

# Study on the Major Problems that Causes Carcass and Organs Condemnation and Associated Financial Losses at Elfore Export Abattoir, Bishoftu, Ethiopia

Usman Nasir Belay Abebe\*

School of Veterinary Medicine, Jimma University, P.O.Box:307 Jimma, Ethiopia

## Abstract

The study was conducted from December 2014 to April 2015 in Elfore export abattoir at Bishoftu using cross sectional study method. The aim of this study was to identify and determine the major problems that cause carcass and organs condemnation and to estimate the magnitude of the direct losses attributed to the condemned carcass and organs from Ovine and Caprine slaughtered in the abattoir. Standard ante-mortem and post-mortem inspection procedures were followed throughout the study. Ante-mortem inspection was carried out on arrival and in the lairage and abnormalities encountered were recorded, followed by postmortem examination through their identification number to detect gross abnormalities and aesthetic reasons that rendered each organ to be rejected from local and international market. During the study a total of 256 Ovine's and 256 Caprine's Carcass and Organs were examined. The study revealed that in both species 213 (41.6%) livers, 96 (18.75%) lungs, 56 (10.93%) heart, 59 (11.52%) kidney and 34 (6.64%) carcass were rejected due to various causes. *Stelisia hepatica* 68 (13.28%), Emphysema 16(3.12%), pericarditis 16(3.12%), nephritis 13 (2.53%) and traumatic injury 18 (3.51%), were found to be the major causes responsible for rejection of respective organs and carcass respectively. Liver condemnation due to parasites such as *Stelisia hepatica*, hydatidosis and *Cysticercus tenuicollis* contributed to 68(13.28%), 57 (11.13%) and 54(10.54%) respectively of the total condemned liver of Shoa. However, there is no statistically significance difference ( $p>0.05$ ) for all causes of liver condemnation between young and adult as well as between sheep and goats. The annual loss due to the rejection of carcass and organs from the Shoats' slaughtered in the export abattoir is estimated at approximately 612,054.3USD. In conclusions results of the present study justify immediate need of prevention of various pathogens that causes organ and carcass condemnation and pathological abnormalities through development of animal health delivery, enforcement of slaughter policy, education on animal welfare/humane slaughter, and training of slaughterhouse personnel on standard slaughter operations.

**Keywords:** Elfore,Shoat,Ante-Mortem Inspection,Post-mortem Inspection,Organ, Carcass, Condemnation, Annual Loss

## 1. INTRODUCTION

Africa has a population of 205 million sheep and 174 million goats representing approximately 17% and 31% of the world total, respectively (FAO, 1993). Within Africa, the distribution of small ruminants varies widely, with a higher concentration found in dry areas than in humid areas. Sheep and goats produce only about 16% of the world's meat, despite their higher contribution to the total world livestock population (CTA, 2003). Small ruminants (sheep and goats) are important domestic animals in the tropical animal production systems (Devendra and McIeroy, 1982). Within African society they comprise a greater proportion of the total wealth of poor families because of low input requirements such as small initial capital, fewer resources and maintenance cost and ability to produce milk and meat using marginal lands and poor pasture. Furthermore, they need only short periods to reconstitute flocks after disaster and respond quickly to the demand (Hamito, 2008). The livestock population of Ethiopia is the largest in Africa and ranks ninth in the world. The livestock sub-sector accounts for about 30% of the agricultural GDP and about 18% of the total GDP (Roger, 2003).

Ethiopia owns huge number of small ruminants, about 24 million sheep and 18 million goats (LMA, 2001). Sheep and goats cover more than 30% of all domestic meat consumption and generate cash income from export of meat, edible organs, live animals and skins (Zelalem and Fletcher, 1991). However, each year a significant loss results from death of animals, inferior weight gain, condemnation of edible organs and carcass at slaughter. This production loss to the livestock industry is estimated at more than 900 million USD annually (Jacob, 1979). Even though, the livestock sub sector contributes much to the national economy, its development is hampered by different constraints. These include rampant animal diseases, poor nutrition, poor husbandry, poor infrastructure, and shortage of trained man power and lack of government policies (PACE, 2003). The significant economic losses incurred each year in the different abattoirs in Ethiopia are due to mortality, inferior weight gain and condemnation of edible organs at slaughter (Jobre *et al.*, 1996; Abebe, 1995).

Abattoirs provide information on the epidemiology of diseases on livestock to know to what extent the public is exposed to certain zoonotic diseases and estimate the financial losses incurred through condemnation of affected organs and carcasses (Nfi and Alonge, 1987; Van Longtestijn, 1993). As meat is the main source of

protein to man, 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. Yet meat is also condemned from human consumption because of aesthetic values caused by diseases and mechanical damage during slaughtering procedures. Sheep and goats in Ethiopia are the major sources of meat and offal exported to the Middle East. The leather industry derives most of the raw materials in the form of skin from small ruminants. However, a significant amount of organs and carcasses are condemned in the abattoir due to various diseases and pathological abnormalities (Tadesse, *et al.*, 2012).

The purpose of meat inspection comprising of ante mortem and post mortem examination, are to remove gross abnormalities from meat and its products, prevention of distribution of contaminated meat that could result to disease risk in man and animals and assisting in detecting and eradication of certain disease of livestock (Van Longtestijn, 1993 ). The importance of ante mortem inspection in the abattoir has long been recognized in an attempt to avoid the introduction of clinically diseased animals into the slaughter hall. Ante mortem inspection should be done within 24 hours of slaughter and repeated if slaughter has been delayed over a day (Gracey, 1999 and Teka, 1997). A proper ante mortem inspection of the animal makes the task of routine post mortem inspection simpler and straight forward procedure. Post mortem inspection is the center around which meat hygiene revolves since it provides information indispensable for the scientific evolution of clinical signs and pathological processes that affect the wholesomeness of meat (Gracey and Huey, 1999).

