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Prevalence of Bovine Cysticercosis at Holeta Municipality Abattoir and Taenia Saginata at Holeta Town and its Surroundings, Central Ethiopia

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Abstract

A cross section study was conducted during November 2011 to March 2012 to determine the prevalence of Cysticercosis in animals, Taeniasis in human and estimate the worth of Taeniasis treatment in Holeta town. Active abattoir survey, questionnaire survey and inventories of pharmaceutical shops were performed. From the total of 400 inspected animals in Holeta municipality abattoir, 48 animals had varying number of C. bovis giving an overall prevalence 12% (48/400). Anatomical distribution of the cyst showed that highest proportions of C. bovis cyst were observed in tongue, followed by masseter, liver and shoulder heart muscles. Of the total of 190 C. bovis collected during the inspection, 89(46.84%) were found to be alive while other 101 (53.16%) were dead cysts. Of the total 70 interviewed respondents who participated in this study, 62.86% (44/70) had contract T. saginata Infection, of which, 85% cases reported using modern drug while the rest (15%) using traditional drug. The majority of the respondent had an experience of raw meat consumption as a result of traditional and cultural practice. Human Taeniasis prevalence showed significant difference ($p<0.05$) with age, occupational risks and habit of raw meat consumption. Accordingly individuals in the adult age groups, occupational high risk groups and habit of raw meat consumers had higher odds of acquiring Taeniasis than individuals in the younger age groups, occupational law risk groups and cooked meat consumers, respectively. In this analysis there was no statistically significant difference observed between sex, religion educational back grounds and marital status ($p>0.05$). An inventory of pharmaceutical shop (pharmacies, drug stores and rural drug vendors) revealed a total of 925,000 adult taeniacidal drug doses worthing a total of 3,006,250 ETB (Ethiopian birrs) during five years of 2006 and 2010. Vermox and Niclosamide were the most frequently sold drug for the treatment of Taeniasis, while praziquantel was the least sold drug. In conclusion, the study revealed high prevalence of T. saginata metacestodes throughout the edible organs together with existence of deep-rooted tradition of raw meat consumption. This may magnify the public health hazards of T. saginata in the study area. As a result, the disease deserves due attention to safeguard the public health and further promote beef industry in the country.

Keywords: Abattoir • Cysticercosis • Taeniasis • Cattle • Prevalence

Introduction

Bovine cysticercosis refers to the infection of cattle with metacestodes of the human tapeworm [1]. It is a major problem for producers in Sub Saharan Africa. The clinical effect of cysticercosis on infected animals in generally not significant, however, in addition to the effect on human health. Many cases of Taeniasis in man are asymptomatic, except for some anal pruritis due to emerging tape warm segments but with severe infection human beings may experience loss of weight, anorexia, abdominal discomfort, and digestive up-set [2]. Economic losses may be high due to the condemnation of heavily infected carcasses and the necessity to freeze or boil infected meat and losses may also occur from restriction of exports. T. saginata occurs in the small intestine of human and the metacestode (C. bovis) is found in cattle. Most incidents in cattle arise as a result of direct exposure to proglottids shed from farm workers, but there have been some reports of large scale outbreaks resulting from sewage-contaminated feed or forage [3].

In developed countries, even if the disease has a very low prevalence, the problem with the removal and treatment facilities in their sewage system plays a role in the distribution of eggs, since it was recorded that the egg can survive in sewage. There are 77 million human carriers of Taenia saginata out of which about 40% live in Africa. The prevalence of Taeniasis 64.2% reported by Abunna et al [4] and 51.1% by Regassa et al. [5] based on questionnaire survey revealed that it is a well-known disease in Ethiopia. On the other hand the prevalence of Cysticercosis was reported to be 26.25% in cattle slaughtered at Hawassa municipality abattoir [4] 13.3% in Wolita Sodo abattoir [5] and 4.4% in Jimma municipality abattoir [6]. Therefore, this research work was carried out in Holeta Municipal abattoir with the following objective to determine the prevalence of Cysticercus bovis in cattle slaughtered at Holeta municipal abattoir and to assess socio-economic implications of T. saginatas in Holeta town and its surroundings.

