



Prevalence, distribution and economic importance of *Cysticercus tenuicollis* in visceral organs of small ruminants slaughtered at modjo export Abattoir, Central Oromia

Yacob Hailu Tolossa*, Birhane Abera Serdo, Hika waktole, Birhane Wakjira and Emebet Etisa

Addis Ababa University, College of Veterinary Medicine and Agriculture,
P.O. box 34, Debre-zeit, Ethiopia,

* Corresponding author: e-mail: yacob.hailu@aau.edu.et or yamilaya2008@gmail.com

Abstract

Cross sectional study was conducted at Modjo Export Abattoir in central Oromia from October, 2014 to April 2015 to determine the prevalence, distribution of *Cysticercus tenuicollis* (*C. tenicollis*) and to estimate the financial losses attributed due to condemned organs from slaughtered sheep and goats. Ante-mortem inspection was conducted in the lairage and all abnormalities encountered were recorded, followed by post-mortem examination by tracing them by their identification number to detect gross abnormalities. A total of 400 sheep and goats (90 sheep and 310 goats) carcasses were randomly sampled and examined using routine postmortem examination for presence of *C. tenuicollis* in the visceral organs of the animals using standard meat inspection procedures. Out of the 310 goats and 90 sheep inspected for visceral organs, *C. tenuicollis* was found in 30.6% of goats (n=95) and 48.9% of sheep (n=44), respectively. There were statistically significant difference between the species ($P<0.05$). Adult goats (42.2%) and sheep (80.4%) were more infested than kids (19.2%) and lambs (15.9%), respectively. There were statistically significant difference between the Age ($P<0.05$). Goats (55%) and sheep (57.6%) from highland areas were more infested than goats (4.7%) and sheep (25%) from lowland areas ($P<0.05$). The cyst causes considerable economic loss due to condemnation of edible organs, especially the liver and lung which estimated 51,428.57 USD per year. Appropriate control measures need to be introduced to reduce the prevalence of these parasites in small ruminants.

Keywords: Abattoir, *C. tenuicollis*, goats, sheep, prevalence, Oromia.

Introduction

Ethiopia with its great variation in climate and topography possesses one of the largest livestock populations in the world, which is managed by small holder farmer under extensive low input traditional management system and adjunct to crop production. In Ethiopia there are about 38 million cattle, 30 million small ruminants, 1 million camel, 4.5 million equines and 40 million poultry [1]. Sheep and goats cover more than 30% of all domestic meat consumption and

generate cash income from export of meat, edible organs, live animals and skins. Furthermore, they need only short periods to reconstitute flocks after disaster and respond quickly to the demand [2].

Cestodes of the family taenidae which infest the dogs (definitive host) are transmitted to a range of intermediate host species where they cause cysticercosis [3]. Meat inspection data are a potential source of information and have an important role to play in epidemiology and preventive measure [4].

Monitoring disease and other conditions at slaughter has been recognized as one way of assessing the disease status of a herd [5] however this source of information is not being fully exploited worldwide. Infestation with the larval stage of some species of *Taenia* is of veterinary importance because they cause economic losses due to destroying of infested offal or meat [6].

Cysticercus tenuicollis is the metacestode of the tapeworm *Taenia hydatigena*. 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. Infested carnivores eliminate *T. hydatigena* eggs with their faeces. 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 omentum, mesenteries and the serosal surface of the peritoneal cavity. However, unusual locations like the lungs, the kidneys and the brain, have also been reported [7]. Where they attach and initiate post-oncospherical development (Jorgen and Brain, 1994). Mature Cysticeci have a smooth inner surface and contain only a single invaginated scolex, in contrast to hydatid cysts [8].

The prevalence of the *C. tenuicollis* infestation varies according to the geographical areas and generally reaches higher incidences in countries with a lower degree of sanitary control and with an uncontrolled wild carnivore population [9] ; [10]. Infestation of small ruminants with cysticerci of *T. hydatigena* is frequently not significant, and most of the times a diagnosis are made at the abattoir. However, 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 [11] and [12].