All gross lesions should be identified at least in a general way. A routine post mortem inspection of a carcass or an organ should be carried out as soon as possible after completion of dressing. The main purpose of post mortem examination is to detect and eliminate abnormalities, including contamination, thus ensuring that only meat fit for human consumption is passed for food (Gracey, 1999). It is necessary to be aware of the extent to which the public is exposed to certain zoonotic diseases detected in abattoirs and financial losses through condemnation of organs. Meat and meat products are extremely perishable (Sirak, A., 1991).

In Ethiopia, there were studies conducted by (Ejeta *et al.*, 2008; Ephrem *et al.*, 2012) that indicated a higher economic loss resulting from condemnation of edible organs and carcass due to parasitic causes. Nevertheless, they failed to show extent and impact of these parasitic and infectious diseases in combination as causes of organs and carcass condemnation at export abattoirs. Various investigations have been conducted through abattoir surveys to determine the economic importance of organs and carcass condemnation in Ethiopia (Jembere, 2002; Yimam, 2003; Assefa, 2005). According to a recent report, out of 2,688 sheep and goats examined in the HELIMEX abattoir, 2,898 organs (lung, heart, liver and kidney) were condemned from international and domestic market (Jibat, 2006).

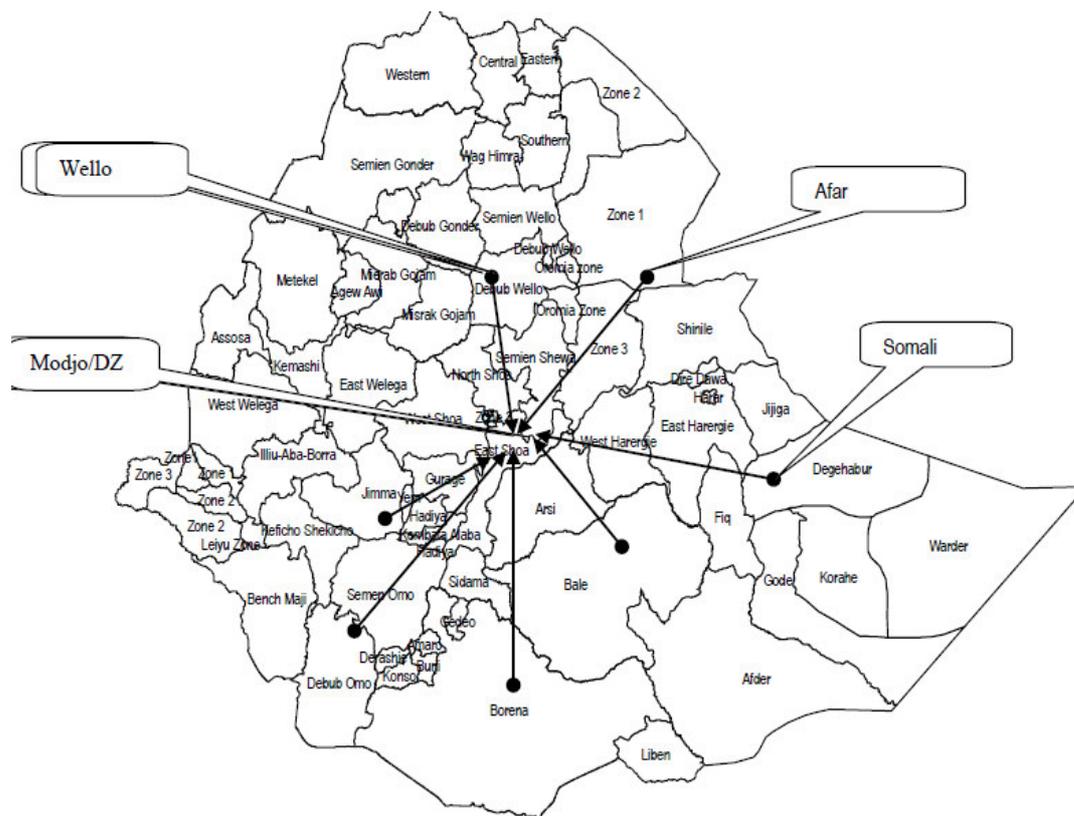
Disease causes extensive financial wastes as a result of direct and indirect economic losses, because disease is the major concern to small ruminants industry. Study conducted in different abattoirs of Ethiopia revealed that parasitic infection of livers; pneumonia, pericarditis and nephritis are found to be the major causes of organs condemnation, with an approximate annual loss of 2.7 million ETB at Debre Zeit HELIMEX abattoir (Jibat, 2006) and 106, 788. 18 ETB in Gondar Municipal abattoir (Yimam, 2003). Even though various investigation have been conducted through abattoir survey to determine the prevalence and economic losses resulting from organs condemnation in Ethiopia, most of the survey are focused on parasitic cases such as hydatidosis and fasciolosis (Assefa, 2005; Yimam, 2003; Jembere, 2002). Causes of organ condemnation due to other factors were lacking. Recently, several modern abattoirs like HELIMEX, Elfora, Metehara, Modjo and Luna have been established in Ethiopia. This increase in the number of abattoirs shows increase in demand of carcass and organs supply, but the supply is decreasing due to disease and production problems. In view of this, proper evaluation of economic losses due to organ and carcass condemnation resulting from various diseases at abattoirs is needed. Therefore, the objectives of this study are:

- To identify the major causes of organs and carcasses condemnation and rejection rate at Elfore export abattoir and
- To assess the direct economic losses from condemnation of organs and carcasses in the abattoir.

