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Prevalence and Public Health Implication of Bovine Cysticercosis in Hawassa Municipal Abattoir

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Abstract: A study was undertaken from November 2009 to February 2010 in cattle slaughtered at Hawassa municipal abattoir with the objective of estimating the prevalence and public health implication of *Taenia saginata cysticercosis*. Questionnaire survey and inventory of pharmaceutical drug shops were also used to determine human taeniasis and associated financial losses. Ante and post mortem examination of 421 cattle at the abattoir showed a prevalence of 17.33% (73) for cysticercosis. Of the total cysticerci collected, 56(41.17%) were found to be viable while 80(58.82%) were degenerated. The percentage of *Cysticercus bovis* cysts in different organs was observed as 37.5% in the shoulder muscle, 33.92% in the tongue, 17.85% in the heart and 10.71% in the masseter muscle, respectively. Results indicated that age, sex, breed, and origin of animals didn't have significant effect ($p>0.05$) on prevalence of cysticercosis. The prevalence of taeniasis among interviewed respondents of Hawassa town was, 59.37% (38 of 64). Result indicated that the age, sex and religion didn't have significant effect ($p>0.05$) on prevalence of the disease; however, a statistically significant difference was observed in the disease prevalence between raw and cooked meat eaters. For the years 2008 and 2009, a total worth of 184,406 ETB was estimated from a sell of 92,203 adult taenicidal drugs. The results of this study revealed that taeniasis was a wide spread public health problem in the study area which needs due attention to safeguard the public.

Key words: Abattoir · Cattle · Cysticercosis · Prevalence · Public Health · Taeniasis

INTRODUCTION

Bovine cysticercosis, parasitic zoonosis, is a muscular infection of cattle caused by the metacestode of the human intestinal *Taenia saginata* [1]. It has a worldwide distribution and is very common in Africa reaching a level of 30-36% in Kenya, 20% in Guinea,18% in Sierra Leone, 20% in Cameroon and 80% in Ethiopia [2]. Bovine cysticercosis has little effect on animal health, but it is economically important disease as it causes carcass condemnation arising from heavy infestation with the cyst cerci of *Taenia saginata* as well as the cost of inspecting meat, the necessity to freeze or boil infected meat and losses may also occur from restriction of exports of live animal and animal products. The presence of cyst cerci in muscles is not associated with clinical signs, however, the adult tape worm in man produce diarrhea, hunger pain, abdominal discomfort, pruritis ani, constipation and nausea [3]. Taeniasis, human infection with the adult tape worm, *T. saginata*, is observed both in rural and urban areas. 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 beef in most parts of the country. The infected person is usually parasitized by a single *T. saginata* tape worm [2, 4].

The life cycle of the parasite, *T. saginata*, involves humans as final host and cattle as intermediate host. Even if cysticerci exists in cattle musculature, some muscles are infected more than others; preferred predilection sites ranked statistically by decreasing importance are myocardium, tongue , masseter, shoulder muscle [5]. Lack of awareness about raw meat consumption, existence of higher population density, poor hygiene and sanitary facilities are some of the factors that facilitate the transmission.

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The prevalence and intensity of bovine cysticercosis in cattle depends mainly on infection pressure and degree of protective immunity before reaching the age of grazing [6]. Therefore, the present study was under taken with the objectives of determining prevalence of bovine cysticercosis and its public health implication in Hawassa municipal abattoir.

MATERIALS AND METHODS

Study Area: The study was conducted in Hawassa town at Hawassa municipality abattoir. Hawassa city is bounded by Lake Hawassa in the West, Hawassa zuria woreda in the South and East part and Oromia region in the North. The city is located 275 km South West of Addis Ababa and it is capital city of South Nations Nationalities and Peoples Regional State (SNNPRS) with a total area of 50 square km. Geographically it lies between 07° 05^0 latitude North and 38° 29° longitude East. The altitude of the city is 1680 meters above sea level and the climate is warm with mean annual temperature of 20.9°C and mean annual rainfall of 997.6mm.

Population: Population size of Hawassa city in 2006 is 123,322 out of which 62,885 are males and 60,437 are females. The livestock population of Hawassa (Sidama zone) is cattle 1,573,318, goat 183,464, sheep 221,505, horses 49,150, ass 48,653 and poultry 1,196,504 [7].

