

A Study of Prevalence and Financial Loss of *Cysticercus Tenicollis* in Visceral Organ of Sheep Slaughtered at Jimma Municipal Abattoir, Southwest Ethiopia

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Abstract

A cross-sectional study was carried out from November 2015 to March 2016 on a total of 384 sheep slaughtered at Jimma municipal abattoir to determine the prevalence and estimate direct financial loss due to *Cysticercus tenuicollis*. Ante-mortem examinations and post-mortem organ inspections were performed following standard procedures. A total of 205 animals were found positive for *Cysticercus tenuicollis* with an overall prevalence of 53.4% (95% CI = 48.0-58.0) with a significant difference ($p=0.000$) between age groups which was higher in adult animals than in younger age groups. The relative cyst distribution in visceral organs was higher in omentum (38.0%) followed by liver (25.5%) with an estimated financial loss of 21528 ETB from liver condemnation. This study revealed that the occurrence of high prevalence of *Cysticercus tenuicollis* in sheep slaughtered at Jimma abattoir with a significant financial loss which deserve proper disposal of affected organs and implementation of parasite control programs in the area.

Keywords: Prevalence, *Cysticercus tenuicollis*, Sheep, Jimma, Ethiopia.

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1. INTRODUCTION

Ethiopia is the second in Africa, and the sixth in the world, in terms of sheep population. In spite of huge population and importance of small ruminants, the country has benefited little from this enormous resource owing to a multitude of problems like poor nutrition, poor animal production systems, reproductive inefficiency, management constraints, lack of veterinary care, and disease being the most important (Sisay, 2007). Parasitic diseases in the tropics are responsible for great losses in the meat industry than any other infectious or metabolic disease (Perry *et al.*, 2002). Like many other African countries, it is known that liver fluke, Hydatid cyst and *Cysticercus tenuicollis* are major parasites responsible for low productivity in Ethiopia livestock industry due to imposing poor weight gains and condemnation of organs and carcass of sheep and goats (Abebe, 1995). Infections with the larval stage of some species of *Taenia* are of veterinary importance, because they cause economic losses due to condemnation of infected offal or meat (Radfar *et al.*, 2005). From this *Taenia* species, *Cysticercus tenuicollis* is the most important parasite of sheep and goats (Yehualashet *et al.*, 2012), which causes organ condemnation from slaughter houses (Radostits *et al.*, 2007).

Cysticercus tenuicollis is the larval stage of the canine tapeworm *Taenia hydatigena*. This cestode has been found in a large number of hosts throughout the world (Senlik, 2008). The intermediate host becomes infected by ingesting proglottids or eggs passed in the feces of the dog in pastures or feeding areas. 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 different part of the body and the cysts are most commonly found attached to the omentums, mesenteries, liver and peritoneum (Radostits *et al.*, 2007).

Normally, infection with *Taenia hydatigena* is not very pathogenic in dog (Radfar *et al.*, 2005) and infection of small ruminants with cysticerci of *Taenia hydatigena* is frequently not significant and the effect of this infestation upon the hosts depends largely on the degree of the parasitism, the organs involved and the existence of other concurrent infections (Urquhart *et al.*, 1996; Wondimu *et al.*, 2011).

The prevalence of *Cysticercus tenuicollis* is quite common and considerably high in the world and in some countries even more than 85% of the sheep population was found to be infected with this metacestode (Senlik, 2008). However, the prevalence varies from one area to another. Generally, there is higher incidence in countries with lower degree of sanitary and uncontrolled wild carnivore population (Budka *et al.*, 2004).

In Jimma town, in the southwestern part of Ethiopia, the hygienic conditions are poor. Backyard slaughtering of domestic animals, particularly, sheep and goats; and feeding of stray dogs with condemned organs are common practices (Abduljewad, 1988). Despite this, in the study area there was no so far study was conducted on the prevalence and financial loss of *Cysticercus tenuicollis* in sheep.

Therefore, the aims of this study were;

- To determine the prevalence of *Cysticercus tenuicollis* in sheep slaughtered at Jimma municipal abattoir.
- To assess the direct financial loss due to liver condemnation in the abattoir.

3. MATERIALS AND METHODS

3.1. Descriptions of Study Area

The study was conducted in jimma municipal abattoir in jimma town, oromia national regional state, south western Ethiopia. Jimma town is located at 352 km south western of Addis Ababa. Geographically, Jimma is located at 7⁰13' and 8⁰56' N latitude and 35⁰52' and 37⁰37E longitude. The climatic condition of the area is 'Woynadega' with altitude ranging between 1720 to 2110 m above sea level and receives annual rainfall which ranges between 1200 to 2000mm. 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 livestock population of about 2016823 (cattle), 942908 (Sheep), 288411 (Goats), 74574 (Horses), 49489 (Donkeys), 28371 (Mules) and 1139735 (Poultry) (CSA, 2009).