## 2. MATERIALS AND METHODS

### 2.1. Study Area

The study was conducted from December 2014 to April 2015 in Elfore meat Export abattoir at Bishoftu. Elfore abattoir is found in Bishoftu town, which is located at 9°N and 40 °E with an altitude of 1880 m.a.s.l in the central highlands of Ethiopia, 47kms south east of Addis Ababa. It has annual rainfall of 1151.6 mm of which 84% falls down during the long rainy season that extends from June to September and the remaining during the short rainy season that extends from March to May. The mean annual minimum and maximum temperatures is 8.5°C and 30.7°C, respectively and the mean humidity is 61.3% (NMSA, 2003).



**Figure 6.** Map showing study area and live animal supply chains to Elfore Abattoir.  
**Source:** (Belachew and Jemberu, 2003).

## 2.2 Study Animals

Small ruminants destined for slaughter was from different parts of the country including Bale, Afar, Somale and Borena. A total of 256 sheep and 256 goats destined for slaughter was inspected during ante mortem and post mortem inspections with their specific identification numbers and recorded accordingly on a format prepared for this purpose.

## 2.3 Sampling, Sample Size Determination and Study Methods

A cross-sectional study was conducted in sheep and goats slaughtered in the abattoirs. In this study, animals was grouped in to young (under 1 year of age in goats and 1 years and 3 months in sheep) based on eruption of one or more incisor teeth. Those having two pairs and above permanent teeth (i.e.  $\geq 1\frac{1}{2}$  years (for sheep) and  $\geq 2$  years (for goats) were grouped as adult (Vatta *et al.*, 2006). Body condition scoring was also carried out based on the handbook given by Ethiopian Sheep and Goat Productivity Improvement Program, ESGPIP (ESGPIP, 2007). Animals belonging to a group of young and adult were randomly sampled using systematic random sampling method and examined by antemortem and postmortem examination. The sample size required for this cross-sectional study was calculated according to the formula given by Thrusfield (2005). The sample size was determined based on expected prevalence of 50%, confidence interval of 95% and desired level of precision of 5%.

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

$n$  = numbers of individuals to be sampled

$P_{exp}$  = expected prevalence

$D^2$  = desired absolute precision.

1.96 = 95% confidence level

Accordingly, the sample size was 384. But, the sample size was raised to 512 Shoat with the intention to increase the precision of the study.

### 2.3.1 Abattoir Survey

#### 2.3.1.1. Antemortem inspection

Pre-slaughter examinations of small ruminants was conducted in the lairage by grouping the animals based on

species, age, body condition and place of origin. Antemortem inspections was conducted on individual animals, while the animals was entering into the lairage and after they entered in to the lairage in mass. Both sides of the animals were inspected at rest and in motion. Moreover, the general behavior of the animals, nutritional status, cleanliness, and sign of diseases and abnormality of any type was registered according to the standard antemortem inspection procedures (Campos, 2006). Following the judgments passed by (FAO, 1994), animal fit for human consumption was allowed for slaughter.

#### 2.3.1.2 Post mortem examination

During postmortem inspection liver, lungs, heart, kidney and carcasses was thoroughly inspected by visualization, palpation and making incisions where necessary for the presence of cysts, parasites and other abnormalities. Pathological lesions were differentiated and judged according to guidelines on meat inspection for developing countries and the results are recorded and the decisions at postmortem inspection is classified in to the following categories of judgment such as approved as fit for human consumption, conditionally approved as fit for human consumption, totally condemned as unfit for human consumption and partially condemned as fit for human consumption (FAO, 1994).

### 2.4 Assessment of Direct Economic Loss

All affected organs and carcasses was rejected from international market. To evaluate the economic losses, only the direct monetary losses due to rejection of liver, heart, kidneys and carcass were considered. The analysis was based on annual slaughter capacity of the abattoir considering market demand, average market prices on international and the rejection rates of specific organs and carcasses. The annual slaughter rates were estimated from retrospective data recorded in the past years. The economic loss due to condemnation was estimated by the formula set by (Ogunrinade and Ogunrinade 1980) as follows:

$$EL = \sum srk \times Coy \times Roz$$

Where:

EL = Annual economic loss estimated due to organ and carcass condemnation from International market.

$\sum srk$  = Annual sheep/ goats slaughter rate of the abattoir

Coy = Average cost of each sheep or goats liver/ lung/ heart/ kidney/ brain and carcass

Roz = Condemnation rates of sheep/goats/liver/lung/heart/kidney/brain and carcass.

### 2.5. Data Management and Statistical Analysis

The collected data were analysed using Stata12. Descriptive statistics were used to determine the level of organs and carcass condemnation rates defined as proportion of condemned organs and carcass to the total number of organs and carcasses examined. Possible variation between rejection rates of specific organs, age groups, origin and species of animals were taken into consideration. Data generated from ante mortem and post mortem meat inspection was recorded in Microsoft EXCEL 2013 program. Logistic regression was used to identify association between the outcome variable (post mortem findings) and various potential risk factors using Stata 12. The data obtained during the study were subjected to 95% confidence interval statistical analysis for possible variation between rejection rates of specific organs, age groups and species of animals and differences was regarded statistically significant if the 95% confidence interval drawn do not overlap to each other. The lower and upper limits of the 95% confidence interval for a proportion was calculated according to two methods described by Newcombe, 1998 and Wilson, 1927).

## 3. RESULTS

### 3.1. Abattoir Survey

**Ante-Mortem Inspection:** The ante-mortem inspection was carried out on all 512 Shoats (256 Ovine and 256 Caprine) for the detection of any abnormalities encountered in Elfore export abattoir. A total of 51 (19.92%) ovine and 30 (11.71%) Caprine species were found to have the abnormalities as depicted in Table 1. Depression was higher in caprine species and Tick infestation was higher in ovine species and followed by skin problems and locomotion problems in Ovine and Caprine respectively. There is no statistically significance difference ( $p > 0.05$ ) for all abnormalities/ conditions encountered during ante-mortem inspection between sheep and goats.

