

## Research Article

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## Major Cause of Organ and Carcass Condemnation in Apparently Healthy Small Ruminant Slaughtered at Addis Ababa Abattoir Enterprise, Ethiopia

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### Abstract

Study was conducted from November 2008 to March 2009 to determine the major causes of organ and carcass condemnation and associated annual magnitude of financial loss at Addis Ababa abattoir enterprise. Out of 1052 examined sheep and goats 459 (43.6%) livers, 307 (29.18%) lungs, 130 (12.36%) Hearts, 108 (20.27%) kidney and 28 (2.66%) carcass were condemned. The major causes of condemnation were parasite 52.24%, cirrhosis (11.2%), hepatitis (9.2%) and mechanical damage (8.12%) for liver; pneumonia (32.2%), emphysema (19.5%) and hydatidosis (15.9%) for lung; pericarditis (43.07%), calcification (17.7%), Abscess (5.4%), *Cysticercus ovis* (8.4%) and other (25.4%) for heart; nephritis (30.5%) for kidneys, abscess (50%), bruising (29%) and other causes for carcasses. Rate of condemnation due to hydatidosis was higher in the lungs (4.3% in sheep and 5.0% in goats) than in the liver (3.3% in sheep and 3.4% in goats) significant higher rate of liver, lung, heart, kidney and carcass condemnation were not observed between age groups ( $p>0.05$ ), but significantly higher rate of organ and carcass condemnation were observed with in sex group of sheep ( $P<0.05$ ). However significant difference in the rate of organ and carcasses condemned were not observed by species of the animals ( $p>0.05$ ). Total annual loss due to organ and carcass condemnation was estimated one million Ethiopian Birr (90909.09 USD). Result of the present work warrant immediate need for the prevention of causes of organ and carcass condemnation and pathological abnormalities through development of and animal health delivery, enforcement of slaughter policy, education of sheep and goat traders, and training of slaughter house personnel on standard slaughter operations.

**Keywords:** Abattoir; Addis Ababa; Carcass; Condemnation; Financial loss; Goats; Organ; Sheep

### Introduction

Ethiopia, with over 42 million head, has the third largest number of sheep and goat among African nations and rank eighth in the world [1]. Small ruminant (sheep and goats) are among economically important livestock in Ethiopia. There are about 25.5 million sheep and 22.78 million goats [2]. They contribute a quarter of domestic meat consumption, about half of the domestic wool requirements about 40% of fresh skin and 92% of the value of semi-processed skin and hide export trade it is estimated that 1,078,000 sheep and 1.128.000 goats are used in Ethiopia for domestic consumption annually.

Many important livestock diseases that inflict major socio-economic losses in Ethiopia occur every year. Annual disease losses amount to 8-10%, 14-16% and 11-13% of cattle, sheep and goats populations respectively. It is estimated that some 700 Million Birr (1 US\$=9.2) is lost annually due to helminthes (internal parasite) infestation of domestic animals. Besides affecting the quantity and quality of livestock products, the prevalence of infectious and economically important animal disease in Ethiopia excludes the country from profitable international markets; there by greatly reducing the country's foreign exchange earnings poor husbandry practice and inadequate veterinary services are of the major factors favoring the expansion of livestock diseases [1].

However, each year a significant loss result from death of animals, inferior weight gain, condemnation of edible organs and carcass at slaughter house. This production loss to the livestock industry is estimated at more than 900 million USD annually [3]. A recent study conducted at HELMEX abattoir, Debre Zeit, Ethiopia indicate the annual direct financial loss form international and domestic markets

due to organ and carcass condemnations from different pathological lesions was estimated at 2.7 million Ethiopian Birr (312,655 USD) annually. This total loss could be partitioned in to the loss incurred due to disease which amounted to 187,868.6 USD and the rest, 124,686.4 USD, was due to human factors either as a result of mishandling of animals during transport to the slaughter house or due to faulty slaughter operations in the abattoir [4].

