

Original Article

Bovine Cysticercosis in Durame Municipal Abattoir, Central Ethiopia Region

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ABSTRACT: A cross-sectional study was conducted at the Durame municipal abattoir with the aim of determining the prevalence of bovine cysticercosis in slaughtered cattle. A total of 384 randomly selected cattle of different ages, sexes, breeds, body conditions, and origins were examined through routine ante-mortem and detailed post-mortem inspection procedures. The overall prevalence of bovine cysticercosis was found to be 9.6% (37/384). Although slight variations in prevalence were observed among different categories: breed, sex, age, body condition, and origin. None of these factors showed a statistically significant association with infection ($p > 0.05$), indicating widespread environmental exposure. Anatomical distribution of cysts revealed a higher predilection for the tongue (56.82%), followed by masseter muscles (22.72%), shoulder muscles (11.36%), and heart (9.1%). The findings demonstrate that bovine cysticercosis is moderately prevalent in the study area and poses both public health and economic concerns. Therefore, integrated control measures focusing on improved sanitation, enhanced meat inspection, and public awareness on safe meat consumption are essential to reduce the burden of the disease.

KEYWORDS: Bovine, Cysticercosis/Taeniasis, Durame, Ethiopia, Municipal Abattoir, Prevalence.

1. INTRODUCTION

Central Statistical Agency data indicate that Ethiopia possesses the largest livestock population in Africa, with approximately 53.99 million cattle, 25.5 million sheep, 24.06 million goats, 1.91 million horses, 6.75 million donkeys, 0.35 million mules, 0.92 million camels, and 50.38 million poultry (CSA, 2013). Despite this vast resource, animal diseases remain a major constraint, causing considerable economic losses in countries where livestock production plays a central role in agriculture. Although developing countries host nearly two-thirds of the global livestock population, their contribution to global meat and milk production remains disproportionately low (FAO, 1995).

Livestock production losses occur annually due to animal mortality, reduced growth performance, and the condemnation of carcasses and edible organs during meat inspection. In Ethiopia, cattle contribute about 45% of domestic meat consumption and serve as a major source of export income through the sale of live animals. However, despite the country's strategic proximity to major export markets such as the Middle East and parts of Africa, earnings from livestock exports remain below potential (EARO, 2000).

Parasitic diseases are among the leading factors limiting livestock productivity worldwide. Among these, tapeworm infections are particularly significant, as they affect both animals and humans and have persisted for thousands of years (Radostits *et al.*, 2007). Bovine cysticercosis, caused by the larval stage of *T. saginata*, is a zoonotic disease of considerable economic and public health importance (OIE, 2006; FAO, 2011). The disease involves a life cycle that requires both cattle and humans, with humans serving as the definitive host and cattle as the intermediate host (Fukuda, 2003).

Transmission occurs when cattle ingest feed or water contaminated with human faeces containing parasite eggs. Such contamination may arise directly or indirectly through sewage systems, flooding, or the application of untreated waste to grazing lands (Geysen *et al.*, 2007; Abuseir *et al.*, 2007). The parasite localises in the muscles of cattle, leading to bovine cysticercosis, while in humans it causes taeniasis (Roberts and Janovy, 2009).

The prevalence of this disease is closely linked to socioeconomic conditions, sanitation practices, and cultural habits, particularly the consumption of raw or undercooked beef (Symth, 1994). Although more common in developing countries with poor hygiene, infections also occur in developed countries where raw or undercooked beef is consumed. Notably, parasite eggs can survive most sewage treatment processes, and even advanced meat inspection systems have not fully eliminated the disease (Minozzo *et al.*, 2002).

The occurrence of cysticerci in cattle leads to condemnation or mandatory processing of infected meat through freezing, heating, or salting before it can be deemed safe for consumption. These measures increase production costs, reduce the market

value of beef, and restrict trade opportunities. Consequently, bovine cysticercosis poses a significant economic burden on the meat industry and limits the export potential of affected countries (Fukuda, 2003).

Despite Ethiopia's large livestock population and its significant contribution to the national economy, the productivity and economic benefits derived from this sector are severely constrained by parasitic diseases, particularly bovine cysticercosis. The persistence of this zoonotic parasite is associated with poor sanitation, inadequate meat inspection systems, and cultural practices such as the consumption of raw or undercooked beef. The presence of cysticerci in cattle results in carcass condemnation, increased processing costs, reduced meat quality, and decreased market value, ultimately leading to substantial economic losses. Furthermore, the zoonotic nature of the disease poses a public health risk to humans, especially in areas where hygienic conditions are insufficient.

