International Journal of Livestock Research, Vol. 12 (1) Jan' 2022
http://www.ijlr.org
eISSN: 2277-1964

Original Research

Prevalence, Related Risk Factors and Distribution of Cyst of *Cysticercus bovis* in Cattle Subjected to Slaughter at Nekemte Municipal Abattoir, Western Ethiopia

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How to cite this paper: Shuramo, M. Y., Gutama, K. P., Bulcha, M. R., & Pal, M. (2022). Prevalence, Related Risk Factors and Distribution of Cyst of Cysticercus bovis in Cattle Subjected to Slaughter at Nekemte Municipal Abattoir, Western Ethiopia. *International Journal of Livestock Research*, 12(1), 27-32. https://dx.doi.org/10.5455/ijlr.20220130050629

Received : Dec 12, 2021
Accepted : Jan 17, 2022
Published : Jan 31, 2022

Abstract

A cross-sectional study were conducted from December 2014 to April 2015 to estimate the prevalence of Cysticercus bovis, investigate associated risk factors and evaluate organ level distribution of the cysts in cattle slaughtered at Nekemte Municipal abattoir, Western Ethiopia. There were 525 samples collected and processed in total. A systematic random sample strategy was used to choose the study animals. An ante-mortem examination was used to investigate potential risk factors. Post mortem examination was done by visual inspection and palpation and where necessary one or more incisions were made to detect small cysts. Descriptive statistics were used to summarize the prevalence of bovine cysticercosis and Chi-square (X2) test was applied to compare the infection status with regard to the hypothesized risk factors and (P<0.05) was set for statistical significance. The study showed that out of 525 cattle examined at the abattoir, the overall prevalence of Cysticercus bovis were 2.89% (95%:1.43-4.29). Out of 15 Cysticercus bovis infected cattle, 5 (33.3%) of Cysticercus bovis were present in the triceps muscle and heart, 7 (46.7%) in tongue, 2 (13.3%) in biceps muscle and 1 (6.7%) in masseter muscle. The statistical analysis revealed that there was no statistical association (P > 0.05) between the prevalence of Cysticercus bovis and origin, sex, age groups and body conditions of the animals. This study identified the impacts of Cysticercus bovis from active abattoir survey, which clearly indicated the existence of the parasites in the present time. As a result, eradicating this parasitic disease necessitates collaboration between public health and veterinary authorities. Furthermore, a thorough and detailed meat examination at the slaughterhouse is highly imperative.

Keywords: Abattoir, *Cysticercus bovis*, Cyst distribution, Nekemte, Prevalence

Introduction

Developing countries possess over two-thirds of the world's livestock, but only contribute to a third of the world's meat and a fifth of the world's milk (FAO, 1995). Ethiopia, too, is one of the countries with abundant and diversified livestock resources, with cattle accounting for 53,990,061 of them (CSA, 2013). However, many factors affect the maximum benefit to be obtained from livestock production and parasitic diseases are the major factors (MoARD, 1997). Among the parasitic diseases, taeniasis is one of the most important diseases that have economic as well as public health significance (Kidanu, 2011; Pal, 2007).

The terms cysticercosis and taeniosis refer to foodborne zoonotic infections with larval and adult tapeworms, respectively. Bovine cysticercosis is an infection of cattle caused by the larval stage, *Cysticercus bovis*, of the human intestinal cestode; *Taenia saginata* (Cabaret *et al*., 2002; Pal, 2007). This parasite is universally distributed in developing as well as in developed countries (Pal,2007). Taeniasis, caused by *Taenia saginata*, is a common helminthic disease in Ethiopia, with prevalence rates ranging from 10% to 70% (Kebede *et al.,* 2009).

Taeniasis in humans causes nausea, abdominal discomfort, epigastric pain, diarrhea, increased appetite or loss of appetite, weakness, weight loss, and intestinal blockage (Neva and Brown, 1994; Pal, 2007). Live cattle having *Cysticercus bovis* shows no symptoms, however, heavy infestation by the larvae may cause myocarditis or heart failure (Gracey and Colllins, 1992).

Taenia saginata is found all throughout the world, although it is more common in under developed countries, where poor sanitation, poor animal husbandry techniques, and habits of consuming undercooked beef enhance parasite spread (Pal, 2007). Cysticerci pose a public health risk because infected raw or undercooked beef can cause taeniasis in humans. In addition to the cost of refrigeration and extra handling and shipping, economic losses related with bovine cysticercosis include outright condemnation of carcasses with broad infestation and degradation of carcasses that are exposed to refrigeration (Dorny *et al*., 2009).