As the meat are the main sources of protein to human being, it should be clean and free from diseases of particular importance to the public such as tuberculosis and cysticercosis. Meat is also condemned at slaughter house to break the chain of some zoonoses which are not transmitted to man directly via meat like hydatidosis and other important diseases of animals such as fasciolosis [5,6].

Yet meat is also condemned from human consumption because of aesthetic values caused by diseases and mechanical damage during slaughtering operation procedures [7]. A report of the prevalence of

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Echinococcus granulosus (adult stage of the hydatid cyst) in dogs indicated 25.45% [8]. The presence of hydatidosis was also reported in man in the south-west Ethiopia. Hydatidosis is maintained as a major zoonotic disease in the country because small ruminants are mainly slaughtered at the backyard for home consumption without any veterinary inspection, the absence of rigorous and enforced meat inspection legislation and long standing habit of feeding offal to dogs. The presence of large number of stray dogs throughout the country exacerbates the problem. However, there is no information describing the causes and associated magnitude of organs and carcass condemnation in slaughtered sheep and goat at Addis Ababa Abattoir Enterprise. Determination of the causes and magnitude of organ and carcass condemnation in these animals using abattoir surveillance by considering associated risk factors for evaluation of associated economic loss are needed where economic realities often determine the type and scope of preventive measures to be used. Therefore the objectives of this study were; to determine the major causes of organ and carcass condemnation in apparently healthy sheep and goat slaughtered and to estimate the associated magnitude of economic loss at Addis Ababa Abattoir enterprise.

## Materials and Methods

### Study area

The study was conducted at Addis Ababa Abattoir Enterprise, Ethiopia, from December 2008 to April 2009. Where cattle, small ruminant and swine are slaughtered. The average annual slaughtered animals where 36,000 sheep and 18,000 goat according to animal report of the abattoir of LMA, 2009 [9]. The obtained beef, mutton, lamb, goat meat and edible organs like liver, lung, heart and kidney, was distributed to the customers. Addis Ababa is the capital city and administrative center for the Federal Democratic Republic of Ethiopia. Geographically, the area is located with in an altitude of about 2,400 m above sea level and receives a mean annual rainfall of season 18000 mm in bimodal with average minimum and maximum temperatures are 10.7°C and 25.6°C respectively [10].

### Study animals

A total of 1052 animals comprising (600 sheep and 452 goats) where randomly selected and identified by species, age, and sex during ante mortem inspection. The animals were originating from different areas of the country (Arsi, Bale, Afar, Shoa, Ogaden, Wollo, Omo, Jimma, and Borena) representing different agro ecological zones (highland, semi arid and arid). It was impossible to track back the origin of each animal as they were being mixed before they arrive at the abattoirs. Animals were transported to the abattoir using vehicles and on foot. Age grouping in to young for goats less than 1 year and sheep less than 1.25 years while adult for goat more that 1 year and sheep more than 1.25 years [11]. Random sample size distributions were as shown in Table 1 below.

### Abattoir survey

Detailed meat inspection procedure were applied and examination

Species	Sex				Total (%)
	Male		Female		
	Young (%)	Adult (%)	Young (%)	Adult (%)	
Sheep	159 (38.4)	255 (61.6)	34 (18.3)	152 (81.7)	600 (100)
Goats	111 (29.5)	265 (70.5)	17 (22.4)	59 (77.6)	452 (100)
Total	270 (25.6)	520 (49.4)	51 (4.9)	211(19.6)	1052 (100)

Table 1: Number of animals examined.

were done after evisceration, the liver, lung, heart, kidney and carcass were thoroughly examined by visual inspection, palpation and systematic incisions for the presence of gross pathological lesions and parasite were differentiated and judged based on guidelines on meat inspection for developing countries [7].

### Study design

Cross sectional study by abattoir survey were conducted for the determination of major causes of organ and carcass condemnation in apparently healthy sheep and goat slaughtered at Addis Ababa Abattoir Enterprises by post mortem examination.