**Table 1:** Summary of abnormalities/conditions encountered during ante-mortem inspection

Conditions encountered during ante-mortem inspection	Species of animals		
	Caprine(n=256)	ovine(n=256)	total (n=512)
Skin problems	4(1.56%)	7(2.73%)	11(2.14%)
Lameness	4(1.56%)	2(0.78%)	6(1.17%)
Emaciation	3(1.17%)	9(3.51%)	12(2.34%)
Tick infestation	2(0.78%)	17(6.64%)	19(7.42%)
Depression	12(4.68%)	7(2.73%)	19(7.42%)
Nasal discharge	3(1.17%)	5(1.95%)	8(1.56%)
Coughing	2(0.78%)	4(1.56%)	6(1.17%)
<b>Total</b>	<b>30(11.71%)</b>	<b>51(19.92%)</b>	<b>81(15.82%)</b>

**Post-Mortem Examinations:** All animals that had been examined by ante-mortem inspection were all subjected to post mortem examination. A total of 512 Shoats (256 Ovine and 256 Caprine) were slaughtered and thoroughly examined by following standard postmortem procedure. From the total organs and carcasses examined in both species 213 (41.6%) livers, 96 (18.75%) lungs, 59 (11.52%) kidney, 56 (10.93%) heart, and 34 (6.64%) carcass were condemned from the international and local market based on their major parasite and gross pathological lesions (Table 2).

**Table 2:** Total number of animals slaughtered and rejection rate of specific organs and carcass

Species	Age	Body condition Total No. of animals Frequency of lesion and percentage of rejected organ								
		good	medium	poor	Total	Liver	lung	Heart	kidney	carcass
Caprine	Young	42	69	20	131	60(45.8%)	23(17.6%)	17(12.97%)	16(12.21%)	7(5.34%)
	Adult	47	58	20	125	51(40.8%)	15(12%)	12(9.6%)	10(8%)	7(5.6%)
total		89	127	40	256	111	38	29	26	14
Ovine	Young	43	63	22	128	56(43.7%)	24(18.7%)	14(10.93%)	18(14.06%)	14(10.9%)
	Adult	40	62	26	128	46(35.9%)	34(26.6%)	13(10.15%)	15(11.71%)	6(4.68%)
Total		83	125	48	256	102	58	27	33	20
Over all total		172	252	88	512	213	96	56	59	34

The origin of animals from Bale area has higher organs and carcass condemnation rate (Odds ratio = 1.67) compared to those animals originated from Somale, Afar and Borena as depicted on (Table 3).

**Table 3:** Summary of organs and carcass condemnation with respect to age, origin and species of animals using univariate logistic regression

Variables	No. Examined	No. affected	Prevalence	Odds Ratio	P-Value	95% CI
<b>Origion</b>						
Bale	128	90	70.31%	<b>1.67*</b>	-	-
Somale	128	75	58.59%	0.59	0.05	0.35-1.00
Affar	128	89	69.53%	0.96	0.89	--
Borena	128	83	64.84%	0.77	0.35	
<b>Age:</b>						
Young	259	178	68.72%	*	-	-
Adult	253	159	62.84%	0.76	0.16	0.53-1.23
<b>Species:</b>						
Caprine	256	173	67.57%	*	-	-
Ovine	256	164	64.06%	0.85	0.4	0.59-1.23

Species  $X^2=0.7$  Age  $X^2= 1.97$  origin  $X^2= 4.91$

Out of the total livers condemned in both species, the principal causes of condemnation were *Stelisia hepatica* 68 (31.92%), Calcification 41 (19.24%), Hepatitis 46 (21.59%), *Cysticercus teniculosis* 32 (15.02%) and hydatid cyst 18(8.45%) (Table 4). Liver condemnation due to parasites such as *Stelisia hepatica*, *Cysticercus tenuicollis* and hydatid cyst contributed to 68 (31.92%), 32 (15.02%) and 18 (8.45%) respectively of the totally condemned liver of both species (Table 4). There is no statistically significance difference ( $p>0.05$ ) for all causes of liver condemnation between young and adult as well as between sheep and goats.

**Table 4:** Summary of liver condemnation and its rejection rates

Causes of liver

Condemnation	Caprine (256)			Ovine (256)			Total Shoats	
	Young(n=131)	Adult(n=125)	Total	Young(n=128)	Adult(n=128)	Total	Total (n=512)	
Stelisia hepatica	19	17	36	14	18	32	68	
Cysticercus teniculus	14	10	24	6	2	8	32	
Hydatid cysts	4	6	10	7	1	8	18	
Calcification	13	8	21	11	17	28	49	
Hepatitis	10	10	20	18	8	26	46	
<b>Total</b>	<b>60(45.8%)</b>	<b>51(40.8%)</b>	<b>111(43.35%)</b>	<b>56(43.75%)</b>	<b>46(35.93%)</b>	<b>102(39.9%)</b>	<b>213(41.6%)</b>	

Species  $X^2=0.7$  Pr= 0.402 Age  $X^2= 1.97$  Pr=0.16

A total of 58 (22.65%) and 38 (14.84%) lungs in sheep and goats species respectively, were condemned. Even though lung was not exported for international market, it was examined for the purpose of breaking the transmission cycle of diseases and hence, 96 lungs were condemned from local market based on any gross lesions and parasites. The major causes of lung condemnation were hydatid cyst 29 (30.2%), *Cysticercus teniculus* 22 (22.91%), pneumonia 20 (20.83%), emphysema 16(16.66%) and calcification (9.37%) (Table 5). There is no statistically significance difference ( $p>0.05$ ) for all causes of lung condemnation between age groups and species of both sheep and goats.

