

PREVALENCE, PUBLIC HEALTH AND FINANCIAL SIGNIFICANCE OF BOVINE METACESTODES IN BAMBASI MUNICIPAL ABATTOIR, BENISHANGUL GUMUZ REGIONAL STATE, WESTERN ETHIOPIA

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ABSTRACT: Background: Taeniasis and hydatidosis are parasitic zoonoses that present major public health problems in lower income countries. Objectives: The study was conducted to estimate the prevalence, assess public health and financial significance of bovine hydatidosis and Cysticercosis at Bambasi Municipal abattoir, from October 2024 to October 2025. Methods: A cross-sectional study was conducted according to the standard procedures recommended for ante-mortem and post-mortem inspections. 384 sample size was calculated and 100 respondents were interviewed, besides this, loss assessment was estimated. Results: The overall prevalence of hydatidosis and *Cysticercus bovis* among cattle slaughtered at Bambasi municipal abattoir during the study period were 13.28% (51/384) and 5.72% (22/384) respectively. Statistical analysis showed that except between age and sex of slaughtered cattle and infection status there was no statistically significant variation for all associated risk factors ($p < 0.05$). Infection variation of *C. bovis* among sex, BCS and breed of slaughtered cattle found at margin of variation ($p < 0.05$). Organ distribution shows the infection of hydatid cysts and *C. bovis* in slaughtered cattle had the tendency to be located more in liver and lung. Characterization of hydatid cysts indicate that out of 51 hydatid cyst collected at the abattoir during postmortem examination and subjected to fertility and viability testing, 35(68.62%) of them were fertile, and 16(31.4%) were non-fertile. Also from the total 22 *cysticercus bovis* collected at the abattoir 18/22(81.81%) of them were fertile, and 4/22(18.18%) were non-fertile. In the current study; an overall annual financial losses due to organ condemnation and carcass weight loss from total infected cattle was 99, 8794.8 ETB. Conclusions and Recommendations: The community awareness assessment in this study reveal that lack of knowledge on risk factors, zoonosis and control mechanism of the hydatidosis and cysticercosis. The current study result suggests that the occurrence of the hydatid cyst and cysticercus bovis infection in the area is a great alarm for both medical and Veterinary authorities. Thus, the development of effective disease management and awareness creation are required to overcome these problems.

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Keywords: *Bambasi; Cattle; Financial losses; Prevalence; Public awareness*

1. INTRODUCTION

1.1. Background

Ethiopia with its great variation in climate and topography possesses one of the largest livestock populations in the world, which is managed by smallholder farmer under extensive low input traditional management system and adjunct to crop production. The livestock population of Ethiopia is currently estimated at 57.83 million cattle, 28.89 million sheep, 60.51 million poultry, 29.7 million goats, excluding nomadic areas (CSA, 2016). The sub sector has an enormous contribution to Ethiopia's national economy and livelihoods of many Ethiopian farmers in the various farming system (Belete, 2009) and serves as a source of food, traction, manure, raw materials, cash income, foreign exchange earnings and has social and cultural values. The sub sector contributes about 30% of the national Gross Domestic Product (GDP) and 45% of the agricultural GDP (Roger *et al.*, 2003). It also contributes 15% of the export earnings (Behnke, 2010).

In the country, cattle are important source of income for agricultural community and Ethiopia's economy, because they provide a vast range of products such as meat, milk, hide and manure (Yohannes, 2007). Cattles are also major source of foreign currencies in Ethiopia (Endashew, 2007). However, this great potential is not properly exploited. This is because of endemic disease burdens, traditional management system, inferior genetic makeup coupled with malnutrition and absence of well-developed market infrastructure (MOARD, 2005). Among the many prevalent livestock diseases, parasitic disease represent a major constraint to livestock development in the general and *metacestodes* is among the major parasitic diseases contributing to low productivity of meat production due to carcass or organ condemnation, in particular (Parija, 2004)

Taeniosis and hydatidosis are parasitic zoonoses that present major public health problems in lower income countries (Taylor *et al.*, 2007). Bovine cysticercosis refers to the infection of cattle with metacestodes of the human tapeworm *Taenia saginata*. Bovine Cysticercosis is a major problem for producers in sub Saharan Africa. The clinical effect of cysticercosis on infected animal is not significant, however, in addition to the effect on human health, economic losses may be high due to the condemnation of heavily infected carcasses and the necessity to freeze or boil infected meat, restriction of export and herd (Oladela *et al.*, 2004). Hence, bovine cysticercosis is an important public health and economic problems caused by its consequences on public health, nutritional and economy of some countries (Wanzalaw *et al.*, 2006). 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. In developing countries, taeniasis or bovine cysticercosis constitutes a serious, but less recognized public health problem (Minnozz *et al.*, 2002). Inadequate health education and low availability of *taenicides* are the major obstacles for the control of such infections. 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.

Hydatidosis is a zoonotic infection caused by adult or larval stage of *cestode* belonging to the genus *Echinococcus*. *Hydatid* disease (Hydatidosis) is characterized by cyst containing numerous tiny protoscolices that most often develop in the liver and lungs and also develop in the kidneys, spleen, nervous tissue, bone and other organs. As per an estimate, 50 million cases of such infestation occur worldwide with 50,000 people dying from this problem annually (WHO, 2006). 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 (Taylor *et al.*, 2007)

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 (Eckert and Deplazes, 2004). The cystic echinococcosis occurs throughout the world and causes considerable economic losses and Public health problems in many countries (Torgerson, 2003). Hydatidosis causes decreased livestock production and condemnation of offal containing *hydatid* cysts in slaughter houses *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 (Sobhash, 2004).