Hence knowledge on the extent of *Cysticercus bovis* in cattle would have paramount importance in justifying the need of an effective control scheme by considering the public health damages and economic loses. However, there is no current information regarding the prevalence of *Cysticercus bovis* in cattle slaughtered at Nekemte municipal abattoir. The objectives of this study was to estimate the prevalence, investigate associated risk factors and determine cyst distribution of *Cysticercus bovis* in cattle subjected to slaughter at Nekemte Municipal Abattoir, Western Ethiopia.

Materials and Methods

Study Area Description

The study was conducted in Nekemte town, East Wollega Zone of Oromia regional state, Western Ethiopia. Nekemte is 328 km away far from Addis Ababa. It is located between a latitude and longitude of $9^0$5'N$36^0$33'E and has elevation of 2088 meter above sea level. The area receives the average annual rainfall of 1850mm. The mean monthly minimum and maximum temperature were 10.5 and 31^0C, respectively. The livestock population of the area comprises of 925, 144 cattle, 220, 875 sheep, 146, 775 goats, 92,250 equines, 794, 484 head of chickens and 176,532 bee hives. Nekemte Municipal Abattoir is located at Bake Jama kebele on the main road of Nekemte-Gimbi. In this abattoir, on an average 30 cattle were slaughtered every day (NTAO, 2013).

Study Animals

The study animals were all animals of both sexes brought to the Nekemte abattoir for slaughter. The majority of the slaughtered animals were brought in from various markets in and around the town (Arjo, Arjo Gudatu, Bandira, Bedele, Diga, Getama, Nekemte, Sorga, Uke and Wayutuka).

Study Design

A cross sectional study was conducted from December, 2014 to April, 2015 to estimate the prevalence, investigate associated risk factors and cyst distribution of Bovine cysticercosis in Nekemte Municipal abattoir.

Sample Size Determination and Sampling Method

The total number of cattle required for the study was calculated by using the formula suggested by Thrusfield, (2007). 2.98% expected prevalence is taken (Abuna *et al.*, 2011), to determine samples size with 95% confidence interval (CI) and 5% desired absolute precision.

$$n = \frac{1.96^2 p\,(1-p)}{d^2}$$

Where,

n = sample size of the study population
d = desired precision
p = expected prevalence

Accordingly, based on the above formula a sample size of 314 was calculated, but to increase the level of precision sample size had been increased to 525. Systematic random sampling technique was employed in the lairage to select study animals by using 5 sampling interval.

Methods of Data Collection and Procedures

Ante mortem Examination

The unique marks on each animal's body, which were tagged before slaughter, were used to identify it. During the ante-mortem inspection, the age, sex, body condition and the origin of each individual animal was identified and recorded. On the basis of muscle mass and fat cover on the ribs, hip, between hooks, pins, spine, and transverse processes, study animals were divided into three basic categories: poor, medium, and good (Nicholson and Butterworth, 1986).

The age of the animal was estimated on the basis of dentitions De lahunta and Habel (1986) and all animals slaughtered were local zebu breed of cattle at the age of 4 years and above; grouped into three; 4-6 years, 6-8 years and greater than 8 years.

Postmortem Examination

During postmortem inspection, carcass and predilection site of the suspected parasites were thoroughly inspected according to Meat Inspection Regulation by Government of Ethiopia (MoA, 1972). Each organ was assessed macroscopically by visual inspection and palpation and where necessary one or more incisions were made to detect small cysts (Soulsby, 1982). Up on examination the post-mortem judgment to be passed on the organs was recorded.

Data Management and Analysis

Data collected from antemortem and postmortem examination was entered into Microsoft Excel. Descriptive statistics was carried out to summarize prevalence of *Cysticercus bovis*, the proportion of the positive organs and anatomical distribution of the cysts in each organ. Chi-square was carried out in order to assess the magnitude of the difference of comparable variables using STATA 11. In all cases the difference between different groups were tested for significance at probability level of 0.05 or less.

Results

Prevalence and Associated Risk Factors

Out of 525 animals examined at abattoir, the overall prevalence of C*ysticercus bovis* was 2.86% (95%:1.43-4.29). There was no statistically significant difference in sex, age, body condition score and origin of the animal with the occurrence of *Cysticercus bovis* (P>0.05) (Table 1).

