A Crossectional Study of Bovine Cysticercosis in Nekemte Municipal Abattoir, East Wollega Zone, Oromia Regional State, Western Ethiopia

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Abstract: A cross sectional study was conducted from November 2008-March 2009 to estimate the prevalence of the Bovine Cysticercosis in cattle slaughtered at the Nekemte municipal abattoir and *T. saginata* infestation in human in Nekemte town. To accomplish this study, inspection of bovine carcasses in the abattoir and a questionnaire survey were used. Cyst distribution and viability of Bovine Cysticercosis was also determined. Of the total of 384 inspected carcasses, 8 carcasses had varying number of *C. bovis*, giving an overall prevalence 2.08% (8/384). Cysts were detected in shoulder muscle (47.05%), tongue (25%), masseter muscles (12.5%) and heart (12.5%). From a total of 34 cysticerci collected (61.76%) were viable were viable and (3) 12.5% were classified. There were no statistical significant difference (p>0.05) in prevalence between age, sex and body condition scores of animals. Data from the questioner survey showed that, from the total of 125 interviewed respondents, 17.5% (21/120) reveled having contracted *T. saginata* infection. The prevalence was statistically significant between religion of respondents (p<0.05). However, the infestation with *T. saginata* did not significantly different (p>0.05) with the educational status, sex and age of the respondents. The habit of eating raw meat, use of latrines and backyard slaughter are the main risk factors for Bovine Cysticercosis in the area. The current study revealed the importance of cysticercosis and taeniasis both in economic and public health aspects. Therefore, attention should be given to improve meat inspection procedures and sanitary conditions as well as public awareness and environmental hygiene for control of the disease.

Key words: Prevalence, Bovine Cysticercosis, *Taenia Saginata*, abattoir, nekemte, Ethiopia

INTRODUCTION

Bovine Cysticercosis is an infection of cattle with metacestodes of the human tapeworm, *Taenia saginata* (Ogunremi *et al.*, 2004) which is a cosmopolitan disease occurring in developed as well as developing countries (Cabaret *et al.*, 2002; Dorny *et al.*, 2009; Minozzo *et al.*, 2002). The prevalence of Bovine Cysticercosis is highly variable worldwide, ranging from 0.007-6.8% in Europe (Dorny *et al.*, 2009). In East African countries prevalence rate is often around 30-60% (Tembo, 2001) and remains a public health concern that reduces export earnings in many countries Edem and Usoh (2009). The prevalence of Bovine Cysticercosis in Ethiopia reported, so far, varies from relatively lower prevalence of 3.1% in the central part to 26.25% in the Southern part of the country (Abunna *et al.*, 2008; Hailu, 2005).

In Ethiopia, the habit of eating raw meat such as "kurt" or "kitfo" which are served in raw or undercooked are source of *T. saginata* infection in man. This tradition of eating raw beef represents a major risk factor contributing to the high prevalence (Mamo, 1988). The nation's domestic meat consumption of about 45% comes from cattle which generates an export income mainly from the sale of live animals (EARO, 2000). The public health and economic consequences of this parasite may be considerable due to downgrading and the condemnation of carcasses (Boone *et al.*, 2007). The World Health Organization included cysticercosis as part of the Neglected Zoonosis subgroup for its 2008-2015 strategic plans for the control of neglected tropical diseases (WHO., 2007).

The life cycle of the Bovine Cysticercosis involves human and cattle as final and intermediate hosts, respectively (Lees *et al.*, 2002). Pasture contamination is direct or indirectly caused by humans who eliminate proglottids with eggs in their feces, favoring the occurrence of such parasite (Abunna *et al.*, 2008; Asaava *et al.*, 2009). Transmission to animals occurs by the ingestion of food or water contaminated with the feces

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of infected humans (Geysen *et al.*, 2007). Ingested eggs in cattle develop in to cysticerci which can often be detected during meat inspection at routinely inspected localization sites of the parasite including heart, skeletal muscles and diaphragm (Gracey *et al.*, 1999).