**Table 5:** Summary of lung condemnation and its rejection rates

Causes of lung

Condemnation	Caprine (256)			Ovine (256)			Total Shoats	
	Young(n=131)	Adult(n=125)	total	Young(n=128)	Adult(n=128)	total	Total(n=512)	
Hydatid cysts	4	4	8	11	10	21	29	
Cysticercus teniculus	5	6	11	3	8	11	22	
emphysema	6	1	7	6	3	9	16	
calcification	2	2	4	1	4	5	9	
pneumonia	6	2	8	3	9	12	20	
<b>Total</b>	<b>23(17.55%)</b>	<b>15(12%)</b>	<b>38(14.84%)</b>	<b>24(18.75%)</b>	<b>34(26.56%)</b>	<b>58(22.65%)</b>	<b>96(18.75%)</b>	

Species  $X^2=0.7$  Pr= 0.402 Age  $X^2= 1.97$  Pr=0.16

The major causes of heart condemnation were found to be pericarditis, calcification, adhesion and hydro-pericardium. Out of the total 56 (10.93%) hearts condemned due to gross abnormalities, pericarditis contributes about 7 (12.5%) and 9 (16.07%) while congestion 3 (5.35%) and 6 (10.71%), adhesion 2 (3.57%) and 7 (12.5%) and hydro pericardium 10 (17.85%) and 2 (3.57%) in sheep and goats respectively (Table 6). There is no statistically significance association for the causes of heart condemnation between age and species of sheep and goats ( $p>0.05$ ).

**Table 6:** Summary of heart condemnation and its rejection rates

Causes of heart

Condemnation	Caprine (256)			Ovine (256)			Total Shoats	
	Young(n=131)	Adult(n=125)	total	Young(n=128)	Adult(n=128)	total	Total (n=512)	
Hydatid cysts	2	3	5	4	1	5	10	
Congestion	4	2	6	2	1	3	9	
Pericarditis	5	4	9	2	5	7	16	
Adhesion	5	2	7	1	1	2	9	
Hydropericarditis	1	1	2	5	5	10	12	
<b>Total</b>	<b>17(12.97%)</b>	<b>12(12.9.6%)</b>	<b>29(11.32%)</b>	<b>14(10.39%)</b>	<b>13(10.15%)</b>	<b>27(10.54%)</b>	<b>56(10.93%)</b>	

Species  $X^2=0.7$  Pr= 0.402 Age  $X^2= 1.97$  Pr=0.16

Out of the 59 (11.52%) kidneys condemned due to calcification 19 (32.2%) was the first principal cause for kidney condemnation in both species (Table 7). Whereas, Nephritis 13 (22.03%) accounting for 5 (4.47%) and 8 (13.55%) kidneys in Ovine and Caprine respectively. There is no statistically significance association for the causes of kidney condemnation between age and species of sheep and goat ( $p>0.05$ ).

**Table 7:** Summary of kidney condemnation and its rejection rate

Causes of kidney

Condemnation	Caprine (256)			Ovine (256)			Total Shoats Total (n=512)
	Young(n=131)	Adult(n=125)	total	Young(n=128)	Adult(n=128)	total	
calcification	6	3	9	6	4	10	19
abscess	1	2	3	3	6	9	12
Atrophy	1	1	2	3	2	5	7
Nephritis	3	2	5	5	3	8	13
hydronephritis	5	2	7	1	0	1	8
Total	16(12.21%)	10(8%)	26(10.15%)	18(14.06%)	15(11.71%)	33(12.89%)	59(11.52%)

Species  $X^2=0.7$  Pr= 0.402 Age  $X^2= 1.97$  Pr=0.16

The principal pathological lesion that cause carcasses to be rejected from international market were traumatic injury 18(52.94%), followed by pox like lesion 5 (14.7%) of the total carcass rejected during the study (Table 8). There is no statistically significance difference for all causes of carcass condemnation between age of young and adult and species of sheep and goat ( $p>0.05$ ).

**Table 8:** Summary of carcass condemnation and its rejection rate

Causes of carcass

Condemnation	Caprine (256)			Ovine (256)			Total Shoats Total(n=512)
	Young(n=131)	Adult(n=125)	total	Young(n=128)	Adult(n=128)	total	
Tuberculosis	1	1	2	1	2	3	5
Traumatic injury	3	1	4	10	4	14	18
Pox like lesion	1	2	3	2	0	2	5
Joundice	1	2	3	1	0	1	4
Poor bleeding	1	1	2	0	0	0	2
Total	7(5.34%)	7(5.6%)	14(5.46%)	14(10.93%)	6	20(7.81%)	34(6.64%)

Species  $X^2=0.7$  Pr= 0.402 Age  $X^2= 1.97$  Pr=0.16

### 3.2. Assessment of Direct Economic Loss

The annual direct economic loss from domestic and international market of organs and carcasses condemned at the export abattoirs was estimated to be 612,054.3 US\$ i.e. approximately 12,465,908 ETB (1USD = 20.4 ETB).

**Table 9:** Findings of the direct economic loss due to organs and carcass condemnation

Organ/carcass	Average rejection rate of organ and carcass of shoats	Average annual slaughter rates of shoats	Average price of organs and carcass
Liver	41.6%	240,000 (Max.)	4.5USD/KG
Carcass	6.64%		4.5USD/KG
Kidney	11.52%	200,000(Min.)	4.5USD/KG
Heart	10.93%		4.5USD/KG

## 4. DISCUSSION

Meat inspection is commonly perceived as the sanitary control of slaughter animals and meat. The aim of meat inspection is to provide safe and wholesome meat for human consumption. The responsibility for achieving this objective lies primarily with the relevant public health authorities who are represented by veterinarians and meat inspectors at the abattoir stage. Meat inspection and meat hygiene shall make sure that meat and meat products are safe and wholesome for human consumption. The classical ante-mortem and post-mortem procedures were designed to detect disease in an animal before slaughter and the lesions produced by the disease after slaughter respectively (Herenda *et al.*, 2000).

