

## Epidemiological Studies on *Cysticercus bovis* at Gondar ELFORA Abattoir, North West of Ethiopia

Ezeddin Adem<sup>1</sup> and Tewodros Alemneh<sup>2\*</sup>

<sup>1</sup>Metema Woreda Office of Agriculture and Rural Development, Metema, Gondar, Ethiopia

<sup>2</sup>Woreta City Office of Agriculture and Environmental Protection, S/Gondar, Woreta, Ethiopia

### Abstract

A cross-sectional survey was undertaken in the abattoir to study the prevalence of *Cysticercus bovis* in cattle originated from different localities and to determine the cyst prevalence as well as distribution in different organs within infected animals in Gondar ELFORA abattoir from October, 2009 to March, 2010. Out of the total 450 cattle slaughtered and examined at Gondar ELFORA abattoir, 9 animals (2.0%) were identified positive for *Cysticercus bovis* infection. Predilection sites for *Cysticercus bovis* were observed and their relative infestation rates were recorded. As a result of this study, predominantly cysts were found on shoulder muscle (55.56%) followed by masseter muscle (33.33%) and tongue (11.11%). The prevalence and occurrence of *Cysticercus bovis* was also studied based on the geographical locations of slaughtered cattle. Accordingly, cattle from low lands and high lands had showed a prevalence of 6.45% and 0.307%, respectively. In conclusion, *C. bovis* is prevalent and is one of the major parasitic diseases that causes huge carcass condemnation of slaughtered animals and poses serious financial loss in the socio-economy of the study area. Therefore, public health awareness should be created on improving personal and environmental hygiene for breaking the life cycle of the disease.

**Keywords:** *Cysticercus bovis*; Gondar ELFORA; Prevalence; Epidemiological study

### Introduction

Bovine cysticercosis is a muscular infection of cattle and is caused by larvae of the human intestinal cestode *Taenia saginata*. Its life cycle is entirely dependent on the link between man and cattle so that any break in this links can result in the total elimination of the parasite. Tapeworm infections have been recorded in history from 1500 BC and have been recognized as one of the earliest human parasite [1].

Cysts of *Cysticercus bovis* can be found anywhere in the carcass or meat and viscera [2]. The distribution of *Taenia saginata* is wider in developing countries where hygienic conditions are poor and where the inhabitants traditionally eat raw meat or insufficiently cooked meat [3,4]. Forty percent (40%) of the cases was reported in Africa [3,5]. Researchers reported that this disease being very common in developing countries like Ethiopia. It is associated with poor hygiene and local factors including cultural background, (eating raw meat "Kurt", Kitfo" semi cooked meat), economic condition and religious beliefs, close proximity of humans to cattle kept with little or no distinction between companion or utility functions [3].

Slaughtering is often carried out in open air in absence of abattoirs [3]. Transmission of the parasite occurs most commonly in the environment characterized by poor sanitation, primitive livestock husbandry practice and inadequate meat inspection, management, control police [6].

Bovine cysticercosis is responsible for considerable amount of economic losses which can approach 30% when allowance is made for the loss in the carcass weight and the cost of freezing for the infected meat [7]. The health caused by the adult worms in human gives rise to high medical costs [7]. Generally, the loss is determined by disease prevalence, grade of the animals infected, potential markets, prices of cattle and treatment costs for detained carcass [8] and medical costs for infected human beings [5]. The average annual loss due to taenicial drugs for treatment in Ethiopia

was estimated to be 4,937,583.21 ETB or 225,036.97 USD [9-11]. Bovine cysticercosis is widely distributed in Ethiopia and a number of individuals reported the prevalence of bovine cysticercosis in different parts of the country. According to these reports, a prevalence of 9.7% in Debre Zeit by Amsalu [12], 21% in Nekemte by Ahmed [9], 13.85% in Debre Zeit by Getachew [13], 19.5% in Bahir Dar by Mulugeta [14], and 3.2% in different agro climatic zones by Tembo [15] was recorded.