Several reports from different part of Ethiopia indicated that *hydatid* cyst is prevalent in livestock (Olika, 1997). 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 (Jobire *et al.*, 1996).

The *metacestodes* along with the financial losses they incurred are frequently reported from different corners of Ethiopia (Sissay *et al.*, 2008) and the disease is much more common where dogs and domestic animals live in a very

close association (Fromsa and Jobre, 2011). Self-sufficiency in food production, increase in rural income and foreign currency earning of the country through improving the quality and quantity of market oriented livestock and their items are the main objectives of the agricultural development policies of Ethiopia. However, *metacestodes* still causes great health and economic problems in market oriented livestock due to in fact that slaughtering of livestock is predominant and uncooked offal and carcass wastes are normally given for dogs in the country. Despite of its great economic and public health significance, there is lack of information on prevalence, zoonotic and economic impact of bovine *metacestodes* of cattle in Assosa Zone.

1.2 Statement of the Problem

The occurrence of *metacestode* infections in cattle represents a significant public health concern and economic challenge in various parts of the world, including Ethiopia. In the Benishangul Gumuz region, particularly at the Bambasi Municipal Abattoir, there is a lack of detailed data on the prevalence and identification of key *metacestodes*, such as those caused by *Echinococcus granulosus* and *Taenia saginata*. These infections can result in serious veterinary health problems, decreased livestock productivity, and pose risks of zoonotic disease transmission to humans. Despite the potential for high infection rates, few studies have been conducted to estimate the prevalence of these parasites at this specific site. The absence of thorough characterization of the cysts hampers effective control efforts and can impede accurate diagnosis and treatment. Moreover, public awareness regarding the transmission, health risks, and prevention of *metacestode* infections remains dangerously low. This highlights the urgent need for a comprehensive investigation into the prevalence and characteristics of major *metacestodes* in cattle at the Bambasi Municipal Abattoir, as well as an assessment of community awareness. Such research will enhance understanding of the epidemiology and public health of these infections in the region and support the development of targeted educational programs to improve public health and livestock management practices.

1.3 Objectives of the study

1.3.1 General Objectives

To estimate the prevalence of bovine *metacestodes*, and assess the public health and financial importance of bovine *metacestodes* in the Bambasi municipal abattoir, Assosa, Ethiopia.

1.3.2 Specific objectives

- To estimate the prevalence of bovine hydatidosis and cysticercosis and assess associated risk factors.
- To investigate cyst burden, organ distribution, and characterization of cysts in the study area
- To assess community awareness about zoonotic impact of hydatid cyst and *Cysticercus bovis* at Bambasi municipal abattoir.
- To assess the financial importance of hydatidosis and cysticercosis in the study area

2. MATERIALS AND METHODS

2.1. Study Area

The study was conducted at Bambasi municipal abattoir which is found at Bambasi town. Bambasi district is located at 616km on the main road from Addis Ababa to the regional capital city, Assosa and 45km in the north east direction of Assosa town. The study was conducted from October, 2024 to October, 2025 at Bambasi Municipal abattoir. Bambasi district has 38 kebeles stretches over an area of 2210.16 K.m square with human population of 62693. The area is found in the north west of the country between latitude of 9 and 11° N and longitude of 34 and 35° E and its altitude range is 1500-1900 meter above sea level. Annual rain fall is between 1350-1400 mm with uni modal type of rain fall that occurs between April and October. Annual temperature ranges between 21°C - 35°C. The livelihood of the society largely depends on mixed livestock and crop production having livestock population of 36,735 Cattle, 10732 Goat, 3739 Sheep, 4467 Equines, 41438 Poultry and 23423 beehives (CSA, 2023).

