

procedures for developing countries. As summarized in (table 5) the rate condemnation of liver as a result fasciolosis was relatively higher in cattle with poor body condition 31 (47.7%) followed by liver of cattle with medium body condition 30 (46.2%) while the rate rejection of liver due to Hydatid cyst was higher in cattle with medium body condition 10 (55.6%) than cattle with poor body condition 8 (44.4%). Similarly, the rate condemnation of lung as a result of Hydatid cyst, carcass (masseter muscle) due to *Cysticercus bovis* and spleen due to Hydatid cyst were correspondingly higher in cattle with medium body condition than that poor body condition, 28 (65.1%) and 15 (34.9%), 4 (80%) and 1 (20%), and 9 (81.8%) and 2 (18.2%) respectively.

Liver and Lung rejection rates: The principal causes of liver condemnation were fasciolosis and Hydatid cyst, while that of lung was Hydatid cyst. Out of 384 cattle slaughtered and inspected livers at Ambo municipality abattoir during postmortem inspection 65 (16.9%) livers were condemned or rejected due to gross finding of fasciolosis and 18 (4.7%) livers were condemned due to gross identification of Hydatid cyst on the liver tissue. The overall liver condemnation due to gross findings

these parasitic diseases or lesions were 83 (21.6%), which was the most common rejected organ in this present-day study (table 4). The rate rejection of liver due to fasciolosis is 63 (96.9%) in male and 2 (3.1%) in females as described in (table 3) above. With the same way of postmortem findings 43 (11.2%) lungs were rejected as a result of Hydatid cyst detection on the lung tissue during postmortem inspection of slaughtered cattle (table 4). The rate rejection of lung due to gross identification of Hydatid cyst in males and females were 41 (95.3%) and 2 (4.7%) respectively as described in (table 3) above. As indicated in this table, both the rate rejection of liver due to fasciolosis and lung due to Hydatid cyst were higher in males than females. There was no significant difference in rejection rates of liver between male and female or sex due to fasciolosis and Hydatid cyst, because $p\text{-value} > 0.05$, that is Pearson's chi-square value and $p\text{-value}$ are equal to 0.568 and 0.451 respectively, and there is also no significant association between liver condemnation and body condition the cattle presented for slaughter (Pearson's chi-square value is 1.398 and $p\text{-value}$ is 0.497), which means $p\text{-value}$ is greater than 0.05.

Rejection rates of Heart and Tongue: The principal causes of condemnation for heart and tongue were Hydatid cyst and *Cysticercus bovis*, which was Hydatid cyst for heart and *Cysticercus bovis* in both organs. A total of 12 (3.1%) cattle hearts were rejected due to gross abnormalities caused from Hydatid cyst and *Cysticercus bovis*. The rate rejection of heart as a result of Hydatid cyst and *Cysticercus bovis* were 7 (1.8%) and 5 (1.3%) respectively (table 3). The corresponding the rejection rate of heart due to *Cysticercus bovis* was 4 (80.0%) in males and 1 (20.0%) as indicated in (table 3). The condemnation rate of tongue due to *Cysticercus bovis* was 9 (2.3%); it was identified only male cattle slaughtered. There was no significant difference in rejection rate of heart between males and females or sex due to Hydatid cyst and *Cysticercus bovis*, respectively (p-value > 0.05), that is Pearson's chi-square value and p-value are equal to 1.527 and 0.217 respectively.

Rejection rates of Kidney and Spleen: Out of the total number of cattle slaughtered in Ambo municipality abattoir during the study period 2 (0.5%) and 11 (2.9%) of kidney and spleen were rejected respectively due to gross postmortem finding of Hydatid cyst in both cases of organs (Table 4). The condemnation of kidney and spleen were found only slaughtered male cattle (Table 3).

This table 5 shows that in present study, the overall prevalence of bovine fasciolosis from liver condemnation, and total prevalence of bovine hydatidosis from rejection of liver, lung, heart, kidney and spleen; the overall prevalence of bovine cysticercosis due to rejection of tongue, heart and masseter muscle/carcass were 16.9%, 21.1% and 4.9% respectively.

Table 2: Distributions of numbers, age, sex and rates of cattle slaughtered that were recorded during postmortem inspections.