The nation's domestic meat consumption of about 45% comes from cattle, which generates export income mainly from the sale of live animals [16].

On the other hand, the contributions of *Cysticercus bovis* to organ condemnation in slaughtered cattle at different abattoir have been reported [17,18]. It is a great problem in developing country like Ethiopia due to the cultural habit of eating raw meat in form of "kurt" and "kitfo" as routine dish and during holidays has promoted the spread of human taeniasis in Ethiopia [19]. The above mentioned problems allow the parasite to continue its life cycle till to date and in the coming future [20,21].

Therefore, the objective of this research is to determine the prevalence and occurrence of bovine cysticercosis in Gondar ELFORA abattoir and to see the association of the prevalence of the parasite with the risk factors.

**\*Corresponding author:** Tewodros Alemneh Engdaw, Faculty of Veterinary Medicine, University of Gondar, PO Box: 196, Gondar, Ethiopia, Tel: +251920499820; E-mail: [tedyshow@gmail.com](mailto:tedyshow@gmail.com) (or) [joteddy85@yahoo.com](mailto:joteddy85@yahoo.com)

Received July 04, 2016; Accepted July 21, 2016; Published July 25, 2016

**Citation:** Adem E, Alemneh T (2016) Epidemiological Studies on *Cysticercus bovis* at Gondar Elfora Abattoir, North West of Ethiopia. J Vet Sci Technol 7: 364. doi:10.4172/2157-7579.1000364

**Copyright:** © 2016 Adem E, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

## Materials and Methods

### Study area

The study was conducted in North Gondar, North western part of Ethiopia. It is divided into three major agro-climatic zones: highland, mid-highland and lowland. The altitude ranges from 4620 meters in the Semen Mountain in the North to 550 meters in the west. The rainfall varies from 880 mm to 1772 mm with a mono-modal distribution, while the minimum and maximum temperatures are in the order of -10°C in the highland and 44.5°C in the West. The area is also characterized by two seasons, the wet season from June to September, and the dry season from October to May (Figure 1).

The farming system of the study area is characterized by a mixed crop-livestock production system. Transhumance, from the highlands to western lowlands, is practiced as an important strategy to secure grazing resources for the highland livestock during the dry season of the year. In the case of the lowlands, crop farming is not as intensive as high and mid-highland areas and livestock has larger contributions to the farmer's livelihood.

### Study population

According to the 2015 report of the Central Statistics Authority, there are 2,408,544 million cattle, 979,800 million sheep, 1,383,656 million goats, 31,456 million Horses, 272,655 Donkeys, and 2.9 million human populations. The herd size varies greatly, and it ranges from 2.11 to 7.15 animals (high and mid altitudes) to around 65 in the lowlands.

### Sample size determination

The study animals were cattle coming to Gondar ELFORA abattoir for slaughter. Simple random sampling method was used for sampling

and using the 95% confidence interval the sample size were determined by the formula [22]:

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

Where; n: required sample size;  $P_{exp}$ : expected prevalence; d: desired absolute precision

### Study methodology

During the period of this study (October 2009 to April 2010), ante mortem and postmortem examinations were performed on 450 cattle in Gondar ELFORA abattoir. For the ante mortem examination, general condition of the animal was observed by visual inspection and age, breed as well as the origin of the animal were recorded. Out of the total 450 cattle, 124 were from low land localities and the rest 326 cattle were from high lands. All cattle that were subjected to the abattoir during the study period were old aged and males.

In this abattoir survey, random sampling technique was followed to select the animal to determine prevalence of bovine cysticercosis in the study area.

During the study period, bovine carcasses were randomly examined for the presence of *C. bovis* following the customary meat inspection procedure stipulated in the minister of agriculture meat inspection regulation [23]. There were visual inspections and palpations followed by multiple incisions of each organ (heart, tongue, shoulder, liver, masseter and diaphragm muscles) to examine the cysts of *C. bovis*. In positive cases the site and infestation of cyst were recorded. One deep incision in to triceps muscle of both sides was made. Similarly, tongue surface was examined by palpation then the inside part was examined by making deep incision in the ventral part of the tongue.