Although Ethiopia has strong potential for livestock export, the prevalence of bovine cysticercosis continues to hinder its competitiveness in international markets. Hence, there is a critical need for up-to-date assessments on the magnitude, economic impact, and contributing factors of this disease in order to design effective control and prevention strategies. Therefore, the aim of the study was to estimate the prevalence of *C. bovis* in cattle slaughtered at the Durame municipal abattoir.

2. MATERIALS AND METHODS

2.1. STUDY AREA DESCRIPTION

The study was conducted in the Durame Municipal abattoir, which is situated in Kembata Zone, Central Ethiopia Regional State. The town was located at 352 km from Addis Ababa at an elevation range from 1650 to 1700 m.a.s.l and between 7° 04' N of longitude and 38°28'E of latitude. The rainfall of the area was 1497 mm, and the average annual temperature was 13.5 °C. The area was characterized by two seasons, the wet season from June to September and the dry season from October to May. Agriculture is the main occupation of the population of the area. The agricultural activities are mainly mixed type, with cattle rearing and crop production undertaken side by side. A semi-intensive system of livestock management predominates the area. The Human population of the Kembata Zone was 683,167, of which 337,852 are men, and 345,315 are women (CSA, 2013)

2.2. STUDY ANIMALS

Cattle presented to the Durame municipality abattoir for routine meat inspection were used for the cross-sectional survey. During the abattoir survey, post-mortem examinations were carried out on a total of 384 cattle. Most of the cattle slaughtered at the study abattoir were local/indigenous breeds. All cattle slaughtered during the study were young and old, and both sexes. The animals examined for the presence of *C. bovis* in different organs were selected randomly. The majority of cattle presented to the Durame municipal abattoir were drawn from market-oriented areas (Shone, Wolaita Sodo, Shinshicho, Boditi, Durame, Arsi Negelle, Kedida Gamela Woreda).

2.3. STUDY DESIGN AND SAMPLING METHOD

A cross-sectional study was carried out on randomly selected animals slaughtered at the Durame municipal abattoir. The study was based on routine meat inspection on randomly selected cattle slaughtered at the abattoir. The randomly selected animals for routine meat inspection were given an identification number. This is to avoid the unnecessary mixing with organs during inspection. Visual inspection of all exposed surfaces was made in all active organs (shoulder muscles, hearts, masseters (cheek muscle), diaphragms, tongues, livers, etc.). This is followed by incision of all those organs to be examined for the presence of *C. bovis* cysts.

2.4. SAMPLING AND SAMPLE SIZE DETERMINATION

A simple random sampling method was used to include animals in the study. Therefore, the sample size was determined by the formula suggested by Thrusfield (2005) with 95% confidence interval of evidence of disease presence in the study area. A value of 50% was assumed in the study area since no study was done in this area on the selected topic.

Sample size estimation was calculated using the formula:

$N = 1.96^2 \times p \exp (1 - p \exp) / d^2$ (Thrusfield, 2005).

$$N = \frac{1.96 \text{ pexp} (1 - \text{pexp})}{d^2}$$

Where N=required sample size, P exp=expected prevalence d²= desired absolute precision. In the current study, we used 95% as confidence interval with an absolute precision of 0.05. To get the maximum sample size, the expected prevalence was estimated at 50%.

Thus $N = 1.96^2 \times 0.5 (1 - 0.5) / 0.05^2 = 384$.

Therefore, 384 cattle were to be sampled with a random sampling technique.

2.5. STUDY METHODOLOGY

2.5.1. ABATTOIR SURVEY

Detailed meat inspection was conducted during an active abattoir survey on randomly selected 384 cattle slaughtered at the Durame municipal abattoir. During ante mortem inspection, each of the study animals was identified by assigning an identification number. Age, sex (male and female), body condition score and place of origin from which the animals were brought should be recorded. Body condition score of Moderate body condition (Shallow tail head cavity, Round ended horizontal process is identified, rounded /not sharp and identified ribs) and Good body condition (Fat cover under skin, pin bones cannot felt even high pressure, Horizontal process cannot seen easily and Rids cannot felt except firm pressure) according to (Neary and Yager, 2002), age was categorized into young (<5 yrs) and old (>5 yrs) based on owners' information and Estimation of age was carried out by dentition according to (De Lahunta and Habel, 1988).