In the present study, organs condemnation rate showed that, liver and lung were the most frequently affected organs with the highest condemnation rate followed by kidney, heart and carcass. This finding is in agreement with reports of (Cadmus and Adesokan, 2009) who recorded that lungs (45.7%) and the liver (32.9%) were the most affected organs with the kidney (0.02%) and the heart (0.01%) being the least. Similar findings were also reported within Ethiopia in Gondar (Yimam, 2003) outside Ethiopia in Nigeria (Ojo, 1992).

The current study revealed that parasites and poor management practices are the major causes of organ and carcass condemnations. Parasitic causes like *Stelisia hepatica*, *Cysticercus tenuicollis* and hydatidosis were found to be the major parasitic conditions responsible for organ condemnation. There was no statistical difference in the rate of organ and carcass condemnation from parasitic infestation considering the origin of animals. This indicates that parasitic diseases of sheep and goats are widely distributed throughout the country.

In the present finding, hydatid cysts were frequently observed in the lungs than livers of small ruminants. Similar findings were also reported (Bekele *et al.*, 1988, Khan *et al.*, 2001). However, the most common site for hydatid cyst was the liver followed by the lungs in the Middle East (Abo-Shehada, 1993; Kamhawi, 1995). The presence of small ruminant hydatidosis at slaughterhouses has been documented in Ethiopia (Yitbarek *et al.*, 2012). Bekele *et al.* (1988) were reported a prevalence rate of 16.4% in sheep which is higher than the current finding (3.51% in liver and 5.66% in lung). Similarly Jobre *et al.* (1996) reported prevalence of 11% and 6% from South Omo and DebreZeit slaughterhouses, respectively, in sheep and goats. The low prevalence in the present study is explained by the fact that increased international market demand and population growth has resulted in shortage of animal supply, hence, many younger animals are slaughtered now than ten years ago.

Hydatid cyst is one of the major causes of organs condemnation in the present findings. 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 the long standing habit of feeding offal to dogs.

Animals transported on foot suffer from transportation stress and lack of feed and water. Those which were transported on open trucks are overcrowded. Furthermore, animals are suffocated at the lairage and there was short resting time before slaughter for the animals to recover from physical stresses. These conditions were causes of emphysema and pneumonia as observed at a higher magnitude from pathological lesion in this study. This indicates also violation of animal welfare stretching from farm to slaughter. Pneumonia and Emphysema were the major causes of lung condemnation both in sheep and goats. Pneumonia might be also a result of endemic diseases of sheep and goats such as pasteurellosis, which is triggered by stress and contagious caprine pleuropneumonia. Losses from liver condemnation are generally associated with infections of public health importance and for aesthetic reasons (Nurit *et al.*, 2011). Almost half of livers were condemned due to parasites. The rate of livers condemned in this study (41.6%) was relatively higher than a report in Kenya (5.2%) (Mungube *et al.*, 2006). Mungube *et al.* (2006) have also reported cumulative incidence of liver condemnation due to *St.Hepatica* which was 28% and 22% in sheep and goats, respectively, which is higher than the result obtained in the present findings, 15.02% and 16.9% in sheep and goats, respectively.

The total percentage of carcass encountered with abnormalities was 6.64% (34/512) resulting in 340 kg of meat loss with higher occurrence of carcass abnormalities observed in sheep (7.81%) than in goats (5.46%). Out of the various reasons of carcass condemnation traumatic injury was the most frequently encountered abnormality with the traumatic injury rate of 3.51% (18/512) which is lower than the 4.4% reported by Mitchell (1980). Traumatic injury caused almost half of all carcasses condemned. Traumatic injury occurs due to beating of animals during transportation and the use of rough vehicles. Apart from affecting carcass value, traumatic injury has also animal welfare implications as excessive use of sticks while driving to the abattoir, mishandling of animals during loading and unloading, improper transportation vehicle and at slaughter could be responsible for causes of condemnation (Edwards, 1997). Traumatic injury could also result in the slaughterhouses when animals struggle during slaughter (Gracey, 1999) as stunning of small ruminants was not practiced at Elfore Export abattoir in particular and in other abattoirs in general in Ethiopia. It has been suggested that traumatic injury during transportation is the major source of economic loss in Africa and Asia (Mitchell and Slough, 1980).

During red meat production, major condemnation occurs in the abattoir during skinning and evisceration, that some condemnation could occur during transport, lairage and deboning and that the most effective control point is in the chiller. Therefore, it is absolutely essential for meat inspectors to ensure that skinning and evisceration are done properly (Herenda *et al.*, 2000). Pericarditis, nephritis, hepatitis, abscess, traumatic injury and calcifications were important causes for the condemnation of edible organs like heart, kidney, liver and carcasses in this study. Similarly the same causes were found at Gondar (NMSA, 2003) and HELMEX (Jibat, 2008). Though *Cysticercus tenuicollis* and *Stelisia hepatica* do not have public health importance, they are considered as important cause of economic loss in the meat industry since viscera harbouring them are rejected for aesthetic reasons. The threat these parasites pose to small ruminants' 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 stray dogs on grazing land together with livestock and the deep rooted habit of feeding dogs with offal, including sheep and goats heads are important risk factors. This may lead to the perpetuation of the life cycle between intermediate hosts (ruminants) and the final hosts (dogs) for *C. tenuicollis* and hydatidosis.