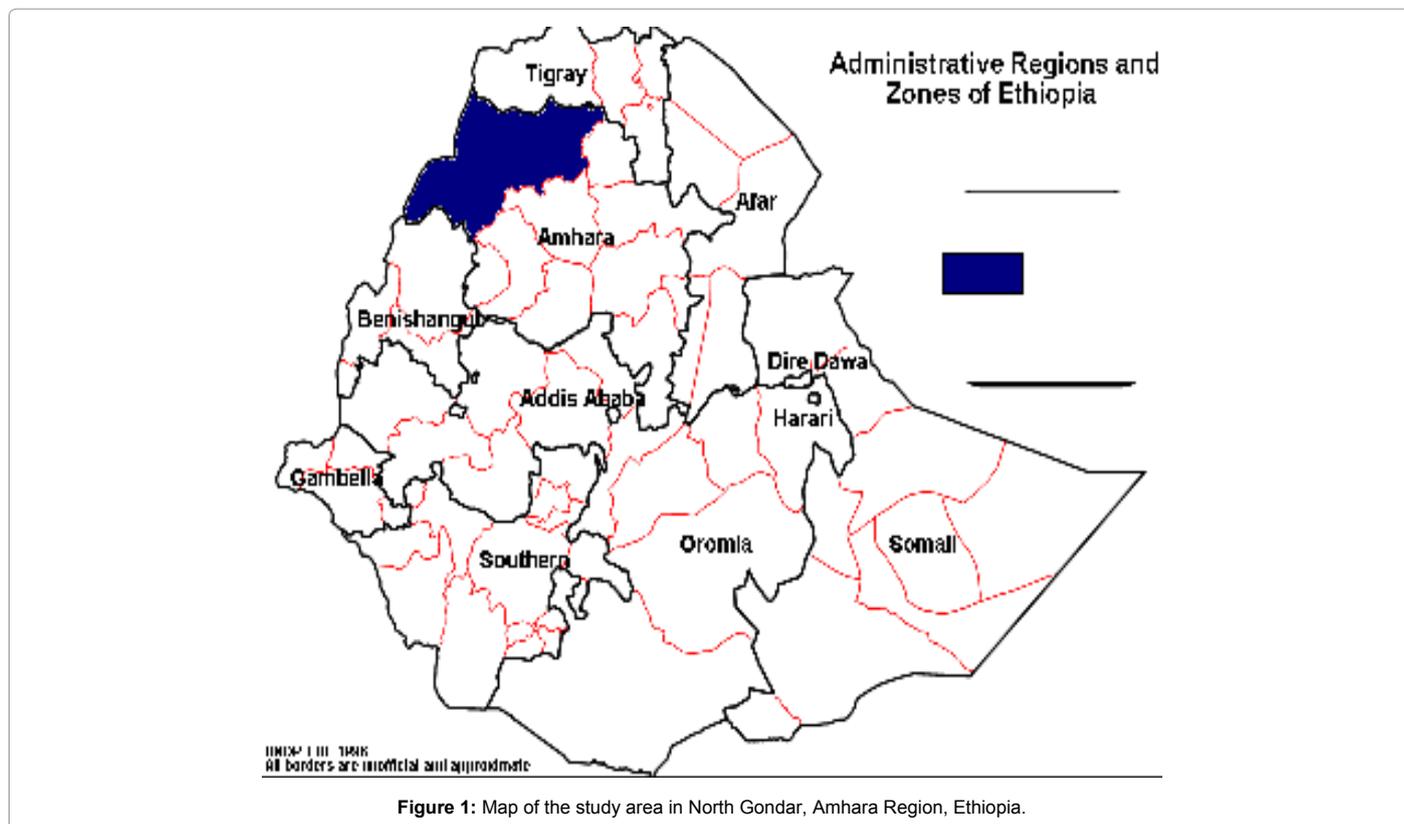


Figure 1: Map of the study area in North Gondar, Amhara Region, Ethiopia.