Materials and Methods

Study area

The study was conducted at Holeta Municipal abattoir which is found in Holeta town. The study was carried out from November 2011 to March 2012. Holeta is located at Finfine Surrounding Oromia special Zone, Welmera districts of Oromia. The town is located at about 44 KM west of Addis Ababa, the capital of Ethiopia, geographically located at latitude of 09° 03' 00"N

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and longitude of 38° 30'0 0" E. The altitude of the area is 2391 m.a.s.l and the annual mean temperature ranges between 11°C –22°C. Walmara district is bordered by Addis Ababa to the East; Ejere district to the West, Sululta district to the North and Sebeta Hawas district to the south and its weather condition is classified as 39% woinadega and 61% Dega. The area has a short rainy season from March to April and a long rainy season from June to September. There are numerous small and large-scale dairy farms embracing local, exotic and cross-breed. The livestock population of Walmara district is estimated at 188,221 cattle, 108,652 sheep, 15,420 goats 365,294 poultry, 8,062 horses, 1,406 donkeys, 229 mule and 1,853 traditional, 870 transitional beehives. Slaughter animals are coming to Holeta abattoir from different areas surrounding the town [7].

Study design and study animals

It is crosses sectional study in which active abattoir survey; qustionare drug shop inventories were conducted. The study population was cattle presented to the abattoir inspection. From animals presented to the abattoir, study animals were randomly selected.

Sample size determination

The sampled size for this study was estimated using the formula described by Thrusfield [8] with 50% prevalence was considered to calculate the sample size using the following formula.

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

Where:

n=Required Sample Size;

P exp=Expected prevalence;

D=Desired absolute precision;

Accordingly, the calculated sample size for estimating prevalence in purposive sampling was 384. However, in order to make a prevalence estimate more precise, the sample size was set to 400. Hence, a total of 400 animals were sampled for the study.

Study methodology

Active abattoir survey: A cross-sectional study was conducted on randomly selected animals slaughtered at Holeta municipality abattoir. A total of 400 cattle were randomly sampled and routinely inspected for the T. saginata cysticercosis. The sanitary infrastructure of the study areas is generally poor resulting in contamination of grazing fields by human excreta. The breeds of animals used in this particular study were the local and crossbred with the Holstein-Friesian. Each selected animal was given an identification number, and sex, age, breed and origin of each animal were recorded. During meat inspection, identified animals and their respective organs were strictly examined for the detection of T. saginata cysticercosis.

Visual inspection followed by multi-incisions of 0.5 cm in each organ was made to examine the cysts of T. saginata. Lesions consisting of cysticerci are 5–8 mm by 3–5 mm, translucid and filled with brownish fluid T. saginata metacestode samples were transported to the laboratory of Holeta health center and Veterinary clinic. The viability of cysts were ascertained by placing them in a normal solution with 30% Ox bile and incubated at 37-oC for 2 hrs. The cysts were regarded as viable if the scolex evaginats after the incubation period. Examination was performed microscopically for scolex whether it was T. saginata or other metacestode based on the size of cysticercus and absence of hooks on the rostellum of the evaginated cyst [9,2].

Questionnaire survey

A pretested questionnaire was administered to 170 randomly selected volunteer respondents from whom pre-informed consents were obtained. The interview was done by using a structured questionnaire. The potential risk factors of Taeniasis, were considered. Occupationally high-risk groups were those who had a strong relationship with meat, meat products and animals, such as abattoir workers, butcher men, meat inspectors, cookers and farmers; whereas the low-risk groups were arbitrarily selected as those who do not have as such a strong relationship with meat and meat products, such as students, teachers, other civil servants and private workers.

Inventory of pharmaceutical shops: In case of drug inventory, relevant information was gathered from volunteer pharmaceutical shops in Holeta town. Different human drug stores located in Holeta town were invented for the amount of drugs sold and their respective costs the treatment of human Taeniasis. Drug inventory was conducted on 8 randomly selected volunteer pharmaceutical shops out of the existing drug shops. In line with this, the annual adult doses of taeniacidal drug sales from 2005 to 2009 were gathered to be analyzed for the socio-economic significance of Taeniasis in the study area.

