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Bovine Cysticercosis: Prevalence, Cyst Viability and Distribution in Cattle Slaughtered at Kombolcha *Elfora* Meat Factory, Ethiopia

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Abstract: A cross-sectional study on bovine cysticercosis was conducted at Kombolcha *Elfora* meat factory from October 2009 to March 2010 with the objectives of determining the prevalence of *Taenia saginata* cysticercosis, cyst viability, distribution and its public health implication. A total of 420 carcasses were examined during the study period, of which 28(6.7%) were infected with *T. saginata* metacestodes. A total of 160 cysticerci were detected, of which 110 (68.7%) were live. The prevalence of infection varied significantly between age ($p < 0.05$), but no statistical significance difference between sex and origin of animals. On the other hand, the questionnaire survey indicated that *Taenia saginata* taeniasis was a public health problem in the town and its surrounding areas in which, 62 (31%) had contracted *T. saginata* infection at least once in their life time from the total of 200 interviewed individuals. From this, 62.8% (44 of 70) had habits of raw meat consumption. There was statistically significant ($p < 0.05$) difference between the prevalence of *taeniasis* between individuals which had habit of raw meat consumption and individuals consuming cooked meat. Therefore attention should be given for awareness creation for the people not to consume raw meat and to use toilets to decrease the contamination of grazing areas.

Key words: Bovine cysticercosis · Ethiopia · Kombolcha · Prevalence

INTRODUCTION

Bovine cysticercosis is caused by the larval stage of the beef tapeworm Taenia saginata. Humans are the final hosts of the parasite. Infection in man is acquired by ingestion of raw or undercooked beef containing the larval cysts, Cysticercus bovis, while cattle become infected by ingesting tapeworm eggs passed with human faeces [1]. The life cycle and transmission of *T. saginata* occurs most commonly in environments characterized by poor sanitation, poor livestock husbandry practices and inadequate meat inspection and control. Poor sanitation, traditional livestock husbandry practices, inadequate meat inspection and management and control policies favors transmissions of the parasite [2].

Bovine cysticercosis is the disease that remains a major public health problem in lower income and some industrialized countries [3]; however, the prevalence is low in developed countries [4]. It is quite common in Africa; prevalence level of 40% was reported [5]. It is however well known that studies regarding *C. bovis* in Ethiopia are very much limited in large cities. Therefore, this study of *C. bovis* was carried out with the objectives of determining the prevalence, to assess risk factors and public health implications associated with *C. bovis* in Kombolcha *Elfora* meat factory.

MATERIALS AND METHODS

Study Area and Study Animals: The study was conducted at Kombolcha *Elfora* meat factory which is located 375 kms northeast of Addis Ababa at an altitude of 1500-1840m above sea level. The average annual temperature, rainfall and humidity are 19.75°C, 1045mm and 60%, respectively. The study animals were cattle (both male and female) originated from different districts; Dessie zuria, Kombolcha, Batti, Raya and Kemissie and slaughtered at Kombolcha *Elfora* meat factory.

Study Design and Sample Size: A cross-sectional study was conducted from November 2009 to March 2010 on cattle slaughtered at Kombolcha *Elfora* meat factory for the purpose of determining the prevalence of *Taenia saginata* cysticercosis, cyst viability, distribution and its

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public health implication. Studied animals were selected by simple random method using the number given for both ante-mortem and postmortem eaxmination. The samples size was determined according to Thrusfield [6] for simple random sampling using 50% expected prevalence at 95% absolute precision. Accordingly, 384 cattle were calculated, but to increase the accuracy of prevalence 420 cattle were sampled and examined. Following selection of animals, before slaughter, their origin, sex and age were recorded. Age was determined based on dentition pattern and the age was categorized in to adult (<5 years) and old (≥ 5 years).

The diaphragm, triceps, masseter muscle, heart muscle, liver and tongue of 420 slaughtered cattle were examined for the presence of *C. bovis*. Carcasses of these animals were thoroughly inspected after making incisions using the methods described by Okafor [7] and Anosike [8]. As soon as metacestode was detected it was removed with surrounding tissue for test of viability by further laboratory examination. Then the metacestodes were dissected out and transferred to Kombolcha Regional Veterinary Laboratory after mixing with 90ml saline plus 10 ml bovine bile and incubated at 37°C for 1 to 2 hours to allow evagination of the scolex when it was live [9]. After incubation, the scolex pressed between two glass slides and examined under the microscope for evagination of the scolex. When the scolex observed evaginated, it was recorded viable [8].

Questionnaire survey was administered to 200 individuals to assess the public health implication of *Taenia saginata* around Kombolcha.

Data Analysis: Descriptive statistics was used to analyze the data using SPSS versions 16. Measure association were done using Chi-square (χ^2) test at 95% confidence level and odds ratio (OR) was calculated to measure the strength of association. Tests were considered significant at $p \leq 0.05$.

RESULTS

Of the total 420 inspected animals, 28 (6.7%) were positive for *C. bovis*. There was no statistically significant difference ($p > 0.05$) in the prevalence of *C. bovis* between male and female cattle. The highest prevalence (9.2%) was observed on cattle from Kemissie and the lowest (6%) was recorded from Raya. However, no significant difference ($p<0.05$) was observed among different origin of cattle (Table 1).