The pericardium of the heart was opened and incision was made in to the cardiac muscle from the base to the apex. When we come to masseter muscle, several deep incisions in to the internal and external muscle were made parallel to the plane of jaw. Moreover, the kidneys, spleen, liver and the lungs were inspected in the usual methods of inspection.

## Results

### Overall occurrence

Out of the total 450 cattle examined at the abattoir, 9 (2.0%) were found to be positive for *Cysticercus bovis*.

### Occurrence of *Cysticercus bovis* in different agro-ecological zones

Among the 124 cattle examined, which came from low lands, 8 (6.45%) of them were found to be positive for *Cysticercus bovis* and from the 326 cattle, which came from high lands, only one (0.307%) was found to be positive (Table 1).

### Occurrence of *Cysticercus bovis* in different organs of cattle

Shoulder muscle, tongue, masseter muscle, heart, liver and diaphragm were inspected. Among the nine (9) cattle that were confirmed positive, 5 (55.56%) were from shoulder muscle, 1 (11.11%) from tongue and 3 (33.33%) were from masseter muscle (Table 2).

Similarly, this study significantly showed that from the observed old aged cattle, the most affected organ was shoulder muscle, followed by masseter muscle and the tongue.

## Discussion

Among the 450 carcasses of cattle inspected in Gondar ELFORA abattoir from October 2009 to March 2010, 5 carcasses were found to harbor cysts of *C. bovis* with an overall prevalence of 2.0% in various organs.

Though the prevalence of *Cysticercus bovis* is low in developed countries [24], the infestation rate is often around 30% in developing countries like Africa. However; in the present study, the rate of occurrence of *Cysticercus bovis* in Gondar was found to be 2.0% which was lower than the study made by Dawit [10]. This might be because of the differences in the experiences of meat inspectors as well as variations in veterinary services deliveries and peoples' awareness on

the prevention of the disease in different localities. Moreover, in the routine inspection of beef carcasses, there was practical limitation to the degree of incision permissible for gross mutilation that decreased the marketability of the carcass as a result of which many infestations remained undetected.

In Ethiopia, various studies and reports revealed that the rate of infestation of cattle by *Cysticercus bovis* was different and higher than the current study in various agro-ecological zones; Natnael [25] in Debre zeit Elfora export abattoir reported 22.75%, Fufa [11] in Hawassa municipal abattoir reported 26.25%, Hailu [26] in East Shoa reported 17.5%, Ahmed [9] in Nekemte municipal abattoir reported 21%, Getachew [13] in Debre Zeit abattoir reported 13.8%. Likewise; in different African countries the occurrence is high. For instance, 20% in Senegal, 27% in Tanzania, and 38% in Kenya was recorded [27].

In this study, the assessment of occurrence of *Cysticercus bovis* based on the origin of cattle (high land and low land) had been done and among those animals submitted to the abattoir and inspected, 326 cattle (72.44%) were from highlands and the remaining 124 (27.56%) were from low lands. The rate of *C. bovis* occurrence in the highland animals were 0.307% and in the lowland cattle were 6.45%. The variation in the rate of occurrences in different altitudes might be related to the less resistance of the egg of the parasite (tape worm ova) to survive in the cold grazing environmental conditions of highlands for longer periods.

*Cysticercus bovis* is commonly found in muscle of mastication, particularly masseter muscle, shoulder muscle, heart, tongue, diaphragm and occasionally in fat, liver, lungs and lymph nodes. However, in the present study, cysts were found on shoulder (55.56%), masseter (33.33%) and tongue muscles (11.11%). From several reports, variation and deviation in localization of cysts were quite possible. For instance, in Addis Ababa abattoir, the infection rate of *Cysticercus bovis* was high as 16.3% in foreleg [28]. Some reports from Shoa Oromia Regional State showed 4.7% in liver and 0.7% in lungs [26]. On the other hand, Hailemariam [29], and Amsalu [12] indicated that examination of the tongue was the most effective means of detection for bovine cysticercosis.