The economic loss in the abattoir was relatively high because of its export standard. However, this study analysed those losses only through condemnation of edible organs and carcass from international market. A total loss 612,054.3 USD or 12,465,908 ETB was incurred in the abattoir which is higher than the report of (Jibat, 2008) total annual financial loss due to organ and carcass condemnation of 2.7 million ETB (312,555 USD) on study conducted at the HELMEX and lower than the report of (Sisay *et al.*, 2013) total annual financial loss due to organ and carcass condemnation of 548,128,894.10ETB (33,668,850.99 USD) on study conducted at the HELMEX. However, some of rejected carcass unfit for international market but fit for domestic market

including approved lung and heart were sold with salvage value in the town in a very low price at the abattoir. The current finding concerning the economic loss did not include the loss from poor flaying techniques that downgrades the quality and quantity of skins which is also the main source of foreign currency of the country. Liver condemnation accounts highest part of the losses (41.6%) of the total direct losses whereas lung, kidney, heart and carcass takes 18.75%, 11.52%, 10.93% and 6.64% respectively. The indirect losses from body weight gain, mortality at the farms, public health implications 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 diseases in Ethiopia is scarce and inadequate because of lack of information on the prevalence and partly by the complexity of the analysis.

## 5. CONCLUSION AND RECOMMENDATIONS

Parasitic diseases and pathological conditions were the major causes of financial loss through organ and carcass condemnation at Elfore export abattoir, which may also reflect the same scenario in other slaughter-houses in Ethiopia. Proper meat inspections are essential to remove gross abnormalities from meat and its products. Furthermore, it helps in the prevention of the distribution of contaminated meat that results in public health risk. In this study the condemnation of liver and lung were found to be very immense. Pneumonia, hepatitis, emphysema, calcification, *Stelasia hepatica*, abscess, atrophy, nephritis, *cystercus teniculusis*, traumatic injury, adhesion and hydatid cyst were found to be major causes of liver, lung, kidney, heart and carcass condemnation in the abattoir. According to the result of this study, parasitic diseases, pathological conditions, mechanical damage during evisceration and traumatic injury were the major causes of financial loss through organ and carcass condemnation at Elfore export abattoir. Thus result in extensive financial losses about 12,465,908 ETB per annum from direct economic losses. The present study indicated that a significant amount of money was lost due to diseases and abnormalities. Hence, this study may be valuable for the country by providing data in monitoring disease conditions and management practices of animals that have public health hazard and aesthetic value. Therefore,

- Awareness should be created for the animal attendants, farmers, customers, abattoir workers and butchers regarding the public health significance of diseases of animal origin and the related losses.
- Animals should be handled and transported without stress, careful and thorough ante-mortem inspection and post-mortem inspection have to be exercised with proper identification of each animal.
- Training should be offered to abattoir workers on the overall consideration in the due course of production, the condemned organs should be incinerated. So that it is easier to break the cycle of pathogens.
- Abattoirs should be supplied with ample water and waste disposal systems could be given special attention by the abattoir personnel.
- Regular deworming of small ruminants and dogs and elimination of stray dogs should be practiced.

Further studies should be carried out in small ruminants that are going to be slaughtered in different abattoirs of the country and introduce preventive measures to reduce unnecessary financial losses encountered in the industry.

## ACKNOWLEDGEMENT

The authors would like to thank the **ELFORE** export abattoir for their cooperation.

## 6. REFERENCES

- Abebe, G. (1995). Current status of veterinary education and animal health research in Ethiopia. In: veterinary medicine impact on human health and nutrition in Africa. Proceeding of an international conference ILRI, Addis Ababa, pp. 133-138.
- Abo-Shehada, M.N., (1993). Some observations on hydatidosis in Jordan. *J. Helminthol.*, 6677: 248-252.
- Assefa, M. (2005). Parasitic causes of carcass/organ condemnation at Asella municipality Abattoir. DVM Thesis, Faculty of veterinary Medicine, Addis Ababa University,
- Bekele, T., M.E., Mukassa and O.B. Kasali, 1988. The prevalence of cysticercosis and hydatidosis in Ethiopian sheep. *Vet. Parasitol.* 2288: 267-270.
- Belachew, H. and Jemberu, E. (2003). Challenges and opportunities of livestock trade in Ethiopia. Challenges and opportunities of livestock marketing in Ethiopia. In: Yilma Jobre and Getachew Gebru. (Eds), *Proceedings of 10th annual conference of the Ethiopian Society of Animal Production (ESAP) held in Addis Ababa, Ethiopia, August 22-24, 2002*. ESAP, Addis Ababa, Ethiopia. pp. 1-14.
- Cadmus, S. and Adesokan, H. (2009). Causes and implications of bovine organs/offal condemnations in some abattoirs in Western Nigeria Trop. Anim. Health Prod., <http://dx.doi.org/10.1007/s11250-009-9334-7>.
- CTA (2003). Small Ruminants Research and Development in Africa. Proceedings of the second Biennial conference of the African small ruminants' research network AICC, Arusha, Tanzania. P1.