Study Animals: Cattle that were slaughtered in Hawassa municipality abattoir are animals studied from November 2009 to February 2010. The animals examined were selected randomly. Majority of cattle were expected to come from Arsi, Tula, Hawassa, Dimitu and its surrounding.

Study Type: A cross sectional study was conducted in which case active abattoir survey, questionnaire and drug shop inventory were used.

Sampling and Sample Size Determination: The total number of cattle required for the study was calculated based on the formula given by Thrusfield [8]. Using simple random sampling method taking 95% confidens interval. The expected prevalence of bovine cysticerosis in Hawassa is 26.25% [9]. Chi-square is statistical analysis used.

Substituting the values in the formula gives sample size of n=297, but 421 cattle were inspected, with the intention of maximizing the study animals or sample size.

Study Methodology

Active Abattoir Survey: The cross sectional study, which was based on the active abattoir survey, was conducted during detail meat inspection on randomly selected 421 cattle slaughtered at Hawassa municipality abattoir. Before inspection the animals were observed ante- mortem and the age, sex, breed, origin and tag number of each animal was recorded.

Meat inspection during post mortem examination time was made in accordance with the procedures of the Ethiopian Ministry of Agriculture Meat Inspection Regulations (1972) for the detection of *T. saginata* cysticercosis (Bovine cysticercosis). Visual inspection/assessment and palpation followed by multi incisions on each organ of predilection sites for *C. bovis* examination (Heart, masseter, tongue, shoulder, diaphragm, and oesophagus) were made to found the cysts of *T. saginata.*

All positive samples (Cysts) were transported to laboratory section of Hawassa University main campus for the confirmation of cyst viability. The cysts were incubated in 30% ox bile solution using normal saline solution for 1-2 hours. After this, the scolex of the cysts was examined. The cysts were regarded as viable if the evaginated scolex becomes invaginatedduring the incubation period and at the same time the scolex was ascertained/ checked whether it is *T. saginata* metacestode or other based on the size of cysticercus and absence of hooks on the rostellum of the evaginated cyst [10, 11].

Questionnaire Survey: Questionnaire Survey on the disease occurrence and risk factors were administered/ instituted on 64 volunteer respondents from whom pre-informed consents were obtained. The question was aimed to know the cherished (Appreciated) and honored tradition of eating raw beef, awareness about the risk of eating raw beef, age, religion and sex factors. The presence and usage of sanitary facilities like latrines/toilet, knowledge about *T. saginata* life cycle, specific questions regarding medical history related to traditional and modern taenicidal drugs, impacts of taeniasis and possible options were included to estimate the risk factors associated with taeniasis.

By doing these, risk factors associated with the occurrence of disease in human and public impact of the disease was assessed.

Inventory of Pharmaceutical Drug Shops: Hawassa town has different human drug stores. In this town drug inventory was conducted on 8 randomly selected

volunteer pharmaceutical shops out of drug shops existing in the town, to know the amount of drugs sold and cost of drugs they sold to human for the treatment of human taeniasis.

During drug inventory time, how patients come to the drug shop i.e. by prescriptions of physicians or by themselves were also assessed. Together with this, annual adult dose of taenicida*l* drug sold (Based on patient complaints and prescription) in 2008 and 2009 were gathered to know the socio economic impacts of Taeniasis in the study area.

Data Management and Analysis: Abattoir and questionnaire data were collected and recorded on specially designed forms on Microsoft Excel sheet. A statistical analysis was done by Ch-square test and a significance level is determined if the computed p-value is less than 0.05. Pharmaceutical inventory data were arranged and analyzed.

RESULTS

Abattoir Survey Data

Prevalence: Among 421 cattle inspected in Hawassa municipality abattoir *T. saginata* cysticercosis was prevalent in 17.33% (73 of 421) (Table-1).

Risk Factors for Prevalence of Bovine Cysticercosis: Prevalence of bovine cysticercosis in the study area is associated with different risk factors which facilitate the occurrence of this parasitic disease. Among these factors are breed, origin of animals, sex and age factors are the observed ones. Between these was no significant difference ($p>0.05$) showing prevalence did not show statistical variation.

Anatomical Distribution of Cysts: Active abattoir survey data showed that there was variation in the anatomical distribution of cysticercus in organs inspected. As cited in the Table-2 of the organs examined, the highest proportions of *C. bovis* cysts were observed in tongues, followed by shoulder, heart and masseter.