2.5.2. POST-MORTEM EXAMINATION

During post mortem inspection, palpation of the organs followed by incision of organs was made to examine for the presence of *C. bovis*, according to the guideline by Ministry of Agriculture (1972), for masseter muscle: deep linear incision were made parallel to the mandible; the heart were incised from base to apex to open the pericardium and incision also made in the cardiac muscle for detail examination. Deep, adjacent and parallel incisions were made above the point of the elbow in the shoulder muscle. Examination of the kidney, liver, and lung was also conducted accordingly.

2.6. DATA ANALYSIS

The data obtained from the ante-mortem and post-mortem examination of all sampled animals were recorded, coded and stored on a Microsoft Excel spreadsheet 2010. The stored data were then imported, and descriptive statistics, such as frequency and percentage, were used to determine the prevalence of *C. bovis*. At the same time, tests were used to compare the association between categorical risk factors and the occurrence of the disease. For statistical inference, a significance level (p-value) of less than 0.05 was considered a statistically significant result.

3. RESULTS

3.1. PREVALENCE OF BOVINE CYSTICERCOSIS

Of the total of 384 inspected animals in the Durame municipal abattoir, 37(9.6%) animals were found positive for *C. bovis* at post-mortem inspection. Prevalence of bovine cysticercosis in the study area was also associated with different risk factors such as breed, body condition, sex and age of animals. There was no significant difference ($p > 0.05$) between sex, body condition and breed with prevalence of the disease (Table 1). Animals that came to the abattoir were young and old age of both sexes. There was no statistical significance difference in prevalence of *C. bovis* with sex, age, breed, body condition and origin of animals (tables 1, 2, 3, 4, 5).

TABLE 1 The prevalence of *C.bovis* based on Breed

Breed	Number of examined	Number of positive	Prevalence%	χ^2 (p-value)
Local	348	34	9.7	0.0022(0.963)
Cross	36	3	8.3	
Total	384	37	9.6	

TABLE 2 The prevalence of *C.bovis* based on Sex

Sex	Number of examined	Number of positive	Prevalence%	χ^2 (p-value)
Male	330	32	10.31	2.0410(0.153)
Female	54	5	10.8	
Total	384	37	9.6	

TABLE 3 The prevalence of *C.bovis* based on age group

Age	Number of examined	Number of positive	Prevalence%	χ^2 (p-value)
Young	270	27	10	1.8543(0.173)
Old	114	10	11.4	
Total	384	37	9.6	

TABLE 4 The prevalence of *C.bovis* based on Body condition

Body condition	Number of examined	Number of positive	Prevalence%	χ^2 (p-value)
Good	221	19	8.44	0.6665(0.414)
Medium	163	18	10.86	
Total	384	37	9.6	

TABLE 5 The prevalence of *C.bovis* based on the origin of the animal

Animal origin	Number of examined	Number of positive	Prevalence%	χ^2 (p-value)
Arise Negelle	62	11	7.69	7.037(0.134)
Shone	76	6	5	
Wolaitasodo	82	11	9.3	
Boditi	58	3	14.1	
Shinshicho	54	4	12.3	
Durame	52	2		
Total	384	37	9.6	

3.2. ANATOMICAL DISTRIBUTION OF CYSTS

Analysis of active abattoir survey data showed that there was a variation with regard to the anatomical distribution of cysticercus cysts in the organs inspected. The highest proportions of *C. bovis* cysts were observed in the tongue 50(56.82%), followed by the masseter muscle 20(22.72%), the shoulder muscle 10(11.36%), and the heart 8(9.1%), respectively, of the total of 88 cysts collected during the study period.

4. DISCUSSION

The present abattoir-based investigation conducted in Durame demonstrated an overall prevalence of 9.6% bovine cysticercosis, indicating that infection with *Taenia saginata* remains an important parasitic and zoonotic problem in the study area. This finding is comparable with several previous reports from Ethiopia, where prevalence values ranging from approximately 7% to 18% have been documented in different abattoirs (Megersa *et al.*, 2010; Kebede *et al.*, 2009; Regassa *et al.*, 2008). However, it is lower than reports from some high-risk areas where prevalence exceeded 20% (Abunna *et al.*, 2008), while higher than findings from areas with improved sanitation and stricter meat inspection systems (Tembo, 2001). Such variation may be attributed to differences in agro-ecological conditions, community awareness, sanitation infrastructure, and meat inspection efficiency.