Hence the current study was to achieve the following objectives:

- To determine the prevalence of *C. tenuicollis* in slaughtered sheep and goats in the Modjo Export abattoir.
- To assess the distribution of *C. tenuicollis* in visceral organs of sheep and goats
- To determine financial impact of visceral organs condemnation due to the *C. tenuicollis*.

Materials and Methods

Descriptions of study area

The study was conducted at Modjo town, Lume district in East shoa zone of oromia Regional state. Modjo town located at 8° 36' 0" North, 39° 7' 0" East with an altitude of 1,788 m a.s.l in the central highlands of Ethiopia, lying 70 km south east of Addis Ababa, the capital city. The area has two (short and long) rainy season. Its annual rainfall varies from 750mm to 1250mm of which 80% falls down during the long rainy season. The mean annual temperature is 27.1 °C, and the mean humidity is 59%.

Study Population

The study population constituted of local breeds of sheep and goats coming from lowland and highland areas of the country and slaughtered at Modjo export abattoir. All slaughtered animals, were males. Majority of the slaughter animals come from places such as Arsi, Bale, Borana, Matahara, Somali, Yabelo areas which represent the lowland and highland regions of the country. In this study, small ruminants were categorized as: based on age groups, young and adult; based on agro-ecological zones: highland and lowland and based on species: sheep and goats.

A total of 400 animals (90 sheep and 310 goats) were randomly selected and identified by origin, species and age during ante mortem inspection. The age grouping was based on eruption patterns. Animals with no erupted permanent incisor teeth were classified as young (under 1 year of age in goats and 1 year and 3 months in sheep), while those with one pair or more permanent incisors' teeth were classified as adults (above or equal to 1 year of age in goats and 1 year and 3 months in sheep [13] ; [14].

Study design and Sample size determination

A cross sectional study was conducted from October, 2014 to April, 2015 by collecting data on events associated with *C. tenuicollis* in sheep and goats slaughtered at Modjo Export Abattoir. The sample size was determined using the formula as described by [15], at 95% confidence interval, 5% precision and with 50% expected prevalence [16].

Accordingly, the minimum sample size was 384; but in order to increase precision, it was 400 samples were taken for study.

Post-mortem examination

During postmortem examination visceral organs were inspected for the presence of *C. tenuicollis* by applying the routine meat inspection procedures [17].

Assessment of economic losses

Direct economic losses assessed by considering market demand, average market prices and the rejection rate of specific organs. Therefore, direct annual economic losses assessed by using the following formula set by (Eckert *et al.*, 2001) $EL = \Sigma sr_x \times Coy \times Roz$ Where: EL = Annual economic loss estimated due to organ disposal from international market, Σsr_x = Annual sheep and goats slaughter rate

of the abattoir, Coy = Average cost of each sheep or goats liver, Roz = Disposal rates of sheep and goats liver.

Data Management and 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 SPSS version 20 computer software and presented in tables. The Chi-square test utilized to assess significant differences in prevalence, distribution and economic importance of *C. tenuicollis*. A difference should be taken as significant at a p-value less than 0.05.

Results

Abattoir survey Post mortem inspection

Table 1: The overall prevalence of *C.tenuicollis* in sheep and goats slaughtered

Species	No of examined	Prevalence (%)	X ²	P-value
Goats	310	95(30.6)	19.250	0.000
Sheep	90	44(48.9)	37.472	0.000
Total	400	139(34.8)		

Table 2: Comparative prevalence of *C.tenuicollis* in highland and lowland sheep and goats

Species	No of examined	Origin	Prevalence (%)	x ²	P-value
Goats	310	highland (160)	88(55)	92.283	0.000
		Lowland (150)	7(4.7)		
Sheep	90	highland (66)	38(57.6)	7.474	0.006
		Lowland (24)	6(25)		