### Data management and statistical analysis

Data collected during study period were entered in to Excel spreadsheet (Microsoft Excel 2007). Descriptive statistics were used to determine major cause of organ and carcass condemnation rate by using percentage. Association of the risk factors were calculated with consideration of age, sex, species and abnormalities were evaluated by person's chi-square ( $\chi^2$ ) and differences were regarded statistically significant if P-values were less than 0.05.

### Assessment of economical losses

To evaluate the economic losses, only the direct monetary losses due to rejection of liver, lung, heart, kidney and carcass were considered. The analysis was based on annual slaughter capacity of the abattoir considering market demand, average market price on domestic markets, and rejection rates of specific organs and carcasses. The annual slaughter rates were estimated from retrospective slaughter data recorded in the past three years. Financial losses were then computed mathematically by adapting the formula of Ogunrinade 1980 for liver [12].

$$EL\ srx * coy * Roz$$

Where

EL - Estimated annual economic loss due to organs and carcass condemnation from domestic market.

Srx - Annual sheep /goat slaughter rates of the abattoir.

Coy - Average cost of each sheep/goat liver /lung/Heart/Kidney/ carcass.

Roz - Condemnation rates of sheep /goat liver /bung/Kidney/ Heart/ carcass.

## Results

### Post mortem examination

Out of 1052 small ruminant examined during the study period, 459 (43.6%), 307 (29.18%), 130(12.36%), 108 (10.27%) and 28 (2.66%) of all liver, lungs, hearts, kidney and carcasses, respectively, were condemned, respectively from gross abnormalities as unfit for human consumption (Table 2). The most frequently condemned organ was liver followed by the lungs. Significant difference in the rate of organs and carcasses condemned were not observed by species of animals and pathological abnormalities ( $P>0.05$ ).

Percentage of condemnations of Liver (43.2%), Lung (27.83%), Heart (11.67%), Kidney (12.33%) and Carcass (2.5%) in sheep like wise (44.25%) (30.1%) (13.27%) (17.5%) and (2.88%) were condemned in respective organ and carcass of goats. Regarding age insignificance was observed (Table 2) between both sexes in both study species ( $P>0.05$ ).

Risk factors		Number of Examined	Liver (%)	Lung (%)	Heart (%)	Kidney (%)	Carcass (%)
Sheep	Male	414	167(40.34)	103(24.88)	42(10.14)	44(10.63)	-
	Female	186	92(49.46)	64(34.41)	28(15.05)	30(16.13)	-
	X <sup>2</sup>		4.3551	5.8022	3.009	3.5920	6.0488
	P-value		0.037	0.016	0.083	0.058	0.014
	Young	193	2.1509	2.2654	0.9166	1.0219	2.5009
	Adult	407	0.142	0.132	0.338	0.312	0.114
	X <sup>2</sup>		2.1509	2.2654	0.9166	1.0219	2.5009
	P-value		0.142	0.132	0.338	0.312	0.114
Total		600	259(43.17)	167(27.8)	70(11.67)	74(12.3)	15(2.5)
Goat	Male	376	156(41.49)	113(30.05)	48(12.77)	25(6.65)	12(3.19)
	Female	76	37(48.68)	27(35.53)	12(15.79)	9(11.84)	1(1.32)
	X <sup>2</sup>		1.3376	0.8858	0.5020	2.4510	0.7963
	P-value		0.247	0.347	0.479	0.117	0.372
	Young	129	63(49.2)	37(28.9)	12(9.4)	11(8.6)	2(1.56)
	Adult	323	137(42.3)	103(31.8)	48(14.8)	23(7.1)	11(3.4)
	X <sup>2</sup>		3.1022	0.3569	2.3584	0.2948	1.1031
	P-value		0.078	0.550	0.125	0.587	0.294
Total		452	200(44.25)	140(30.1)	60(13.3)	34(17.5)	13(3.0)
Overall		1052	459(43.63)	307(29.2)	130(12.4)	108(10.3)	28(2.66)

