

Prevalence, Economic Impact and Public Perception of Hydatid Cyst and *Cysticercus bovis* on Cattle Slaughtered at Adama Municipal Abattoir, South Eastern Ethiopia

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Abstract: A cross sectional and retrospective studies were conducted from January up to May 2013 to determine the prevalence, estimate direct financial loss and public perception of Cysticercosis and Hydatidosis at Adama Municipal Abattoir, Central Oromia regional state of Ethiopia. Out of 422 cattle examined at the abattoir, the overall prevalence of *C. bovis* and Hydatidosis were (19.7%) and (27.5%) respectively. The prevalence of both diseases vary significantly varies with the breed, origin and body condition of the animals ($p < 0.05$). Anatomical distribution of Metacestode showed the highest proportion of *C. bovis* cysts were observed on tongue (37.4%), followed by heart (28.7%) whereas, the highest proportion of calcified Hydatid cyst was recorded on lung (59.7%) followed by liver (15.9%). There were also co-infection of hydatidosis with cysticercosis on organs like heart and kidney. Of the 192 cysts of *C. bovis* selected for viability tests, the higher proportion of viable cyst (49.3%) were observed on heart. Accordingly, of the total 1670 examined Hydatid cysts, 610 cysts were found to be fertile and further laboratory results of viability showed (9.16%) and (27.4%) motile and non-motile cysts respectively. The rest of 1060 cysts were unfertile of which sterile accounts (16.5%) and that of calcified were found to be (47.0%). From the 1198 Hydatid cysts tested for cyst size, 59.8% were small, 36.0% medium and 5.8 % were found to be large in size. Direct annual financial losses due to organ condemnation were estimated to be 34,927,200 ETB. Questionnaire survey also indicated 18% of respondents had contracted Taeniasis and this significantly varies with risk factors like sex, age, resident area and educational status of the people. On top of these, retrospective study for the year 2011 and 2012 revealed similar trend of the diseases in which from the total 27, 180 cattle were slaughtered, the prevalence of *C. bovis* and Hydatid cyst was (10.9 % and 46.3%) and (63.3 % and 38.1%) for the consecutive years respectively. The study revealed that continuous existence of Metacestode in the study area having huge public health and economic significance. Hence, implicating the need to alarm different stakeholders to look and improve methods to prevent and control the diseases.

Key words: Adama • *Cysticercus bovis* • Financial Loss • Hydatid Cyst • Municipal Abattoir

INTRODUCTION

The world human population is growing at a rate much faster than food production and increase is mainly in developing countries, which are unable to assure adequate food to their people. Developing countries have nearly two third of the world's livestock production but produces less than a third of the world's meat and a fifth of its milk [1]. Similarly, Ethiopia owns large livestock

population of which Cattle accounts 44.3 million [2]. In the country, Cattle are important source of income for rural communities and are one of the nation's major sources of foreign currency from export. 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 [3].

Of the diseases that cause serious problems, parasitism represents a major impact on livestock production in the tropic. Among the parasitic disease metacestodes of *Taeniasis* and *Echinococcus* are the most important diseases that have economic as well as public health significance. Bovine cysticercosis has a worldwide distribution, but it is quite common in Africa reaching a level of 80% in Ethiopia, 30-36% in Kenya, 15% in Rwanda, 20% in Guinea, 18% in Sierra Leone, 20% in Cameroon, 2% in Senegal and 8% in Sudan [4].

Hydatidosis is caused by the dog tape worm *Echinococcus* and its larval stage, the Hydatid cyst. This parasite is found world widely and cause serious public health problems in certain parts of the world [5, 6]. Larvae of *Echinococcus* or Hydatidosis are a disease of mammals due to the developments of cysts in certain organs or viscera. The larval stage (Metacestode) of this tapeworm has both public health and economic significance. The problem associated with tapeworm is more serious in Ethiopia because of the common habits of consuming of under cooked meat. Several studies have been conducted through abattoir survey to determine the prevalence and economic loss resulting from organ condemnation in many abattoirs of Ethiopia [7, 8]. However, most of the studies were focusing only on the prevalence and economic significance of the diseases. Moreover, to establish appropriate strategy for prevention and controls, it is very important to know public perception about the diseases to specific agro-ecological zones with respect to socio-economic status. Thus, it would be essential to have information on occurrence of the diseases, economic loss and public perception and practice at the study area. Thus, the study was design to determine prevalence and public health significance and estimate financial loss due to Hydatidosis at Adama Municipal Abattoir, Eastern Ethiopia.

