



Prevalence and Socio-Economic Importance of Major Bovine Metacestodes in Bedele Municipal Abattoir, Southwestern Ethiopia

Himiru Kano¹, Dereje Tulu^{2*}

¹West guji Zone Livestock Development and Fishery Office, P. O. Box: 81, Bule Hora, Ethiopia.

²Tepi Agricultural Research Center, P.O.Box:34. Tepi, Ethiopia.

*Corresponding author. E-mail: derejetulu5@gmail.com

Abstract- A cross sectional study was conducted to determine the prevalence and socio economic importance of the major metacestodes of the cattle from November, 2016 to April 2017 at Bedele municipality abattoir. Accordingly, of 550 selected slaughtered cattle, the prevalence of cysticercus bovis and Hydrated cyst was found to be 2 % (11/550) and 10.5% (58/550), respectively. Data analysis of statistical significance for the prevalence of hydatid cyst and cysticercus bovis indicates that there was no statistically significance different ($P>0.05$) observed among age and body condition scores. The anatomical distribution of these parasites includes various organs. Of the total 11 cysticercus bovis cysts collected, 4 (36.4%) of the heart and tongue of each and 3(27.3%) of muscles are positive organs. In addition, among the 58 hydatid cysts collected, 42(72.4%) of them were found in lung, 9(15.5%) of them are in liver, 3(5.2%) of in kidney and 4(6.9) of in the lung and liver. Analysis between educated ($P<0.02$) and raw meat consumption individuals ($P<0.00$) but the analysis is not significant for the latrine availability ($P>0.09$). During the inventory of pharmaceutical shops, it was noted that estimates of yearly adult taenicial drugs dose was 7554, with a total worth of 16,548.00 Eth. Birr. In conclusion, the finding of the present study revealed that the zoonotic and socio economic importance of diseases needs further attention.

Keywords: Abattoir, Cysticercosis, Cysticercus bovis, Hydatid cyst, Metacestodes, Bedele.



I. INTRODUCTION

Bovine cysticercosis refers to the infection of cattle with metacestodes of the human tapeworm [16]. As per an estimate, 50 million cases of such infestation occur worldwide with 50,000 people dying from this problem annually [32]. It causes significant economic impact in many parts of the world, particularly developing country by hindering the exports of animals and animal products. Financial losses can be considerable when large numbers of animals are affected. Most incidences arise from 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 [31]. Hence, bovine cysticercosis is an important public health and economic problems caused by its consequences on public health, nutritional and economy of some countries [30]. In developing countries, taeniasis or bovine cysticercosis constitutes a serious, but less recognized public health problem [14]. Taeniasis caused by *taenia saginata* is well known disease in Ethiopia with a prevalence ranging from 10% to 70% [13].

Bovine cysticercosis and taeniasis are common where hygienic conditions are poor and the inhabitants traditionally eat raw meat or insufficient cooked or sun cured meat [14]. Inadequate health education and low availability of taenicides are the major obstacles for the control of such infections [18]. Due to this reasons, taeniasis is more common in developing countries including Ethiopia where meat is an important component of human diet and traditionally it is consumed as raw in many occasions.

Cystic echinococcosis is an important problem for public health and the economy in many parts of the world. It is one of the most important zoonotic diseases and it is of great social importance [3]-[4] and [8]. Hydatidosis caused by the larval stage (metacestodes) of *Echinococcus granulose* is the most wide spread parasitic zoonosis. Dogs are the usual definitive hosts while large number of mammalian species can be intermediate hosts, including domesticating ungulates and man [6]-[22] and [28]. The cystic echinococcosis occur throughout the world and causes considerable economic losses and Public health problems in many countries [1]-[12] and [27]. Hydatidosis causes decreased livestock production and condemnation of offal containing hydatid



cysts in slaughter houses [2]-[6] *echinococcus granulosus* infection is endemic in East and south Africa, central and south America, South eastern and Central Europe, Middle East, Russia and China. The highest incidence is reported mainly from sheep and cattle rearing area [21].