Highest numbers of cysts were found on triceps muscle (41.9%), followed by heart (20.6%), tongue (16.9%), massetor (14.4%), liver (3.7%) and diaphragm (2.5%). The highest number of viable cysts was found in triceps (32.5%) and the lowest in diaphragm (1.3%).There was significant difference in the viability of cysts among different sites of detection (Table 2).

Table 1: Prevalence of bovine cysticercosis on the basis of age, sex and origin

	No. of examined animals	No. of infected animals	Prevalence (%)	χ^2	p-value
Age					
Old	337	17	5.0		
Adult	83	11	13.3	7.212	0.007
Total	420	28	6.7		
Sex					
Male	296	19	6.4		
Female	124	9	7.5	0.099	0.753
Total	420	28	6.7		
Origin					
Kemissie	65	6	9.2		
Kombolcha	45	3	6.7		
Batti	62	4	6.5	0.851	0.931
Dessie zuria	80	5	6.3		
Ray	168	10	6.0		
Total	420	28	6.7		

Table 2: Number of dead and live *C. bovis* cysts in different organs of infested animals

Infested organs	No. of live /viable/ cysts (%)	No. of dead cysts (%)	Total (%)
Triceps	52 (32.5)	15 (9.4)	67 (41.9)
Heat	20 (12.5)	13 (8.1)	33 (20.6)
Tongue	18 (11.3)	9 (5.6)	27 (16.9)
Massetor	15 (9.4)	8 (5)	23 (14.4)
Liver	3 (1.9)	3 (1.9)	6 (3.7)
Diaphragm	2 (1.3)	2(1.9)	4 (2.5)
Total	110 (68.7)	50 (31.2)	160 (100)

Table 3: Prevalence of *T. saginata* in human population of Kombolcha town

Variable	No. of interviewed	No. of infected	(%)	χ^2	p-value
Sex					
Male	107	38	61.1		
Female	93	24	38.7	2.19	0.139
Total	200	62	31.0		
Habit					
Cooked meat consumption	130	18	13.8		
Raw meat consumption	70	44	62.8	51.1	0.000
Total	200	62	31		

Of the total 200 interviewed respondents, 62 (31%) had contracted *T. saginata* infection at least once in their life time. Of these individuals, 71% (44 of 62) had habits of raw meat consumption. There was statistically significant ($p < 0.05$) difference between the prevalence of *taeniasis* between individuals which had habit of raw meat consumption and individuals consuming cooked meat. The prevalence of taneiasis was higher in male individuals than females but there was no statistically significant difference ($P > 0.05$) between the prevalences in the two sex groups. The prevalence of taeniasis between sex and habit of raw meat consumption is presented (Table 3).

DISCUSSION

Bovine cysticercosis was detected from 6.7% of cattle slaughtered at Kombolcha *Elfora* meat factory. The result is in agreement with previous studies of Getachew [10] and Nigatu [11] who reported *C. bovis* with prevalence of 6.01% from Mekelle and 7.5% at Addis Ababa, respectively; but higher than report of Tembo [12] who reported prevalence of 3.11% in central Ethiopia. However, Ahmed [13], Hailu [14] and Abunna *et al.* [15] reported extremely higher level of *C. bovis* with prevalence of 21% in Nekemt, 17.5% in East Shoa and 26.3% in Awassa, respectively. The difference in prevalence of bovine cysticercosis might be associated with sample size, difference in the method of detection especially the number of incisions made on the skeletal muscles, or due to difference in prevalence of *C. bovis* in the different study areas.

The prevalence of *C. bovis* was higher (13.3%) in adults compared to the prevalence in old age groups (5%) and there was statistically significant difference between the prevalence. This significant variation in prevalence of *C. bovis* might be due to age dependant immunity. The re-stimulation of animals' immunity following continuous invasion of onchospheres, would explain the development of a strong immunity which do not allow further development of more cysticerci from invading onchospheres, but spared viable cysticerci from the initial infestation [16].

Highest numbers of cysts were found on triceps muscle (41.9%), followed by heart (20.6%), tongue (16.9%), massetor (14.4%), liver (3.7%) and diaphragm (2.5%). This finding is in agreement with the report of Gracey and Collins [17] and Abunna *et al.* [18]. This might be due to blood kinetics and animals' activities. Any factor affecting the blood kinetics in the animal affects the distribution of onchospheres [16]. Most of these organs except the heart, are consumed raw or under cooked and could be a potential public health hazard in contracting taeniasis [17].

Higher level of *T. saginata* infection was found in adult male individuals than female individuals. The result in this study was in agreement with the report of Dawit [19] and Hailu (2005) [14]. Similarly, Abunna *et al.* [15] reported more infection of Taneiasis in adult male than female.

In conclusion, bovine cysticercosis, the larvae of *T. saginata* is a potential public health hazard in the study area. Therefore, strengthing the meat inspection in the abattoir and avoiding of backyard slaughter should be practiced in the study area. People consuming raw meat should be informed about the risk of bovine cysticercosis.

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