult sheep and goats were higher than that of the young sheep. The difference in infection rates between young and adult may be due to the fact that the adult animals (sheep and goats) lived longer and picked large number of eggs during grazing as compared to the young ones which only lived for a shorter period of time.

The epidemiology of *C. Tenuicollis* was not well established in sheep and goats; hence, it may be difficult to explain why significantly more livers were condemned in goats (25.61%) than in sheep (22.04%) (Jibat *et al.* 2008). The difference in prevalence recorded in my study in the different agro-ecological zones may be attributed to differences in temperature and humidity (Morgan *et al.*, 2009). The greater prevalence of *C. Tenuicollis* in midland than in lowland areas may be due to the absence of vegetation in lowland areas. This is agreement with the findings of (Woinshet *et al.*, 2010).

Adults were more heavily infected than young animals. This is in agreement with the findings of (Woinshet *et al.*, 2010) who found lower infection rates in lambs. The higher rate of infection in adult animals may be attributed to age itself. Adult animals might have picked more eggs of *T. hydatigena* during their life. Our finding, however, does not support the reports of (Zahang *et al.*, 2010) who stated that cestode parasites produce significant quantities of antigens in adult animals, which protect small ruminants from infection.

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6. CONCLUSION & RECOMMENDATION

During this study low prevalence of *C. tenuicollis* was recorded both in sheep and goats slaughtered at Jimma municipal abattoir. The cysts in small ruminants had a tendency to be located more percentages in the mesentery than other organs. According to the result of this study *C. tenuicollis* is the most and major causes for respective organs of shoats to be rendered from international and local market and this results in extensive financial loss of the country. Based on the results of the present survey, the following recommendations are forwarded:

- ❖ Regular de-worming of dogs and elimination of stray dogs should be practiced and training of abattoir workers on procedures and cares during flaying and evisceration should be done.
- ❖ Different workshops should be prepared to enhance the awareness of the animal attendants, farmers, customers, abattoir workers and butchers pertaining proper disposal of condemned offals and carcasses.
- ❖ Immediate attention should be paid to the safe and controlled elimination of all condemned abattoir materials and the sale of contaminated offal's and organs of sheep and goats, and feeding of dogs should be stopped.
- ❖ Awareness creation programs should be launched for the butchers, abattoirs workers, meat sellers, and dog owners about the danger of the metacestodes for human and animal health.
- ❖ Strategic application of chemotherapy with appropriate anthelmintics at appropriate time should be implemented.
- ❖ A control program should be mounted on the number of stray dogs in the study area due to their involvement in the life cycle of the parasite.

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AUTHOR'S BIBLIOGRAPHY

Dr. Yitagesu Seyoum is currently a student of MVSC in veterinary Epidemiology, School of Veterinary Medicine at College of Agriculture and Veterinary Medicine, Jimma University, Oromia, Ethiopia. He holds a doctor of veterinary science degree from Hawassa University of Ethiopia. He does have a lot of research papers experience with Prof. Mahendra Pal of India.