## Conclusion

The wide distribution of *C. bovis* is associated with several factors including: raw and under cooked beef consumption, bush defecation and poor waste disposal and sewage treatment system, low level of public awareness and presence of backyard slaughtering practices.

Geographical Location	No. of Carcass Inspected	Breed		Positive for <i>C. bovis</i>	Relative percentage among the total positive value (%)
		Local	Cross		
High land	326	322	4	1 (0.307%)	11.11
Low land	124	124	0	8(6.45%)	89.89
<b>Total</b>	<b>450</b>	<b>446</b>	<b>4</b>	<b>9 (2%)</b>	<b>100</b>

Table 1: Occurrence of *Cysticercus bovis* in relation to Animals' Origin.

Cyst Location	No. of Breeds Positive			Age			Origin	
	Exotic	Local	Cross	young	Adult	Old	High land	Low land
Shoulder muscle	0	5 (55.56%)	0	0	0	5 (55.56%)	1 (100%)	4 (50%)
Tongue	0	1 (11.11%)	0	0	0	1 (11.11%)	0	1 (12.5%)
Masseter muscle	0	3 (33.33%)	0	0	0	3 (33.33%)	0	3 (37.5%)
Heart	0	0	0	0	0	0	0	0
Liver	0	0	0	0	0	0	0	0
Diaphragm	0	0	0	0	0	0	0	0
<b>Total</b>	<b>0</b>	<b>9 (100%)</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>9 (100%)</b>	<b>1 (100%)</b>	<b>8 (100%)</b>

Table 2: Occurrence of *Cysticercus bovis* in different predilection sites of carcass.

This study confirmed the occurrence of bovine cysticercosis in different origin of cattle slaughtered at Gondar ELFORA abattoir. However, the prevalence was lower as compared to previous studies performed in other parts of Ethiopia. Although we couldn't compare the prevalence of *C. bovis* in relation to sex, age and body condition of animals, cattle from low lands were found more prevalently infected than those originated from high lands.

In general, veterinarians and medical professionals ought to work in collaboration for the control of this disease. Similarly, public health awareness should be created through public media on improving personal and environmental hygiene for breaking the life cycle of the disease. Further detailed study by considering various age groups, sex and breeds shall be conducted to know the prevalence of the disease in the area in relation to different parameters.

#### Acknowledgements

The authors special thanks goes to Dr. Seleshe Nigatu (DVM, MVSc), Gondar ELFORA Abattoir and University of Gondar Faculty of Veterinary Medicine Instructors for their continual guidance to bring this research to completion.