3.2. Study population

The study was conducted on sheep with different age of indigenous breed and all male slaughtered at Jimma municipal abattoir. The exact origins of all animals were unknown, even the suppliers themselves does not know the exact origin of all sheep, but most of from different local market of Jimma town and the surrounding nearest Districts. Slaughtered animals reached at Jimma municipal abattoir by transporting using vehicles. In this study, sheep were categorized into two age groups, 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 according to the guidelines set by (Getanby, 1991).

3.3. Study Design

A cross sectional study was conducted from November 2015 to March 2016 by collecting data on events associated with *C. tenuicollis* in sheep slaughter at jimma municipal abattoir.

3.4. Sampling

3.4.1. Sample size determination: The sample size required for this study was determined according to (Thrusfield, 2005) formula.

$$N = \frac{1.96^2 \times P_{exp} (1 - P_{exp})}{d^2}$$

Where, N = required sample size
P_{exp} = expected prevalence and
d = desired absolute precision

There was no previous study on prevalence of *C. tenuicollis* in sheep in the study area. Therefore, an expected prevalence of 50% was used to estimate the sample size. Using desired 95% confidence interval, 5% precision, the number of sheep needed to determine the prevalence of *C. tenuicollis* in the study area was calculated to be 384.

3.4.2. Sampling method

The study animals were selected from the slaughter line at time of postmortem examination using simple random sampling technique after serial number given during ante-mortem examination according to their arrival.

3.5. Study Methodology

3.5.1. Ante-mortem inspection

Pre-slaughter examinations were conducted in the lairage in order to determine the age group. Serial number was also given to 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 Urquhart *et al.* (1996) and followed the judgments passed by FAO (1994). Animals suspected for any disease conditions during ante-mortem examination were excluded from sampling.

3.5.2. Post-mortem examination

During post-mortem examination, visceral organs were thoroughly inspected by applying the routine meat inspection procedures involving visualization, palpation and systematic incisions for the presence of parasites and other abnormalities, paying attention to the visceral organs and tissues in abdominal, thoracic and pelvic cavities (Herenda *et al.*, 2000).

3.6. Assessment of Financial Loss

An attempt was made in order to estimate economic significance of *Cysticercus tenuicollis* in sheep from the cost of condemned liver. To calculate the economic loss, the following parameters were taken into consideration; The mean market price of single liver at Jimma town was collected from butchers, the rejection rates of liver and Average annual slaughter rate of sheep at the abattoir was estimated based on observation during the study period together with the judgment of senior meat inspectors of the abattoir. The economic loss due to liver

condemnation was estimated by the formula set by (Ogunrinade and Ogunrinade, 1980) as follows:

$$EL = \Sigma Srx \times Coy \times Roz$$

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

Srx = average annual sheep slaughter rate of the abattoir

Coy = Average cost of each sheep liver

Roz = Condemnation rates of sheep liver

3.7. Data Management and Analysis

Data collected were entered into Microsoft excel spreadsheet and analyzed. All the data analysis was done by Statistical Package for Social Science (SPSS) software version 20. Pearson's chi-square (χ^2) was used to evaluate the association present among the different age group. P-value less than 0.05 (at 5% level of significance) were considered as significant. Descriptive statics such as percentages and frequency distribution were used to describe the nature and the characteristics of the data.

4. RESULTS

Out of a total of 384 sheep slaughtered and examined during November 2015 to March 2016 at Jimma municipal abattoir 205(53.4%) of animals were found harbouring *Cysticercus tenuicollis* in one or more of their visceral organs (Table 1).

The prevalence of *C. tenuicollis* was significantly higher in adult sheep than in the young age group (P = 0.000).

In this study different visceral organs were affected with *C. tenuicollis* in which a single or multiple organs were involved. Among the visceral organs omentum was widely affected constituting 38.0%. of cysts were found occurring in two or more of the visceral organs of animals slaughtered (Table 2).