Data management and analysis

Abattoir, questionnaire and drug inventory data were recorded on specially designed forms and preliminary analysis was done in Microsoft Excel. The abattoir data were summarized and prevalence was calculated for the area. Anatomical distribution of C. bovis and cyst viability were tabulated. The questionnaire data were also summarized and analysed to assess the association of potential risk factors for Taeniasis among different respondents using logistic regression Stata version 9 Special Edition Pharmaceutical inventories data were summarized using frequency table.

Results

Abattoirs survey

From the 400 inspected animals in Holeta abattoir, 48 animals had varying number of C. bovis giving an overall prevalence 12%. There was no significant difference observed (P<0.05) in the prevalence of cysticercosis in relation to the risk factors, age, sex, body condition and breeds of the study animals. Open-vial stability of IMR reagents (Table 1).

Variables	No	Cases	Prevalence	P-value	OR (95%CI)
Age					
≤ 10years	65	12	18.46		1
>10years	335	36	10.75	0.086	.53(.26, 1.09)
Sex					
Male	357	43	12.04		1.22 (.44, 3.34)
Female	43	5	11.63	0.703	1
Body condition					
Poor	491	31	6.31	0.991	.99(.53, 1.89)
Good	139	37	26.62		1
Breed					
Exotic	32	7	21.88		1
Local	368	41	11.14	0.08	.44 (.178, 1.10)

Table 1. Logistic regression analysis of factors associated with the occurrence of bovine cysticercosis in organs inspected at the Holeta Municipal abattoir during the study period

Analysis of the active abattoir survey showed that there was a significant variation with regard to the anatomical distribution of cysticercus in the organs inspected. As indicated in Table 2, the highest proportions of C. bovis cyst were observed in tongue, followed by masseter muscle, liver, shoulder and heart. A total of 190 cysts were detected during the inspection. Of the total of 190 C. bovis collected during the study period 89(46.84%) were found to be a live while other 101(53.16%) were degenerative cyst (Table 2).

Organ	No	Positive organ	Prevalence (%)	Cyst number	Viable cyst (Proportion)
Tongue	400	45	11.25	57	36 (63.16)
Masseter	400	26	6.5	52	23 (44.23)
Liver	400	16	4	29	12 (41.38)
Lung	400	0		0	0
Heart	400	13	3.25	25	10 (40)
Shoulder	400	10	2.5	27	8 (29.63)
Total	2400	110	27.5	190	89 (46.84)

Table 2. Anatomical distribution and viability of cysts among inspected organs

Questioner survey

From the total 70 of interviewed respondents who participated in this study, 62.86% had contract T. saginata infection. The logistic regression analysis of the risk factors showed statistically significance difference in the prevalence of Taeniasis with age, occupational risks, marital status and habit of raw meat consumption (p<0.05) (Table 3). In this analysis there was no statistically significance difference between, religion and education status (P>0.05).

Variables	No	Cases	Prevalence	OR (95% CI)	P-value	Adjusted OR (95%CI)
Age						
≤ 15 y	5	2	40	1		1
16-30 y	40	19	47.5	1.4 (0.2-9.0)	0.641	5.8 (0.2-156.0)
>30 y	25	23	92	9.8 (1.0-99.9)	0.05	292.0 (.87-98576)
Sex						
Male	36	26	72.22	1		
Female	34	18	52.94	0.39 (0.14-1.13)	0.059	0.14 (.02-.91)
Religion						
Christian	48	35	59.52	1.5 (0.5-4.4)		1.8 (.30-10.8)
Muslim	22	12	54.54	1	0.272	1
Occupation						
Low Risk	51	26	50.98	1		1
High Risk	19	18	94.74	7.7 (0.9-66.0)	0.025	0.40 (.01-14.7)
Education						
Elementary	22	16	72.72	1		1
High School	36	23	63.89	0.8 (0.2-2.6)	0.653	0.99 (.10 – 9.3)
College	12	5	41.67	0.4 (0.1-1.8)	0.224	0.66 (.04-10.5)
Marital Status						
Single	48	25	52.08	1		1
Married	22	13	59.09	5.8 (1.3-16.4)	0.062	0.38 (1.1-18.8)
Meat consumption						
Less	14	2	14.29	1		1
Medium	40	21	52.2	3.9 (.07-36.3)	0.234	1.9 (.08-59.9)
High	16	14	87.5	21.2 (2.0-192.9)	0.004	19.4 (1.5-795.1