**Table 2:** Total condemnations of organ and carcass Rate (%).

The frequency of liver condemnation was statistically significant difference was not observed in sheep (259/600, 43.17) and goats (193/452, 42.70) ( $p > 0.05$ ), but frequency of kidney condemnation, statically significant difference was not observed in condemnation of rates of lung, heath, kidney and carcass between the two species of animals ( $p > 0.05$ ). In sheep, significantly higher ( $p < 0.05$ ) rate of condemnation of liver, lung and carcasses were observed in the female than male, but there was significant difference were observed in sex of goats ( $p < 0.05$ ). No age difference was observed in the organs and carcass condemnation rates in sheep and goat ( $P > 0.05$ ) (Table 3).

In sheep age difference was observed in liver cirrhosis (0.00% in young and 8.84 in the adult) ( $p = 0.000$ ), Stilesia hepatica (6.74% in young and 3.19% in the adult) ( $p = 0.47$ ) and mechanical damage (4.15% in young and 1.47% in the adult) ( $p = 0.043$ ). In goat there was no statistically significant age difference between young and adult age categories (Table 3) concerning the cause of liver condemnation, except mechanical damage caused significant loss of liver in young (13.28%) than in adult (1.55%)  $p = 0.000$ .

Pneumonia was the major causes of lung rejection with a rate of 32.14% (99/308) followed by emphysema (19.48%, 60/308) (Table 4). There was no statistically significant difference between sheep (117/600, 29.5%) and goats (131/452, 28.98%) ( $p > 0.05$ ); however, statistically significant difference was observed ( $p < 0.05$ ) between the young and adult age groups of both species in the frequency of lung condemnation from any causes, except statistically high significant difference observed in adult sheep in case of emphysema (7.86%) than in goat 95.57%) ( $p = 0.012$ ).

Significant difference between the sex groups in sheep and goats, with relation to specific causes was not observed ( $p > 0.05$ ), except calcification causes significant lung condemnation in Male sheep (3.62%) than in female sheep (1.6%) ( $P = 0.007$ ) (Table 4); Frequency and percentage of organ and carcass condemnation by sex (0.5%). Rate of condemnations due to hydatidosis was higher in the lung (4.33% in

sheep and 5.09% in goats) than in the liver (3% in sheep and 3.54% in goats) (Table 4).

Out of a total of 130 hearts condemned, pericarditis contributed 43.08% (56/130) followed by other unidentified causes (24.62%) calcification (17.6%), *Cysticercus ovis* (8.4%) and abscess (5.38%) (Table 5). No statistically significant difference was observed between the two species ( $p < 0.05$ ) in heart condemnation rate. In both species no statistically significant difference within age and sex categories regarding the causes of heart condemnation rare (Table 5).

Renal problems were observed in 108 pairs (10.27%) of the total kidneys examined (Table 6). Nephritis accounting for 30.56% (33/108) was the major pathological lesion. There was no statistically significant difference between the age, groups and sex groups ( $p > 0.05$ ) However nephritis caused higher rate of kidney condemnation in female goats (5.34%) than in male sheep (2.41%) ( $p = 0.018$ ).

The major pathological conditions for carcass rejection from human consumption were Abscess accounting for 50% (24/28), bruising 28.57% (8/28) and poor body condition (21.43% 6/28) (Table 6) and other causes.

Fasciolosis caused statistically higher liver condemnations (Table 7) in sheep (11.67%) than in goats (7.3%) ( $P = 0.018$ ), hepatitis was found to be a major cause of liver condemnation in goats (5.31%) than in sheep (2.83%) ( $p = 0.017$ ), Mechanical damage has caused statistically higher rate of liver condemnation in goat (4.87%) than in sheep (2.33%) ( $p = 0.025$ ). In sheep, there was no statistically significant difference between male and female sex categories except for *Fasciola* species where it was significantly higher in the female sheep (15.59%) than in the males (9.90%) ( $p = 0.045$ ). In goat, there was no statistically significant difference between male and female categories regarding the cause of liver condemnation.