For the control of infection of the Bovine Cysticercosis, besides personal hygiene beef should be subjected to effective inspection for cysticerci and should be eaten only after proper cooking (Abunna *et al.*, 2008). In the present study area, the hygienic conditions are poor and raw beef consumption is common which promote the transmission of cestode infections. According to, the study of Ahmed (1990), the prevalence of Bovine Cysticercosis in Nekemte abattoir was 21%. Therefore, the purpose of the present study was to indicate the current status of cysticercosis in slaughtered cattle at Nekemte Municipal Abattoir.

MATERIALS AND METHODS

Study area: The present study was conducted from November 2008-March 2009 at the Nekemte Municipal Abattoir. Nekemte town is located in East Wollega, Oromia Regional State, Western Ethiopia, at 330 km to the West of Addis Ababa. The area lies within an altitude of 1650-2,088 m above sea level. The mean annual rainfall of the area ranges from 1500-2200 mm and the average mean temperature is 15°C. The estimated livestock population of the area is 78,178 cattle, 9,894 sheep, 6,477 goats, 3,287 donkey, 1,598 horses and 665 mules, respectively (CSA, 2009).

Study population: The study populations consisted of local zebu cattle presented to Nekemte Municipal Abattoir from different local markets of surrounding district towns, mainly from Getama, Arjo Gudatu, Diga, Amuma, Bandira, Sasiga and Gutin marketing sites. The study animals were randomly selected and routinely inspected for Bovine Cysticercosis. Sex, age, breed and origin of each animal were recorded. Based on the appearance of ribs and dorsal spines for zebu cattle as per the description given by Nicholson and Butterworth (1986), animals were grouped into poor, medium and good body condition categories. The age of study animals was estimated by means of their dentition as described by Pasquini (2003) and conventionally categorized as young (≤3 years) and adult (>3 years).

Sample size and sampling methods: The sample size was determined based on the expected prevalence of 21% prevalence using the formula given by Thrusfield (2013) at 95% confidence interval and 5% absolute precision.

Accordingly, the required sample size was 254 animals. However, to increase the level of accuracy on determining the prevalence, 384 animals were sampled. Similarly, based on the formula given by Arsham (2002) (0.25/SE2SE = 5%), for questionnaire surveys, a total of 100 respondents were required to be sampled. However, a total of 125 individuals were selected randomly and interviewed using structured questioner.

Study design: A cross-sectional study was conducted from November 2008-March 2009, to determine the prevalence of Bovine Cysticercosis. Meat inspection was made in accordance with Solomon (1990) for the detection of *C. bovis*. Moreover, a cross-sectional study was conducted by a structured questionnaire survey to assess the prevalence of *T. saginata* and associated risk factors.

Postmortem examinations: Active abattoir survey was conducted during routine meat inspection on randomly selected 384 slaughtered animals. During ante-mortem examination, each study animal was given an identification number. Of the 384 *Bovine Carcasses* inspected, 333 were male and were 51 female animals with ages ranging from 3-8 years. Related risk factors such as sex, age and body condition scores were recorded before slaughtering. The age was categorized as young (≤ 3 years) and adults (>3 years). Based on the body condition, animals were grouped as poor, medium and good Nicholson and Butterworth (1986). However, animals with poor body condition were not slaughtered during the study period. After slaughtering, carcass incisions and inspection was done following the methods earlier described by Anosike (2001). Visual inspection followed by multi-incisions of 0.5 cm in each organ (heart, diaphragm, shoulder, tongue, liver, kidney, lung and masseter muscle) were made to examine the cysticerci.

From all positive samples, the cysts were carefully dissected and transported to the veterinary laboratory for viability test. The viability test of cysticerci were assessed by incubating the cysts in a normal saline solution containing 30% of bile at 37°C for 1-2 h to allow evagination of the scolex of the live cysts (Rodriguez-Hidalgo *et al.*, 2003). The cysts were regarded as viabl'e if the scolex evaginats after the incubation period.

Questionnaire survey: A semi structured was administered to 125 volunteer respondents. The interview was conducted personally by using a structured questionnaire. In the questionnaire survey, the potential risk factors of taeniasis such as presence usage of

sanitary, habit of raw meat consumption facilities, knowledge of *T. saginata* life cycle, age, sex, religion, occupation, educational levels and marital status were considered. Age of respondents was categorized as (<15, 15-30, >30 years). Similarly, religion, occupation status and education level of respondents were considered.