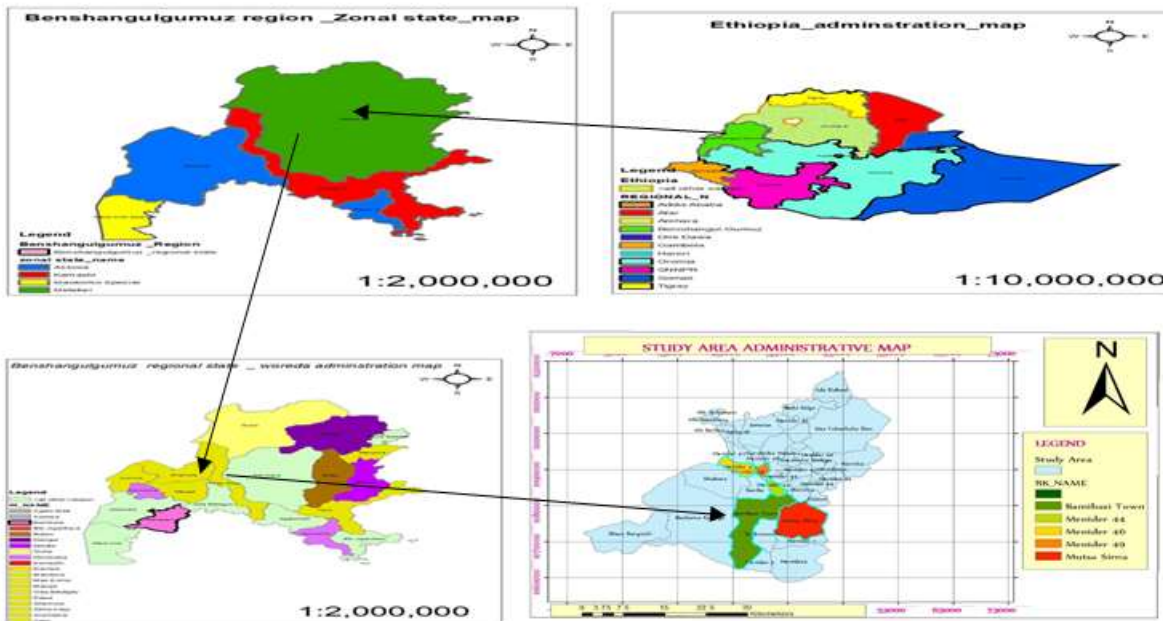


Figure 1: Map of study area (Banbasi woreda Agricultural office, 2025)

2.2. Study population

The study was undertaken on both sexes of local breeds of cattle and on some exotic breeds brought from different agro ecologic zones of Ethiopia that was slaughtered at Bambasi municipality abattoir. Most of cattle slaughtered at the abattoir were adult males of local breeds. A few exotic females were culled due to old age, poor performance and reproductive problems were also slaughtered.

2.3. Study Design

A cross-sectional study was conducted according to the standard procedures recommended for ante-mortem and post-mortem inspection by food and agriculture organization (FAO) from October 2024 to October 2025, to determine the prevalence of metacestodes at Banbasi slaughter slab. Questionnaire survey: aiming to assess public awareness about hydatidosis, cysticercosis and the risk factors for its occurrence was carried out at Banbasi town during the study period. The questionnaires querying the extent of awareness on the disease, control measures taken and other related factors of the respective individuals, such as householders, abattoir workers. The detail format is found on Annex .

2.4 Sampling Methods and Sample Size Determination

These study animals were selected by simple random sampling technique in Bambasi municipal abattoir during the study period. The number of animals required for the study was determined by using formula given by Thrusfield (2007), by using 95% level of confidence, 50% expected prevalence and 0.05 desired absolute precision.

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

Where: n = required sample size, P exp= expected prevalence and d = desired absolute precision.

Accordingly, the required sample size for this study 384 study animals were sampled. For a questionnaire survey sample size was calculated based on the formula recommended by Arsham (2002).

$$N = 0.25/SE^2$$

Where N=sample size, SE=standard error assuming the standard error of 5% at a precision level of 0.05 and the confidence interval of 95%. Accordingly, 100 volunteer individuals were selected and interviewed considering different age, sex and working conditions.

2.5 Ante Mortem and Post Mortem Examination

Ante-mortem examination was conducted on randomly selected 384 cattle for the presence of disease or abnormality before they were slaughtered. Age, sex, breed, and body condition of each randomly selected animal were recorded. The post mortem inspection was carried out according to the guideline by Ministry of Agriculture (MoA, 2011). The examination was conducted through visualization, palpation and two longitudinal ventral incision of the tongue from the tip of the root, one deep incision into the triceps muscles of both sides of the shoulder, deep incision into external and internal muscles of the masseter parallel to the plane of the jaw, longitudinal incision of the heart from base to apex, three parallel incisions into the long axes of the neck muscles on both sides as well as one extensive incisions on the diaphragm; visual examination, palpation and incision of liver and kidneys. Findings were registered according to the organs inspected.

2.6 Cyst Characterization

2.6.1 Fertility and viability test

The cyst recorded during meat inspection was removed with the surrounding tissue and taken to Asossa Regional Veterinary Parasitology Laboratory for fertility and viability test. The *C. bovis* cyst viability test was checked by placing them in 40% ox-bile solution diluted in a normal saline and incubated at 37°C for 1 to 2 hrs. A cyst was regarded as viable if the scolex evaginated during the incubation period.

Presence or absence of protoscolex in hydatid fluid was assessed and cysts are classified as fertile and infertile respectively. Fertile cysts were subjected to viability test. A drop of sediment containing the protoscolex was placed on the microscopic glass slide and a drop of 0.1 % eosin solution was added to protoscolex in hydatid fluid on microscopic slide and covered with cover slip and then examined under a high power microscopy (40x) with the principle that viable protoscolex should completely or partially exclude the dye while the dead ones take it up (Macpherson *et al.*, 1985).

2.7 Monetary Loss Assessment

Organ condemned due to metacestodes were properly recorded then; the total number of organ condemned was multiplied by retail market price of each organ (Ethiopian Birr). Accordingly; the direct economic loss assessment due to metacestodes was estimated. All livers, lungs, hearts, and kidneys which were positive for metacestodes were totally condemned. Similarly, masseter, shoulder, heart, lung, and tongue positive for *Cysticercus bovis*. The total annual economic losses associated with condemnation of these organs due to hydatidosis and cysticercosis was assessed according to standard method described by (Ogunrinade and Ogunrinade, 2002).