Viability of Cyst: From the total of 136 *C. bovis* cysts collected from the abattoir during the study period 56(41.17%) were found to be viable (Live) while the other 80 (58.82%) were degenerative.

Questionnaire Survey: Identification of respondents for questionnaire survey was based On random selection of volunteers from Hawassa town. All individuals surveyed were aware of *T. saginata* taeniasis and the respondents who were questioned in this study disclosed finding proglottids in their faeces, and under wear, which indicate the presence of *T. saginata.*

However, the majority of them (85.93%) have not taken any measure to prevent themselves from being infected. This was mainly because of the great attitude of people towards the consumption of raw or under cooked beef and human infection by *T. saginata* is not generally considered to be threatening health problem in Ethiopia.

The prevalence study (Reports) of taeniasis among interviewed respondents of Hawassa town who was participated in this study, 59.37% (38 of 64) had contracted *T. saginata*. Of these individuals 93.75% took taenicidal drugs by themselves and the rest 6.25% took treatment with the prescription of the physicians.

Through personal communication with physicians it was noted that, because of the habit of eating raw meat (Kurt) dishes, taeniasis is one of the most important human parasitism encountered in the study area. This honored tradition of eating raw meat increased the demand (Need) of personals for the taenicidal drugs which is reported by pharmacists from the interview instituted.

Table 1: Risk factors associated with the occurrence of *C. bovis*

Risk factors	Total number	Number positive	Prevalence (%)	P-value
Age				..869
< 3 years	51	10	19.6	
3-5 Years	121	20	16.52	
>5years	249	43	17.26	
Sex				.929
Male	397	69	17.38	
Female	24	4	16.66	
Origin				.071
Arsi	79	19	24.05	
Tulla	119	20	16.80	
Hawassa	161	26	16.14	
Borana	62	8	12.9	
Breed				.058
Local	373	60	16.08	
Cross breed	48	13	27.08	

Table 2: Viability and anatomical distribution of cysts among inspected organs

Organs inspected	No	Total cysts	Viable cyst (%)
Shoulder	421	51	21(37.5)
Masseter	421	15	6(10.71)
Tongue	421	54	19(33.92)
Liver	421	0	0
Heart	421	16	10 (17.85)
Lung	421	0	0
Total		136	56(41.17)

Table 3: Potential risk factors of Taeniasis among respondents

Variables	No	Cases infected	Prevalence (%)	P-value
Age				.803
15-24	23	13	56.52	
24-34	26	15	57.69	
>34	15	10	66.67	
Sex				.38
Male	41	26	63.41	
Female	23	12	52.17	
Religion				.419
Christian	50	31	62	
Muslim	14	7	50	
Meat consumption				.001
Raw	55	37	67.27	
Cooked	9	1	11.11	

Table 4: Taenicidal drugs in inventory pharmacies in the year 2008 and 2009.

	Doses in			
Name of drug	2008	2009	Total	Cost (birr)
Praziquantel	10582	19258	29840	59680
Vermox	16201	13570	29771	59542
Niclosamide	17561	15031	32592	65184
Total	44344	47859	92203	184406

Association of Risk Factors with Prevalence of Taeniasis: Among the respondents interviewed the majority of them had an experience of raw meat consumption as a result of traditional and cultural practices. A statistical analysis showed that there was a highly significant variation between raw meat and cooked meat eaters ($p<0.01$).But no significance variation among age, sex and religion ($p>0.05$) (Table 3).

Inventory of Pharmaceutical Shop: Pharmaceutical drug shop inventory was conducted in Hawassa during the study period to estimate the economic impact of taeniasis. During inventory time information required was collected through personal interviews (Communication) with the pharmacists, their assistants and shop owners.

Estimates/amounts of drug and cost of drugs they sold (Yearly adult Taenicidal drug doses and its worth) for humans to treat adult stage of human metacestode were collected through interview from the years 2008 and 2009 revealed that a total of 92,203 adult taenicidal drug doses and a total worth of 184,406 Ethiopian birr (Table 4).