Data management: The data collected from abattoir and questionnaire were coded and stored in Microsoft Excel. Statistical analysis was done using SPSS Version 20. The outcome variables for the abattoir study were analyzed using STATA and associations between variables were tested using Chi square test (χ^2). The prevalence rate of Bovine Cysticercosis was calculated by dividing the number of animals harboring cysts by the total number of animals examined. Questionnaire survey data were also summarized using descriptive analysis and important factors were tested with logistic regression. Statistical significance was set at p<0.05.

RESULTS AND DISCUSSION

Post mortem findings: In total, 8 animals presented a varying number of *C. bovis* with an overall prevalence of 2.08%. The result showed that the prevalence of Bovine Cysticercosis did not varied statistically with age and body score (p>0.05) (Table 1). Shoulder muscles were the structure most common location for cysts (47.05%), followed by the tongue (26.47%), the masseter muscles (17.64 %) and heart 8.82% (Table 2). A total of 34 cysts were detected from animals positive for cysticercosis at inspection. Out of 34 cysts examined, 21(61.76%) were viable and (3)12.5% were found classified.

Questionnaire survey findings: Of 125 interviewed respondents 21 referred to be positive to taeniosis, representing a prevalence of (16.8%). In the positive population 95.2% (n = 20) refer to use modern drugs while 4.8% (n = 1) reported the use of traditional drugs for taeniosis treatment. The educational status, gender and age of respondents did not influenced the prevalence of the parasitosis (p>0.05). However, the prevalence of the disease was higher in Christians (19.4%) than in Muslims (9.1%) (p = 0.01).

In the present study an overall prevalence of Bovine Cysticercosis was found to be 2.08%. This finding is agreed with the previous researches of Dawit (2004) in Wolaita Soddo (2.59%) similar results were also reported by Getachew (2008) at Jimma in South-Western Ethiopia (2.9%); Tembo (2001) from Central Ethiopia (3.11 %) and Tolosa *et al.* (2009) in Jimma Municipal Abattoir 2.93%, respectively. On the other hand extremely higher

Table 1: Factors associated with the occurrence of Bovine Cysticercosis in carcass inspected at Nekemte Municipal Abattoir during 2008-2009

Risk factors	No. of animals	Positive	Prevalence (%)	(χ^2)	p-values
Age					
Adult	320	7	2.19	0.86	0.710
Young	64	1	1.56		
Body condition					
Medium	149	5	3.35	2.685	0.153
Fat	235	3	1.27		
Sex					
Male	333	7	2.10	1.049	0.720
Female	51	1	1.96		
Total	384	8	2.08		

Table 2: Location and viability of *C. bovis* in infested animals inspected at the Nekemte Municipal Abattoir during 2008-2009

Location of parasitic vesicles	Cysts		
	Total (%)	Viable (%)	Non-viable (%)
Shoulder	16(47.05)	10(62.5)	6(37.5)
Tongue	9(26.47)	8(88.8)	1(11.11)
Masseter	6(17.64)	2(33.33)	4(66.66)
Heart	3(8.82)	1(33.33)	2(66.66)
Overall	34(100)	21(61.76)	13(38.23)

prevalence of *C. bovis* were reported by Ahmed (1990) in Nekemt (21%), Hailu (2005) in East Shoa (17.5%), Kebede (2008) in North West Ethiopia (18.49%) and Abunna *et al.* (2008) in Awassa (26.25%). The differences in the reported prevalence might be because of the differences in the skills and motivation of meat inspectors or the personal and environmental hygiene. The lower prevalence in this study might be because of improvement in hygienic conditions and changes in feeding habits of population in the study area. According to, Pawlowski and Murrell (2001) and Opara *et al.* (2006), in experienced meat inspectors could most likely miss out quite number of viable cysticerci which blend with the pinkish-red color of them and be passed for human consumption (Table 3).