Then after, the direct and indirect financial losses were calculated on a yearly basis. Average market prices of the lungs, liver, kidneys, heart, masseter, shoulder tricep muscle, tongue and a kilogram of beef was found to be 50, 50, 50, 50, 50, 100 and 500 Ethiopian Birr (ETB), respectively. Average carcass weight of the Ethiopian Borana breed cattle is estimated as 126 kg. The indirect losses were estimated on the basis of live weight losses caused by hydatidosis and bovine cysticercosis (Polydorou, 1981). The total economic losses was calculated as the summation of cost of offal's condemned plus the cost of carcass weight losses (ILCA, 1993).

2.8 Questionnaire survey

Questionnaire survey on human taeniasis and hydatidosis occurrence and their associated factors was administered on 100 randomly selected volunteer respondents from Bambasi town that pre-informed consents were obtained. The predisposing factors of taeniasis such as age, sex, religion, occupation, educational levels (illiterate, primary school, secondary school, preparatory stage, college and university), habit of raw meat consumption, presence and usage of sanitary facilities especially toilet and knowledge of *T. saginata* and *E. granulosus* was assessed. Following detailed discussion on the objectives of the study with each participant, the interview was conducted face to face.

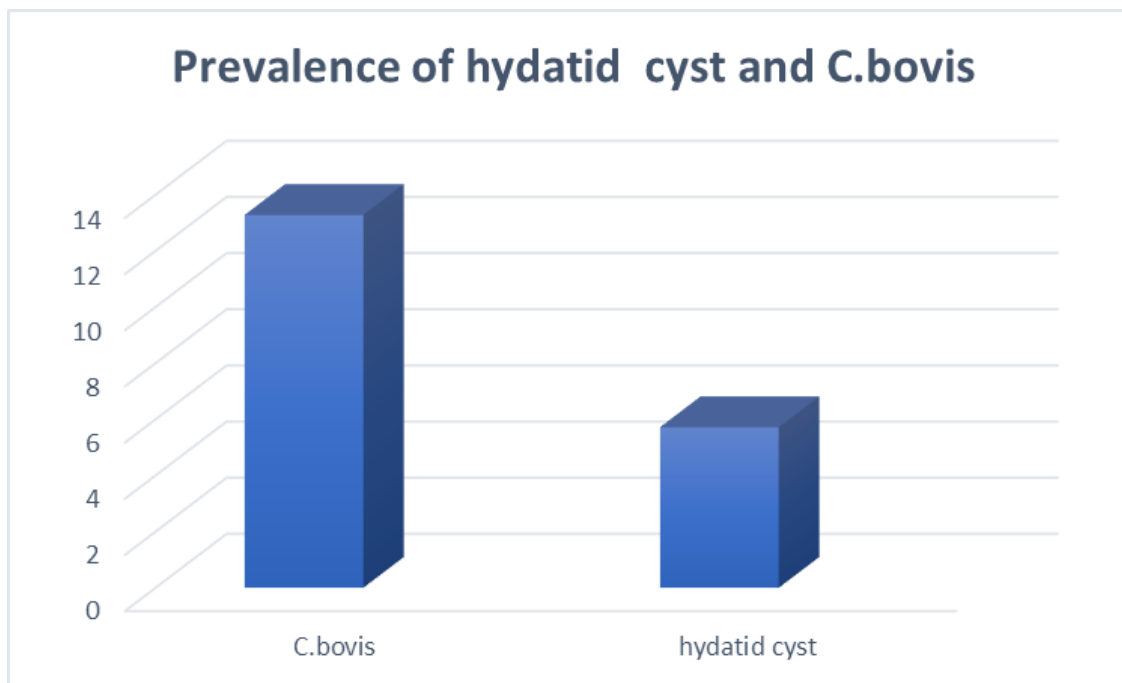
2.9 Data management and Analysis

Microsoft excel 2010 data base system was used for entry, coding and simple calculation of collected data. All statistical data analyses were done by using statistical software for social science (SPSS) version 20. The statistical association among *Cysticercus bovis*, hydatid cyst infection and risk factors were analysed by multiple logistic regression model. A statistically significant difference between variables exists when value $p < 0.05$ at 95% confidence level (CI). Burden of the cyst was calculated by using Microsoft excel .

3.RESULT

3.1 Prevalence and Associated Risk Factors

In the present study, total 384 cattle slaughtered in the Bambasi municipal abattoir were examined for the presence of *C. bovis* and hydatid cyst. Out of the 384 cattle examined an over prevalence of 51/384(13.28%) and 22/384 (5.72%) hydatid cyst and *C. bovis* were recorded respectively.



3.2 Associated Risk Factors

Higher number of hydatid cyst was recorded in adult cattle age group (14.20%) than in the young age group (6.52%) of slaughtered cattle. Based on the body condition score of slaughtered cattle, higher number of hydatid cyst was recorded in cattle with poor body condition score (40.74%), followed by medium (12.50%) and good body condition scores (10.48%) . According to the origin of slaughtered cattle hydatid cyst occurrence was 9.2% in animals brought from Bambasi town, 16.92% in animals brought from Keshmando, 14.28% in animals brought from other near by woredas (Table 3). Statistical analysis showed that there was no statistically significant difference between hydatid cyst prevalence and associated risk factors except for sex of an animal and body condition scores ($p < 0.05$). In majority of animals harboring hydatid cyst, the cysts had the tendency to be located more in lungs (41.2%) and liver (33.33%), followed by heart (25.49%). More *C. bovis* was recorded in adult age group 47/257(18.28%) than in young age group of slaughtered cattle 13/127(10.23%).