DISCUSSION

The prevalence of cysticercosis in Ethiopia varies widely. The present study shows the prevalence of *T. saginata* meta cestode among the carcass inspected, which is nearly similar to the findings of Ahmed [12] from Nekemt (21%), Getachew [13] from Debrezeit (13.8%) abattoirs and also to the reports of Over *et al.* [14] in Senagal 20% and in Tanzania 27%, Florova [15] 14-18.2% in Kenya. The prevalence is lower than the findings of Hailemariam [16] in different part of Ethiopia (30%) abattoirs and reports of Onyango –Abuje *et al.* [17] in Kenya (33.02%). Oppositely, lower prevalence than this was reported from developing countries such as 6.67% in Chad Florova [15] and 0.48 -1.08% in Germany [18]. Similarly, Hailu [19] reported comparable prevalence of (17.5%) from animals slaughtered in East Shoa.

In Ethiopia lower prevalence than the present study was reported by others. To mention some prevalences, 7.5% in Addis Ababa [20] 3.6% in Addis Ababa municipal abattoir [21] 9.7% [22] in Debrezeit and 4.9% from Gondar, Dawit [23].

Majority of these reports were based on surveys carried out on carcasses subjected to the routine meat inspection procedures. Variation of prevalence may be due to personal and environmental hygiene, variation in the method and quality of meat inspection, management of animals, experience and diligence of inspector and other factors contribute for the change of prevalence of *T. saginata* cysticercosis.

There was no significant change observed between age, sex, breed and origin of animals ($p>0.05$). For the present prevalence the above individual variables did not matter. The insignificance may be from need of increased sample size than the present study.

Regarding the anatomical distribution of the cyst tongue was the first organ affected. The organs affected in order of proportions of the cysts were tongue, shoulder, heart and masseter. However, viability test of the cysts revealed that it was the shoulder which harbored the highest number of viable cysts (37.5%), followed by tongue (33.92%) followed by heart (17.85%) and masseter (10.71%) when compared with other inspected organs. In all organs the findings were less than from the findings of Abunna *et al*. [9] which were tongue (50%), shoulder (49.5%), masseter muscles (49.2%) and the heart muscle (43%).

The variations in anatomical distribution of *T. saginata* Meta cestode in different pre- dilection site depend on a number of factors, such as animal's daily activity and blood kinetics. Any geographical and environmental factors affecting blood kinetics in the animal affect the distribution of oncospheres as well and hence, affect pre-dilection sites during meat inspection

Gracey *et al*. [24]. Also different researchers reported that the variation may be due to the strain differences with in *T. saginata* Jenberie [4].

More importantly, most of these organs, except diaphragm and lung are consumed raw or under cooked and could be a potential public health hazard in contracting taeniasis. For example, there is a habit of consuming raw or under cooked tongue and rumen fold preparation known as 'Milas senber' as well as raw liver, kidney or muscle consumption in Ethiopia Abunna *et al*. [9].

Questionnaire Survey: Human taeniasis was a wide spread health problem in the study area reaching the prevalence of 59.37%. The present results agrees with the findings of Hailu [19] (79.5%), Abunna *et al*. [9] and Dawit [22] (69.2%) (64.2%).

The prevalence of *T. saginata* varies among individuals depending on different factors, such as occupational back grounds (High risk and low risk groups) and awareness about the clinical picture of the disease. Finally, *T. saginata* is medically and economically important cestode parasite. Infection with *T. saginata* metacestode cause economic loss in beef industry, while as that of taeniasi*s* causes public health problem.

CONCLUSION AND RECOMMENDATIONS

The prevalence of *Cycticercus bovis* and taeniasis in the result of present study were indicated, importance of the disease in both economic and public health aspects. Eradication of infection requires co-operation between the Public Health and Veterinary authorities [24]. Condemnation of infected organs, down grading of carcass and hindering of export of animal and animal products were some of the causes of financial losses, which can be easily tackled by avoiding afore mentioned factors. Finally, the study reflects the zoonotic and economic impacts of *C. bovis* infestation that needs serious attention in order to keep public health. In line with findings of present study, the following points are recommended in order to mitigate the effects of the disease.

- Strict routine meat inspection of slaughtered animals should be carried out, so that, infected carcasses can be condemned accordingly and human infestation with *C. bovis* will be reduced.
- There should be prohibition(Ruling out) of backyard slaughtering system of animals through establishing and reinforcing of government intervention, construction of slaughter houses which full fill the basic facilities of an abattoir, such as chilling and freezing room to reduce condemnation of lightly infected carcasses.
- People have to be educated about the disease situation, to make public participation in breaking of continuous cycling of this parasite.

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