#### Assessment of direct economic loss

The annual direct financial loss from domestic markets due to

Abnormality	Frequency and percentage of condemnation (%)									
	Sheep (n=600)					Goat (n=452)				
	Young (n=193)	Adult (n=407)	Total	X <sup>2</sup>	p-value	Young (n=129)	Adult (n=323)	Total (n=452)	X <sup>2</sup>	p-value
<i>Fasciola</i>	18(9.3)	52(12.7)	70(11.7)	1.5120	0.219	7(5.4)	26(8.03)	33(7.3)	0.9373	0.333
Cirrhosis	0(0.0)	36(8.8)	36(6.0)	18.161	0.00	2(1.5)	11(3.4)	13(2.9)	1.1358	0.287
Hepatitis	7(3.6)	10(2.4)	17(2.8)	0.6509	0.420	7(5.4)	17(5.3)	24(5.3)	0.0049	0.944
<i>Stilesia hepatica</i>	13(6.7)	13(3.2)	26(4.3)	3.9612	.047	6(4.6)	12(3.7)	18(4)	0.2112	0.646
<i>Cysticercus tenicollis</i>	10(5.2)	15(3.7)	25(4.2)	1.6829	0.431	5(3.9)	19(5.9)	24(5.3)	0.7381	0.390
Calcification	1(0.52)	17(4.2)	18(3.0)	9.4133	0.052	2(1.5)	13(4.0)	15(3.3)	1.0436	0.903
Mechanical damage	8(4.2)	6(1.5)	14	4.0981	0.043	17(13.2)	5(1.55)	22(4.9)	26.929	0.000
Hydatid cyst	4(2.1)	16(3.03)	20(3.4)	1.4112	0.703	4(3.1)	12(3.7)	16(3.5)	1.4742	0.831
Abscess	1(0.5)	11(2.7)	12(2.0)	9.0083	0.109	4(3.0)	11(3.4)	15(3.3)	2.8925	0.576
Other	6(3.0)	8(1.9)	14(2.3)			4(3.1)	6(1.8)	10(2.2)		

Table 3: Cause of Liver condemnation by age.

Abnormality	Frequency and percentage of condemnation (%)									
	Sheep(n=600)					Goat(n=452)				
	Male% (n=414)	Female%(n=186)	Total% (n=600)	X <sup>2</sup>	p-value	Male%(n=376)	Female% (n=76)	Total% (n=452)	X <sup>2</sup>	p-value
Pneumonia	37(8.8)	21(11.3)	58(9.7)	0.8138	0.367	36(9.6)	5(6.6)	41(9.1)	0.6878	0.407
Emphysema	22(5.3)	15(8.1)	37(6.2)	1.6780	0.195	16(4.3)	7(9.2)	23(5.1)	3.2142	0.073
Hydatid cyst	14(3.4)	12(6.45)	26(4.3)	3.7714	0.287	19(5.05)	4(5.3)	23(5.1)	1.4742	0.831
Abscess	3(0.7)	2(1.1)	5(0.83)	12.2601	0.031	3(0.8)	1(1.3)	4(0.9)	2.8925	0.576
Calcification	15(3.6)	3(1.6)	18(3.0)	14.2503	0.007	16(4.3)	3(3.95)	19(4.2)	1.0436	0.903
Other	13(3.14)	20(10.75)	33(5.5)			14(3.7)	7(5.2)	21(4.6)		
Overall	104(25.12)	73(39.24)	177(29.5)			104(27.65)	27(53.52)	131(28.98)		

Table 4: Frequency and percentage of condemnation Lung.