Table 1: Logistic regression analysis of hydatid cyst on the basis of associated risk factors at Bambasi municipal abattoir.

Risk factors	Categories	No. Examined	No. Positive	Prev. %	CHI2	P -value
Breed	Local	331	46	13.89	0.79	0.37
	Cross	53	5	9.43		
Sex	Female	39	1	2.56	4.32	0.03
	Male	345	50	14.49		
Age	Young	46	3	6.52	2.07	0.2
	Adult	338	48	14.20		
BCS	Good	229	24	10.48	19.30	0.000
	Medium	128	16	12.5		
Origin	Poor	27	11	40.74	3.69	0.2
	Bambasi twon	142	13	9.2		
	Keshmando	130	22	16.92		
	Others	112	16	14.28		

3.3 Organ Distribution and Size Measurement of Hydatid Cysts

The distribution of cystic echinococcus in lung, liver and heart, was found to be 34.293%, 25.3%, and 27.71 % respectively. From the total of 51 cysts counted, 64.7% (33), 29.4% (15) and 5.8% (3) were small, medium, and large, respectively (Table 4).

Table 2: Number and hydatid cysts size recorded in different organs at Banbasi municipal abattoir.

Organ	Large		Medium		Small		Total account	
	No.	%	No.	%	No.	%	No.	%
Liver	1	33.33	5	31.25	11	23.43	17	25.30
Lung	2	66.66	7	43.75	12	31.25	21	34.93
Heart	0	0	3	18.75	10	31.25	13	27.71
Total	3	100	15	100	33	100	51	100

3.4 Characterization of Hydatid Cyst

From the total 51 hydatid cyst collected at the abattoir during postmortem examination and subjected to fertility and viability test, 35(68.62%) of them were fertile, and 16(31.4%) were non-fertile; out the fertile cysts, 14 (40%) were viable and 21(58.8%) non-viable; again, among the non-fertile, 13(81.25%) sterile and 3(18.75%) calcified (Table 5).

Table 3: Bovine Hydatid Cyst fertility and Viability in different organs at Bambasi at municipal abattoir

Organ	Fertility 35(68.62%)		Non fertility 16(31.4%)		Total
	Viability	non viability	Sterile	Calcified	

Lung	6	9	4	2	21
Liver	5	7	4	1	17
Heart	3	5	5	0	13
Total	14 (41.17%)	21 (58.82%)	13(81.25%)	3 (18.75%)	51

The the results of a logistic regression analysis examining the association between various risk factors and the prevalence of *cysticercus bovis* at Bambasi municipal abattoir was. Presented in the following table-6 . Breed , age, and body conditions were risk factors which were associated with *C.bovis* with $P<0.05$ whereas sex and origins were not potential factors in this findings with $p>0.05$ (Table6).

Table 4: Logistic regression analysis of *cysticercus bovis* on the basis of associated risk factors at Bambasi municipal abattoir.

Risk factors	Categories	No. Examined	No. Positive	Prev. %	X ²	P value
Breed	Local	346	20	5.2	3.43	0.05
	Cross	38	2	0.52		
Sex	Female	38	5	1.30	0.19	0.65
	Male	346	17	4.42		
Age	Young	127	5	1.30	4.2	0.04
	Adult	257	17	4.42		
BCS	Good	211	16	4.16	0.91	0.05
	Medium	135	5	1.3		
Origin	Poor	38	1	0.26	2.03	0.36
	Bambasi twon	180	11	2.86		
	Keshmando	164	8	2.08		
	Other	40	3	0.78		

3.4.1 Organ distribution of *Cysticercus bovis*

The distribution of *C. bovis* in liver, Lung, heart and tongue muscle was found to be 8/22 (36.36%), 7/22(31.8%), 4/22 (18.18%) and 3/22(13.63%), respectively (Table 7).

Table 5: Number of *Cysticercus bovis* recored in different organs

Organ	Total account	
	No.	Percent
Heart	4	18.18
Lung	7	31.81
Tongue	3	13.63
Liver	8	36.36
Total	22	100

3.5 Characterization of *Cysticercus bovis*

From the total 22 *C. bovis* collected at the abattoir during postmortem examination and subjected to fertility and viability test, 18/22(81.81%) of them were fertile and 4/22(18.18%) were non-fertile (Table 8).

Table 6: Fertility and Viability of *Cysticercus bovis* in different organs

Organ	Fertility 18/22(81.81%)		Non fertility 4/22(18.18%)		Total
	Viability	non viability	Sterile	Calcified	
Heart	1	2	1	0	4(18.18%)
Lung	1	3	2	1	7(31.81%)
Tongue	2	1	0	0	3(13.63%)
Liver	4	4	0	0	8(36.36%)
Total	8/18(44.44%)	10/18 (55.55%)	3/4(75%)	1/4 (25%)	22/384

3.6 Financial Losses Encured

3.6.1 *Financial Losses due to Hydatid Cyst*

From the total of 384 cattle examined, 51 (13.28%) were found harboring hydatid cysts. Among them, 21 (41.2%), 17 (33.33%), and 13 (25.49%) of the hydatid cysts were located in the lungs, liver and heart respectively. The overall occurrence of cystic echinococcosis and percentage involvement of lung, liver, and heart were used as input to estimate the financial loss attributable to organs condemned in the present study. The mean annual numbers of cattle slaughtered at Banbasi municipal abattoir during the last two years was 1800, and the overall occurrence of cystic echinococcosis was found 51/384(13.28%) during the study period.