	Age		Sex	
	Young- adult	Adult	Males	Females
No. of animals slaughtered	43	41	363	21

Rates of slaughtered animals	11.2%	88.8%	94.5%	5.5%
Total	43 (11.2%)	341 (88.8%)	363 (94.5%)	21(5.5%)

Table 1: Abnormalities encountered during AME on cattle slaughtered at Ambo municipality abattoir.

Abnormalities identified	Number of affected Animals		Total (n=384)
	Male (n=363)	Female (n=21)	Percentage
Local swelling	4 (1.0%)	0	4 (1.0%)
Pale mucus membrane	33 (9.0%)	2 (9.5%)	35 (9.1%)
Hernia	2 (0.6%)	0	2 (0.5%)
Rough hair coat	9 (2.5%)	1 (4.8%)	10 (2.6%)
Depression	6 (1.7%)	2(9.5%)	8 (2.1%)
Blindness	6 (1.7%)	0	6 (1.6%)
Nasal discharge	3 (0.8%)	0	3 (0.9%)
Excessive salivation	1 (0.3%)	0	1(0.3%)
Lacrimation	1 (0.3%)	0	1 (0.3%)
Leech infestation	3 (0.8%)	0	3 (0.9%)
Skin injury	4 (1.0%)	0	4 (1.0%)
Pregnancy	0	1 (4.8%)	1 (0.3%)
Bloody urine	2 (0.6%)	0	2 (0.5%)
Horn fracture	2 (0.6%)	1 (4.8%)	3 (0.9%)
Total	76 (20.9)	7 (33.3)	83 (21.6)

Key: (n= represent number of animals affected)

Table 3: Distributions of sex of cattle, causes of organs condemnation and rates of rejection

organs	Causes organs of condemnation	sex	
		Male	Female
liver	Fasciolosis(n=65)	63(96.9%)	2(3.1%)
	Hydatid cyst(n=18)	18(100.0%)	0
lung	Hydatid cyst(n=43)	41(95.3%)	2(4.7%)
heart	Cysticercus bovis(n=5)	4(80.0%)	1(20.0%)
	Hydatid cyst(n=7)	7(100.0%)	0
tongue	Cysticercus bovis(n=9)	9(100.0%)	0
carcass	Cysticercus bovis(n=5)	4(80.0%)	1(20.0%)
kidney	Hydatid cyst(n=2)	2(100.0%)	0
spleen	Hydatid cyst(n=11)	11(100.0%)	0

Key: (n= represent frequency of lesions occurrence).

Table 4: Distributions of lesions/diseases, numbers and rates of organ rejections

Lesions/ Diseases	Organs						
	Liver	Lung	Tongue	Heart	Kidney	Carcass	Spleen
Fasciolosis	65 (16.9)	0	0	0	0	0	0
Hydatid-cyst	18 (4.7)	43 (11.2)	0	7 (1.8)	2 (0.5)	0	11 (2.9)
Cysticercus- bovis	0	0	9 (2.3)	5 (1.3)	0	5 (1.3)	0
Total	83 (21.6)	43 (11.20)	9 (2.3)	12 (3.1)	2 (0.5)	5 (1.3)	11 (2.9)

Key: the parenthesis “()” represent percent (%)

Table 5: Distribution of body conditions, lesions and frequency or percentage of organ condemnation.

Organs	Lesions/diseases	Body condition		
		Good Frequency (%)	Medium Frequency (%)	poor Frequency (%)
Live	Fasciolosis (n=65)	4 (6.1)	30 (46.2)	31 (47.7)
	Hydatid cyst (n=18)	0	10 (55.6)	8 (44.4)
Lung	Hydatid cyst (n=43)	0	28 (65.1)	15 (34.9)
	Hydatid cyst (n=7)	0	7 (100)	0
Heart	<i>Cysticercus bovis</i> (n=5)	0	5 (100)	0
	<i>Cysticercus bovis</i> (n=9)	0	9 (100)	0
Tongue	<i>Cysticercus bovis</i> (n=5)	0	4 (80)	1 (20)
Carcass	Hydatid cyst (n=2)	0	2 (100)	0
Kidney	Hydatid cyst (n=11)	0	9 (81.8)	2 (18.2)

Key: (n= represent frequency of lesions occurrences).