Abnormality	Frequency and distribution of lesions												
	Sheep and goat (n=1052)			Sheep(n=600)					Goats (n=452)				
	Sheep n=600	Goat n=452	Total n=1052	Young n=193	Adult n=407	Total n=600	X <sup>2</sup>	p-value	Youngn=129	Adult n=323	Total	X <sup>2</sup>	p
Pericarditis	31(5.1)	25 (5.5)	56(5.3)	11(5.7)	20(4.9)	31(5.7)	0.1649	0.685	6(4.6)	19(5.8)	25(5.5)	0.2674	0.605
Calcification	12(2)	11(2.4)	23(2.2)	2(1)	10(2.4)	12(2)	9.4133	0.042	2(1.5)	9(2.8)	11(2.4)	4.0024	0.406
Abscess	5(0.8)	2(0.4)	7(0.6)	1(0.5)	4(0.9)	5(0.8)	9.0083	0.109	0.00	2(0.6)	2(0.4)		
<i>Cysticercus ovis</i>	7(1.2)	4(0.8)	11(1.1)	2(1)	5(1.5)	7(1.6)	0.5032	0.438	1(0.7)	3(0.9)	4(0.8)	0.0248	0.875
Other	15(2.5)	18(3.8)	33(3.4)	2(1)	13(3.9)	15			2(1.5)	16(2.4)	18(3.4)		
overall	70(11.6)	60(13.2)	130(12.3)	18(9.3)	42(10.3)	70(11.6)			11(8.5)	49(15.2)	60(13.2)		

Table 5: Frequency and percentage lesions causing heart condemnation.

organ and carcass condemnation at Addis Ababa abattoir enterprise was estimated at 998,430.8 Ethiopian Birr. This total loss could be due to diseases and human factors either as a result of mishandling animals

during transports to the slaughterhouse or due to faulty slaughter operations in the abattoir.

Species	Risk factors		Pathological lesions (%)																
	Sex	Number of examined	1. INTRODUCTION	2.1 Study Area	2.2 Study Animals	2.4 Study Design	2.5. Data Management and Analysis	3 RESULT	Table: 5	Table 9: Frequency and percentage of condemnation of Lung.	Table 11: Pathological cause organ and carcass condemnation	Nephritis	Pericarditis	Hdronephrosis	Hepatitis	Cirrhosis	Mechanical damage	Calculi	Others
sheep	Male	414					3(0.7)					12(2.9)	18(4.3)	7(1.6)	13(3.4)	21(5.0)	11(2.6)	4(0.9)	31(7.4)
	Female	186					-				9(4.9)	13(6.9)	4(2.2)	4(2.2)	15(8.1)	3(1.6)	4(2.1)	20(10.7)	
	Total	600					3(0.5)				21(3.5)	31(5.1)	11(1.8)	17(2.8)	36(6.0)	14(2.3)	8(1.3)	51(5.1)	
	X <sup>2</sup>	23.82					1.354				1.403	1.8275	0.150	0.4565	2.0371	0.6139	0.3684	1.3684	
	P-value	0.000					0.244				0.232	0.176	0.698	0.499	0.153	0.433	0.242	1.3684	
Goat	Male	376					4(1.1)				7(1.8)	21(5.6)	1(0.2)	17(4.5)	9(2.4)	18(5.3)	4(1.1)		
	female	76					1(1.3)				5(6.6)	4(5.2)	2(2.6)	7(9.2)	4(5.3)	4(5.3)	-		
	Total	452					5(1.1)				12(2.6)	25(5.5)	3(0.6)	24(5.8)	13(2.8)	22(4.8)	4(0.8)		
	X <sup>2</sup>	1.056					0.367				5.4436	0.0125	5.366	2.7650	1.8636	0.0309	0.8157		
	P-value	0.304					0.848				0.020	0.911	0.021	0.096	0.172	0.860	0.366		

Table 6: Pathological cause organ and carcass condemnation.