Hence, direct financial losses due to condemnation of organs and indirect financial losses due to carcass weight loss were calculated as follows on annual basis.

$$DL = (AS \times PLu \times CLu) + (AS \times PLi \times CLi) + (AS \times PHr \times CHr)$$

$$(1800 \times 50 \times 0.412) + (1800 \times 50 \times 0.333) + (1800 \times 50 \times 0.254) +$$

$$DL = (37,080) + (29,970) + (22,860) = 89,910 \text{ ETB.}$$

Where;

DL = Direct losses associated with hydatid cyst

AS = Estimated mean annual slaughter;

PLu = Percent involvement of the lung;

CLu = local retail price of a lung;

PLi = percent involvement of the liver;

CLi = local retail price of a liver;

PHr = percent involvement of the heart;

CHr = local retail price of a heart.

$$\text{Indirect losses (IL)} = 5\% \text{NAS} \times \text{PH} \times \text{CPB} \times 126 \text{ kg} (0.05 \times 1800 \times 0.133 \times 500 \times 126) = 754,110 \text{ ETB } (\$).$$

Where 5% = A reduction of 5% in meat production due to cystic echinococcosis;

NAS = average number of cattle slaughtered annually;

PH = prevalence of cystic echinococcosis;

CPB = current average price of 1 kg of beef at Banbasi;

126 kg is the dressed average carcass weight of adult cattle.

Total economic loss (TL):

The total economic loss due to hydatid cyst during the study period calculated by considering both direct economic and indirect economic loss as follows:

$$TL = DL + IL (89,910 + 754,110) = 844,020 \text{ ETB (5,626.8 USD) (Table 5)}$$

4.4.2. Economic Losses due to *Cysticercus bovis* during study period

From the total of 384 cattle examined, 5.72% (22/384) were found harboring *C. bovis*. 8(36.36%), 7(31.81%), 4(18.18%) and 3(13.63%) *C. bovis* was recored in liver, Lung, heart, and tongue muscle respectively. The overall prevalence of *C. bovis* and percentage involvement of lung, heart, liver and tongue muscle were used as input to estimate the financial loss attributable to organs condemned due to cysticercus bovis in the present study.

The mean annual numbers of cattle slaughtered at Banbasi municipal abattoir during the last two years was 1800, and the overall occurrence of cysticercus bovis was found 22/384(5.72%) during the study period.

Hence, direct financial losses due to condemnation of organs and indirect financial losses due to carcass weight loss were calculated as follows on annual basis.

$$DL = (AS \times PLiv \times CLiv) + (AS \times PTong \times CTong) + (AS \times PHr \times CHr) + (AS \times PLu \times CLu)$$

$$(1800 \times 50 \times 0.36) + (1800 \times 50 \times 0.133) + (1800 \times 50 \times 0.18) + (1800 \times 50 \times 0.31)$$

$$DL = (32,400) + (17,700) + (16,200) + (27,900) = 94,200 \text{ ETB}$$

Where;

DL = direct losses associated with cysticercus bovis

AS = estimated mean annual slaughter;

Pliv = percent involvement of the tongue;

Cliv = local retail price of a Tongue;

AS = estimated mean annual slaughter;

Ptong = percent involvement of the tongue;

Ctong = local retail price of a Tongue;

PLu = percent involvement of the lung;

CLu = local retail price of a lung;

PHr = percent involvement of the heart;

CHr = local retail price of a heart.

$$\text{Indirect losses (IL)} = 5\% \text{NAS} \times \text{PH} \times \text{CPB} \times 126 \text{ kg } (0.05 \times 1800 \times 5.72 \times 500 \times 126) = 64824.8 \text{ ETB}$$

Where 5% = A reduction of 5% in meat production due to cysticercus bovis;

NAS = average number of cattle slaughtered annually;

PH = prevalence of cysticercus bovis;

CPB = current average price of 1 kg of beef at Banbasi;

126 kg is the dressed average carcass weight of adult cattle.

Total economic loss (TL):

The total economic loss can be evaluated by considering both DL and IL as follows:

$$TL = DL + IL (89,910 \text{ ETB} + 64,824.8 \text{ ETB}) = 154,734.8 \text{ ETB}$$

Total financial loss from hydatidosis and *Cysticercu bovis* was:

$$154,734.8 \text{ ETB} + 844,020 \text{ ETB} = 99, 8794.8 \text{ ETB}$$

3.7 Assessment of community Perception and knowledge on Bovine Metacestodes

3.7.1 Sociodemography of respondents

This aspect of the analysis deals with the personal data on the respondents of the questionnaires given to them. The total numbers of questionnaires distributed were 100 and all of the questionnaires were returned. The demographic characteristics of the study participants include: gender, level of education, age, toilet usage, marital status and habit of raw meat/vegetable consumption of respondents. Of the total 100 interviewed respondents who participated in this study, (54%) of the respondents were males and 46% were females. In the present survey, dominant participants (42%) were greater than 35 years of age followed by 41% in 16-25 years and 17% in 25-35 of the age categories. Higher respondents (38%) were college graduate followed with 33% secondary school, 22% primary school, 12% college level and 7% illiterate. The table below shows the details of back ground information of the respondents.

