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# Prevalence of Bovine Cysticercosis in Cattle Slaughtered at Gondar Elfora Abattoir

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**Abstract:** A cross -sectional study was conducted from November 2009 to April 2010 on bovine cysticercosis in cattle slaughtered at Gondar ELFORA abattoir with the objective of determining the prevalence, viability and distribution of bovine cysticercosis. A total of 768 carcasses were examined during the study period, of which 23 (2.99%) were infected with *Taenia saginata* metacestode. From a total of 6912 samples inspected, 32 systicerci were detected, of which 11(34.38%) were viable. The anatomical distribution of cysticerci were 12 (37.5%) in cardiac muscle, 8(25%) in masseter muscle, 8(25%) in shoulder muscle, 4 (12.5%) in tongue and 1 (3.13%) in liver. The prevalence was not varied significantly between breed, age and origin of the animals. In conclusion, even if the study revealed low prevalence of *T. saginata* metacestode, the disease deserves due attention to safeguard the public health and further promote beef industry in the country. Therefore, appropriate control and preventive measures need to be taken in order to minimize risks associated with cysticercosis.

**Key words:** Gondar ELFORA · Bovine Cysticercosis · Cattle · Prevalence · Viability Test

## INTRODUCTION

*Taenia saginata* and its metacestode *Cysticercus bovis*, the unarmed beef tapeworm, belong to the class cestoda order cyclophyllidae Family Taenidae and genus Taenia [1, 2]. The adult is ribbon-shaped, multisegmented and hermaphroditic flatworm, its body divided in to three distinct parts consisting of scolex (Head), neck and strobila. The scolex measuring 1mm to 2mm in diameter, has four strong hemispherical sackers. There is no rostellum and hooks and the predilection site in the intestinal mucosa is in the proximal part of the jejunum [3, 4]. The neck is short unsegmented with a germinal structure immediately behind the scolex, which continuously produces proglottids. The strobila is a chain of segments, made up of sexually immature and mature gravid segments in linear sequence and each segment is called proglottid. Strobilazation occurs at the distal part of the neck [5].

An adult *T.saginata* tapeworm has 600-2000 segments each of which is hermaphroditic with one set of reproductive organs and genital pores which open on the lateral margins of the segment [6, 7]. Self and cross fertilization between and among proglottids is possible. Human feeding habits and modes of life are responsible for the spread of Taeniasis/Cysticercosis infections. Man's customs and traditions of consuming raw, inadequately cooked beef dishes like kourt and kitffo in Ethiopia containing viable bladder worms perpetuate human infection. Cattle are infected by ingestion of pasture and drinking water contaminated with *T.saginata* eggs [8]. Dispersion of *T. saginata* eggs is favored by the following factors like, Man's indiscriminate defecation, the use of sewage effluents and sludge as fertilizer on pasture, the use of immigrant labor from countries with high prevalence of infection in feedlots, scavenger birds (Seagulls) and flooding water [9].

Adequate meat inspection, abstinence from eating raw or inadequately cooked beef (Thorough cooking of meat at a temperature of 56-60°C) and freezing the infected carcass at -10°C for 10 days prevent human infection. Chemotherapy in humans reduces the spread of eggs and infection in cattle [5].

Therefore, the objective of the study was:

- To assess the current status of bovine cysticercosis in cattle slaughtered at Gondar ELFORA abattoir (Prevalence, cyst viability and distribution).

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## MATERIALS AND METHODS

**Study Area Description:** The study was conducted in North Gondar, North western part of Ethiopia. Gondar is located 727 kms north western Addis Ababa in Amhara regional state. It is divided into three major agro-climatic zones; high land, mid high land and low land [10].

**Study Animal:** The study was conducted on 768 local and cross breed cattle originated from neighboring provinces such as Gondar Zuria, chiliga, Belessa, Foggera, Wogera, Armachiho and Dembia.

**Study Design:** A cross sectional study was conducted from November 2009 to April 2010 by collecting data on events associated with *C.bovis* in cattle at Gondar ELFORA abattoir.

**Sample Size Determination:** The required sample size of the study was determined by the formula given in Thrushfield [11] with 95% confidence interval and at 5% desired precision. By using this formula and prevalence of 4.9% reported by Dawit [12] the required sample size becomes 294. But in order to increase the accuracy of the study, the sample size is increased to 768. Thus a total of 768 cattle were randomly sampled and examined for the presence of *C. bovis*.

**Study Methodology**

**Ante Mortem Examination:** During ante mortem examination, detail records about the breed, sex, age and origin of the animals was recorded. The age estimation was based on dentitions [13].

**Post Mortem Examination:** During post mortem examination, heart, liver, lung, tongue, masseter muscle, ticeps muscle, neck muscle, intercostals muscle and diaphragm was systematically inspected for the presence of C. bovis by applying the routine meat inspection procedures which consists primary examination involves visualization and palpation of organs and muscles, where as the secondary examination involves further incisions in to each organs in case where a single or more *C. bovis* was found. Whenever and wherever the cyst was apparent the number of the cyst per organ or muscle was recorded [14].

