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Research Article

Study on Prevalence, Cyst Distribution in Visceral Organ and Economic Loss of *Cysticercustenuicollis* in Sheep Slaughtered at Haramaya Manucipal Abattoir, Eastern Hararghe, Oromia, Ethiopia

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Abstract

A cross sectional study was conducted from November 2018 to June 2019 in apparently healthy sheep at Haramaya manucipal abattoir to estimate the prevalence, cyst distribution and economic loss of *Cysticercustenuicollis* in Slaughtered sheep. Ante-mortem inspection was carried out on arrival in the lairage; temporal identification numbers were given for individual animals were recorded. Then after, post-mortem examination was performed in each organ and carcass of individual animals along their identification number to detect gross abnormalities and aesthetic reasons that rendered each organ to be rejected from local market. During the study, a total of 384 sheep were randomly sampled and examined postmortem after slaughter for presence of C. *tenuicollisin* the visceral organs of the animals using standard meat inspection procedures and laboratory result. The collected data and stored into Microsoft excel was analyzed using SPSS.ver.20 (USA) statistical software. Out of the 384 sheep inspected for visceral organs, C. *tenuicolliswas* found in of 89 (23.2%) sheep. Adult sheep 87 (24.6%) were more infested than young 2(6.5%) with statistically significant difference (p=0.021). Sheep with poor body condition 21 (34.4%) were found most infected compared to medium 47 (24.5%) and good 21 (16%) body condition with statistically significant difference (p=0.016). More infected sheep were found in kersa 50 (41%), Aweday 25 (20%) and haramaya 14 (10.2%). This study also shows that C. *tenuicollisis* more frequently detected in the liver 40 (10.4%) of sheep than any other visceral organs and the peritoneum was the least 9 (2.3%). The liver lesions are unsightly and affect the texture of the tissue, making it unsuitable for human consumption and as a result extensive financial loss associated with condemnation of liver occurred. The annual loss due to the rejection of liver from the sheep slaughtered in the Haramaya municipal abattoir was estimated approximately 77,220.8 ETB. So as to reduce these losses, further comprehensive studies that include all the representative export and local slaughter houses should be done as to introduce appropriate preventive and control strategies that avoid the unnecessary financial losses.

INTRODUCTION

Ethiopia with its great variation in climate and topography possesses one of the largest livestock populations in the world, which is managed by smallholder farmer under extensive low input traditional management system and adjunct to crop production [1]. The country owns about more than 38,749,320 cattle, 18,075,580 sheep, 14,858,650 goats, 456,910 camels, 5,765,170 equines and 30,868,540 chickens with livestock ownership and currently contributing to the livelihoods of an estimated 80% of the rural population [2].

Small ruminants are among those domestic animals important in tropical animal production system including Ethiopia [3]. Which contribute more than 30% of local meat and generate income from export of meat, live animals and skins [4]. Unlike the large potential of small ruminants in the country, their productivity is low. The major constraints that greatly affect the economy of small ruminant production in Ethiopia are diseases [5]. Parasitic diseases in the tropics are responsible for great losses in the meat industry than any other infectious or metabolic disease [6]. Some of the economic losses are organ or carcass condemnation in slaughter houses and abattoirs for the presence

of larval stage of some taenia species with or without public health importance [7].

Cysticercustenuicollis is the metacestode of the tapeworm Taeniahydatigena. Adult worms have been reported to have been found in the small intestines of dogs, cats, mice and wild carnivores, like the wolf and the fox [**8**].Infested carnivores eliminate T. hydatigena eggs with their faces. Herbivores become infested with the eggs on account of having feed on contaminated pastures. Possible intermediate hosts for *C. tenuicollis* are squirrels, cattle, sheep, goats and other wild ruminants and also swine. After ingestion, the egg's shell is digested and the oncospheres become free to migrate through the intestinal walls, reaching the liver through the hepatic portal system. The oncospheres may remain in the liver or migrate to the omentem, mesenteries and the serosal surface of the peritoneal cavity. However, unusual locations like the lungs, the kidneys and the brain, have also been reported [9].

