

**HARAMAYA UNIVERSITY  
FACULTY OF VETERINARY MEDICINE**

**MAJOR DISEASES OF EXPORT ORIENTED LIVESTOCK IN  
EXPORT ABATTOIRS IN /AROUND ADA LIBEN WEREDA,  
DEBRE ZEIT.**

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## **LIST OF ABBREVIATIONS**

ETB	Ethiopian Birr
FAO	Food and Agricultural Organization of the United Nation
HELIMEX	Hashim Nur's Livestock and Meat Export Abattoir
LDAO.....	Lume district Agricultural office
LDSP.....	Lume District Strategic Planning
masl	meters above sea level
MOARD	Ministry of Agriculture and Rural Development
SNNPR	Southern Nation Nationalities and People's Regional State
TLU	Tropical Livestock Unit
UNDP	United Nations Development Program
USD	United States Dollar
WHO	World Health Organization

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## **ABSTRACT**

The study was conducted from December to April 2007/ 2008 in Hashim's Ethiopian Livestock and Meat Export (HELIMEX) abattoir at Debre Zeit, Luna and Modjo modern export abattoirs at modjo. The aim of this study was to identify and determine the major diseases of organ and carcass condemnation and to estimate the magnitude of the direct losses attributed to the condemned organs and carcasses from sheep and goats slaughtered in the abattoirs. Standard antemortem and postmortem inspection procedures were followed through out the study. Antemortem inspection was carried out 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 229 sheep and goats and 229 organs and carcasses were examined. The study revealed that 176 (76.8%) livers, 141 (61.5%) lungs, 47 (20.5%) hearts, 32 (27.5%) kidneys 27 (11.8%) brain and 28 (12.2%) carcasses were rejected due to various causes. Hepatitis (23.9%), pneumonia (43.2%), pericarditis (10%), nephritis (9.6%), *oestrus ovis* (8.3%) and bonny carcass (8.7%) were found to be the major causes responsible for rejection. of respective organs and carcass. The annual loss due to the rejection of organs and carcasses from the small ruminants slaughtered in the export abattoirs is estimated at approximately 152,173.125 USD. Conclusions and recommendations are forwarded regarding causes of organ/carcass condemnation and resultant economic loss.

**Key Words:** *Sheep, goats, organ, carcass, condemnation, export abattoir, antemortem inspection, postmortem examination, east shewa.*

## **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 are important domestic animals in the tropical animal production system (Devendra and Meclorey, 1990). Within African society small ruminant comprise a greater proportion of the total wealth of the poor families, because of the low input requirements such as small initial capital, fewer resources and maintenance cost. They are also able to produce milk and meat in readily usable quantities using marginal lands and poor pasture and crop residues. Furthermore, their production cycle make them need only short periods to reconstitute flocks after disaster and respond quickly to the demand (Getenby, 1991)

Ethiopia has a large livestock population in Africa, which is estimated to be around 34-40 million TLU out of which 17% and 12% of cattle and small ruminants, respectively, are found in Ethiopia (FAO, 1993).

Livestock and livestock products also constitute one of the major export resources of the country and play a vital role in the country's economy (ESTS, 1997). Ethiopia owns huge number of small ruminants, estimated to be 42 million heads of sheep and goats. Small ruminants are found mainly in the lowland agro-ecology which constitutes 65% of the area, where 25% sheep and close to 100% goats population exist (PACE-Ethiopia, 2003). Sheep and goats cover more than 30% of all domestic meat consumption and generate cash income from export of meat carcass, edible organs, live animals and skins (Fletcher and Zelalem, 1991).

Hence, an increase in small ruminants production could contribute to the attainment of food self sufficiency in the country particularly in response to protein requirement for the growing human population as well as to enhance the export earning (Teferi, 2000).

Each year a significant economic loss results from mortality, poor weight gain, condemnation of edible organs and carcasses at slaughter. This production loss in the livestock industry is estimated at more than 900 million USD annually (Jacob, 1979; Abebe, 1995; Jobre *et al.*, 1996).

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-Ethiopia, 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).

A thorough meat inspection procedure requires two steps. Antemortem and postmortem inspections. The importance of antemortem inspection in the abattoir has long been recognized in an attempt to avoid the introduction of clinically diseased animals into the slaughter hall and should be done within 24 hours of slaughter and repeated if slaughter has been delayed over a day (Gracey, 1986; Teka, 1997).

The purposes of meat inspection, comprising of antemortem and postmortem 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 diseases of livestock (Van Longtestijin, 1993). It is necessary to be aware of the extent to which the public is exposed to certain zoonotic diseases detected in abattoirs and the financial losses through condemnation of affected organs and carcass (Nfi and Alonge, 1987).

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, hydatidosis, cysticercosis, and fasciolosis (Sirak, 1991).