Table 7. Background of the questionnaires' respondents in Bambasi town (n=100)

Risk factors	Categories	Frequency	Percentage
Sex	Female	46	46%
	Male	54	54%
Age	16-25	41	41%
	25-35	17	17%
	>35	42	42%
Education level	Illiterate	7	7%
	Primary	22	22%
	Secondary	33	33%
	College	38	38%
Consumption habit	Cooked	44	44%
	Raw	56	56%
Toilet Usage	No	15	15%
	Yes	85	85%
Marital status	Married	56	56%
	Single	44	44%

3.7.2 Assessment of the risk factors

Out of 100 respondents, 90% of them responded that had their own dogs and 58% of them share the same house with their dogs. 58% of the respondents were habit of consuming raw meat. A very high percentage (95%) report the respondent's showed that a lack of dog deworming. Many respondents responded there were stray dogs (85%) in the area. Free grazing cattle was common (83%). Offal disposal practices show that 68% of the respondents throw offal to their dogs, and 70% dispose of offal into the environment. Majorities (68%) of questionnaire respondents consume raw vegetables and 90% of them practice washing vegetables before raw consumption.

Table 8 Potential risk factors of metacestodes based on the questionnaires' interview in the Bambasi town (n=100)

Risk factors	No.respondents	Positive response (%)
Dog ownership	100	90%
House sharing with Dog	100	58%
Do you eat raw meat	100	58%
Lack of dog deworming	100	95%
Stray dog in locality	100	85%
Wild dogs in the grazing ground	100	80%
Free grazing cattle	100	83%
Offal thrown to dog	100	68%
Offal thrown to environment	100	70%
House sharing with Dog	100	85%
Do you consume raw vegetable	100	68%
Practice washing vegetables before raw consumption	100	90%

3.7.3 Assessment of zoonosis and transmission mechanism of Bovine Hydatidosis and *Cysticercus bovis*

The assessment results indicate among 100 respondents regarding zoonosis and transmission mechanisms of metacestodes 40% of respondents recognized that humans could be infected by metacestodes (hydatid cyst and *C. bovis*). The 55% of questionnaire respondents responded that of metacestode infection transmission can occur between

humans and dogs. Only 25% of study participants were aware of the transmission pathway involving dogs and cattle. The 60% of respondents were understanding that eating raw or partially cooked offal could lead to infection. 44% knew that consuming unwashed vegetables could serve as a source of human infection and 45% them known contaminated soil contact as a transmission route.

Table 9 Assessment result on the knowledge of zoonosis and transmission mechanism of metacestodes

Total number of respondents were 100	No. of interviewed	Positive response (%)
Possibility human to be infected by metacestodes	100	40%
Knowledge on transmission between human and dogs	100	55%
Knowledge on the transmission between dogs and cattle	100	25%
Knowledge on the transmission to dogs via eating uncooked offal	100	60%
Raw/parcially cooked vegetables as source of human infection	100	44%
Knowledge on the transmission when contacting contaminated soil	100	45%

DISCUSSION

The overall occurrence of *hydatid cyst* in cattle slaughtered at Bambasi municipal abattoir during the study period was 13.28%. This result roughly aligns with the results reported by Kebede *et al.* (2009a, 2009b) who found a prevalence of 16% in Wolita Sodo. Unlikely result was greater than the previous works reported by Bezuayehu *et al.* (2014) 11.3% in Harar; Ochi *et al.* (2016) 3.99% in Juba, South Sudan; Abera and Teklebran (2017) 11.21% in Wolayta; Akebergn *et al.* (2017) 6.5% in Debre Berhan.

In this study, the prevalence among local breeds was 13.89%, while slightly lower prevalence in cross breeds cattle 9.43%. The p-value 0.37, suggests no statistically significant variation between breed of slaughtered cattle at Bambasi municipal abattoir and infection status. Similar findings have been reported by Abunna *et al.* (2007). A significant difference was recorded between gender of slaughtered cattle at Bambasi municipal abattoir, showing a higher prevalence in males cattle (14.49%) compared to females (2.56%). This aligns with some studies, such as those by Regassa *et al.* (2010). Conversely, other studies, like that of Giday *et al.* (2003), report no statistically significant among sex of slaughtered cattle. The prevalence of hydatid cyst in adults slaughtered cattle (14.20%) was higher than in young animals (6.52%), but this difference was not statistically significant ($p=0.2$). Similar study reported by Tsegaw *et al.* (2006).

Based body condition score of slaughtered cattle high prevalence of hydatid cyst was recorded in cattle having poor BCS (40.74%) compared to those with good BCS (10.48%). The difference was highly statistically significant ($p=0.000$), This supports findings by Abunna *et al.* (2007), who identified poor body condition as a risk factor, possibly due to compromised immunity making animals more susceptible to infection. Regarding to the origin of slaughtered cattle brought from Bambasi town had a prevalence of 9.2%, from Keshmando 16.92%, and from others locality 14.28%. Although differences were recorded, the statistical analysis revealed no statistically significant association between origin of slaughtered cattle and infection status ($p=0.2$). Similar findings were reported by Regassa *et al.* (2010), where geographic origin influenced prevalence but not significantly associated.