The economic importance of echinococcosis in livestock is due to condemnation of edible carcasses and offal such as liver, lung and heart. In severe infection the parasite may cause retarded performance and growth, and reduce quality and yield of milk and meat. For example, in the Yugoslavia 10% reduction in milk yield and 5% carcass weight due to hydatidosis is described condemned organs even the whole carcass represent high financial loss in many countries [20]-[26] and [29].

Several reports from different part of Ethiopia indicated that hydatid cyst is prevalent in livestock [7]-[10] and [17]. In Ethiopia studies conducted in different abattoirs indicated that cystic hydatidosis is the prevalent and considerable economic loss is associated with it. Certain deep rooted traditional activities have been described as factors associated with the spread and high prevalence of the diseases in some areas of the country. These can include the wide spread the backyard slaughter of animals, the corresponding absence of rigorous meat inspection procedures, long standing habit of feeding domesticated dogs with condemned offal and the subsequent contamination of pasture and grazing fields. This can facilitate the maintenance of the life cycle of *echinococcus granulosus* which is the causative agent of cystic hydatidosis and consequently the high rate of infection of susceptible host [11].

Human echinococcosis is much more common in the rural areas of Ethiopia where dogs and domestic animals live in very close association [7]. Human behavior plays significant role in the epidemiology of echinococcosis and the dynamics of transmission differs between dogs and its normal intermediate host and human hosts. In Ethiopia, cattle are mainly raised under extensive husbandry practice by rural communities. Existence of higher population density, raw meat consumption, low awareness and poor hygiene and sanitary infrastructures may facilitate transmission of the between animals and human beings in the rural areas. At present, the most practical way of detecting metacestodes are by postmortem inspection of the exposed prediction



site. Although there were some research works carried out in certain part of the country, the status of metacestodes in livestock and economic and public health impact of these parasites were not so far studies in the study area. Therefore, this study was under taken to determine to prevalence and socio-economic importance of bovine cysticercosis and hydatidosis in bovines slaughtered in Bedelle municipal abattoir.

II. MATERIALS AND METHODS

Study area

The study was carried out at Bedele Municipal abattoir. Bedelle is located in southwestern Ethiopia in the Ilubabor zone of the Oromia Region. The town is located at the distance of about 483 Kilometers from Addis Ababa. It is situated at latitude of 8⁰ to 6⁰80” North and longitude of 36⁰ to 20⁰97” East and at elevation of 1400 to 2010 meters above sea level. Its temperature ranges from 12.50 C⁰ to 27.50 C⁰ and less than 1400mm annual rain fall. The farming system of the area is mixed type where crop production and livestock rearing are done on side by side. In the study area majority of the animals kept by rural farmers are cattle, sheep and goat, there also some donkeys and horses, but in the urban the diary and other farm activity is also done. The natural grass lands in the area (swampy area, forest margin, water logged lands, mountain sides and roads sides) are traditionally used as grazing fields for livestock. The main grazing land is separated from cultivated lands to reduce the possible chance of damage to crop by livestock. The area is marked by the presence of numerous mountains, rivers, streams and lakes.

Study population

The study population was comprised of cattle provided for slaughter from different localities in the Bedelle Municipal abattoir. These cattle were comprises of indigenous (local) breed of animals of different age, sex, body conditions and origin category found under the extensive grazing system.

Study design

A cross sectional and retrospective study were conducted to determine the prevalence and socio-economic significance of bovine metacestodes. Post mortem examination of cattle slaughtered at



Bedelle municipal abattoir from November, 2016 to April 2017 was conducted to determine the prevalence of metacestodes. In addition, retrospective data was collected from different human drug pharmacies were selected based on availability of data and on their voluntaries.