Table 3: Distribution of *C.tenuicollis* in the visceral organs of infested animals

Animals examined	Organs predilection of cyst					
	Lung (%)	Mesentry(%)	peritoneum (%)	abdominal (%)	Liver (%)	Omentum(%)
Goats 310	4(1.3)	4(1.3)	15(4.8)	35(11.3)	23(7.4)	43(47.8)
Sheep 90	0(0)	0(0)	2(2.2)	7(7.8)	13(14.4)	28(31.1)

3.1.2. Assessment of financial loss

Direct economic losses associated with disposed organs are significantly high. The annual monetary

loss due to rejection of organs were also calculated and found to be 51,428.57 USD per year in export and local market loss.

Discussion

In the current study out of 400 sheep and goats, 139 (34.8%) were found to be positive for *C. tenuicollis*. The cyst (*C.tenuicollis*) was found in 44 (48.9%) and 95 (30.6%) of sheep and goats respectively. The prevalence of *C. tenuicollis* was higher in sheep (48.9%) as compared to goat (30.6%) with statistically significant difference ($P<0.05$). This may be due to the grazing behavior and management system of the animals may be responsible for the differences in prevalence between sheep and the goats.

The prevalence of *C. tenuicollis* found in sheep in this study (48.9%) is higher than the prevalence reported by other authors, such as 32.7% in three export abattoir (ELFORA, HELMEX and Luna) [18], 37.03% in India abattoir [19] and 18.04% in Iran [20]. The relatively higher prevalence of *C.tenuicollis* recorded in the study could be due to the variations in agro ecology, the degree of pasture contamination and the way of raising and grazing of these animals which may favors the transmission cycle between ruminants and dogs.

The prevalence by age revealed that higher infestation rates were seen in adult animals (80.4% in sheep and 42.2% in goats) and the lowest prevalence was seen in younger animals (15.9% in sheep and 19.2% in goats). Similar result was reported in a study done by [21] in animals with the age of adults (above one year and three month age) (61.5% in sheep and 68.8% in goats) and the lowest prevalence was recorded in younger animals (less than one year and three month age) (52.1% in sheep and 59.03% in goats). This may be

due to high ingestion of eggs of *T. hydatigena* and more close contact to the final host (dogs), in young's animals, mostly kept indoors, then older animals.

The current study revealed that *C.tenuicollis* in sheep and goats from lowland and highland areas (57.6%) and goats (55 %) respectively. This result contradicts with results [21] who reported higher prevalence in goats from highland (68.1%). This may be due to grazing or feeding and management practice. In highland there might be a close contact between sheep and dogs (as final host). The lower prevalence in both sheep and goats in this study from lowland areas might be due to environmental conditions such as high temperature and low humidity which adverse conditions for the survival of the eggs of *T. hydatigena*. (he only compare goats prevalence)

In this study, the infestation rate of *C. tenuicollis* in different organs of sheep and goats was observed, although, the liver, lung, peritoneum, mesentery were also infested, the majority of cysts were located more in the omentum. This is due to the fact that omentum covers larger surface area in the peritoneal cavity. Our findings are concord with the observation [22]. Although organ wise infestation rate of both sheep and goats were comparable 0 and 1.3 % (lung and mesentery), 2.2 and 4.8% (Peritoneum), 7.8 and 11.3% (abdominal), 14.4 and 7.4% (liver) and with the highest infestation 31.1 and 47.8% in (omentum) respectively., These results agree with results by [20] who reported cysticerci in sheep (84.85%) and goats (82.14%) omentum. It would be good if he compare all organs' infestation with other study.