Table 1: Prevalence of *Cysticercus tenuicollis* in different age groups of sheep slaughtered at Jimma municipal abattoir

Age group	Number of Examined	Prevalence (%)	95% CI	df	X ²	P-Value
Adult	274	170(62.0)	56.0-68.0	1	28.81	0.000
Young	110	35(31.8)	22.0-40.0			
Total	384	205(53.4)	48.0-58.0			

Table 2: Distribution of *Cysticercus tenuicollis* in the visceral organs of Sheep slaughtered at Jimma municipal abattoir

Number of animals examined	Visceral organs affected	Number of animals harboring <i>Cysticercus tenuicollis</i>	Proportion (%)
384	Liver	98	25.5
	Mesentery	61	15.9
	Omentum	146	38.0
	Peritoneum	30	7.8

In this study a preliminary estimate of direct financial loss incurred from liver condemnation in sheep due to *C. tenuicollis* was determined. Accordingly, based on estimated average mean annual slaughter rate of 3840 heads of sheep at Jimma abattoir, the average rejection rate of liver from a total of 384 studied animals was 75(19.53%) and also considering the mean current local market price of a single liver at Jimma, an estimated financial loss of 21528 ETB was inevitable.

5. DISCUSSION

The present investigation showed a high prevalence of *C. Tenuicollis*(53.4%) in sheep slaughtered in Jimma Municipal abattoir. This was in line with the findings of Wondimu *et al.*, (2011) who reported 56.8% from HELMEX, Debezeit. However, it was relatively higher when compared to the finding of Mekuria *et al.*, (2013) from Dire Dawa municipal abattoir and Abebe *et al.*, (2014) from Dessie Manicipal Abattoir, who reported 22.8% and 45.69% respectively. It was also higher than the reports from other countries; for instance, 13.1% from Nigeria (Saulawa *et al.*, 2011), 24% from Turkey (Senilk, 2008), 16.7% from Germny (Hasslinger and Weber-Werringhen, 1988) and 23.27% from Egypt (El-Masry, 1986). Furthermore; it was lower than the findings of Sissay *et al.*, (2008) who reported 79% from four abattoirs located in eastern part of Ethiopia. This difference in prevalence of *C.tenuicollis* in the different locations could be due to the variations in temperature, agro-ecology, the degree of pasture contamination, the presence of stray dogs on the farm and the access of dogs to infected visceral organs. which may favors perpetuation of the life cycle of this parasite between ruminants, dogs and other wild canids.

According to the present study, prevalence of *C. tenuicollis* by age revealed that higher infestation rates

were recorded in adult sheep (62%), whereas, the lowest prevalence were recorded in younger sheep (31.8%). This was agreed with the findings of Abdulatif *et al.*, (2015) who reported a prevalence of 54.3% in adult sheep and 43% in young sheep. Similar findings also reported by Woinshet and Girma (2010) who recorded the prevalence of 47.4% in adult sheep and 35.8% in young sheep. This difference in infection rates between young and adult may be due to the fact that the adult sheep lived longer and picked larger number of eggs during grazing as compared to the young ones, which only lived for a shorter period of time in a given environment and mostly kept indoors.

According to the present study, from those infected animals the cyst mostly found in omentum(38%), followed by liver(25.5%), mesentery(15.9%), and peritoneum(7.8%). This agreed with the observation of Wondimu *et al.*, (2011), Samuel and Zewde (2010), Radfar *et al.*, (2005) and Senlik (2008) who reported that omentum is the predominant predilection sites for *C. tenuicollis*. This may be due to the fact that omentum covers larger surface area in the peritoneal cavity than other tissues.

The total direct financial losses due to *C. tenuicollis* in sheep at Jimma municipal abattoir was estimated to be 861.12 US dollar (USD) i.e. approximately 21,528 ETB. This result was lower than from the previous reports; for instance, the estimated total losses from *C. tenuicollis* in small ruminants due to liver condemnation in Helmex abattoirs were 65,269.89 USD (Wondimu *et al.*, 2011). The difference in the amount of economic losses could be due to the variation in the number of species slaughtered in the abattoir (this calculated only for sheep), frequency of liver infested, mean annual slaughter rate of the abattoir and variation in the retail market price of organs of different country. Such losses are particular importance in Ethiopia, which has low economic output where sheep and goat production are the major livestock industries.

6. CONCLUSION AND RECOMMENDATIONS

This study revealed high prevalence of *Cysticercus tenuicollis* in sheep slaughtered at Jimma municipal abattoir. The preferred predilection sites of *Cysticercus tenuicollis* were liver, omentum, mesentery and peritoneum, and of this omentum was the predominantly preferred organ. This high prevalence of *Cysticercus tenuicollis* in the study area predominantly cause liver condemnation with a consequent of high financial losses observed at Jimma abattoir. Therefore, based on this finding the following recommendations are suggested.

- All condemned organs should be properly disposed to avoid access by carnivorous animals.
- Regular dog deworming programs should be designed to avoid environmental contamination with the eggs of patent parasites.
- Awareness creation programs may be organized for animal owners, butchers and abattoir workers to limit the prevalence of *Cysticercus tenuicollis* in Jimma area.

7. REFERANCE

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