Assessment of direct economic loss

The annual slaughter rate of abattoir was estimated to be 2357 cattle (obtained from retrospective abattoir records of the past three years). Therefore, the direct annual economic loss due to condemnation of organs was calculated based on the current average market price per organ at the local area, Ambo town as indicated in (Table 6) below.

Table 6: Distribution of organs, causes of condemnation, total rejection rates, average current market price and money losses due to rejection of these organs.

Organs	Total rejection of each organ	Average current market price	Annual slaughter rates of cattle	Money losses in ETB
Liver	21.6%	40.00 birr	2357	20741.60
Lung	11.2%	27.50 birr	2357	7259.56
Heart	3.1%	10.00 birr	2357	730.67
Tongue	2.3%	15.00 birr	2357	813.17
Kidney(pairs)	0.5%	22.50 birr	2357	265.16
Total				29810.16 ETB

Finally, using all the above essential information, which were recorded during data collection period and the formula specified by Ogunrinade and Ogunrinade [31], the total direct annual economic losses due to rejection of liver, lung, heart, tongue and kidney at Ambo municipal abattoir was estimated to be 29810.16 Ethiopian Birr. In this study, higher economic losses were encountered from liver condemnation 20741.60 Ethiopian Birr (due to fasciolosis and Hydatid cyst), and followed by economic losses from lung condemnation 7259.56 Ethiopian Birr due to Hydatid cyst (table 6).

DISCUSSION

Meat inspection is conducted in the abattoir for the purpose of screening and removing animal products with abnormal pathological lesions unsafe for human consumption and having poor aesthetic value. The main function of meat inspection is to assist in monitoring diseases in the national herd and flock by providing feedback information to the veterinary service to control or eradicate diseases and to produce wholesome products and to protect the public from zoonotic hazards. Diseased animals that show signs of abnormality during ante mortem

inspection should not be allowed to enter the abattoir for slaughter [14].

In this present day study, the most commonly encountered abnormalities during ante mortem inspection were pale mucus membrane 35 (9.1%), followed by rough hair coat 10 (2.6%), depression 8 (2.1%) and blindness 6 (1.6%). pale mucus membrane was the highest encountered ante mortem inspection problem and the least encountered abnormalities were excessive salivation, lacrimation and pregnancy. During this present-day study one pregnant female and two males were suspended from slaughter. During the period of present study, from the total of 384 slaughtered cattle organs examined during postmortem inspection, 83 (21.6%) livers, 12 (3.1%) hearts, 9 (2.3%) tongues, 2 (0.5%) kidneys and 5 (1.3%) masseter muscles (carcass) were condemned/ rejected as unfit for human consumption. Here, losses from liver condemnation were assumed to occur since hepatic pathology is associated to infection that might have public health importance and aesthetic value [18]. In the same way 43 (11.2%) lungs and 11 (2.9%) spleen were rejected as not allowed for eat of pet animals. In the case of this study, the condemnation/ rejection of organs were due to macroscopic pathologic lesions of major

parasitic causes such as: fasciolosis, Hydatid cyst and *Cysticercus bovis*. Thus, liver was condemned due to fasciolosis and hydatid cyst; lung, kidney and spleen were condemned due to hydatid cyst; the heart was rejected as unfit for human consumption as a result of Hydatid cyst and *Cysticercus bovis* parasitic lesions detection while tongue and carcass/masseter muscle were condemned from food of human due to *Cysticercus bovis* identifications. The total prevalence of bovine fasciolosis, hydatidosis and cysticercosis were 16.9%, 21.1% and 4.9% respectively.

In Ethiopia bovine fasciolosis has been reported to be one of the major causes/diseases problems of livestock's industries/abattoirs and annual economic losses of approximately 64 million USD was estimated due to reduced production of by fasciola parasite [26] and it is found almost in all regions of this country, but the prevalence, epidemiology and species of fasciola present significantly vary with locality. This is attributed mainly due to the variation in the climate and ecological conditions such as altitude, rain fall, temperature and livestock management systems [7]. Similarly, researches conducted by different authors of the country indicated

that the wide distribution of fasciolosis or the disease in the country with its prevalence reaching up to 84% [20].