- Devendra, C. and G.B. Mcleroy, 1982. Goat and sheep production in the tropics, Intermediate Tropical Agricultural Series, Longman Publishing Group, London.
- Edwards, D.S., A.M. Johnston and G.C. Mead, (1997). Meat inspection and overview of present practice and future trends. *Vet. J.*, 115544: 135-147.
- Ejeta, G., T. Jibat, Y. Asfaw and A. Wudie, (2008). Causes of abattoir condemnation in apparently healthy slaughtered sheep and goats at HELMEX abattoir, DVM Thesis, Faculty of Veterinary Medicine, Haramaya University, Debre Zeit, Ethiopia. 159(5): 305-311.
- Ephrem, B., W. Molla and A. Amare, 2012. Prevalence and Economic Losses of Bovine Fasciolosis in Dessie Municipal Abattoir, South Wollo Zone, Ethiopia. *European Journal of Biological Sciences*, 4: 53-59. Ethiopian highlands. *Trop. Anim. Hlth. Prod.*, 23: 155-167.
- ESGPIP, (2007). Body Condition Scoring of Sheep and Goats. Technical Bulletin No. 8. [www.esgPIP.org/PDF/Technical%20bulletin%20No8.html](http://www.esgPIP.org/PDF/Technical%20bulletin%20No8.html). Accessed from internet on Friday, January 01/2013
- FAO (1982): Echinococcus/hydatidosis; surveillance, prevention and control FAO/UNEP/WHO guide line, FAO animal production and health paper. Rome. P.29.
- FAO(1993). Agro state data, Statistical division, Rome, Italy
- Gracey, I.F., O.S. Collins and R.J. Huey, 1999. pp: 223-260.
- Hamito, D., (2008). Preface In: Sheep and Goat Production Handbook for Ethiopia, pp: 5.
- Herenda, D., Chambers, P.G., Ettriqui, A., Seneviratna, P. and Silva, T.J. (2000). FAO Animal Production and Health, Manual on Meat Inspection for Developing Countries, Food and Agriculture Organization of the United Nations
- Jembere, S., (2002). A survey of causes of organs/carcass condemnation in slaughtered cattle at Nazareth abattoir. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, Debre Zeit, Ethiopia.
- Jibat, T., 2008. Causes of organ and carcass condemnation in small ruminant slaughtered at DebreZeit HELMEX abattoir. DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University, DebreZeit, Ethiopia.
- Jobre, Y., F. Lobago, R. Tiruneh, G. Abebe and P.H. Dorchie, 1996. Hydatidosis in three selected region in Ethiopia, An assessment trial on its prevalence, economic and public health importance. *Revue. med. Vet.*, 114477: 797-804.
- Kamhawi, S., N. Hijjawi, A. Abu-Ghazaleh and M. Abbas, 1995. Prevalence of hydatid cysts in livestock from five regions in Jordan. *Ann. Trop. Med. Hyg.*, 8899: 621-629.
- Khan, A.H., A.A. El-Buni and M.Y. Ali, 2001. Domestic herbivores from Benghazi, Libya and their reactivity of antigens produced from them. *Ann. Trop. Med. Parasitol.*, 9955: 337-342.
- LMA, 2001. Brief baseline information on Ethiopian livestock resources base and its trade, Livestock Marketing Authority, Addis Ababa, Ethiopia.
- Mitchell, J.R. and C.A.B. Slough, 1980. Guide to meat inspection in the tropics, Common wealth Bureau of Animal Health, UK.
- Mungube, E.O., S.M. Bauni, B.A. Tenhagen, L.W. Wamae, J.M. Nginyi and M.J. Mugambi, 2006. The prevalence and economic significance of *Fasciola gigantica* and *Stilesia hepatica* in slaughtered animals in the semi-arid coastal Kenya. *Trop. Anim. Hlth. Prod.*, 3388: 475-483.
- NMSA, 2003. National Meteorology Service Agency. Addis Ababa, Ethiopia
- Nurit, M., Hailemariam, Z. and Mindaye, S. (2012). Major Cause of Liver Condemnation and Associated Financial Loss at Kombolcha Elfora Abattoir, South Wollo, Ethiopia. *European Journal of Applied Sciences*, 4: 140-145
- Ogunrinade, A. and Ogunrinade, B.I. (1980). Economic importance of bovine fasciolosis in Nigeria. *Trop. Anim. Hlth. Prod.* 12:155-160.
- Ojo, S., 1992. A Survey of Pathological Conditions in the Slaughter Goats in Zaria Slaughterhouse. Faculty of Veterinary Medicine, Ahmadu Bello University, Zaria, pp. 1-4.
- Roger Blench, Robert Chapman and Tom Slaymaker, 2003. Pro-Poor Livestock Policy Initiative, a study of the role of livestock in poverty reduction strategy papers. A living from livestock PPLPI working paper no. 1.
- Sirak, A., 1991. Causes of organ condemnation in livestock improvement conference.
- Sisay, D, Belay. A and Hailu. D, 2013. Study on the major health problem that causes carcass and organs condemnation At Hashmi's Nuru export Abattoir, Debrezeit, Ethiopia, *Global Veterinaria* 11 (4): 362-371.
- Tadesse, G., A. Akalu, T. Fentahun and M. Chanie, 2012. *Cysticercus tenuicollis*: Occurrence at Hashim Nur's Meat Export Abattoir, Debre-Zeit, Ethiopia. *Advances in Biological Research*, 6: 221-225. Van Longtestijin, J., 1993. Integrated quality meat safety: A new Approach. *Meat Focus International*, 2: 123-128.
- Teka, G., 1997. Food Hygiene. Principles and Methods of food borne disease control with special reference to

- Ethiopia. Faculty of Veterinary Medicine, Addis Ababa University, pp: 110-112. Febiga Philadelphia, pp: 40-160.
- Thrusfield, M (2005). *Veterinary Epidemiology*. Oxford, Black Well
- Van Longtestijn, J.G., 1993. Integrated quality. *Meat safety: a new approach*. *Meat Focus Int.*, 22: 123-128.
- Wilson, E. B. (1927). "Probable Inference, the Law of Succession, and Statistical Inference," *Journal of the American Statistical Association*, 22: 209-212
- Yimam, M. (2003). Major causes of organ condemnation in ruminants slaughtered at Gondar abattoir, North West Ethiopia. Debre Zeit: Faculty of Veterinary Medicine, Addis Ababa University, DVM Thesis.
- Yitbarek, D., M. Tefera and M. Bekele, 2012. Prevalence of Hydatidosis of Sheep Slaughtered at Abergelle Export Abattoir, Mekelle, northern Ethiopia. *Global Veterinaria*, 9: 490 - 496
- Zelalem, A. and I. Fletcher, 1991. Small ruminant productivity in the central highlands of Ethiopia. The Improvement Conference (NLIC), Addis Ababa, Ethiopia, 13-15 November, 1991, Institute of Agricultural Research (IAR), Addis Ababa, Ethiopia.