MATERIALS AND METHODS

Study Area: The study was conducted in Oromia regional state, East shewa zone at Adama City which is found about 99 km from Addis Ababa, the capital city of Ethiopia. The City is located at 08°33'N 39°16'E. Adama is located on the main roads of Addis Ababa to Dire Dawa road. In addition, the Ethio-Djibouti Rail way that crosses and the number of population the City are 300,000 [9]. Moreover about 25,000 estimated people visit every day. The populations of the city are increasing from time to

time so that the demand of meat consumption is rising from time to time. Adama Municipal Abattoir is located at Boku shenan kebele on the main road of Adama-Wanji road. In this abattoir an average 100 cattle are slaughtered every day.

Study Population: Animal population for this study was cattle brought to the abattoir from different areas mainly from Kerayu, Arsi, Harar, Bale and Borena. Accordingly, those animals were subjected as a study population for active abattoir survey. For questionnaire survey, respondents were selected based on simple random sampling of individual from Adama city. Accordingly, 100 volunteer individuals were interviewed.

Study Design: A cross sectional and retrospective studies were conducted from January up to May 2013 to determine the prevalence, economic significance and public perception of Cysticercosis and Hydatidosis at the study area.

Sampling and Sample Size Determination: The total number of cattle required for the study was calculated according to formula [10]. Systematic random sampling was used to select the study animals. By the rule of thumb, where there is no information for an area, it is possible to take 50% expected prevalence. The Z value of 1.96 is used at 95% CI and margin of error is 5% (n = sample size, P =proportion, D = margin of error). Accordingly, the sample size (n) of the study was calculated as follows,

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

where,

n = Sample size

p = Expected prevalence

d = Desired level of precision (5%)

Study Methodology

Retrospective Study: A retrospective study of the last two years (2011 and 2012) were retrieved from recorded data at the abattoir and analyzed to detect the prevalence of Metacestode.

Active Abattoir Survey: The active abattoir survey was conducted during meat inspection on randomly selected 422 cattle slaughtered at Adama municipal abattoir. In the survey, study animal were selected by systematic random

sampling on the basis of the entrance of animals into lairage. In line with these, risk factors such as age, sex, origin, breed and body condition score were recorded during anti-mortem inspection. During postmortem inspection, detail carcass and predilection sites of the suspected parasites were thoroughly inspected and the number of organ infected with the parasite and the number of cysts per each organ were also recorded. Up on examination the postmortem judgments to be passed on the organs were recorded and the direct financial loss was estimated according to [11, 12]. The annual average cattle slaughtered in the abattoir was 19,800 while the current market price of each organs and carcass were used to estimate the financial losses. For confirmation of cyst fertility and viability, all encountered fertile cysts were taken to Asella Regional Parasitology laboratory. The diameter of the cyst was arbitrarily classified into three categories: small (<5cm), medium (between 5-10cm) and large (>10cm) [13]. The cyst volume was also classified into three categories: low (volume < 6ml), medium (between 6-20ml) and high (>20ml).

Furthermore, the collected cysts were classified based on the presence (known as fertile cyst) and absence (known as infertile cysts) of brood capsule containing protoscolices in hydatid fluid. Likewise, infertile cysts were further classified as sterile (fluid filled cysts without any protoscolices) and calcified [35]. Fertile cysts were also subjected for viability test. To determine viability of protoscolices for Hydatid cyst, a drop of fluid consisting of protoscolices was placed on microscope slide and after covering with cover slip observation for the amoeboid like peristaltic movement of protoscolices with an objective of $\times 40$. When it became doubtful to observe such movements, a drop of 0.1% aqueous eosin solution was added to equal volume of protoscolices in hydatid fluid on a microscope slide with the principle that viable protoscolices should completely or partially exclude the dye while the dead one take it up. *C. bovis* cysts were incubated at 37°C for 1-2hrs in a 40% ox bile solution diluted in normal saline. After this the scolex was examined under microscope by pressing between two glasses slides. The cysts were regarded as viable if the scolex evaginate during the incubation period [14].