T. hydatigena of dogs are important from both sanitary and veterinary vies due to the presence of its larval stage in peritoneal cavity of sheep, goats, cow, and wild ruminants and swine with severe pathological effect to these hosts. The disease threaten the animal health especially sheep [10]. The effect of parasites in live small ruminants is insignificant unless it is complicated by the presence of concurrent infections. However, the presence of *Cysticercustenuicollis* in ruminants is an indicator of the incidence of T. *hydatigena* among wild and domestic carnivores. Furthermore, during its life cycle in the intermediate hosts like sheep and goats, *C. tenuicollis* causes fibrosis and scar formation along the migration sites of visceral organs like liver. Despite the liver lesions are unsightly; they affect the texture of the tissue, making it unsuitable for human consumption; however, the parasite doesn't have human health hazard [11].

Various investigations have been also conducted to determine the prevalence and economic importance of organs condemned in Ethiopia [12]. Fasciola, Hydatid cyst and *Cysticercusteniucollis* were the major parasites responsible for condemnation of organs and carcass in small ruminant [13]. However, most of the surveys paid attention to organ condemnation due to parasites in shoats. Hence, there are practically no dependable and precise information with regard to organ condemnation of sheep especially on liver due to parasitic cases likes *C. tenuicollis* and also there is no earliest information about *C. tenuicollis* prevalence in study area but there was studied before 11 year, (2007) and there is scarcity of study prevalence of *C. tenuicollis* to separate origin of animal in study area those staying in the same epidemiological and climatic condition. In view of this, proper evaluation of economic loss due to liver condemnation and to compare present and previous prevalence of *cysticercustenuicollis* and deferent Origin of study area whether there is deferent or not and if there is deferent to increase precision of why deferent prevalence of *cysticercustenuicollis* occurred in the same local area i.e. the same epidemiological and climatic condition in sheep at abattoir of study area was needed.

Despite the above investigations, there is scarcity of information about *C. tenuicollis* prevalence or status in Ethiopia and in study area. Therefore, the objective of this study was:

- To determine the prevalence *cysticercustenuicollis* in sheep slaughtered at Haramaya municipal abattoir, Eastern Ethiopia
- To determine cyst distribution in visceral organs of sheep slaughtered at Haramaya municipal abattoir, Eastern Ethiopia.
- To assess the economic impact of *C. tenuicollis* at Haramaya municipal abattoir, Eastern Ethiopia

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Haramaya town the Eastern Hararghe Zone of Oromiya Region, Eastern Ethiopia. The area is located, 14 km from West of Harar city and 508 km East of Addis Ababa. The estimated animal population in the area is about 63,723 cattle, 13,612 sheep, 20,350 goats, 15,978 donkeys, 530 camels and 42,035 chickens. The production system of the district is mixed type. Topographically, it is situated at altitude of 1600 to 2100 m above sea level, which puts the area into the category of a highland with the mean annual temperature and relative humidity of 18°C and 65%, respectively. Haramaya is located 9° 24′ N 42 ° 01′ E at an altitude of 1950 meters above sea level [14] (Figure 1).

Study Population

Study population are sheep that slaughtered in Haramaya municipal Slaughter house, A total of 384 sheep were randomly selected and identified by sex, body conditions and age during ante mortem inspection and their sources where, neighboring localities district and/or regions for Slaughtre in Haramaya manicepal abattoir were included in the study population. In the areas of their origin (Aweday, Haramaya and Kersa), the animals were owned by smallholder farmers under traditional management system. All sheeps Slaughtered were local breeds. In the study, sheep will categorize into different body conditions (poor, moderate, and good) according to the guidelines and both sex, male and female, of local breed sheep slaughtere for human consumption. All selected animals were grouped into 2 age groups based on the number of pairs of incisors that are young and adult; Sheep 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.

