



## Public health implications of bovine Cysticercosis from cattle slaughtered at Dilla municipal abattoir, Southern Ethiopia

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Active abattoir survey;  
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 Dilla town;  
 Taeniasis;  
 Questionnaire survey

### ABSTRACT

A cross sectional study was conducted during November 2013 to June 2014 to estimate the prevalence of Cysticercosis from abattoir survey and Taeniasis within the society found in and around Dilla town. Active abattoir survey and questionnaire survey were performed to accomplish the study. Of the total of 400 inspected cattle carcasses, 17 had varying number of *C. bovis* giving an overall prevalence of 4.25% (17/400). Anatomical distribution of the cyst showed that highest proportions of *C. bovis* cyst were observed in shoulder muscle and tongue (29.41%), followed by, masseter muscle (23.53%), heart (11.76%) and liver (5.88%). Of the total 69 interviewed respondents, 57.79% (40/69) had contracted *T.saginata* infection. The majority of the respondent had an experience of raw meat consumption (65.29%, 45/69) as a result of traditional and cultural practice. From those raw meat consumers, 62.2% (28/45) were experienced taeniasis. However, no significant association was observed between raw meat consumption and taeniasis ( $p < 0.05$ ). The findings of this study including prevalence of *C. bovis* and questionnaire survey of taeniasis prevalence indicated the importance of Cysticercosis and Taeniasis in public health aspects. Therefore, due attention should be given to the public awareness and strict routine meat inspection in order to safe guard the public health.

### Research article

### INTRODUCTION

Bovine cysticercosis is a cystic stage of *Taenia saginata*, zoonotic parasite with its significant impact on human health. The cystic stage usually affects the muscle of cattle where humans are susceptible from the contaminated raw meat (Taylor et al., 2007). *Taenia* infection in human is referred to as Taeniasis and the one caused by the larval stage is referred to be cysticercosis (Hancock et al., 1989). Bovine cysticercosis, caused by the metacestodes of *T. saginata*, is distributed worldwide occurring in developed as well as developing countries (Dorny et al., 2009). However, the prevalence of

this parasite is considered to be higher in developing countries. This phenomenon is related to poor sanitation, traditional cattle husbandry systems and inadequate meat inspection facilities (Cabaret et al., 2002; Dorny and Praet, 2007). The life cycle and transmission of parasite occurs most commonly in environments characterized by poor sanitation, primitive livestock husbandry practices and inadequate meat inspection, management and control policies (Mann, 1983; Phiri et al., 2003). Humans are the obligate final host and become infected by ingesting infected meat that has been inadequately cooked or frozen (Scandrett et al., 2009). Most incidents arise in cattle as a result of direct exposure to proglottids shed

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from humans, but there have been some reports of large scale outbreaks resulting from sewage-contaminated feed or forage. Even in developed countries where high standard of abattoir meat inspection that identify measly from beef carcass, did not succeeded in eliminating this parasites (Frolova, 1982; Smith, 1994).

Generally cysticercosis in animals is expected to have insignificant clinical effect. Nevertheless, it is economically important as it causes carcass condemnation arising from heavy infestation with the cysticerci of *T. saginata*. Additionally, there is cost related to inspecting meat, the necessity to freeze or boil infected meat and losses may also occur from restriction in exportation of live animal and their products (Soulsby, 1982). Cysticercosis was significantly more prevalent in between man and animal and the use of causal workers in feedlots may be factors that are conducive to *Taenia saginata* transmission (Dorny et al., 2002). In previous studies, taeniasis or bovine cysticercosis is an important meat-borne zoonosis with the impact on the safety of food presented for human consumption in different parts of the country. The reported prevalence of taeniasis in the human population has been found to range from 31.0% to 89.4% in Ethiopia (Tembo, 2001; Abunna et al., 2008; Megersa et al., 2010; Bedu et al., 2011; Endris and Negussie, 2011). In Ethiopia, the prevalence of bovine cysticercosis ranges from 3.1 % in the central part to 26.25% in the southern part of the country (Tembo, 2001; Dawit, 2004; Nigatu, 2004; Hailu, 2005; Abunna et al., 2008). High prevalence of cysticercosis is related to the tradition of eating raw beef which is considered one of a major risk factor for its transmission (Mamo, 1988). However, there is limitation in terms of countrywide study on prevalence of bovine