Table 3. Potential risk factors for Taeniasis prevalence among the interviewed respondents

Inventory of pharmaceutical shops

An inventory of pharmaceutical shops (pharmacies, drug stores and rural drug vendors) was conducted in Holeta town. Estimates of yearly adult taeniacidal drugs dose and its worth were collected through personal interview with individuals in charge of pharmacies and using their records for the year 2006 and 2010. This revealed a total of 472013 adult taeniacidal drug doses were sold for a total worth of 1,416,039 Eth. Birr (Table 4). Vermox and Niclosamide were the most frequently sold drug for the treatment of Taeniasis, while Praziquantel was least sold drug.

Drugs	2006	2007	2008	2009	2010	Total	Total Cost
Niclosamide	16267	16503	15382	16697	16131	80980	242940
Vermox	69502	66759	69736	68671	68717	343385	1030155
Praziquantel	9943	9797	9975	9753	8180	47648	142944
Total	95712	93059	95093	95121	93028	472013	1416039

Table 4. Annual taeniacidal drugs sold in different pharmaceutical shops at the study area

Discussion

Results of the present study demonstrated somewhat high proportion of Bovine cysticercosis/Taeniasis in the study area. Bovine cysticercosis usually does not cause much morbidity or mortality among cattle, but it does cause serious economic problems in the endemic areas due to the condemnation of meat or downgrading of carcasses in light infections contributing to constraint in food security and safety [10]. On the other hand, cysticercosis causes economic loss through condemnation of infected meat and offal. The economic losses as a result of the condemned and downgraded carcasses due to treatment or processing of carcasses for human consumption are substantial [11]. In East Africa, T. saginata cysticercosis has been reported as a widespread and extremely common [12].

The results of the present study also reflect both the economic and zoonotic importance of this disease, which is in agreement with the above statements. The prevalence of C. bovis among the carcasses inspected at Holeta abattoir was 12% higher than the findings of Dawit [13] (4.9%) at Gondor and Tembo (2001) (3.1%) in the central Ethiopia and it is less than the findings of other authors such as 26.3% by Abunna et al. [4] in Hawassa, 17.5% by Hailu [14] in East Shoa. However, it is in agreement with the findings of Getachew [15] at Debre Zeit (13.8%), Regassa et al [5] (13.3%) at Wolita. The majority of the findings in Ethiopia were based on surveys carried out on carcasses subjected to the routine meat inspection procedures. Hence, the same limitations with which meat inspection shares globally were reflected in this study. Accordingly, the lower prevalence of bovine cysticercosis in this study might be attributed to the variation in the personal and environmental hygiene, religion, culture and feeding habit of the population, breeds included and their production system.

Furthermore, low prevalence of the present finding could be partly due to practical limitations to the number of incisions allowed and many infestations could be undetected as already demonstrated by other authors [16]. As gross mutilation lowers the marketability of carcasses and introduce contamination, owners do not allow multi incisions for the detail investigation. It is also now recognized that local breeds are resistant to parasitic disease infections [2]

Regarding the anatomical distribution of the cysts, the organs affected in order of the proportion of the cysts were tongue, followed by masseter muscle, liver, shoulder and heart. The most frequently affected organ with the highest number of cysts was the tongue. Viability test of the cysts revealed that it was the tongue which harboured the highest number of viable cysts (63.16%) followed by masseter (44.23%), liver (41.38%), and heart (40%). The proportion of tongue affected with C. bovis was 63.16% which is higher than the reports of Abunna et al [4] (10.4%). However, the present finding is in agreement with the findings of Megersa et al [17] (40.43%). Generally, the method of meat inspection, the ability of the meat inspector to identify the cases, difference in the management, sample size and sampling method, the number of cuts, and other factors can contribute for the variation of prevalence of bovine cysticercosis.