Study Design

A cross sectional study was conducted from November 2018 to June , 2019 by collecting data on events associated with *C. tenuicollis*in sheep slaughtered at Haramaya municipal abattoir, to estimate prevalence, cyctdisterbution of organ and liver condemnation and to calculate the direct financial loss

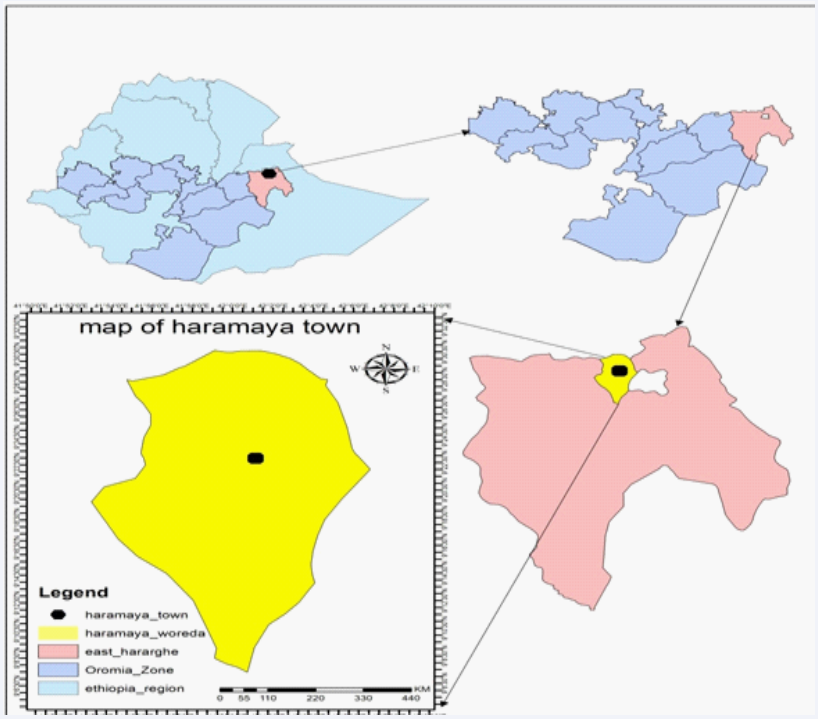

Figure 1 Map of Study Area

due to condemnation of liver in sheep slaughtered at Haramaya municipal Slaughtering Service House.

Sampling

Sample Size Determination:

The Sample size required to study this parasite was determined according to [15], formula.

$$n = \frac{1.962\ P_{exp}(1-P_{exp})}{d^2}$$

Where, n= required sample size

P_{exp}= expected prevalence and

d= desired absolute precision

Here, 95% level of confidence interval, 0.05 absolute precision and 17% expected prevalence Sisay*et al*. [16], were used. By substitution all the values; 111 animals were calculated; however, to increase precision a total of 384 animals were sampled.

Sampling Method: The sampling procedures were carried out using systematic random sampling in such a way that sampling units were selected at equal intervals with the first animal being selected randomly [17]. The study animals (sheep) were selected from the slaughter line using systematic random sampling technique.

Data Collection and Examination

Active Abattoir Survey: Active abattoir survey was conducted during routine meat inspection on randomly selected sheep. Pre-slaughter examinations were conducted in the lairage in order to determine the sex, age, and origin and body condition of animal. Identification number was given for each animal to examine after evisceration. During ante-mortem examination animals were clinically examined for any sign of illness while standing and moving according to and followed the judgments passed. Animal detain during ante-mortem examination was excluded from sampling. The metacestodes are readily visible in the organs or musculature at autopsy and therefore; diagnosis of C. *tenuicollis*is usually made during postmortem examination in abattoirs and packing plants [18]. So, After slaughtering the sheep post mortem examination was carried out, using routine standard meat inspection procedures (visualization, palpation and systemic incisions) for the presence of parasites and other abnormalities, paying attention to the visceral organs and tissues in abdominal, thoracic and pelvic cavities [19]. All the positive samples was kept in nylon containers, then bringing to the pathology and parasitology laboratory, college of Veterinary Medicine, Haramaya University, Haramaya, for further studies. The samples collected were confirmed to be *Cysticercustenuicollis* cysts using their predilection sites, characteristics, size and morphology of bladder cyct during pm examination and by size, morphology and size of cyct after transported to laboratory. But, some time it was also calcified in liver.