cysticercosis. Although there were some research works carried out with associated factors, there is still little information regarding the recent status of bovine cysticercosis and the prevalence of *T. saginata* in humans in areas like Dilla and its surroundings. Therefore, the objective of this study was to estimate the prevalence of cysticercosis in animals and taeniasis in human.

## MATERIALS AND METHODS

### Description of the Study Area

Dilla town is currently functioning as an administrative center of the Gedeo Zone in the Southern Nations Nationalities and Peoples Region (SNNPR) in Ethiopia Geographically, Dilla town is located on 6°24'30"N Longitude and 38°18'30"E Latitude with an average elevation of 1570 meters above sea level. Comparatively, the town is located 90 Kms from Hawassa, the capital of SNNPR and 359 Kms on the main road from Addis Ababa to Nairobi. Dilla is one of the main market centers in Southern Ethiopia and it is one of the fastest growing urban centers in the country. Based on the 2007 population and housing survey of Ethiopia, the population of Dilla town was estimated to be about 59,150. Livestock population of the town was estimated to be 12,475. The town is covering a total land area of about 1123.4 hectare. The mean atmospheric temperature of the town varies from 20°C in summer to 28°C in winter and the average rain fall is 1257.2mm (CSA, 2008).

### Study Animals

Animals which were presented to Dilla municipal abattoir mainly come from Dilla and

the surrounding area (Wonago, Kura, Bore, Sonkicha, Tunticha and Kibre Mengist). Local zebu cattle and cross breed presented to abattoir for slaughter were used as a study population for active abattoir survey.

### Study Type and Sample size

A cross-sectional study was carried out from November 2013 to June 2014. By following a systematic random sampling method, a total of 400 cattle were randomly sampled and routinely inspected for the presence of *T. saginata* metacestodes in edible parts of the slaughtered cattle. The total number of cattle required for the study was calculated based on the formula given by Thrusfield (2005) for a simple random sampling method. By rule of thumb where there is no information for an area it is possible to take 50% of expected prevalence. Using 5% degree of absolute precision, 384 animals need to be sampled but, 400 animals were sampled.

### Study Methodology

**Active Abattoir Survey:** Active abattoir survey was conducted during routine meat inspection on systematically selected 400 cattle slaughtered at the abattoir. Ante-mortem and post-mortem examinations were conducted by visiting the abattoir three days a week. During ante-mortem examination, each study animal was given an identification number and its sex, age and origin was recorded. This is to avoid the unnecessary mixing with organs during inspection. Age estimation was done based on owner information and dentition. During inspection, each predilection sites were inspected according

to the guideline of Ministry of Agriculture (1972).

**Questionnaire Survey:** A semi-structured questionnaire was administered to 69 volunteer respondents from Dilla city. In the questionnaire survey, usage of toilet, and raw meat consumption habit were addressed.

### Data Management and Analysis

Abattoir data was collected and recorded and the data was carefully entered into Microsoft excel. The outcome variable for the abattoir study were cases *Cysticercus bovis* detected during routine post mortem inspection at Dilla municipal abattoir. Logistic regression was employed to analyze the association of the occurrence with the potential risk factors like sex, origin, breed, age, and body score condition using STATA statistical software version 11. Multivariate analysis for the risk factors of active abattoir and questionnaire survey during study period was used in which the degree of associations among risk factors was indicated with Odds ratio.