The observed prevalence in this study reflects the persistence of the parasite's lifecycle, which is strongly linked to environmental contamination with human faeces. In many parts of Ethiopia, including rural and peri-urban settings, inadequate latrine utilization and improper waste disposal practices facilitate the dissemination of *T. saginata* eggs onto grazing fields (Geysen *et al.*, 2007). Additionally, cultural practices such as the consumption of raw or undercooked beef (locally known as "kurt" and "kitfo") further perpetuate transmission between humans and cattle (Tembo, 2001). Therefore, the detected prevalence likely represents a combination of behavioral, environmental, and infrastructural factors.

With regard to risk factors, the present study showed no statistically significant association ($p > 0.05$) between infection and breed, sex, age, body condition, or origin of animals. The absence of significant variation among breeds is in agreement with previous studies (Kebede *et al.*, 2009; Regassa *et al.*, 2008), suggesting that genetic susceptibility plays a minimal role in the epidemiology of bovine cysticercosis. Instead, exposure to contaminated environments appears to be the dominant determinant. Similarly, the lack of significant difference between sexes aligns with the findings of Abunna *et al.* (2008), indicating that both male and female cattle are equally exposed under traditional management systems.

Although statistically non-significant, a slightly higher prevalence was observed in older animals (11.4%) compared to younger ones (10%). This trend is consistent with earlier reports (Megersa *et al.*, 2010), which suggest that older animals may have a higher probability of infection due to prolonged exposure to contaminated pasture and water sources. However, the absence of statistical significance in the present study implies that infection can occur at any age, particularly in endemic areas where contamination is widespread.

In terms of body condition, animals with medium condition showed a somewhat higher prevalence than those in good condition, although the difference was not significant. This observation agrees with the findings of Regassa *et al.* (2008), who reported no clear relationship between body condition and infection status. This may be explained by the fact that bovine cysticercosis is generally sub-clinical and does not produce overt clinical signs that significantly affect the body condition of infected animals.

The variation in prevalence among different animal origins, although not statistically significant, may indicate differences in local management practices, sanitation levels, and human population density. Higher prevalence in areas such as Boditi and Shinshicho could suggest relatively poorer sanitation or higher levels of environmental contamination, whereas lower prevalence in areas like Shone might reflect comparatively better hygienic conditions. Similar observations have been reported in other Ethiopian studies (Abunna *et al.*, 2008; Megersa *et al.*, 2010).

The anatomical distribution of cysticerci observed in this study showed a clear predilection for the tongue (56.82%) and masseter muscles (22.72%), followed by the shoulder muscles and the heart. This finding is consistent with classical

descriptions of cyst localization in highly active and well-vascularized muscles (Radostits *et al.*, 2007). Comparable distributions have been reported in previous studies (Kebede *et al.*, 2009; Abunna *et al.*, 2008), reinforcing the importance of these organs as primary inspection sites during routine meat examination. The predominance of cysts in these muscles has significant public health implications, particularly in communities where raw beef consumption is common, as these parts are frequently consumed without adequate cooking.

Despite routine meat inspection, the persistence of infection suggests limitations in detection sensitivity. As noted by Minozzo *et al.* (2002), conventional meat inspection procedures may fail to identify lightly infected carcasses, thereby allowing infected meat to enter the food chain. Furthermore, the ability of *T. saginata* eggs to survive under various environmental conditions, including sewage treatment processes, complicates control efforts and contributes to sustained transmission (Geysen *et al.*, 2007).

Overall, the findings of this study highlight that bovine cysticercosis remains endemic in the study area, with infection largely influenced by environmental contamination and human behavior rather than intrinsic animal factors. This underscores the need for integrated control strategies targeting both human and animal components of the parasite's life cycle.

5. CONCLUSION AND RECOMMENDATION

The present study confirms that bovine cysticercosis is a moderately prevalent parasitic disease among cattle slaughtered at Durame, with an overall prevalence of 9.6%, reflecting ongoing transmission of *T. saginata* in the area. The absence of statistically significant associations between infection and host-related factors such as breed, sex, age, body condition, and origin suggests that the disease is primarily driven by widespread environmental contamination and poor sanitation practices rather than individual animal susceptibility. The predominance of cysts in predilection sites like the tongue and masseter muscles further emphasizes the importance of thorough meat inspection and the potential risk of human infection through the consumption of raw or undercooked beef. Consequently, effective control of the disease requires a multidisciplinary approach focusing on improved sanitation, public health education, and strengthened meat inspection systems to interrupt the transmission cycle and reduce both economic losses and public health risks.

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