Sample size determination and sampling methods

The total number of cattle requires for the study were calculated based on the formula given by [25] using systemic random sampling method. Since there is no information for an area, 50% prevalence was used to determine the sample size. By using 95% confidence interval and 5% absolute precision the sample size was calculated, accordingly, the estimated sample size was 384 animals, however to increase the precision 550 cattle were included in the study. For the questionnaire survey, 51 volunteer individuals were randomly selected and interviewing considering different raw meat consumption, availability of latrine and level of education. Regarding the drug inventory, relevant information was gathered from volunteer pharmaceutical shops and clinics in Bedelle town.

Active abattoir survey

In this study animals were selected during ante mortem inspection (AMI) and the related risk factors such as age and body condition were recorded before slaughtering. After slaughtering each predilection sites (organs) of the recorded animals were also carefully followed and inspected for the metacestodes. All the encountered metacestodes were taken to Bedelle Regional Veterinary laboratory for the conformation of metacestodes viability. The metacestodes were incubated at 37⁰C for 1-2 hours and in 40% oxen bile solution diluted in normal saline. After this the scolex were examined under microscope by pressing between two glass slides. The cyst were regarded as viable if the scolex evaginate during the incubation period at the same time the scolex was checked whether it was *teania saginata* or other species based on the size of metacestodes and absence of hook on the rostellum of the evaginated cyst [15] for the hydatid cyst; cysts were grossly examined for any avoidance of degeneration and calcification; and then for its viability examined microscopically (40x) for the presence of protoscolexes which was assessed by the motility of the flame cells as well as staining with 0.1% solution of eosin [15] so that live protoscolexes did not take up the stain, unlike the dead one.



Questionnaire survey

Questionnaire survey on the disease occurrence and risk factor assessment was administered on 51 volunteer responds from which pre-informed consents were obtained. The risk factors of taeniasis such as educational level, availability of latrine, custom of raw meat consumption, information from the butchers and the like were recorded for *Cysticercus bovis* prevalence. In this study the less educated group includes those which attended high school, college and university level educations.

Inventory of Pharmaceutical shops

Different human drug stores located at Bedelle town were inventoried for the amount of drugs and the cost of drugs they sold for the treatment of human taeniasis. Drug inventory was conducted on 6 selected volunteer pharmaceutical shops and patient complaints during 2016 to 2017 were gathered to analyze the socio economic impacts of taeniasis in the area.

Data management and analysis

Data obtained from abattoir and questionnaire survey were recorded, and stored in Microsoft® Excel for Windows 2010 and transferred to Statistical Package for the Social Sciences (SPSS) version 20.0 (IBM SPSS, 2011). Associations between outcome and explanatory variables for all units of analysis were investigated by using Pearson's chi square (X^2). For all the analyses, confidence level (CL) is at 95% and $P \leq 0.05$ were set for significance.

III. RESULTS

During the study period, a total of 550 cattle from in and around Bedelle was inspected and examined after slaughter to determine the prevalence of bovine metacestodes including *Cysticercus bovis* and hydatid cyst. The prevalence of *Cysticercus bovis* and hydatid cyst were found to be 2.0% (11/550) and 10.5% (58/550), respectively. This result indicating that the prevalence of hydatid cyst is higher than *Cysticercus bovis* as shown in table 1.



Table 1. Prevalence of metacestodes

Metacestodes	Number of positives	Prevalence (%)
Cysticercus bovis	11	2.0
Hydatid cyst	58	10.5
Total	69	12.5

As it has been shown in table 2, the organs infected by cysticercus bovis were 4 (36.4%) hearts, 4 (36.4%) tongue and 3(27.2%) muscle. On the other hand, the total number of Hydatid cyst encountered in different organs were 42 (72.4%) of the lungs, 9(15.5%) of liver, 3(5.2%) of kidney and 4(6.9%) of lung and liver together.