## Discussion

The present study revealed that parasite and poor management practices are the major causes of organ and carcass condemnations. Parasitic causes like *Fasciola* species, *Hydatid cyst*, *Stilesia hepatica* and *Cysticercus tenuicollis* were found to be the major parasitic conditions responsible for organ condemnation. Even it impossible to draw back the origin of animal the frequency occurrence of pathological abnormalities show that parasitic disease of sheep and goats are widely distributed through to out the country. The major managerial practice that rendered organ and carcasses unfit for human consumption were faulty evisceration and bruising of carcass mainly brought about by mishandling of animals during transportation to the slaughter houses. Pneumonia was the major cause of lung condemnation in both species. It is observed that animals transported on foot long distance suffer from transportation stress and lack of feed and water. Those which were transported on open trucks are over crowded. Furthermore, animals are suffocated at the lairages and there was short resting time before slaughter for the animals to recover from physical stresses. Those conditions were causes of pneumonia and emphysema an observed at a higher case of incidence in this study. This indicates also violations of animal welfare stretching from farm to slaughter houses. The higher rate of occurrence of pneumonic lungs and poor meat quality are related to mishandling.

Liver condemnations are generally associated with infections of public health importance and for aesthetic reasons [13]. More than half of liver were condemned due to parasites; the rate of livers condemned in this study was relatively higher than a report in Debre Zeit HELMEX abattoir by Ejeta et al. [14] where 9.7% was recorded and a report in Kenya [15]. Mungube et al. have also reported frequency of liver condemnation due to *Fasciola* in goats at a rate of 6.6% which is lower than present finding 7.3%. The higher rate of fasciolosis observed in sheep in comparison with goat could be due to their feeding behavior where sheep are usually grazers and goat tend to be more of browsers making them less exposed to parasites. Mungube et al. have also reported cumulative incidence of liver condemnation due to *Stilesia hepatica* at 28% and 22% in sheep and goats respectively, which is higher than the result obtained in this study (4.33% and 3.98% in sheep and goats, respectively) and also Ejeta et al. reported higher incidence rate of liver condemnation due to *Stilesia hepatica* at 9.5% and 12.1% in sheep and goats, respectively. Ejeta et al. have also reported cumulative incidence of liver condemnation due to *Cysticercus tenuicollis* at 5.2% and 8.3% in sheep and goats, respectively, which is higher than the result obtained in this study (4.33% and 5.31% in sheep and goat, respectively) [14]. The epidemiology of *S. hepatica* and *C. tenuicollis* was not well established in sheep and goats; hence, it may be difficult to explain why significantly more livers were condemned in goats than in sheep. However Bekele et al. have reported a prevalence rate of 37.1% *C. tenuicollis* in sheep slaughtered at Addis Ababa Abattoir which higher than the present report in sheep (4.2%) [16]. This may be due to increase the health services in the conditions in the country. One-tenth of the total condemned livers were due to mechanical damage that was caused by faulty practices during evisceration. Higher frequency of mechanical damage was observed in young animals than adults which might be related to the difficulty associated with the removal of liver from the thoracic cavity.

The presence of small ruminant hydatidosis at slaughter house has been documented in Ethiopia. Bekele et al. reported a prevalence rate of 16.4% in sheep which is higher than the finding in this study [16]. Similarly Jobre et al. reported prevalence rate of 11% and 6% from

Risk factors			PARASITOLOGICAL LESIONS				
Species	Age	No. of Examined animal	Fasciola n (%)	<i>Stilesia hepatica</i> n (%)	<i>Cysticercus tenuicollis</i> n (%)	<i>Hydatid cyst</i> n (%)	<i>Cysticercus ovis</i> n (%)
Sheep	Young	193	18(9.33)	6(3.11)	11(5.69)	10(5.18)	2(1.04)
	Adult	407	52(12.78)	20(4.91)	15(3.69)	40(9.83)	5(1.23)
	Total	600	70(11.67)	26(4.33)	26(4.33)	50(8.33)	7(1.17)
	X <sup>2</sup>		1.5120	1.0291	2.2057		0.0420
	P-value		0.219	0.310	0.332		0.838
Goat	Young	129	7(5.43)	6(4.65)	5(3.88)	7(5.43)	1(0.78)
	Adult	323	26(8.05)	12(3.72)	19(5.88)	28(8.67)	3(0.93)
	Total	452	33(7.30)	18(3.98)	24(5.31)	35(7.74)	4(0.88)
	X <sup>2</sup>		0.9373	0.2112	0.7381		0.0248
	P-value		0.333	0.646	0.390		0.875
Overall	1052						

Table 7: Parasitological causes of organ condemnation.

south Omo and Debre Zeit slaughter houses, respectively in sheep and goats which is similar with the present finding (8% and 9.78% in sheep and goat, respectively) [8].