In the present day study, a prevalence of 16.9% bovine fasciolosis was obtained in cattle slaughtered at Ambo municipality abattoir, which was relatively a lower prevalence when compared with the findings with previous studies such as, [4] at Debre Markos, [20] at Nekemte municipality abattoir, [9] at Addis Ababa abattoir enterprises, [7] at Kombolcha Elfora meat factory abattoir, [29] at Gonder Elfora abattoir, [25] at Mekelle municipality abattoir, [6] at Jimma municipality abattoir, [26] at Nazareth abattoir and [8] Bahir Dar municipality abattoir with a prevalence of bovine fasciolosis 46.4%, 23.4%, 36%, 37.2%, 86.4%, 35.22%, 46.7%, 20.2% and 22.9% respectively. However, the present-day prevalence of bovine fasciolosis is higher when compared with previous findings of Miruk [22] at Asella municipality abattoir and [2] at Adigrat municipality abattoir, that they obtained the prevalence of 3.82% and 9.26% bovine fasciolosis respectively. This variation of bovine fasciolosis prevalence from different meat industries/abattoirs of the countries is probably due to ecological and climatic variation among different areas, and

moreover, due to the management systems variation practiced in that specified area [6] and also various reasons could be offered for different prevalence findings of bovine fasciolosis. Thus, effective control strategies (in case of low prevalence area) to favorable the local environment conditions like the presence of biotopes suitable for the development of the snail intermediate host of the parasite (abundant in rainy season), which enhances the reproducibility of this parasite and the failure of farmers to schedule strategic deworming programmes for their animals (in case of high prevalence area).

Therefore, the timing of treatment can be recommended with the help of detailed epidemiological studies. However, the climatic conditions vary among areas and years; the strategic and economic application of antihelmintics has to be simplified for the farming community. Apart from its veterinary and economic importance throughout the world, fasciolosis has recently been shown to be a re-emerging and widespread zoonosis affecting a number of human populations [18].

Hydatidosis is an important major economic and public health significance in many countries of the world and the factors

governing the prevalence of in a given locality may be associated with the prevailing specific social, cultural, environmental and epidemiological situations, and similarly certain deeply rooted traditional activities could be commonly described as substantiating the spread and high prevalence rates of bovine hydatidosis in Ethiopia in general. These includes the wide spreads of backyard animal slaughtering practice, the corresponding absence of rigorous meat inspection procedures and the standing habits of most Ethiopian people to feed their dogs with condemned offal, which in consequence facilitates the maintenance of the perfect life of hydatidosis [10].

In this present study, the total of prevalence of 21.1% of bovine hydatidosis was obtained from (4.7% liver, 11.2% lung, 1.8% heart, 0.5% kidney and 2.9% spleen) condemnation out of 384 cattle slaughtered at Ambo municipality abattoir. In the present study, bovine hydatidosis prevalence is a relatively lower when compared with the prevalence of previous findings of bovine hydatidosis in Ethiopia; for instance [28], at Assella municipal abattoir, [27] at Addis Ababa abattoir, [8] at Bahir Dar municipality abattoir, [29] at Gonder Elfora,

[13] at Ambo municipality abattoir, and [22] at Asella municipality abattoir, [26] at Nazareth abattoir and [12] at Gonder Elfora abattoir with the prevalence of 62.38%, 23.7%, 35.7%, 24.7%, 29.69%, 52.75%, 54% and 28% respectively. On the other hand, the present day study finding of bovine hydatidosis is higher when compared with a previous findings of different studies on bovine hydatidosis, including Genet *et al.* [18] cattle slaughtered in Gondar abattoir, [17] at Kombolcha Elfora abattoir, [5] at Arbaminch municipality abattoir, [21] at Dire Dawa municipality abattoir and [3] at Adigrat municipality abattoir with the prevalence of 19.87, 12.17%, 20.5%, 20.1% and 18.6% bovine hydatidosis which were lower prevalence than the present day study. This variation in prevalence of bovine hydatidosis is more probably as a result of the difference in origin of animal for slaughter, change in environmental and epidemiological factors, which could affect the rate transmission of hydatidosis. In addition, the age of animals brought for slaughter and difference in socio-cultural structure and the degree of association among the society, livestock and dogs are also contribute to difference in prevalence of bovine hydatidosis.