Questionnaire Survey: To each of randomly selected 100 households in the district of the study area, a risk assessment questionnaire was administered to voluntary individuals who are aged 18 and above. The purpose of

this interview was to assess the public perception about the disease and to estimate the risk factors associated with infection.

Data Analysis: The collected data were recorded on specially designed forms and entered in to the Microsoft excel. The outcome variables for the abattoir study were cases of *C. bovis* and Hydatid cyst detected during routine meat inspection at the abattoir. SPSS 21 statistical software was employed to analyze the association of the occurrence of the two diseases with potential risk factors like age, sex, origin, breed and body condition. Questionnaire survey data were also summarized using univariate and multivariate analysis.

RESULTS

Active Abattoir Survey

Prevalence and Associated Risk Factors: From the 422 animals examined at abattoir, the overall prevalence of *C. bovis* and *Hydatidosis* were 83/422 (19.7%) and 116 (27.5%) respectively. There was statistically significant difference in sex, age, breed, body condition score and origin of the animal with the occurrence of *C. bovis* ($P < 0.05$). Similarly, breed, body condition score and origin of the animals were statistically significant with the occurrence of hydatidosis ($P < 0.05$). However, there was no statistical significance difference between sex and age with the occurrence of the hydatidosis ($p > 0.05$). Higher prevalence of the *C. bovis* was recorded in medium body condition (34.7%) than poor body condition (12.7%) and good body condition (22.3%) (Table 1). Cross breed animals (34.5%) were more infested than local breeds (18.6%) by hydatidosis. Moreover, female animals were highly infested (Table 2).

Anatomical Distribution of Metacestode: During detail postmortem inspection of the slaughtered Cattle, a total of 363 cysticerci detected on different organs, of which 260 (71.6%) cysts were found to be calcified cysts. The highest proportion of calcified cysts (72.8%) and (72.2%) were found in Tongue and Masseter muscle respectively (Table 3). Whereas, a total of 1670 Hydatid cysts were detected out of which 379 (22.7%) were found to be non-calcified form (Table 4). The intensity of hydatidosis infestations showed higher in lung (average of 7 cysts per organ) followed by liver (5 cyst per organ). There were also co-infection of hydatidosis with cysticercosis on organs like heart and kidney.

Table 1: *C. bovis* occurrence with various potential risk factors

Risk factors		No. of Tested Animal	No. +ve (%)	Crude OR (95% CI)	Adjusted OR (95% CI)	P-value
Sex:	Female	36	12 (33.3)	1 0.50 (0.70, 0.92)	1 0.20 (0.5, 0.9)	0.29
	Male	386	104(76.7)			
Age:	4-6yr	135	30 (22.2)	1 0.70 (0.78, 0.89)	1 0.67(0.6, 0.75)	0.28
	7-9yr	287	86 (30.0)			
Breed:	Local	393	102 (25.9)	1 0.70 (0.39, 0.74)	1 0.3(0.25, 0.65)	0.02
	Cross	29	12 (41.4)			
Body Condition	Poor	55	7 (12.7)	1 0.40(0.27, 0.89) 0.90 (0.45,0.98)	1 0.8 (0.28,0.96)	0.00
	Medium	219	76 (34.7)			
	Good	148	33 (22.3)			
Origin:	Arsi	213	72 (33.8)	1 0.42 (0.21, 0.69)	1 0.15(0.5, 0.89)	0.04
	Harar	98	13 (13.3)			
	Borena	111	31 (27.9)			

Table 2: Hydatid cyst occurrence with various potential risk factors

Risk factors		No Tested	No (%) +ve	Crude OR (95% CI)	Adjusted OR (95% CI)	P-value
Sex:	Female	36	17 (47.2)	1 1.5(0.64, 1.76)	1 1.6(0.9, 3.0)	0.11
	Male	386	66 (17.1)			
Age:	4-6yr	135	67 (49.6)	1 1.2(0.79,1.88)	1 1.2(0.6, 1.7)	0.81
	7-9yr	287	16 (5.57)			
Breed:	Local	393	73 (18.6) 1)	1 0.37(0.11,0.92)	1 0.8(0.5, 0. 9)	0. 01
	Cross	29	10 (34.5)			
BCS*	Poor	55	12 (21.8)	1 0.6(0.22,0.96)	1 0.4(0.3,0.8) 0.5(0.46,134)	0.02
	Medium	219	53 (24.2)			
	Good	148	18 (12.2)			
Origin:	Arsi-Asella	213	40 (18.8)	1 0.3(0.10, 0.9)	1 0.4(0.2,0.87)	0.03
	Harar	98	26 (26.5)			
	Borena	111	15 (15.3)			