**Viability Test:** Any cyst which was at meat inspection was removed with the surrounding tissue and taken to University of Gondar Faculty of veterinary medicine laboratory for viability test, then the cyst were incubated at 37 °c in 30% ox bile with 70% normal saline solution for 1-2 hours. A cyst was regarded as viable if the scolex evaginated during the incubation period [14].

**Data Management and Analysis:** Data for each animal risk factor, such as age, breed and origin were recorded on a special sheet prepared for this purpose (Annex 1.) and entered into Microsoft Excel then analyzed using STATA7.0 version [15].

## RESULTS

**Prevalence Study:** A total of 768 cattle were examined for the prevalence of cysticercosis, 23 of them were found to be infected with cysticerci. The overall prevalence of cysticercosis in the study area was recorded as 2.99% (23/768).

Out of 662 animals from highland, 22 animals have been found infected by *C. bovis* which consists 3.32% whereas among 106 animals from lowland, 1 animal (0.94%) have been infected (Table 1). But the analysis shows no significance among cattle from highland and lowland ($p>0.05$).

20 animals were found to be infected from 564 local breed animals which consists 3.55% and out of 204 cross breed animals 3 (1.47%) of them were infected, so there is insignificance association between the two breeds ($p>0.05$)

Out of 617 adult animals, 20 animals have been found infected by *C. bovis* which consists 3.24% whereas among 56 young animals 1 animal was infected which consists 1.79% and out of 95 old animals that are examined 2 of them are infected by *C. bovis*, but the analysis shows there is no significance association ($p>0.05$).

The anatomical distribution of cyst were 9 (28.12%) in heart,5 (15.63%) in shoulder,6 (18.75%)in masseter, 2(6.25%) in tongue, 2(6.25%) in masseter and heart, 3 (9.4%) in shoulder and heart, 2 (6.25%) in masseter and toungue, 2 (6.25%)in shoulder and tongue, 1 (3.13%) in liver and heart (Table 3). The highest proportion of cyst was observed in the heart followed by masseter and shoulder muscle and the lowest proportion was seen at the liver. The majority of infected organ 22 (68.75%) were found harboring cysts only in single organ or tissue whereas the remaining 10 (31.25) were found more than one organ.

Table 1: prevalence of bovine cysticercosis on different ecological zone

| Origin | No of examined animals | No of affected animals | Prevalence (%) |
|---|---|---|---|
| High land | 662 | 22 | 3.32 |
| Low land | 106 | 1 | 0.94 |
| Total | 768 | 23 | 2.99 |

$X^2$ =1.7813, p=0.182

Table 2: Prevalence of bovine cysticercosis on breed wise

| Breed | No of examined animals | No of affected animals | Prevalence (%) |
|---|---|---|---|
| Local breed | 564 | 20 | 3.55 |
| Cross Breed | 204 | 3 | 1.47 |
| Total | 768 | 23 | 2.99 |

$X^2$ =2.22, p=0.136

Table 3: Prevalence of bovine cysticercosis on age wise

| Age | No of animals examined | Affected animals | Prevalence(%) |
|---|---|---|---|
| Old (>6 years) | 95 | 2 | 2.1 |
| Adult (2-5 years) | 617 | 20 | 3.24 |
| Young(<= 2 years) | 56 | 1 | 1.79 |
| Total | 768 | 23 | 2.99 |

$X^2$ = 1.9614 , P= 0.163

Table 4: Frequency and cyst distribution among different organs

| Organ | No of infected organs | Percent (%) |
|---|---|---|
| Shoulder (S) | 5 | 15.63 |
| Heart (H) | 9 | 28.13 |
| Masseter (M) | 6 | 18.75 |
| Tongue (T) | 2 | 6.25 |
| M and H | 2 | 6.25 |
| S and H | 3 | 9.38 |
| M and T | 2 | 6.25 |
| S and T | 2 | 6.25 |
| Liver, Heart and shoulder | 1 | 3.13 |
| Total | 32 | 100 |

Table 5: Relative viability of *C. bovis* in different organs

| Organ | No of cyst collected | No of viable cyst | Percent |
|---|---|---|---|
| Shoulder | 9 | 3 | 33.3 |
| Heart | 17 | 9 | 52.94 |
| Masseter | 12 | 5 | 41.67 |
| Tongue | 4 | 1 | 25 |
| Liver | 1 | 1 | 100 |
| Total | 43 | 19 | 44.2 |

**Viability Test:** A total of 32 cyst were collected at Gondar ELFORA abattoir during the study period, of the total cyst collected 11 (34.38%) of them were viable while others 21 (65.63%) were degenerated cyst (Table 5).