Assessment of economic Losses

An attempt was make in order to estimate economic significance of *Cysticercustenuicollis* from the cost of condemned

liver in sheep. To calculate the economic loss, the following parameters were taken into consideration: The market demand, mean market price, the rejection rates of liver and annual slaughter capacity of the abattoirs. Average market price was determined based on the interview made with 46 personnel of the abattoir and different butchers. The economic losses due to liver condemnation were estimated by the formula set by [20], as follows:

EL = ΣSrx*Coy*Roz

Where, EL = Annual economic loss estimate due to liver condemnation from local market.

Srx = Annual animals slaughter rate of the abattoir

Coy = Average cost of Condemnation organ.

Roz = Condemnation rates of rate.

Data Quality Control

All laboratory procedures including media preparation, procedures of each testing technique was done according to manufacturer production guideline. Sterilization procedures and collection and handling of specimens were carried out in accordance with standard protocols [21].The necessary reagents and samples was checked for contamination each time before handling and kept in proper condition [22].

Data Management Analysis

Data collected were coded accordingly, entered into Microsoft Excel 2007© spread sheet and analyzed by using SPSS version 20 software. Descriptive statistics were used to summarize the collected data. The prevalence of *Salmonella* was calculated using percentage. The associations in the occurrence of *Salmonella* in different sample were assessed using statistical tests such as Chi square test were done by considering (95%) confidence interval (CI) and 5% level of significance. P-value less than or equal to 0.05 was considered as statistically significant.

Ethical Clearance

To make this study ethically sound all the important topics in public health ethics such as consents of the participants and willingness to take part in the study was asked and acknowledged first. All the moral, cultural and religious values of the community were respected. The confidentiality of information and privacy of the participants during sample collection and interview was protected. Access to confidential records and computer files was limited by keeping records under lock and key. All of the objectivity were discussed and analyzed throughout the research.

RESULTS

Abattoir Survey

Post Mortem Inspection Over all Prevalence and Risk Factors of *C. tenuicollis* in sheep: Post mortem inspection of 384 sheep carcasses at Haramaya municipal abattoir revealed *Cysticercustenuicollis*cysts in 89 (23.2%) of the animals: Out of 275 male and 109 females examined, 65(23.6) and 234(22%) were respectively infected. The prevalence of *C. tenuicollis*was higher in male than in female. However, the difference was statistically insignificant (p=0.0735). Among age groups, the prevalence of infection was 87 (24.6%) and 2(6.5%) for sheep adult and young respectively. The prevalence of *C. tenuicollis*was higher in adult than in young with statistically significant difference (P=0.021). Among body condition, the prevalence of infection was 21(16%), 47(24.5%), 21(34.4%) sheep body condition of good, medium and poor respectively. Sheep with poor body condition (34.4%) were found most infected compared to medium (24.5%) and good (16%) body condition with statistically significant difference (P=0.016). The risk of exposure to *C. tenuicollis* based on different origin was examined. Prevalence of *C. tenuicollis* revealed significant variation in the origin of sheep. There was statistically difference in origin of the sheep (p=0.00). most *C. Tenuicollis* infected sheep were found in Kersa 50 (41%) whereas 26(20%) of sheep with *C. tenuicollis* was found in Awe day and 13 ((10.2%) of sheep with *C. tenuicollis* was found in Haramaya. The detailed association of the overall prevalence of *C. tenuicollis* with the considered risk factors was shown in Table 1.