Table 1: *Cysticercus bovis* occurrence with various potential risk factors

Risk Factor	No. of animals examined	No. animals affected (%)	X^2	P-Value
Sex				
Male	475	14 (2.95)	0.15	0.7
Female	50	1 (2)		
Age				
4-6	32	1(3.16)	0.56	0.75
6-8	360	9(2.5)		
>8	133	5(3.76)		
Body condition				
Poor	**26**	0	0.9	0.64
Medium	348	11(3.16)		
Good	151	4(2.65)		
Origin				
Arjo	26	1(3.85)	7.97	0.54
Arjo Gudatu	39	2(5.13)		
Bandira	162	7(4.32)		
Bedele	11	0		
Diga	73	0		
Getema	73	1(1.37)		
Nekemte	11	0		
Sorga	9	1(11.11)		
Uke	59	1(1.69)		
Wayutuka	62	2(3.23)		

Proportion of Organ Affected

Out of the 15 *Cysticercus bovis* infected cattle, 5 (33.3%) of *Cysticercus bovis* were found in the triceps muscle and heart, 7 (46.7%) in the tongue, 2 (13.3%) in biceps muscles and 1 (6.7%) in masseter muscle (Table 2).

Table 2: Distribution of *Cysticercus bovis* in different organs

Infected organ	No. of infected animals	Relative percentage (%)
Tongue	7	46.7
Triceps muscle and heart	5	33.3
Biceps muscle	2	13.3
Masseter muscle	1	6.7
Total	15	100

Discussion

The present study showed that the overall prevalence of *Cysticercus bovis* in Nekemte municipal abattoir was 2.857%. This observation is slightly in agreement with the finding of Abuna *et al*. (2011), at Nekemte municipal abattoir (2.98%) and Tolosa *et al.* (2009) at Jimma municipal abattoir (2.90%). The present finding is lower when compared with a study conducted by Regasa and co-investigators, (2009) in Wolaita soddo municipal abattoir (11.3%) and Abunna *et al*. (2008) in Hawassa municipal abattoir (26.3%). The different prevalences reported in these studies might be due to several factors of which husbandry systems and hygienic practice differences are among the most important. In addition, as multiple incisions of the organs lowers the marketability of carcasses and

introduces contamination, owners did not allow multi-incisions for the detailed investigation and this underestimate the true prevalence, especially when infection is light.

Concerning the anatomical distribution of the *Cysticercus bovis* cyst, some of the previous works mentioned that there were no as such true predilection sites for *Cysticercus bovis* as the presence and number of cysts in any predilection sites varied greatly from animal to animal (Scandrett *et al*., 2009). On the other hand, it was explained that the parasite can migrate via the mesenteric venue to enter systemic circulation and then they filtered out to tongue, heart and masseter muscles as a preferred predilection site (Minnozzo *et al*., 2002). Similarly, the present study reported that relatively higher percentage of these organs was affected by *Cysticercus bovis*. This result is in agreement with other study conducted by Megersa *et al*. (2010) and Tadesse and Sultan (2014). It is mentioned that the reason for the preference of these organs by this cyst could be due to the fact that there is relatively higher supply of arterial blood to the muscle in these organs (Paniken, 2002). Furthermore, unlike other predilection sites of *Cysticercus bovis*, the tongue and heart had no limitations upon incision for inspection and this could also be the reason for the slightly higher observed frequency of *Cysticercus bovis* on the tongue and heart.

Conclusion

The present study indicated that the bovine cysticercosis was prevalent in the study area. The high infection in cattle justifies a program of disease control. Thus, eradication of this helminthic disease requires cooperation between the public health and official veterinary authorities. Public health education to prevent consuming raw meat, correct disposal of condemned organs, avoiding sewage effluents for field irrigation and grazing management of animals during the dry season to avoid access to parasite eggs are all critical. Furthermore, a thorough and meticulous meat examination at the abattoir is recommended.

Acknowledgements

The authors are very thankful to Prof. Dr. R.K. Narayan for his suggestions during the preparation of manuscript and Anubha Priyabandhu for computer help. This paper is dedicated to the scientists who made important contribution in the field of helminthic zoonoses

Conflict of Interests

There is no conflict of interest.

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