#### References

1. Urquhart GMJ, Armour JL, Duncan AM, Dunn FW, Jennings (2013) Veterinary Parasitology. 8th edn. Black Well Science, London, pp: 120-137.
2. Collins DS, Huey RJ (2014) Gracey's Meat hygiene. 11th edn. Bailliere Tindall, 24-28. Oval roads, London NW 17X. pp: 412-420.
3. Fralova A (2014) Taeniosis. In: Zoonotic control. Lysenko A (ed), UNEP Publication, Moscow, pp: 192-239.
4. WHO (1996) Investigating in health research and development. Report of the Ad Hoc Committee on Health Research Relating to Future Intervention Options. WHO, Geneva, Switzerland, p: 268.
5. Fan PC (1997) Annual Economic loss caused by *Taenia saginata taeniacysts* in East Asia. Parasitology Today 13: 194-196.
6. Mann I (1983) Environmental, hygiene and sanitation based on the concept of primary health care as a tool for surveillance, prevention and control of taeniosis/cysticercosis. Current Publication in Health Research in Tropics 36: 127-140.
7. Pawlowski Z, Schultz MG (1972) Taeniasis and cysticercosis (*Taenia saginata*). Advances in parasitology 10: 269-343.
8. Grindle RJ (2012) Economic loss resulting from bovine cysticercosis with special reference to Botswana and Kenya. Trop Anim Health Prod 10: 127-140.
9. Ahmed I (1990) Bovine cysticercosis in animals slaughtered at Nekemt abattoir. DVM Thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia.
10. Dawit S (2004) Epidemiology of *Taenia saginata taeniasis* and cysticercosis in north Gondar zone, North West Ethiopia. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debrezeit, Ethiopia.
11. Fufa A (2012) Study on the prevalence of Bovine cysticercosis in Hawassa Municipal Abattoir and *T. saginata* in Hawassa town and its surrounding South Ethiopia. MSc Thesis, FVM, AAU, Debre Zeit, Ethiopia.
12. Amsalu D (2013) Prevalence and significance of *C. bovis* among slaughtered cattle at Debre Zeit abattoir. DVM Thesis, Debre Zeit, Ethiopia.
13. Getachew B (1990) Prevalence and significance of *C. bovis* among cattle slaughtered at Debre Zeit abattoir. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit (Unpublished).
14. Alemu M (1997) Bovine Cysticercosis Prevalence Economic and Public Health Importance at Bahir Dar Municipality Abattoir. DVM Thesis. Faculty of Veterinary Medicine, Addis Ababa University, Ethiopia.
15. Tembo A (2001) Epidemiology of *T. saginata taeniasis/cysticercosis* in three selected agro-climatic zone in central high land of Ethiopia. Doctoral Dissertation, Addis Ababa University, Debrezeit, Ethiopia.
16. EARO (Ethiopian Agricultural Research Organization) (2015) Beef Research Strategy. Animal Science Directorate. Addis Ababa, Ethiopia, pp: 241-243.
17. Fekadu D (2015) A study on cestodes and metacestode of sheep in Sheno agricultural Research (SHARC), North Shoa. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia.
18. Yimam M (2003) Major causes of organ condemnation in ruminants slaughtered at Gondar abattoir, Northwest Ethiopia. DVM thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia.
19. Gebra-Emanuel T (1997) Food Hygiene - Principles and methods of food borne disease control with special Reference to Ethiopia. Faculty of Medicine, Department of Community Health, Addis Ababa University.
20. Eckert J (1996) Workshop summary: Food safety: meat-and fish-borne zoonoses. Vet Parasitol 64: 143-147.
21. Ethiopian Central Statistical Agency (CSA) (2015) Annual Ethiopian Animal Population Estimates.
22. Thrusfield M (2013) Veterinary Epidemiology. 3rd edn. Edinburgh, Blackwell, pp: 178-197.
23. MOA (2015) Meat inspection regulation. Negarit Gazeta, Addis Ababa, Ethiopia, p: 428.
24. Onyango-Abuje JA, Hughes G, Opicha M, Nginyi KM, Rugutt MK, et al. (1996) Diagnosis of *Taenia saginata* cysticercosis in Kenyan cattle by antibody and antigen ELISA. Vet Parasitol 61: 221-230.
25. Natnael T (2014) Prevalence and Economic Importance of *Cysticercus bovis* in Debre Zeit Elfora Export abattoir. DVM Thesis. JUCAVM.
26. Degefu H (2005) Prevalence and risk factors of *Taenia saginata Taeniasis/ Cysticercosis* in three selection area of eastern shoe. Doctoral Dissertation, MSc Thesis, Addis Ababa University, Debrezeit, Ethiopia.
27. Over HJ, Jansen J, Van Olm PW (2012) Distribution and Impact of Helminth Diseases of Livestock in Developing Countries. FAO Animal Production and Health Paper 180, Rome.
28. Feseha G (1995) Zoonotic disease in Ethiopia. Ethiopian Society of Animal Production, Addis Ababa.
29. Hailemariam S (2013) Animal Health Review 1822-1969. Ethiopia, pp: 102-290.