In the current study conducted at Bambasi municipal abattoir the lungs harbored the highest number of hydatid cysts, with a total of 21 cysts (34.93%), followed by the liver with 17 cysts (25.30%), and the heart with 13 cysts (27.71%). Markedly, the majority of hydatid cysts collected from the lungs was large (66.66%), whereas in the liver and heart, medium-sized cysts were more prevalent. This finding align with study reported by Togun *et al.* (2008), report that lung is the most frequently affected organ in bovines (70%). Conversely, Abdullah *et al.* (2014) in Ethiopia found a higher prevalence of cysts in the liver, accounting for over 60% of cases. The present finding showed that on bovine hydatid cyst, out of 51 cysts examined, approximately 18/22(81.81%) collected hydatid cysts were fertile and 4/22(18.18%) cysts were non fertile. The fertility rate recorded (81.81%) aligns with various studies conducted in Ethiopia, for instance, Tadesse *et al.* (2011) reported a fertility rate of approximately 65-70% in bovine *hydatid cysts* from Ethiopia's Oromia region. Similarly, Abebe *et al.* (2017) found fertility rates ranging from 60-75%

The logistic regression model analysis determines the association between various risk factors and the prevalence of *Cysticercus bovis* at Bambasi municipal abattoir. The prevalence in local breeds (5.2%) was higher than in cross breeds (0.52%), difference is statistically significant ($p < 0.05$). Many studies, such as those by Tewelde *et al.* (2010)

and Gebremariam *et al.* (2014), have reported that local breeds often show higher prevalence rates of cysticercosis compared to exotic or cross breeds. No statistically significant difference was found between sex of study animals and occurrence of the infection; females (1.30%) and males (4.42%) ($P>0.05$). The prevalence was slightly higher in males but not statistically significant. Significantly higher prevalence in adult cattle was recorded (4.42%) compared to young cattle (1.30%) ($P<0.05$). This finding indicate that older animals are more likely to harbor *cysticercus bovis*. This aligns with findings of Abunna *et al.* (2008) and Wubie *et al.* (2015), which reported increased prevalence with age, attributable to cumulative exposure over time.

In the current study prevalence of *C. bovis* was highest in cattle with good BCS (4.16%) and lower in medium 1.3% and poor BCS 0.26%. This finding contrast with report of Wubie *et al.* (2015), that report cattle with poorer Body conditions (BCS) tend to have higher prevalence. There was a marginal statistical association between BCS of study animals and infection status ($p=0.05$).

In this study; annual economic losses due to organ condemnation from cattle infected by *Hydatid cyst* in Bambasi municipal abattoir was estimated to be: 99, 8794.8 ETB. The huge economic loss in the abattoir in this study was due to in the fact that the large number of cattle slaughter rate of the abattoir and also due to their high standard in which any organ with single cyst or calcified cyst was disposed from market. Such loses are important in Ethiopia, which has low economic output where cattle production are the major livestock industries.

Community awarness about the hydatidosis and *cysticercus bovis* disease and associated risk factors is very important in the control of the disease. In the current study the questionnaire survey result showed us the potential predisposing factors associated with the hydatidosis and *cysticercus bovis* infection of cattle are; Common house sharing with Dog, consuming raw meat, lack of dog deworming , roaming of stray dog in locality and wild dogs in the grazing ground, free grazing cattle ,Offal thrown to dog and consume raw unwashed vegetable. This study also indicated lack of knowledge in the community about hydatidosis and *cysticercus bovis* regarding their zoonosis, transmission and control.

4. CONCLUSION AND RECOMMENDATIONS

The current study result reveals that 13.28% of prevalence of hydatidosis and 5.72% of cysticercosis circulated in the study area. Sex and body conditions of risk factors were significantly associated with hydatidosis whereas, breed , age and BCS were significantly associated with cysticercosis in the present findings ($p<0.05$). 68.62% and 31.4% of hydatid cysts were fertile and non- fertile cyst respectively while 81.81% and 18.18% of *Cysticercus bovis* were fertile and non- fertile respectively. Annual financial losses due to organ condemnation and carcass weight loss from total infected cattles were 99, 8794.8 ETB. Common house sharing with dogs, consuming raw meat, lack of dog deworming, presence of large number of stray dogs in the area, consuming raw and unwashed vegetable factors were contributed to continuing of the hydatidosis and cysticercosis. In addition, the community awarness assessment reveal that, lack of knowledge on risk factors of transmission methods, zoonosis (public health risk), and control mechanism of the metacestodes.

Therefore; based on the above conclusions, the following recommendations were forwarded

- Community awareness with related to zoonotic nature, transmission routes, and health risks associated with hydatidosis and cysticercosis.
- Promote proper hygienic practices of meat, including washing vegetables before consumption.
- Strengthen dog deworming programs, to reduce the prevalence of Echinococcus and cysticercosis.
- Strengthen meat inspection procedures at abattoirs
- Encourage proper disposal of offales, dog ownership, confinement
- Implement measures to control stray dog populations through humane methods.
- Develop integrated control programs and effective disease management involving veterinary, public health, and community sectors

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