In agreement with different researchers reported that liver and lung were the commonly affected organs by hydatid cyst [10]. The reason is explained by Gracey [19] in that liver and lung contain the highest capillary bed in the body and the majority of oncospheres are filtered out and trapped in the fine blood capillaries of these organs and small number of oncospheres reached the remaining organs.

The total prevalence of bovine cysticercosis in the present study is 4.9% (2.3% tongue, 1.3% heart and 1.3% carcass/masseter muscle), which is relatively higher as compared with the previous findings of Shiferaw [26] at Nazareth abattoir, [22] at Asella municipality abattoir, [1] at South West Shoa Zone of Oromia region and [16] at Jimma municipality abattoir and [11] at Wolaita Soddo municipal abattoir with prevalence of 0.9%, 2.29%, 4.6%, 4.4% and 2.59% of bovine cysticercosis prevalence respectively, but the present day prevalence of bovine cysticercosis is lower when compared with the previous finding by Shegaw *et al.* [25] at Mekelle municipality abattoir with the prevalence of 7.3%, which was higher than the prevalence of present study finding. These variations in reported prevalence of bovine cysticercosis may be

due to several factors such as: variation in the habit of raw meat consumption, variation in personnel and environmental hygiene, presence of control and eradication programs to the area. Therefore, the prevalence rate of bovine cysticercosis probably as a result of personnel awareness and environmental hygiene through proper use of latrine, which may contribute for less contamination grazing land by human excreta containing *Taenia saginata* eggs that lead to subsequent reduction of chance of infection the intermediate host, cattle.

The direct abattoir loss due to condemnation of liver, lung, heart, tongue and kidney, in the present-day study was calculated using the formula specified by (Ogunrinade, 1980), which was 29810.16 ETB of the total direct economic abattoir annually in average (table 6). In general, this much of economic loss for this is too much high. However, the average annual economic loss encountered in this study area is relatively lower than the different previous studies of economic loss findings. The differences in the amount of money lost in various meat industries could be attributed to differences in the prevalence of diseases, difference in the rejection rate of organs, difference in the slaughtering capacity of abattoirs and also variations in

the management of animals in different part of the country [6].

In this present day study, liver condemnation takes the higher proportion of all losses accounting for 69.6% of all losses followed by lungs, tongue, heart and kidney, which constitutes 24.4%, 2.7%, 2.5%, and 0.9 of the all direct economic losses as a result of condemnation of the above organs due to major parasites diseases including, fasciolosis, hydatidosis and cysticercosis encountered on the cattle slaughtered at Ambo municipality abattoir.

CONCLUSION AND RECOMMENDATIONS

It is progressively more evident that parasitism represents a major drawback to livestock development and production in tropical countries like Ethiopia. Major parasites of livestock industry or abattoirs needs great concern; hence they cause extensive financial losses. However, a proper evaluation of the economic losses from parasitic diseases is lacking, the assessment of losses due to parasitic disease is of great economic importance for many tropical countries. During this present study, postmortem inspection of visceral organs revealed that a significant number of organs

were condemned from the cattle slaughtered at Ambo municipal abattoir as a result of gross pathological lesions caused by parasitic diseases, such as bovine fasciolosis, hydatidosis and cysticercosis. According to the result of this study, fasciolosis and hydatidosis were the most and major causes of liver and lung condemnation respectively. Therefore, it is important to paid attention for strategic zoonotic diseases (parasitic diseases) control programs and to minimize economic losses at different abattoirs in the country. Based on the present study finding postmortem inspection of meat conducted seriously, for instance introduction of meat inspection policy in the country, veterinary professional provide public health education about the zoonotic hazards of eating raw and undercooked beef and impact of feeding practice of dogs with infected and condemned organs/carcass and strategic epidemiological survey on bovine fasciolosis, hydatidosis and cysticercosis conducted in different regions of the country for the purpose of introducing effective control should be recommended.

Conflict of interests

The authors have no conflict of interest regarding the publication of this paper

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