Figure 1: *C. tenuicollis* on the abdominal wall of carcass (Birhane and Yacob, 2015)

C. tenuicollis has no public health significance, but is important cause of economic loss in meat industry due to the fact that organs of sheep and goats harboring the parasite are rejected for aesthetic reasons [23]. Moreover, organs infected with this parasitic stage are not accepted at international market. The high

prevalence of *C. tenuicollis* in the slaughtered animals also indicated that the cyst causes considerable economic loss due to condemnation of edible organs; especially the liver at slaughter house is estimated at 51,428.57 USD.



Figure 2: *C. tenuicollis* on the liver of goat (Birhane and Yacob, 2015)



Figure 3: *C. tenuicollis* on the lung of sheep (Birhane and Yacob, 2015)

Conclusion and Recommendations

C. tenuicollis was the predominant metacestode causing organs sheep and goats disposal with consequent financial losses. High prevalence of *C. tenuicollis* was recorded in slaughtered sheep and goats. Inappropriate disposal of abattoir materials being practiced by this abattoir may enhance 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:

- 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.
- Preventing infected dogs from defecating on pastures grazed by sheep are important measures in lowering the incidence of *C. tenuicollis* in sheep and goats whose final hosts are carnivores, mainly dogs.

References

1. CSA Central Statistical Agency 2006. The Federal Democratic Republic of Ethiopia. Central Statics Authority, Ethiopia.
2. Anonymous, C 2005. Agricultural sample survey, Volume II. Report on livestock and livestock Characteristics (private pea's holdings), Statistical 17. Pathake, K.M.N. and S.N.S Gaur, 1982. The bulletin, pp: 333
3. Torgerson, P.R., D.H. Williams and M.N. Abo-Shehada, 2008. Modelling the prevalence of *Echinococcus* and *Taenia* species in small ruminants of different ages in northern Jordan. *Global Veterinaria*, 2: 092-145.
4. Gracey, I. Collins, O. Huly, R. 1999. Meat hygiene London. Bailliere Tindal, 10: 223-260.
5. Oryan, A. Oghaddar, N. Gaur, S. 1993. Metacestodes of sheep with special references to their epidemiological status, pathogenesis and economic implications in Fars province, Iran *Vet. Parasitol.*, 55: 231-240.
6. Eckert, J. Deplazes, P. Craig, P. Gemmell, M. Gottstein, B. Health, D. Jenkins, J. Kamiya, M. Lightowlers, M. 2001. *Echinococcosis in animals: Clinical aspects, diagnosis and treatment WHO/OIE manual on echinococcosis in humans and Animals: A public health problem of global concern.* World Organization for Animal Health, Paris, France, pp. 72-99.
7. Taylor, M. Coop, R. Wall, R. 2007. *Veterinary Parasitology.* Black Well Publishing Ltd., 3: 210-211.
8. Dwight, D. Bowman, R. Carl, L. Eberhard, M., L. Alcaraz, A. 2003. *Parasitol. Vet.* (8) 139.
9. Budka, H. Buncic, S. Colin, P. Collins, J. 2004. Opinion of the Scientific Panel on Biological Hazards on a request from the Commission related on Revision of Meat Inspection Procedures for Lambs and Goats. *EFSA J.*, 54: 1-49.
10. Woinshet, S. and G. Girma, 2010. Prevalence, risk factors and distribution of *Cysticercus tenuicollis* in visceral organs of slaughtered sheep and goats in central Ethiopia. Published online: 4 March 2010 # Springer Science+Business Media B.V. 2010
11. Urquhart, G. Armour, J. Duncan, J. Dunn, A. Jennings, F. 1996. Department of Veterinary Parasitology, FVM, The University of Glasgow, Scotland, p. 122.
12. Singh, K., S. 2003. *Veterinary helminthological.* Indian Council of Agricultural Research, New Delhi. Pp 38-45.
13. Gatenby, R. 1991. Sheep: In the Tropical Agriculturalist. Macmillan, TCTA, pp. 6-10.
14. Steel, M. (1996): Goats: The Tropical Agriculturalist. London and Basing Stoke Macmillan Education Ltd. ACCT., pp. 79-83.
15. Thrusfield, M. 2005. *Veterinary Epidemiology.* Oxford, Black Well Science, Ltd., 2: 88
16. Woinshet, S. 2008. Cross sectional study on the prevalence of *Cysticercus tenuicollis* in visceral organs of sheep and goats slaughtered at HELMEX export abattoirs. DVM Thesis, FVM, and Addis Ababa University, Ethiopia, pp. 8-13.
17. Herenda, D. Chambers, P., G. Ettriqui, A. Seneviratna, P. da Silva T. 2000. Manual on meat inspection for developing countries, pp. 30-50.
18. Adem, A. 2006. Metacestodes of small ruminants: Prevalence at three export abattoirs (ELFORA, Hashim and Luna), MSc Thesis, FVM, Addis Ababa University, Ethiopia.
19. Pathake, KM., N. S.N.S. Gaur and S.N. Sharma, 2002. The pathology of *Cysticercus tenuicollis* infection in goats, *Global Veterinaria*, 5: 84-87.
20. Radfar, M. Tajalli, S. Talalzadeh, M. 2005. Prevalence and morphological characterization of *Cysticercus tenuicollis* (*Taenia hydatigena* cyst *cerci*) from sheep and goats in Iran. *Vet. Arch.*, 75: 469-476
21. Wondimu, A. Daniel, A. and Hailu, Y. 2011. A study on the prevalence, distribution and economic importance of *Cysticercus tenuicollis* in visceral organs of small ruminants slaughtered at an abattoir in Ethiopia *J, Vet, Med and Anim Health* . pp. 67-74.
22. El-Azay, O. Fayek, S. 1990. Seasonal pattern of fasciola gigantic and *Cysticercus tenuicollis* infection in sheep and goats in Egypt. *Bull. Anim. Health Prod. Afr.*, 38: 369-373.
23. Jibat, T. G. Ejeta, Y. Asfaw and A. Wudie, 2008. Causes of abattoir condemnation in apparently health slaughtered sheep and goats at HELMEX