Table 2. Organs infected by metacestodes

Type of Infection	Organs affected	Numbers of affected	Prevalence (%)	
			Actual	Relative
Cysticercus bovis	Heart	4	0.7	36.4
	Muscle	3	0.5	27.3
	Tongue	4	0.7	36.4
	Sub Total	11	2.0	100
Hydatidosis	Lung	42	7.6	72.4
	Liver	9	1.6	15.5
	Kidney	3	0.5	5.2
	Spleen	0	0.0	0.0
	Lung and liver	4	0.7	6.9
	Sub Total	58	10.4	100



During the study period, a total of 107 young and 443 old animals were sampled. The association between the prevalence of cysticercus bovis and hydatid cyst in cattle among two age groups has been examined. The occurrence of cysticercus bovis and hydatid cyst were 2(1.9%) and 9(2%), 11(10.3%) and 47(10.6%) in young and adults, respectively (table 3). However, there was no statistically significant difference ($P>0.05$) among the two age groups in the prevalence of cysticercus bovis and hydatid cyst.

Table 3. Occurrence of Metacestodes among different age groups

Age group	Total Number	Number of positive	Percentage (%)	X ² square Value (df)	P-value
Cysticercus Bovis					
Young	107	2	1.9	0.012(1)	0.914
Adult	443	9	2		
Hydatid Cyst					
Young	107	11	10.3	0.01(1)	0.921
Adult	443	47	10.6		

A total of 412 animals with good body condition and 138 medium body conditioned animals were examined during the study period. We have tried to examine the association between the prevalence of cysticercus bovis and hydatid cyst in cattle among the medium and good body condition groups. The occurrence of cysticercus bovis and hydatid cyst were 2(1.4%) and 9(2.2%) 15(10.9%) and 43(10.4%) in medium and good, respectively (Table 4). Accordingly, these was no statistically significant variation ($P>0.05$) in the prevalence of both cysticercus bovis and hydatid cyst in between the animals of different body conditions.



Table 4. Occurrence of metaceatodes among different body conditions

Age group	Total Number	Number of positive	Percentage (%)	X ² square Value (df)	P-value
Cysticercus Bovis					
Medium	138	2	1.4	(0.285)(1)	0.593
Good	412	9	2.2		
Hydatid Cyst					
Medium	138	15	10.9	(0.021)(1)	0.921
Good	412	43	10.4		

The analysis of the risk factors associated with occurrence of taeniasis showed statistically significant difference ($P < 0.05$) in between the occurrence of taeniasis and types of meat used as shown in table 5. Additionally, status education ($P < 0.05$) could also affect the occurrence of taeniasis. With this analysis there was no statistically significant difference ($P > 0.05$) in the prevalence of taeniasis between availability of latrine.

Table 5. Questionnaire survey analyzed for taeniasis

Factors	Number of Respondent	Positive	Chi-square	P-value
Education				
Informal and elementary	20	13	5.26	0.02
High school and University	31	10		
Latrine usage				
Yes	37	14	2.87	0.09
No	14	9		
Lating habit				
Roasted	31	5	20.00	0.00
No preference	8	6		
Semi or none roasted	16	12		



During the inventory of pharmaceutical shops, it was noted that the modern taenicidal drugs sold in those shops were produced in the country or imported from abroad. Estimates of yearly adult taenicidal drugs dose and its cost were collected through personal interviews with the pharmacists, their assistants or shops owner. From 2016-2017, a total record of 7554 adult taenicidal drugs dose and a total cost of 16,548.00 ETB (Table 6) were sold. The most common drugs sold during this period of time were albendazole nicolosamide, mebendazole and praziquentael.