Distribution of *C. tenuicollis* in visceral organs: When the data on distribution of cysts in different organs/viscera of infected animals were analyzed and summarized, the majority of the *C. tenuicollis* cysts showed to have tendency to be located in liver 40 (10.4), omentum 22 (5.7), mesentery 13 (3.4) and peritoneum 9 (2.3) of sheep. Most of the positive sheeps were found to carry the parasite in their liver. Out of 89 positive sheep, prevalence of 40 (10.4%) of them were found to harbor the parasite in their liver. Since, in this study, the predominant predilection site for *C. tenuicollis* cyst was liver. Of the 89 positive sheep, liver accounts for 40 (44.5%) and 40 (10.4%) within proportion of organ disterbution, and Prevalence of *C. tenuicollis*in the visceral organs respectively. The detailed of organ disterbution and Distribution of *C. tenuicollis* in the visceral organs was shown in Table 2.

Estimation of Direct Economic Losses: Direct economic losses associated with disposed liver are significantly high. The average mean annual sheep slaughter rate was estimated to be 6120 heads, average rejection rate of the abattoir was 40 (10.4%)

Table 1: Over all prevalence of *C. tenuicollis* of sheep at Haramaya municipal abattoir versus the considered risk factors

Risk Factor		No. examined	Infected number	Prevalence (%)	χ2	P-value
Sex	Male	275	65	23.6	0.115	0.735
	Female	109	24	22		
Age	Adult	353	87	24.6	5.298	0.021
	Young	31	2	6.5		
Body condition	Good	131	21	16	8.276	0.016
	Medium	192	47	24.5		
	Poor	61	21	34.4		
Origin	Haramaya	137	14	10.2	35.354	0.000
	Aweday	125	25	20		
	kersa	122	50	41		

Table 2: Organ distribution and distribution of *C. tenuicollis*in the visceral organs of infested sheeps

Visceral Organs	No. positive	Prevalence (%)	Proportion
Liver	40	10.4	44.9
Omentum	22	5.7	24.7
Mesentery	13	3.4	14.6
Peritoneum	9	2.3	10.1
Liver and peritoneum	1	0.3	1.1
Liver and omentum	1	0.3	1.1
Liver, peritoneum and omentum	1	0.3	1.1
mesentery and omentum	1	0.3	1.1
peritoneum and omentum	1	0.3	1.1

and the average local recent market price of single liver was 55ETB. Therefore, by substituting all the values in the following formula,

EL = Srx*Coy* Roz

EL = (6120*55etb*0.208).

EL = 77220 USD

Total loss= 70,012.8 ETB.

Therefore, the annual direct economic loss from local market of liver condemned at the abattoir due to *C. tenuicollis* was estimated to be 2100384USD$ i.e., approximately 70012.8 ETB (1USD=30ETB)

DISCUSSION

Meat inspection is commonly perceived as the sanitary control of slaughter animals and meat. The aim of meat inspection is to provide safe and wholesome meat for human consumption. The responsibility for achieving this objective lies primarily with the relevant public health authorities who are represented by veterinarians and meat inspectors at the abattoir stage. Meat inspection and meat hygiene shall make sure that meat and meat products are safe and wholesome for human consumption. The classical ante-mortem and post-mortem procedures were designed to detect disease in an animal before slaughter and the lesions produced by the disease after slaughter respectively [22]. In Developing countries, abattoirs play a major role in providing and serving as a source of information and a references center for diseases prevalence [23], suggested that governments or other program aimed at controlling or eradicating disease across African countries such abattoir survey result in the planning and control of livestock diseases [24], mentioned that the infection by larval stages of cestodes is considered a problem with a high economic important and would be formed dangerous common health if the resolution was not be found.