- abattoir, Debre Zeit, Ethiopia. Revue Med, 159: 305-311.
24. Gatenby, R. 1991. Sheep: In the Tropical Agriculturalist. Macmillan, TCTA, pp. 6-10.

25. Steel, M. 1996. Goats: The Tropical Agriculturalist. London and Basing Stoke Macmillan Education Ltd. ACCT., pp. 79-83.

ANNEXES

Annex 2: Estimation of the age of sheep from incisor teeth (Gatenby, 1991) [24]

Permanent incisors	Age of the sheep
None	less than 1 year 3 months
1 pair	1 year 3 months to 1 year to 1 month
2 pairs	1 year 2 month to 2 years 4 month
3 pairs	2 years 4 months to 3 years
4 pairs	more than 3 years

Annex 2: Estimation of the age of Goats from incisor teeth (Steel, 1996) [25]

Age group	Teeth condition
Under 1 year	eight sharp incisors
1-2 years	Central pair of body teeth replaced by permanent once
2-3 years	4 permanent teeth
3-4 years	6 permanent teeth
4-5 years	8 permanent teeth
Over 5 years	worn teeth and some missing

Access this Article in Online	
	Website: www.ijarbs.com
	Subject: Veterinary Medicine
Quick Response Code	
DOI: 10.22192/ijarbs.2019.06.09.004	

How to cite this article:

Yacob Hailu Tolossa, Birhane Abera Serdo, Hika waktole, Birhane Wakjira and Emebet Etisa. (2019). Prevalence, distribution and economic importance of *Cysticercus tenuicollis* in visceral organs of small ruminants slaughtered at modjo export Abattoir, Central Oromia. Int. J. Adv. Res. Biol. Sci. 6(9): 32-38. DOI: <http://dx.doi.org/10.22192/ijarbs.2019.06.09.004>