A proper antemortem inspection of the animal makes the task of routine postmortem inspection simpler and straightforward procedure (Gracey, 1986). Postmortem 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 (Libby, 1995; Gracey, 1986).

All gross lesions should be identified at least in a general way. A routine postmortem 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, 1986). It is necessary to be aware of the extent to which the public is exposed to certain zoonotic diseases detected in abattoirs and the financial losses through condemnation of affected organs and carcasses (Nfi and Alonge, 1987).

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 2688 sheep and goats examined in the HELIMEX abattoir, 2898 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 investigations have been conducted through abattoir surveys to determine the prevalence and economic losses resulting from organ condemnation in Ethiopia, most of the surveys focused on parasitic cases such as hydatidosis and fasciollosis (Asseffa, 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 an increase in demand for carcasses 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 condemnation resulting from various diseases at abattoirs is needed.

The objectives of this study are therefore:

- ✓ To identify the significant causes of organs and carcass condemnations in sheep and goats slaughtered at Hashim, Luna and Modjo modern export abattoirs.
- ✓ To estimate the magnitude of direct economic loss attributed to the condemned organs and carcasses.

## 2. MATERIALS AND METHODS

### 2.1 Study Area

The study was conducted from December to June 2007/ 2008 in Hashim's Ethiopian Livestock and Meat Export (HELIMEX) abattoir at Debre Zeit, Luna and Modjo Modern export abattoirs situated at Modjo.

The HELIMEX abattoir is found in Debre Zeit town, which is located at 9° N and 40° E with an altitude of 1880 masl 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).

Luna and Modjo modern export abattoirs are located in Modjo town which is the center of Lume district in Eastern Shewa Administrative Zone of Oromia Regional State. It is located 70 kilometers south east of Addis Ababa 8°35'N and 39° 10' E at an altitude of 1777 masl. The average maximum and minimum temperature is 28°C and 18°C respectively (EMPDA, 1984).

The total area of Lume district is 752 km<sup>2</sup>, of this 60 km<sup>2</sup> is covered by water. The climatic condition of the area includes *Dega*, (high land) (80%), *Woinadega* (medium land/middle latitude (45%) and *kola* (low land) (25%) (LDSP, 2005).

The livelihood of the people mainly depends on agriculture/mixed livestock and crop production. The livestock population of the area includes 61,253 cattle, 20,953 sheep, 12, 897 goats and 15, 201 Equine species (LDAO, 2005).

## **2.2 Study Animals**

The small ruminants destined for slaughter were all males originated from different parts of the country including Arsi, Bale, Afar, Shewa, Wello, Omo, Borena, and Jenka. They were transported to the abattoir using vehicles and on foot. A total of 215 sheep and goats destined for slaughter were inspected during Antemortem and post mortem inspections with their specific identification numbers and recorded accordingly on a format prepared for this purpose (Annex 1).

## **2.3 Sampling and Study Design**

A cross-sectional study was conducted in sheep and goats slaughtered in the abattoirs. In this study, animals were 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 according to Gatenby (1991) and Steele (1996) (Annex 2 and 3). Animals belonging to a group of young and adult were randomly sampled using systematic sampling method and examined by antemortem and postmortem examination (Annex-1).

## **2.4 Abattoir Survey**

### *2.4.1 Antemortem inspection*

Pre-slaughter examinations of small ruminants were conducted in the lairage by grouping the animals based on species, age and place of origin. The age grouping was performed based on arbitrary classification according to Steele (1996) and Gatenby (1991). The age grouping was based on dentition. Those which have not erupted permanent incisor teeth, were classified as young, while those with one pair or more permanent incisor teeth were classified as adults (Gatentby, 1991; Steele, 1996).

Antemortem inspections were conducted on individual animals, while the animals were 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, sign of diseases and abnormality of any type were registered according to the standard antemortem inspection procedures (Gracey, 1986). Following the judgments passed by FAO (1994), animal fit for human consumption were allowed for slaughter.

#### *2.4.2 Pos mortem examination*

During postmortem inspection liver, lungs, heart, kidney, brain and carcasses were thoroughly inspected by visualization, palpation and making systemic 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 were recorded and the decisions at postmortem inspection are 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)

### **2.5 Assessment of Direct Economic Loss**

All affected organs and carcasses were rejected from international market since partial approval was not practiced in the abattoirs and the analysis was based on the annual slaughter capacity of the abattoirs considering market demand, average market prices in international and local market and the rejection rates of specific organ and carcass. The annual slaughter rates were estimated from retrospective abattoir record. The economic loss due to condemnation was estimated by the formula set by Ogunrinade and Ogunrinade (1980) as follows:

$$EL = \sum s_{rx} \times C_{oy} \times R_{oz}$$

Where:

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

$\Sigma srk$  = 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.