BCS*= Body Condition Score

Table 3: Proportion of calcified Cysticerci in different inspected organs

Organs	Total cyst counted	Calcified cyst	Proportion (%)
Tongue	158	115	72.8
Masseter muscle	77	56	72.2
Heart	121	85	70.2
Kidney	7	4	57.1
Total	363	260	100

Table 4: Organs/carcass based prevalence of Metacestode (*C.bovis* and Hydatid cyst)

Total animal inspected	Organs	<i>C.bovis</i>		Hydatid cyst	
		No +ve	Prevalence (%)	No +ve	Prevalence (%)
	Tongue	158	37.4	0	0.0
	Masseter muscle	77	18.2	0	0.0
	Heart	121	28.7	29	6.9
	Kidney	7	1.7	41	2.8
	Liver	0	0.0	67	15.9
	Lung	0	0.0	252	59.7
	Spleen	0	0.0	19	4.5
Total=422		363		379	

Analysis of active abattoir survey revealed that there was a significant variation in the anatomical distribution of Cysticerci and Hydatid cyst in organs inspected. Of the organs examined, the highest proportion of *C.bovis* cysts

were observed on tongue (37.4%), followed by heart (28.7%) whereas, the highest proportion of calcified Hydatid cyst was recorded on lung (59.7%) followed by liver (15.9%) (Table 4).

Table 5: Viability of *C.bovis* in different organs/or carcass

Organ	No of cyst examined	Viable (%)	Non-viable (%)
Tongue	69	29 (42.03)	40 (57.97)
Masseter muscle	47	17 (36.20)	30 (63.83)
Heart	73	36 (49.30)	37 (50.68)
Kidney	3	0(0.0)	3 (100)
Total	192	82(42.7%)	110 (57.3%)

Table 6: Fertility and Viability of Hydatid cyst in different organs

Organ	No of cysts	Fertile cyst		Unfertile	
		Motile (%)	Non-motile (%)	Sterile (%)	Calcified (%)
Liver	732	19 (2.60)	77 (10.52)	45 (6.148)	591 (80.74)
Lung	852	116 (13.62)	343 (40.26)	206 (24.18)	187 (21.95)
Heart	39	5 (12.82)	18 (46.15)	13(33.33)	3 (7.69)
Spleen	24	11 (45.83)	8 (33.33)	5 (20.83)	0 (0.0)
Kidney	23	2 (8.69)	11 (47.83)	6 (26.09)	4 (17.39)
Total	1670	153(9.16)	457(27.4)	275 (16.5)	785 (47.0)

Table 7: The total cyst counts with respect to size and volume in each infected organ of cattle slaughtered at Adama municipal abattoir.

Organ	Total cyst Counted	Hydatid cyst					
		Cyst volume (%)			Cyst size (%)		
		Small	Medium	High	Small	Medium	Large
Liver	315	118 (37.5)	176 (55.9)	21 (6.7)	189 (60.0)	114 (36.2)	12(3.8)
Lung	821	419 (51.0)	352 (42.9)	50 (6.1)	459 (55.9)	304 (37.0)	58 (7.1)
Heart	35	27 (77.2)	8 (22.9)	0 (0.0)	29 (82.9)	6 (17.1)	0 (0.0)
Spleen	24	20(83.3)	4(16.7)	0 (0.0)	21 (87.5)	3(12.5)	0 (0.0)
Kidney	23	13 (56.5)	10 (31.3)	0 (0.0)	19 (82.6)	4 (12.5)	0 (0.0)
Total	1198	597(49.8)	550 (45.9)	71 (5.9)	717 (59.8)	431 (36.0)	70 (5.8)

Table 8: Estimated financial loss of organs inspected for hydatidosis at the present study in Adama municipal abattoir

Organs inspected	No of organs condemned (Partial and/or total)	Unit Price	Price (ETB)
Liver	67 (17.7%)	40	2680
Lung	252 (66.5%)	10	139,892.60
Heart	29 (7.7%)	15	435
Spleen	19 (5.01%)	5	95
Kidney	12(3.2%)	20	240
Total	379	90.0	5970

Laboratory Test Results

The Viability Tests: Out of the total 363 cysticerci identified, 192 cysts of *C.bovis* were randomly selected and further examined for viability test and higher proportion of viable cyst 36/73 (49.3%) were observed on heart (Table 5). Accordingly, of the total 1670 recorded and examined *Hydatid cysts*, 610 cysts were found to be fertile and further laboratory results of viability showed (9.16%) and (27.4%) motile and non motile cysts respectively. The rest of 1060 cysts were unfertile; from these cysts, sterile accounts (16.5%) and that of calcified were found to be (47%) (Table 6).