## RESULTS

### Abattoir Survey

**Prevalence:** Of the total 400 cattle inspected; 17 cattle were positive for bovine cysticercosis with the prevalence of 4.25. Among different risk factors, the proportion of *Cysticercus bovis* was higher in cross-bred (4.34%), medium BCS (4.33%), >9 years old (6.93%), female (9.43%) cattle originated from Kibre-Mengist (13.3%) places (Table 1).

**Table-1: Proportions of cysts occurrence in inspected organs and carcass at Dilla municipal abattoir during the study period(n=400)**

Variable		Examined animals	Positive animals	Proportions
<b>Breed</b>	Local	377	16	4.24
	Cross	23	1	4.34
<b>BCS</b>	Medium	346	15	4.33
	Good	54	2	3.70
<b>Age</b>	3 - 5 year	89	2	2.25
	5 - 9 year	210	8	3.81
	>9 year	54	7	6.93
<b>Sex</b>	Male	347	12	3.46
	Female	53	5	9.43
<b>Origin</b>	Wonago	306	11	3.59
	Dilla	23	0	0
	Kura	4	0	0
	Sonkicha	18	1	5.56
	K.meng.	15	2	13.3
	Bore	16	2	12..5
	Tunticha	18	1	5.56

**Anatomical Distribution of Cysts:** Analysis of active abattoir survey showed that there was a variation in the infected anatomical distribution of cysticerci in organs inspected. Of the organs

examined, the highest proportion of *C. bovis* cysts were observed in the tongue (29.41%) and shoulder muscle (29.41%) followed by masseter muscles (23.53%), heart (11.76%) and liver (5.88%) (Table 2).

**Table-2: Frequency of anatomical distribution of *C.bovis* (n=400)**

Organs affected	Total number of affected organs	Prevalence	Proportion within organs
<b>Tongue</b>	5	1.25	29.41
<b>Shoulder muscle</b>	5	1.25	29.41
<b>Masseter muscle</b>	4	1	23.53
<b>Heart</b>	2	0.5	11.76
<b>Liver</b>	1	0.25	5.88
<b>Total</b>	<b>17</b>	<b>4.25</b>	<b>100</b>

**Questionnaire survey:** Of the total 69 interviewed respondents who participated in this study, 57.97% (40/69) had contracted *T. saginata* infection. Proportion among different factors of respondents were analyzed and showed higher proportion in male (39.13%), >34 years (36.23%), and in those who consume

raw meat (40.6%). Further analysis showed no significant difference between most of the risk factors (sex, age, meat consumption habit, residence and toilet usage) ( $P>0.05$ ). However, respondents with college level showed less proportion (5.8%) compared to illiterate (15.94%) with a slight significance difference ( $p<0.05$ ) (Table 3).

**Table 3- Proportion of Taeniasis among the interviewed respondents in Dilla city, Southern Ethiopia (n=69)**

Variables		No of interview (Infected)	Proportion	Odds Ratio (95% CI)	P-value
<b>Sex</b>	Female	25 (13)	52	1	
	Male	44 (27)	61.36	1.5 (0.46, 5.1)	0.485
<b>Age</b>	16 - 25	16 (7)	43.75	1	
	25 - 34	14 (8)	57.14	2.1 (0.35, 13.1)	0.409
	>34	39 (25)	64.10	2.9 (0.51, 16.52)	0.228
<b>Education level</b>	Illiterate	18 (11)	61.11	1	
	Primary	21 (14)	66.70	1.1 (0.21, 5.33)	0.939
	Secondary	18 (11)	61.11	2 (0.27, 15.16)	0.488
	College	12 (4)	33.33	10.47	0.052
<b>Consumption habit</b>	Cooked	24 (12)	50	1	
	Raw	45 (28)	62.20	1.5 (0.49, 4.64)	0.473
<b>Residence</b>	Rural	30 (17)	56.70	1	
	Urban	39 (23)	58.97	4.1 (0.7, 24.24)	0.117
<b>Toilet usage</b>	No	3 (2)	66.67	1	
	Yes	66 (38)	57.58	1.03 (0.07, 14.36)	0.983
<b>Total</b>		<b>69 (40)</b>	<b>57.97</b>		