In present finding, hydatid cysts were more frequently observed in lungs than liver of sheep and goats. Additionally similar findings were reported also reported by different authors [17-19]. However, the most common site for hydatid cyst was the liver followed by the lungs in the Middle East [20].

Bruising caused more than one-fourth of all carcasses condemned. Bruising occurs due to use of rough vehicles and beating of animals during transportation. Bruising also caused by excessive uses of sticks while driving to the abattoir, mishandling of animals during loading and unloading, improper transport vehicle where responsible causes at slaughter. Bruising could be also a result of in the slaughter houses when animals struggle during slaughter as stunning of small ruminants was not practiced at Addis Ababa abattoir in particularly and in other abattoir in Ethiopia in general [21]. It has been suggested that bruising during transportation is the major sources of economic loss in Africa and Asia [22].

Abscess, calcification, cirrhosis, nephritis and pericarditis important causes for the condemnation of edible organs like liver, heart and kidney [23]. Ojo reported similar cases in Nigeria and was able to isolate bacteria with public health significance. Salmonella serotypes 14.5% of mutton samples examined from various super markets in Addis Ababa reported [14].

Though *Cysrticercus tenuicollis*, *Cysticercus ovis* and *Stilesia hepatica* do not have public health importance, they are considered as important causes of economic loss, since viscera harboring them are rejected for economic loss and aesthetic reasons. The threat these parasites pose to small ruminant's meat industry in Ethiopia is evident due to the present situation of improper disposal of offal at abattoirs and backyard slaughter. The presence of freely roaming/living stray dogs on grazing land together with live stock and the deep rooted habit of feeding dogs with offal are important risk factors. This may lead to perpetuation of the life cycle between intermediate hosts (ruminants) and the final host dogs for *C. ovis*, *C. tenuicollis* and hydatidosis.

The financial loss in the abattoir is considered high. However, realization of the total (true) economic loss from organ and carcass condemnation is difficult and complex. The indirect losses from mortality at the lairage and public health implication were not included in the analysis in this study. Thus, the total economic loss attributable to diseases of small ruminants and hence, abattoir wastage could be

much higher. The economic analysis of livestock disease in Ethiopia is scarce and inadequate because of lack of information on the prevalence and partly by the complexity of the analysis. Ngategize et al. reported a financial loss associated with liver condemnation due to ovine fasciolosis alone in the central highlands of Ethiopia amounting to be 2-3 million Ethiopian Birr (460,000 USD) [24]. Similarly Jobre et al. have estimated a total annual loss of 1.3 million Ethiopian Birr (260,000 USD) resulting from offal condemnation and carcass weight loss [8].

## Conclusion and Recommendations

Slaughter houses provide excellent opportunities for detecting disease of both economic and public health importance. Government and other programs in Africa can use abattoirs as a source of data to assist in monitoring diseases, provide feedback to producer, to produce whole some products and to protect the public from zoonotic hazards. The present survey report indicates that parasitic disease, other pathological conditions, mechanical damage evisceration and bruising were the major cause of organ and carcass condemnation and financial loss through organ at Addis Ababa abattoir enterprise, which may also reflect the same scenario in other slaughter houses in Ethiopia. To mitigate the economic and public health impacts of diseases of small ruminants, proper disposal of offal, prohibition of backyard slaughter of small ruminants and construction of slaughter houses, better disease control strategies, adequate training of abattoir personnel on the slaughtering operation and regular deworming of stray and home dogs and Education of small ruminant traders how to transport the livestock from farm to markets recommendations are forwarded.

## Competing Interest

The authors declare that they have no competing interest.

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