Cyst Size (Diameter and Volume): Out of the total 1670 recorded *Hydatid cysts*, 1198 were tested for cyst size and 49.8% were found to be small, 45.9% medium and 5.9% were found to be high in volume; whereas 59.8% were small, 36.0% medium and 5.8 % were found to be large in size. The result shows that, most cysts were found to be small being much in lungs when compared to liver (Table 7).

Direct Financial Loss: The direct financial loss due to *Cysticerci* and *Hydatid cysts*, 252 lungs, 67 livers, 150 hearts, 48 kidneys and 19 spleens were condemned during

Table 9: Factors associated with the prevalence of Taeniasis at Adama city during the last five months (2013) of the study period

Risk factors	Category	No. of resp. Value	No +ve (%)	P-value	χ^2
Sex	Male	63	34 (71.8%)	0.03	3.91
	Female	37	0 (0.0%)		
	Total	100	34 (34%)		
Age	<20	31	11 (27.3%)	0.02	3.85
	21-27	24	8 (66.7%)		
	28-45	36	15 (44.4%)		
	>45	9	5 (66.7%)		
	Total	100	39 (39%)		
Marital Status	Single	48	23 (47.9%)	0.08	3.74
	Married	52	17 (32.7)		
	Total	100	40 (40%)		
Resident area	Urban	56	21 (37.5%)	0.03	3.86
	Rural	44	16 (36.4)		
	Total	100	37 (37%)		
Education	Literate	62	22 (35.5%)	0.04	3.95
	Illiterate	38	19 (50%)		
	Total	100	41 (41%)		
Occupation	Government	61	14 (22.5%)	0.55	3.65
	Non-government	39	9 (23.1%)		
	Total	100	23 (23%)		

Table 10: A monthly prevalence rate of bovine cysticercosis and Hydatid cyst of cattle from the year 2011-2012

		Number of +Ve animals				
		C. bovis Hydatid cyst				
		Slaughtered animal Per month/year animal (%)				
Month	2011	2012	2011	2012	2011	2012
Sept.	1245	1452	118 (15.1%)	87 (6.0%)	645 (51.8%)	451 (31.0%)
Oct	1456	1760	109 (7.5%)	91 (5.2%)	397 (27.3%)	231 (13.1%)
Nov.	954	928	93 (9.7%)	68 (7.3%)	486 (50.9%)	342 (36.8%)
Dec.	897	954	69 (7.7%)	79 (8.3%)	563 (62.8%)	395 (41.4%)
Jan.	1763	1989	82 (4.7%)	93 (4.7%)	441 (25.0%)	535 (26.8%)
Feb.	496	578	57 (11.5%)	132 (2.3%)	131 (26.4%)	418 (72.3%)
Mar.	364	487	45 (12.2%)	34 (7.0%)	62 (17.0%)	132 (27.1%)
Apr.	868	2149	56 (2.8%)	75 (3.7%)	218 (11.6%)	235 (11.5%)
May	1026	950	78 (7.02%)	121 (1.2%)	493 (48.0%)	346 (32.9%)
June	957	968	66 (6.9%)	106 (1.1%)	312 (32.6%)	306 (31.6%)
July	1874	1089	124 (14.3%)	87 (8.0%)	543 (62.5%)	231 (21.3%)
Aug.	893	1083	98 (10.7%)	85 (7.8%)	415 (46.7%)	407 (37.3%)
Total	1273	14387	995 (10.9)	1058(63.3)	4706(46.3)	4029 (38.1)

Table 11: Direct estimation of financial loss due to loss of organs/carcaass by bovine cysticercosis and hydatidosis for retrospective data of Adama municipality abattoir from 2011-2012 GC