## DISCUSSION

The prevalence of *C. bovis* among the carcasses inspected at Dilla municipal abattoir was 4.25% which is in agreement with the findings of Tamirat et al. (2018) (4.2%) at Bahir Dar, Ibrahim and Zerihun (2012) (3.6%) at Addis Ababa abattoir, Taresa et al.(2011) (3.65%) at Jimma, Dawit (2004) (4.9%) at Gondar, Megersa et al. (2010) (4.4%) at Jimma and Bedu et al. (2011) (3%) at Zeway. However, higher prevalence of *C.bovis* were registered by Tegegne et al. (2018) (8.97%) in Kombolcha, Moje et al. (2014) (10.1%)at Shashamanne; Abunna et al. (2008) (26.25%) at Hawassa; Kebede et al. (2009) (7.5%) and Regassa et al. (2009) (11.3%) both at Wolaita Soddo abattoirs. The observed difference among these studies

could be explained with the agro-climatic conditions of the study areas, the number of incision made during inspection, the ability of the meat inspector to identify the *C.bovis*, habit or culture of raw meat consumption, sample size and sampling method, level of environmental contamination with the eggs of *T. saginata*, dose and viability of egg consumed (Scandrett et al., 2009). Low infection among the inspected animals in the present study area could be due to limited number of incisions made on the predilections sites. This may in turn lead to missing of infected animals as the sensitivity of detecting the parasite will decline with limited number of incisions (Wanzala et al., 2003). The presence and number of cysts in any given site varied greatly among animals and demonstrate the absence of any true predilection sites for *C. bovis* (Scandrett et al., 2009). The present study

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showed that tongue and shoulder muscle, Masseter, heart, and liver were the muscle, predilection sites for the cysts of *C. bovis* which is similar to the results of Megerssa et al. (2010).

Regarding the anatomical distribution of the cysts, many researchers come up with different results like Abunna et al.(2008) and Getachew (1990) reported triceps as being frequently affected by the cyst, while Mulugeta (1997) found as heart as a preferable organ. However, the present study showed that the most frequently affected organ with the highest number of cysts was the tongue which is in agreement with different studies conducted in different parts of the country (Hailu, 2005; Bedu et al., 2011).

Human taeniasis was a widespread health problem in the study area with the prevalence of 57.79% and agrees with the findings of others, 64.2% by Taylor et al.(2007), 51.1% by Regassa et al.(2008), 56.7% by Bedu et al. (2011). However, it was higher than the report from Kombolcha (31%) (Endris and Negussie, 2011). In the current study, significant association were detected between different level of educational level in which respondents with college education showed lower level of taeniasis compared to illiterate ( $p < 0.05$ ). However, the rest of respondents factor including raw meat consumption showed no significant association with taeniasis ( $p > 0.05$ ). This contradicted with different researches that got association between raw meat consumption with taeniasis (Abunna et al., 2008; Megersa et al., 2010; Bedu et al., 2011; Endris and Negussie, 2011).

## CONCLUSION & RECOMMENDATION

The recorded prevalence of bovine cysticercosis indicated the importance of this disease in the study area. The finding of this work demonstrates the importance of *Taenia saginata* (taeniasis) and *Cysticercus bovis* in human and animals respectively. The recorded prevalence of cysticercosis was found to be lower as compared to previous findings from different parts of the country. In the study area, the introduction of urban and rural health extension programs that taught the people intensively to use latrine might have a significant role for the reduction of *Cysticercus bovis* prevalence. According to selected respondents, higher proportion of respondents showed infection (taeniasis) at least once in their lifetime. In general, the findings of the present study reflects the circulation of cysticercosis and taeniasis in cattle and human, respectively which deserves serious attention by the various stakeholders in order to safe guard the public health. In this regard different intervention mechanisms like strict meat inspection procedures not to miss the cystic parasite and public education to create awareness on its transmission methods should be implemented.

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