During the study period, a total of 384 sheep were examined from out of these, 89 (23.2%) sheep were found to be positive for *C. tenuicollis.* This finding is more comparable with the report of 22.8% dire dawa [25], and in other countries, 23.27% in Egypt [26].The prevalence of *C. tenuicollis* in sheep in this study is relatively lower than that reported from result in a study done by [16], who has recorded prevalence of 14, 12 and 15% in sheep at Harar, Dire Dawa and Jijiga and in other countries, 16.7% in Turkey [27]. Also, relatively higher prevalence of 56.8 % was reported from debrazaitel for aabattoire [28]. In other countries 28.0% from Ankara province [10], In this study there are compare present and previous prevalence of *cysticercustenuicollis* and deferent Origin of study area whither there is deferent or not to increase precision of why deferent prevalence of *cysticercustenuicollis* occurred in the same local area 0 i.e. the same epidemiological and climetic condition in study area and other place in the sheep. During the study period out of these, 89 (23.2%) sheep were found to be positive for *C. tenuicollis* but in previous17% expected prevalence in study area by [16]. And the risk of exposure to *C.tenuicollis* based on different origin was examined. .There was statistically difference in origin of the sheep ($p>0.05$). Most of *C.tenuicollis* infected sheep were found in kersa (41%) whereas 26 (20.8%) of sheep with *C.tenuicollis*was found in Aweday and 13 ((9.5%) of sheep with *C.tenuicollis* was found in Haramaya. So, in this study area prevalence of *C.tenuicollis* revealed significant variation in the origin of sheep and also present study higher than previous. *T. hydatigena* of dogs are important from both sanitary and veterinary vies due to the presence of its larval stage in peritoneal cavity of sheep, goats, cow, wild ruminants and swine with severe pathological effect to these hosts. The disease threaten the animal health especially sheep [29]. As [30], mentioned, the prevalence of the parasite varies from one area to another. Generally, there is higher incidence in countries with lower degree of sanitary and uncontrolled wild carnivore population. As observed by [31], the grazing behavior and management system of the animals may be responsible for the differences in prevalence between this and the other studies. In this study animals were selected from smallholder and backyard management system. In such areas dogs are kept by the animal owners, and believed that the dogs are useful for the community in preventing predators from their livestock. In the area, especially in rural, treating dogs for parasitic diseases is not practiced. Backyard slaughter of small ruminants and disposal of viscera and trimmings on open field is common as a result of small number of abattoire and also there not awareness creation programs launched for the butchers, abattoirs workers, meat sellers and dog owners about transmission, prevention and control of *C. tenuicollis* between dogs and farm animal was not experienced veterinarian in abattoir and have more final host (dog) than previous. All of these are very important to facilitate the life cycle to continue between the final and intermediate hosts.

The present study suggest that the prevalence of *C. tenuicollis* was higher in adult sheep 87 (24.6%), then in then youngones (6.5%) with a statistically significant difference of ($P<0.05$). The prevalence of infection increases with age of the sheep Compared to other reports, the result of this study agree, but lower than the other report for: age above 3 years 37.8% in sheep and in young ones 33.3% in sheep in three export abattoirs by [32]; 47.4% in adult sheepand 35.8% in young sheep by [33], and also agreed

with the observation of [34], which showed higher prevalence in adult than young animals. But, this study disagreed with the observation of [35], which showed higher prevalence in young than aged animals. This study may be due to high ingestion of eggs of T. hydatigena and more close contact to the final host (dogs), in young's animals in this study area, mostly kept indoors, then older animals.

Body condition of sheep was the risk factor in which the prevalence of *C. tenuicollis* with poor body condition (34.4%) were found most infected significantly varied ($\chi 2$ =8.276, *P* <0.05) Sheep with the prevalence of *C. tenuicollis* compared to medium (24.5%) and good (16%) body condition. This finding is in line with the report of [36], and [32], from Northern Jordan, Turkey, Central Ethiopia and dire daw a respectively. But, this study disagreed with the observation of [37], which showed higher prevalence in young than aged animals. 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. But, among other risk factors considered except the slight difference in figures of the prevalence statistically insignificant variation observed. There was no an association between the presence of the disease and sex of the animal (24%), (21%) in male and female respectively with statisticaly in significantly from each other (p>0.05). This contradicts with the findings of [25], and [38], with significantly defferent from each other (p< 0.05) but, This finding is in line with the report of [38], [39], and [37], from Northern Jordan, Turkey and Central Ethiopia respectively. The reason why current finding insignificant among sex might be either due to sex cannot only be attributed by the *C.tenuicollis* infection alone but also management system i.e. feed, and any other cause of stress that cause their immunity suppress and infected with gastro intestinal internal parasites their immunity compromised and amount of ingestion of eggs of *T. hydatigena*. Hence, they had equal exposure and opportunity to get infected.