Organ Type	2011			2012		
	C. bovis No. (%)	Hydatid cyst No. (%)	Estimated loss (ETB)	C. bovis No. (%)	Hydatid cyst No. (%)	Estimated loss (ETB)
Tongue	453 (4.16)	0 (0.0)	13,590	386 (3.42)	0 (0.0)	19300
Masseter	230 (3.0)	0 (0.0)	20,700	295 (2.42)	0 (0.0)	26,550
Heart	286 (4.73)	462 (6.23)	11220	551 (5.07)	484 (5.30)	15,525
Lung	0 (0.0)	2306 (25.02)	23060	0 (0.0)	2223 (24.35)	22,230
Liver	0 (0.0)	1134 (12.06)	45360	0 (0.0)	1144 (12.53)	45,760
Spleen	0 (0.0)	523 (5.86)	2615	0 (0.0)	550 (6.02)	2750
Kidney	0 (0.0)	303 (2.18)	6060	0 (0.0)	115 (1.26)	2300
Total	1080	4138	67620	996	4516	169,180

the study period with the financial loss of 11,820,600 ETB, 12,355,200 ETB, 8,523,900 ETB, 1,782,000 ETB and 445,500 ETB respectively. It was assessed from the mean retail market price of each organs and the total number of organs condemned during the study period. Annual financial loss on the other hand was estimated considering annual slaughter rate of cattle and prevalence of the disease per organ and was calculated to be 34,927,200 ETB per annum at Adama Municipal Abattoir (Table 8).

Questionnaire Survey: Of the total 100 interviewed volunteer respondents from Adama city were participated on various working environments had contracted *Taenia saginata* infection (18%). The risk factors which are responsible for the occurrence of the disease were analyzed by using logistic regression analysis method (Table 9).

Retrospective Study: Retrospective study revealed that from the total 27,180 slaughtered cattle the prevalence of *C. bovis* and Hydatid cyst was (10.9 % and 46.3%) and (63.3 % and 38.1%) for the year of 2011 and 2012 for the consecutive years respectively. Based on the finding of recorded data on the prevalence of the disease (when the average of both years are compressed), it was higher in July (14.3%) and May (48.0 %) for Bovine cysticercosis and Cystic echinococcosis, respectively (Table 10).

Out of the total 2076 *C. bovis* cysts obtained for 2011 and 2012, heart was the dominant organ in harboring the cyst 837 (40.32%) and out of 8654 *Cystic echinococcosis* observed 4329 (52.33%) was relied on the lung. From the recorded data heart was the commonest organ affected both with *C. bovis* and Hydatid cysts (Table 3). From the total 1955 organs condemned in 2011/12-2012/13 due to *C. bovis* an estimated 53,655 ETB were lost. Moreover, 115,525 ETB was lost due to condemnation of organs by the effect of hydatidosis that is 8654 organs destructed. This figure has a significant economic impact and emphasis has to be given to the area.

DISCUSSION

In the present study, the prevalence of *C. bovis* and *Hydatidosis* in cattle slaughtered at Adama municipal abattoir were found to be 83/422 (19.7%) and 116 (27.5%) respectively 10.4%. The current study prevalence of *C. bovis* agreed with the findings of Ahmed [15] who reported prevalence of 21.17% from Nekemte. However the was higher than the findings of Taresa, Melaku and

Chanie [7] and Ibrahim and Zerihun [8] who reported 3.2%, 3.65% and 3.6% prevalence at central part of Ethiopia, Jimma and Addis Ababa localized abattoirs, respectively. Moreover, higher prevalence were reported [16] who reported (26.25%) at Hawassa, Southern Ethiopia. The difference among these studies could be attributed to differences in the agro-climatic conditions of the study areas, culture of raw meat consumption, probability of incision made at inspection site from abattoir to abattoir, dose and viability of eggs and or larvae consumed [17].

The prevalence of hydatidosis in cattle recorded in this study (27.5%) in line with the findings of Getachew [18], 31.44% in Jimma. However, it was lower than with the finding of Tigist [19], 36.58 % in Bahir Dar, Alemayehu [20], 54.8% in Assela and Kebede *et al.* [13], 48.9% in Debre Markos and Wubet [30], 62.96% in Bale Robe. The variation in prevalence of hydatidosis from different areas of a country might be attributed mainly to the differences in animal husbandry system, backyard slaughtering of animals, lack of proper disposal of infected carcass and presence of stray dog could attribute for the variation in prevalence of hydatidosis. On top of this, difference in culture, social activities and attitudes to dogs in different region may contribute for variation [21].