## DISCUSSION

During the abattoir survey conducted at Gondar ELFORA abattoir, the overall prevalence of bovine cysticercosis was indicated as 2.99% which is more or less comparable with works of Dessie [16] 2.7% at Assela, Tembo [17] 3.11% at central Ethiopia and Dawit [12] 4.9% at Gondar ELFORA abattoir and it is different from the works of Nigatu [18] 7.5% at Addis Ababa, Amsalu [19] 9.7% at Gondar and Getachew [20] 13.8% at Debre Zeit. But it is far lower than the reports of Hailemariam [21] 30%, Ahmed [22] 21% and Hailu [23] 17.5% in whole Ethiopia, Nekemt and East Shoa respectively.

Prevalence of this study is very low when comparable with some reports from African countries, such as 20% in Senegal, 27% in Tanzania and 38-62%in Kenya *et al*. [24]. But it is higher than with some reports in developed countries, such as 10.26% in Croatia [25] 0.9% in Cuba [26] and 0.48-1.08% in Germany [27].Thus *Tsaginata* cysticercosis has more public health importance in developing countries like Ethiopia compared with developed countries. Improper removal and treatment of sewage, application of sewage and sludge for pasture as a fertilizer and fecal contamination of feed and/water by farm employees are possible sources of infection in the developed countries [9, 28].

The result indicated that the prevalence of bovine cysticercosis decreases time to time at Gondar ELFORA abattoir, for instance Amsalu [19] 9.7%, Dawit [12] 4.9% and this study (2010) 2.99%. The reason why the prevalence decreases in trend might be due to, the increase use of latrine by farmers, regular deworming of humans and animals as a result of easily availability of taenicidal drugs and gradual decrement of the consumption of raw or under cooked meat as a result of improvement on health education. In this study the prevalence of bovine cysticercosis was not varied significantly for age groups, breed and origin of the animals ($p>0.05$). Possible explanation for this insignificance of variations might be due to the fact that all age groups and breeds of animals are equally susceptible to the infection and most animals are reared with similar husbandry system which leads to equal exposure of the animal to *T. saginata* eggs.

During the study, the most frequently affected organ is the cardiac muscle 12 (36.36%) followed by the shoulder 8(25%) and masseter muscle 8(25%) which is similar to the result of Tembo [17]. But different workers come with different results. For example, Mohammed [29] reported that liver is the most infected organ, Getachew [20]

shoulder is the most infected organ and Amsalu [19] recommended the tongue is effective means of detection. The different result reported by different workers may be due to difference in geographical area, breed of cattle, management system and activity of muscle groups [30]. Therefore, the choice of muscle examined by meat inspectors should be based on the studies done within each country or region [31].

Viability test showed that cardiac muscle had the highest relative frequency proportion of viable cyst 5 (41.66%), followed by shoulder 3 (37.5%) and masseter muscle 2 (25%). The explanation for this result might be due to muscle that are in high activity receives 10-20 times more blood than muscles at rest and the distribution of the cyst is controlled by the volume and intensity of the arterial blood [14].

The wide distribution of *T. saginata/c.bovis* is associated with several factors including, consumption of raw and under cooked meat, such as the favorite dish" kitfo" and "kourt" of the Ethiopians [32] low latrine coverage (49.7% urban, 3.95% rural and 11.5% in the country [33]), bush defecation, poor waste disposal, the use of sludge sewage as a pasture fertilizer, low level of public awareness and presence of backyard slaughtering practice. Eggs of *T. saginata* are capable of surviving in the external environment for a long time. Studies have indicated that it can remain infective for 6-10 months in the soil. It has also been shown that eggs may stay alive in the effluent from sewage treatment plants and that cattle may be at risk when having access to streams carrying this effluent [34, 35]. In Ethiopia bush defecation, the habit of eating raw meat and backyard slaughter might have contributed for the high prevalence of cysticercosis in cattle [17] since conventional meat inspection technique is less sensitive lightly infected carcasses can be easily missed and passed for human consumption [35].

## CONCLUSION

From the result of this abattoir survey, prevalence of bovine cysticercosis was found 2.99%, though the prevalence is not high compared to the other reports, but it induces public health hazards and great economic loss as a result of trimming of organs and carcasses. The risk factors of bovine cysticercosis and its public health significance is due to conventional meat inspection technique which is less sensitive that lightly infected carcasses can be easily missed and passed for human consumption, lack of creating awareness to the people to avoid consumption of eating raw, under cooked or back yard slaughter meat and bush defecation which leads to contamination of the environment in general and the pasture in particular with the egg of *T. saginata,* that plays a role in the perpetuation of the life cycle of the parasite.

In line with the above conclusion, the following recommendations are forwarded:

- Attention must be given to the routine meat inspection and public awareness on improving personal and environmental hygiene.
- Teach peoples specially school children on the danger of raw meat consumption, which is reliable means of bringing cultural changes in the country.
- Educate peoples for the use of latrine and the danger of defecation on the open environment,
- Regular deworming of humans especially the farmers that have close contact with the cattle.

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