Regarding to the questionnaire survey, of 170 respondents, 70% (119/170) had contracted Taeniais which illustrates the significance of Taeniasis in the population of Holeta town and agrees with the findings of others, 64.2% by Abunna et al. [18], 79.5% by Hailu [14] and 69.2% by Dawit [13]. The quality of questionnaire is an important tool in individual cases and in mass investigation for the detection of T. saginata in the carrier population [10]. The respondents who were questioned in this study disclosed finding proglottids in their faeces, underwear, and laboratory diagnosis at health institution which indicate the presence of T. saginata. This is based on the WHO [19] guidelines, which stated that T. saginata is known by its more frequent expulsion through anus than T. solium. The supporting evidence for the occurrence of T. saginata rather than T. solium among the respondents was that almost all of the residents of the town do not eat pork due to religious cult which confirms the current finding to be T. saginata, ruling out possible differential diagnosis of T. solium.

In the present study, human Taeniasis prevalence showed significant difference ($p<0.05$) with age, occupational risks and habit of raw meat consumption. Accordingly, individuals in the adult age groups, occupationally high risk individuals and persons who have the habit of raw meat consumption had higher odds of acquiring Taeniasis than individuals in the younger age groups, occupational law risk groups and cooked meat consumers, respectively. The possible suggestion for this could be that adult people had the habit of eating raw meat than the younger as younger are not allowed to consume raw meat and adult individuals have income and afford consuming raw meat "Kurti" which may be expensive for others. This study clearly indicated that occupationally high risk groups and individuals who have the habit of raw meat consumptions were found to be highly exposed to this disease and this finding is in agreement with the findings of Abunna et al. [4] In this analysis there was no statistically significant difference observed between sex, religion educational back grounds and marital status ($P>0.05$).

Human Taeniasis has importance both in socio economical and health aspects. However, evaluation of the economic aspects is very difficult particularly in developing countries like Ethiopia, where infected people treat themselves with traditional herbal drugs. One of the possible sources of information to evaluate the financial loss is to carry out inventories of pharmaceutical shops, which may not reflect the actual economic impact of the disease. However, inventories of pharmaceutical shops which comprise two years record 2006 and 2006 in Holeta town during the study period indicated that 472,013 adult taeniacidal drug doses were sold for a total worth of 1,416,039 Ethiopian Birr. This indicated that Taeniasis diminishes the household financial resources, which could be easily avoided by eating well-cooked meat and using toilets.

The prevalence of T. saginata varies from country to country and even differs within the same country from area to area depending on factors, such as variation in the habit of raw meat consumption, awareness of patients about the clinical pictures of the disease, variation in personal and environmental hygiene, and other factors related to the variation in the prevalence of Taeniasis among countries. In general, T. saginata is

a medically and economically important cestode parasite, while infection with the cysticercus larval stage in cattle causes economic loss in the meat industry. Therefore, there should be a public awareness about the health and economic significance of the disease by strengthening of training with special reference to the danger of raw or undercooked meat consumption and use of toilets/latrines.

Conclusion

The current study revealed Bovine cysticercosis/Taeniasis is an importance disease both in public health and economical aspects. The findings of this study indicated the disease results in economic loss due to condemnation of infected organs and down grading carcasses, and furthermore, incurring considerable cost of human treatment. Finally, the finding of the present study reflects the zoonotic and economic impact of the disease which needs serious attention by the various stakeholders in order to safe guard the public health.

Based on above findings, the following recommendations are suggested:

- There should be strict routine meat inspection of slaughter animals so that infected carcasses and organs can be condemned accordingly,
- Proper disposal of infected organs in order to break the life cycle of the parasite.
- Educate the public on general personal and environmental hygiene and means of disease transmission, so that all consumers avoid consumption of row meat and encouraged to use toilet for the control of human Taeniasis and cattle cysticercosis.

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