Among the associated risk factors indicated that sex and age related distribution of the diseases on the slaughtered cattle had no association ($p > 0.05$) which was in line with the reports of [16, 22, 23] in different parts of Ethiopia. Although more males than females were infested, it could be related to the sample size and not with sex. However, there were significant association in the prevalence of the diseases between origins, body condition score and breed of animals ($p < 0.05$) which concur with the finding of Regassa *et al.* [24] at Wolaita Sodo. The reason might be due to difference in the habit of raw meat consumption from areas to areas. But, the prevalence of the diseases was found to be on medium body conditioned animals. This is due to the fact that majority of animals slaughtered in the abattoir were medium body conditioned.

Regarding organ distribution, the current study showed that lungs (59.7%) were the most preferred predilection site for Hydatid cysts followed by liver (15.9 %). This might be due to the fact that cattle are slaughtered at older age, during which period the liver capillaries are dilated and most oncospheres pass directly to the lung. It is also possible for the hexacanth embryo to enter the lymphatic circulation and be carried via the thoracic duct to the heart and then trapped in the lungs

[25]. Furthermore, the lungs and liver possess the first great capillaries encountered by the migrating echinococcus oncosphere (hexacanth embryo) which adopt the portal vein route and primarily negotiate hepatic and pulmonary filtering system sequentially before any other peripheral organ is involved [26].

The current study also revealed that tongue (37.4%) were the most preferred predilection site for *C. bovis* followed by heart (28.7%). Similar trend of infestation pattern was also reported [35], 33.9% on heart. However, Genet *et al.* [27] from Gondar abattoir reported that pericarditis; Abscessation and Hydatid cyst were the most common causes of heart condemnation. The differences in the rejection might be due the differences in the prevalence of the disease and variation in animal management systems at different areas. The different prevalence reported in these studies might be due to several factors of which husbandry systems, hygiene differences and eating habits are among the most important. In addition, diagnosis of *Bovine cysticercosis* by meat inspection underestimates the true prevalence, especially when infection is light [28]. The higher prevalence of cysticercosis in developing countries is associated with poor sanitary infrastructure, low awareness and improper disposal of sewage, which also pertains to Ethiopia, where the widespread habit of eating raw meat is an additional important risk factor.

Examination for the condition of cyst fertility and viability 36.2% fertile, 16.5% sterile and 47.0% calcified cysts was obtained. The fertility rate of cysts was higher in lungs than liver. This is in agreement with the result of other workers [29, 30] in different parts of Ethiopia. The variation in fertility, sterility and calcification was described based on strain difference, immune status of the animal and longevity of animal infected with the parasite [31]. The quality of questionnaire is an important tool in individual cases and mass investigation for detection of *T. saginata* in the carrier population (Fralova, 1985). Volunteer interviewed respondents were surveyed in this study disclosed finding proglottids in their feces and underwear, which indicates the presence of human Taeniasis (*T.saginata*) [32]. In the present study, the prevalence of human taeniasis was surveyed based on the questionnaire. Accordingly, 45.9% of surveyed individuals were previously affected with the disease. This result was slightly lower than the findings of Dawit [33] in Gondar and Abunna *et al.* [16] (64.2%) in Hawassa town. The reason of this variation may be related to the habit or culture of raw meat consumption with these different areas.

The transmission of *T. saginata* infection from animals to humans depends on the habit of eating raw or semi-raw meat dishes like “kitfo” in Ethiopia and in other countries like meat tartar Shashlik in USSR, baserterma in near east [34]. There is also significant difference ($p < 0.05$) among age groups in which adult and older age groups higher prevalence associated with long-term exposure and the habit of preferring raw meat consumption than young groups. Moreover in the present study, there was a strong association between sexes and Taeniosis ($p < 0.05$). This might be due to the cultural and social factors in which the males are usually involved in slaughter houses and butchery as well as having access to the hotels meal. This result is in agreement with different reports in various parts of our country [22, 23, 33, 37] and McManus [38] in Nigeria, Fan [40] in Taiwan reported the higher prevalence of Taeniasis in males than females. It expresses that there is strong discrimination of females on consumption of raw meat. On the other hand, rural communities were more prone in contracting Taeniasis ($p < 0.05$) which could be best explained by the fact that most of rural communities slaughter an animal at backyard in a group of households and pass the shared carcass after eating raw meat in common at the area where the animal slaughtered. These predispose the personnel to infection. The survey also indicated significant association among peoples of different educational backgrounds ($p < 0.05$) in which illiterates are more prone to the risk of encountering the disease due to low perception.