In the current study, the major sites from where *C. tenuicollis*was reported were: liver, omentum, peritoneum and mesentery respectively. However, most of the positive animals were found to carry the parasite in liver. For example; out of 89 positive sheep, 10.4 in their liver. And also the study proportion of liver among visceral organ 44.4% this is followed by the omentum, 4.7%, mesentery 3.4%, peretonium 2.3%, of sheep (Table 2) this agreed with the observation of [35], who reported that liver is predominant predilection sites for *C. tenuicollis.* The results were also in agreement with the findings of [39], who reported highest cystcerci in animal liver among other organ of (22.4) in sheep and Similar results were obtained by Oie [40], which declared that *C. tenuicollis* were centralized in the liver of the sheep. But, Samuel [38], disagree with current study that they reported that Omentum is the predominant predilection sites for *C. tenuicollis*. This is may be due to the presence of large amount of protein, carbohydrates and other essential elements which absorbed by the parasite, so that, *C.tenuicollis* prefer liver as organ of supplying essential elements for nourishment

Lastly, in the current study; overall annual economic losses of the study area due to a single organ condemnation (liver) from sheep infested by *C. tenuicollis* was estimated to be: 2100384 USD$ i.e., approximately 70012.8 ETB (1USD= 30ETB). This result is lower than the report of [26], who estimated an economic loss of 65,269.89 USD or 1,044317.79 ETB from condemned liver as a result of report from export abattoire and there is higher total number of animal slaughter. The economic financial a loss in the abattoir was relatively lower because of its local standard in which any liver with single cyst or calcified liver with cyst was not disposed from local market .but in export abattoire it was vice versa and If it was export abattoire and local Such loses are particular importance in Ethiopia, which has low economic output where sheep and goat production are the major livestock industries.

CONCLUSION AND RECOMMENDATION

Abattoirs play major role in providing and serving as a source of information and a references centre for diseases prevalence to control or eradicate diseases and produce wholesome products and to protect the public from zoonotic hazards. Abattoire survey showed *C. tenuicollis* that is a widespread problem with higher economic losses that was causing organ disposal with consequent approximately 70012.8 ETB or 2100384USD$ (1USD= 30 ETB) and higher prevalence among the resident of Haramaya town in slaughtered small ruminant. Besides, the cyst was found distributed the abdominal and pelvic cavities. It was found attached with many visceral organs and tissues, like liver, omentum, peritoneum, and mesentery were the principal organ and tissues where the cyst was located. In the area, especially in rural, treating dogs for parasitic diseases is not practiced. Backyard slaughter of small ruminants as a result of small number of abattoire and disposal of viscera and trimmings on open field is common and also Inappropriate infected offal disposal by being practiced by some of the abattoirs in study area as a result of there is not awareness creation programs launched for the butchers, abattoirs workers, meat sellers and dog owners about transmission, prevention and control of -*C. tenuicollis and* other disease between dogs and farm animal enhance this can facilitates the continuation of the life cycle between the intermediate host and final hosts.

Based on the results of the present study, the following recommendations are forwarded:

- ✓ Awareness creation programs should be launched for the butchers, abattoirs workers, meat sellers and dog owners about transmission, prevention and control of -*C. tenuicollis* between dogs and farm animal.
- ✓ 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 and the livestock health extension workers need to inform dog owners to deworm their dogs regularly.
- ✓ Disposal of affected offal freely for dogs and wild covers

canids (the usual practice in the community) should be prohibited and all the condemned organs should be either buried or incinerated.

- ✓ Thorough meat inspection should be practiced in every abattoirs of the nation
- ✓ Sale of contaminated offal's and organs of sheep and goats should be restricted by law

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