Table 6. Inventory of annual prescribed adult taeniacidal drugs doses and their cost

Teaniacidal drug	2016		2017	
	Dose	Total Cost (ETB)	Dose	Total Cost (ETB)
Albendazole	1697	3394.00	1760	3520.00
Praziquentel	474	1422.00	486	1458.00
Mebendazole	439	1097.00	521	1302.00
Niclosamide	1114	2228.00	1063	2126.00
Total	3724	8141.00	3830	8406.00

IV. Discussion

In the present study, the prevalence of cysticercus bovis at the Bedelle municipality abattoir was 2.0 % (11/550) which is in agreement with the findings of [5] (4.9%) at Gondar and [24] (3.1%) in the Central Ethiopia. However, it was lower than the findings in East shoa (17.5%) by [9] and in Wolaita Soddo (11.3%) by [19]. This variation could be due to difference in vegetation, cattle management system and habit of feeding. As it is indicated by other



researches there is strong association between eating raw meat or semi-roasted dishes like kitifo and the occurrence of cysticercus in Ethiopia [23].

Inventory of pharmaceutical shops records in Bedelle town from 2016-2017 had shown 7554 adult based taenicial drugs doses with a total worth of 16,548.00 ETB had been sold. Inventory of pharmaceutical shops revealed that human taeniasis is an important diseases in the socio-economical and health aspects, despite the fact that the pathogenic significant of cysticercus bovis is considered to be very low [30] however, evaluation of economic aspects is very difficult particularly in developing countries like our country, where infected people treat themselves with the traditional drugs. One of the possible sources of information to evaluate the financial loss is to carryout inventory of pharmaceutical shops which still cannot reflect the actual economic impact of the diseases.

This clearly indicated that taeniasis diminishes the house hold financial resource, which could be easily avoided by eating well cocked meat or meat products and using latrine. The prevalence of *T. saginata* varies from country and even differs within the same country from area to area. This could be due to many factors, such as variation in the habit of raw meat consumption, awareness of patients about the clinical pictures of the diseases, variation in personal and environmental hygiene, and other factors related to the variation in the prevalence of taeniasis among countries. In conclusion, *T. saginata* is medically and economically important cestodes parasite, and infection with the cysticercus larval stage in cattle causes economic losses in there meat industry. Therefore there could be a public awareness about the health economic significance of the diseases by strengthening of training with special reference the danger of raw or under cooked meat consumption and use of toilet.

The prevalence of the hydatid cyst in this study area was 10.5% (58/550), which is relatively in agreement with the finding of [19] in waliatta soddo (15.4%). However, the prevalence of this study was lower than the findings of [11] at south Omo with the prevalence of 25.7%, 24.3% in cattle slaughtered at south Omo and Gonder. So that the lower prevalence of



hydatid cyst in cattle in this study area might be due to low number of dogs around abattoir, good routine meat inspection and proper disposal of organs infected with hydatid cyst.

In general the majority of findings in Ethiopia were based on surveys carried out on carcasses subjected to the routine meat inspections procedures. Hence, the same limitation with which meat inspecting shares globally was reflected in this study. Accordingly, the variation in the prevalence and anatomical distribution of the cyst in different study might be attributed to the methods and quality of the meat inspection, the ability of the meat inspector to identify the cases, difference in management, sample size and sampling methods, the number of cuts, culture of the feeding habit of the population and other factors.

V. CONCLUSIONS AND RECOMMENDATION

The recorded prevalence of metacestodes, the drug shop inventory and questionnaire survey results of this study are indicating the importance of these diseases in the study area. Bovine cysticercosis and cystic echinococcosis are zoonotic diseases and they have also great economic importance resulting in the losses due to the condemnation of infected organs and downgraded carcasses. There can also be huge at the amount of economic losses due to treatment of human taeniasis. The finding of this work demonstrated that the importance of *taenia saginata* and *cysticercus bovis* in human and animals, respectively and cystic echinococcus in animal. Based on the findings of this study the following are recommended:

- Public awareness about the zoonotic and economic impact of this diseases
- Strengthening the abattoirs in the study area and encouraging the community to slaughter their animals in abattoirs
- Control the stray dogs and inform to control the owners.

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