In the present study, direct financial loss was estimated to be 34,927,200 ETB (1.7 Million USD) were lost due to the effect of the diseases during the study period on the peculiar organs examined. Affected organs were condemned accordingly as per the degree of infestation. This result was higher than reports conducted by Assefa, A. and Tesfay [41]. However, this result was lower than the report conducted by Gholam *et al.* [25] and Hassan, Mohammad and Mehrab [42] in Iran who reported 8.2 million and 13,880 USD, respectively. Variations in the amount of economic lost in different abattoirs probably due to the differences in the prevalence of diseases, rejection rate of organs, slaughtering capacity of the abattoirs, local market price of organs and management of animals.

The retrospective data revealed that meat inspection records are among the important source of data to assess the prevalence of disease in animals [43]. As one part of this study, retrospective data were collected from the past two years (2011-2012). The record indicates that, the

prevalence of *C. bovis* was found to be 11.9% in (2011) and 10.9% in (2012). This result could be emanated due to different type of meat inspection results obtained from the compiled data lies in the quality of personnel charged with the responsibility of meat inspection. Similarly, recorded information on Hydatid cyst from the data at Adama municipal abattoir revealed the prevalence of 51.3% in (2011) and 49.5% in (2012). It is slightly in consistent with the findings of Jobre *et al.* [44], 46.5% at Debre zeit, Alemayehu [20], 54.8% in Arsi area and Nebyou [45], 54.9% in Bahir Dar but higher when compared to the result of Kebede *et al.* [13] in different areas of Tigray region, Abunna *et al.* [16], 26.3% in Hawassa [15], 21.2% at Nekemte. The explanation might be dogs have an easy access to viscera of infected animals. Additionally, problem of the society in having awareness about animals slaughtered at backyard implicit the high prevalence of *Cystic echinococcus* at the area.

The anatomical distribution associated with disease from retrospective data indicated that the heart 382/959 (4.73%) and 463/996 (5.07%) for 2011) and 2012) respectively were the most frequently affected organ by *C. bovis*. This might be attributed to the muscular activity of the organ. Moreover, for most meat inspectors' heart is a better organ to inspect for the presence of *C. bovis* through incision. In case of Hydatid cyst infestation, the data indicates the most frequent organ affected was lung (2016/4138 (25.0%) and 2223/4516 (24.4%) for 2011/12) and 2012/13), respectively which might be associated to the softer consistency of the organ. Additionally, recorded data showed the existence of those parasites (*C. bovis* and Hydatid cyst) in all months of retrospective study. This could be attributed to the long period of development of the parasites which takes 3-10 months for the infection to be established in the muscle and organs of the animal and the ability of the cysts to survive long periods for about 9 years once established [4]. Furthermore, retrospective data was manipulated to estimate direct financial loss due to organs and/or carcass condemnation. Accordingly, a total estimate of 169,180 ETB was lost due to the disastereing effect of both *C. bovis* and Hydatid cysts on organs/carcass examined which was estimated based on the local price of organs at that time. These much losses indicate the importance of Metacestode at the area not only from the public health point of view but also have its own impact on the economy of the country.

CONCLUSION

In the present study indicated that the two diseases were prevalent in the study area. Moreover, direct financial loss was estimated due to condemnation of organs and/or carcass condemnation. This study identifies the impacts of metacestodes from past records and active abattoir survey, which clearly indicates the existence of the parasites in the past as well as in the present time. The continuous existence of metacestodes in the study area alarm different stakeholders to look and improve methods to control and prevent the disease. Thus, Eradication of these diseases requires cooperation between the public health and official veterinary authorities. Public health education to avoid eating of raw meat, proper disposal of condemned organs, cattle management system, treatment of animals with anti-helminthes drugs and grazing management of animals during dry season to avoid access of the animals to the parasites eggs are very important. Moreover, proper and detail meat inspection at the abattoir are also recommended.

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