In current study, there was no significant difference in prevalence of cysticercosis between age groups of animals. This result concurs with earlier observation of Hailu (2005), Dawit (2004) and Tembo (2001). A possible explanation for such variation might be due to the fact that most of the animals slaughtered in the current abattoir were adult as extremely young and old animals are not usually slaughtered in the area. Even though slightly more males and animals with medium body condition scores were infected than females and fat animals, no statistical differences were found among these groups which could be explained by the fact that of the majority of animals brought to this abattoir had similar husbandry system and were equally exposed to the disease. The infection of more males than females, agree with the observations of Kebede (2008) and Opara *et al.* (2006).

Table 3: Potential risk factors for Taeniasis prevalence among the interviewed respondents in Nekemte Town during 2008-2009

Risk factors	No. of interviewed	No. of infected	Prevalence (%)	p-values	χ^2
Age					
<15 yeas	12	1	8.3	0.98	0.73
15-30 years	54	10	16.9		
>30 years	59	10	18.5		
Sex					
Male	71	15	21.1	0.138	2.20
Female	54	6	11.1		
Religion					
Christians	103	19	18.4	0.898	0.01
Muslims	22	2	9.1		
Educational level					
Educated	115	20	16.0	0.670	2.60
Uneducated	10	1	10.0		

According to, the current study, the most frequently affected organs were shoulder muscles, tongue, heart and masseter muscles. These preferred predilection sites for the *C. bovis* were comparable with earlier reports in Ethiopia (Abunna *et al.*, 2008; Kebede, 2008; Regassa *et al.*, 2009) and in Africa (Opara *et al.*, 2006; Pawlowski and Murrell (2001). Regarding the predilection sites of *C. bovis*, many workers come up with different results. Ahmed (1990) and Hailu (2005) reported tongue as being frequently affected by the cyst while Getachew (2008) have indicated the liver is the most affected organ. It appears that several factors such as activity of the muscles, age and the geographical area concerned determine largely the predilection sites in cattle (Opara *et al.*, 2006).

Of the total cysts collected, 21(6176%) were viable while the rest 38.23% non-viable. This result disagrees with the findings of Abunna *et al.* (2008) who reported 44.2% live and 65.8% dead cysts in Hawassa Abattoir, South Ethiopia. On the other hand, Nigatu recorded 85.6% viable and 14.4% degenerated or calcified cysts in North-West Ethiopia. However, viability test of the cysts revealed that it was the tongue which harbored the highest number of viable cysts (88.8%) followed by shoulder 62.5%, masseter 33.33% and heart 33.33% which is not in agreement with the report of Abunna *et al.* (2008) and Endris and Negussie (2011).

The disease caused by *T. saginata* infection is locally known as "kosso" and is mainly related to the cherished and honored tradition of eating raw meat in most parts of the country (Jembere, 2002). According to, the data gathered through the questionnaire, the prevalence of human taeniasis was 17.5% which reflects the importance of the disease in the area. Previous reports indicated that consumption of raw beef was strongly associated with *T. saginata* infection (Abunna *et al.*, 2008). In addition, the prevalence of taeniasis was slightly higher in adult (18.5%) and male (21.1%) than in young (16.9%) and female (11.1%) population but statistically not significant (p>0.05). The rest of respondents with the age <15 have rare chance to visit butchers because of financial constraints and cultural restriction.

The present study also revealed that, there was a significant association (p<0.005) between the prevalence of taeniasis and religion of respondents, indicating higher prevalence of infection in the Christian than in Muslim respondents. The possible reason this result may be, the sample size of questioner survey for Christians (103) was not comparable to that of Muslim (22) respondents. This finding is in agreement with findings of Hailu (2005), Dawit (2004), Abunna *et al.* (2008) and Regassa *et al.* (2009).

CONCULUSION

In conclusion, Bovine Cysticercosis is a communicable disease that has public health importance and significant effect on international trade of livestock and livestock products. In the present study, both the abattoir and the questionnaire surveys showed that the disease is important in the area in terms of its economic and public health implications.

RECOMMENDATIONS

The habit of eating raw meat, use of latrines and backyard slaughter are the main risk factors for Bovine Cysticercosis in the aeea. Therefore, to reduce the transmission of taeniasis/*Bovine Cysticercosis*, public education, appropriate use of latrines and improved standards of meat inspection are recommended.

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