## **2.6. Data Management and Statistical Analysis**

Data generated from antemortem and postmortem meat inspection were recorded in Microsoft EXCEL 2003 program. Descriptive statistics was 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. The data obtained during the study was subjected to 95% confidence interval statistical analysis for possible variation between rejection rates of specific organs, age groups and species of animals and differences were 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 were calculated according to two methods described by Newcombe (1998) and Wilson (1927).

### 3. RESULT

#### 3.1 Abattoir Survey

##### 3.1.1 Antemortem inspection

The antemortem inspection was carried out on all 229 shoats (114 ovine and 115 Caprine) for the detection of any abnormalities encountered in the HELIMEX, Luna and Modjo modern export slaughter houses. A total of 52 (45.6%) ovine and 39 (34%) caprine species were found to have the abnormalities listed bellow (Table1). Nasal discharge and dirty wool were higher in both species.

**Table 1:** Summary of Abnormalities/conditions encountered during antemortem inspection.

<b>Conditions encountered</b>	<b>Ovine(n=114)</b>	<b>Caprine(n=115)</b>	<b>Total (n=229)</b>
	<b>%</b>	<b>%</b>	<b>%</b>
Nasal discharge	13 (11)	9 (7.8)	22 (19.1)
Dirty wool	12 (10.4)	9 (7.9)	21 (18.3)
Emaciation	11 (9.7)	8 (6.96)	20 (17.4)
Local swelling	0 (0)	7 (6.1)	18 (15.7)
Tick infestation	12 (11)	3 (2.6)	3 (2.61)
Lameness	4 (3.5)	2 (1.7)	6 (5.22)
Fungal like lesions	0 (0)	1 (0.9)	1 (0.87)
<b>Total</b>	<b>52 (45.6)</b>	<b>39 (34)</b>	<b>39.7 (79.1)</b>

##### 3.1.2 Postmortem examination

All animals that had been examined by antemortem inspection were all subjected to postmortem examination. A total of 229 shoats (114 ovine and 115 caprine) were slaughtered and thoroughly examined by following standard postmortem procedure. From the total organs examined in both species 176 (76.8%), livers,141 (61.6%)lungs,47 (20.5%) heart,32 (27.5%) kidney,27 (11.8%) brain 28 (12.2%) carcass were condemned

from the international and local market based on their gross pathological lesions (Table 2).

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

Species Examined		Total number of animals slaughtered	Frequency of lesions and percentage of rejected organs					Carcass
			Liver	Lung	Heart	Kidney	Brain	
Sheep	Young	64	47 (41.2)	38 (33)	10 (8.8)	5 (4.4)	7 (6.1)	7 (6.1)
	Adult	50	53 (46.5)	35 (31)	13 (11.4)	9(7.9)	7 (6.1)	9 (7.9)
Total		114	100 (87.7)	73 (64)	23 (20.2)	14 (12.3)	14 (12.2)	16 (14)
Goat	Young	65	57 (49.6)	34 (29.5)	8 (6.9)	12 (10)	6 (5.2)	8 (7)
	Adult	50	19 (17)	34 (28.2)	16 (14)	6 (5.2)	7 (6.1)	4 (3.5)
Total		115	76 (66.09)	69 (59)	24 (20.9)	18 (15.2)	13 (11.3)	12 (10.4)
<b>Total shoats</b>		<b>229</b>	<b>176 (76.8)</b>	<b>141 (61.5)</b>	<b>47 (20.5)</b>	<b>32 (27.5)</b>	<b>27 (11.8)</b>	<b>28 (12.2)</b>

Out of the total livers condemned in both species, the principal causes of condemnation were hepatitis 104 (66%), calcification 37 (16.2%), and mechanical damage occurring during evisceration 22 (9.6%) (Table 3) Liver condemnation due to parasites such as *Cysticercus tenuicollis*, *Stilesia hepatica*, and fasciolosis contributed to 22 (9.6%), 17 (7.4%) and 13 (5.7%) respectively of the totally condemned liver of both species. (Table 3). 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 ( $P>0.05$ ).

**Table 3;** Summary of liver condemnation and its rejection rates

Causes of liver condemnation	Ovine(n=114)						Caprine(n=115)						Total shoats(n=229)	
	young (n=64)	CI	adult (n=50)	CI	Total %	CI	Young (n=65)	CI	Adult (n=50)	CI	Total%	CI	%	CI
	Hepatitis	10 (8.7)	0.0483 - 0.1539	12 ( 10.5 )	0.0613- 0.1751	22 (19.3)	0.1311- 0.275	22 ( 19.1)	0.1299- 0.2727	5 ( 4.35)	0.0187- 0.0978	27 (23)	0.1667- 0.3201	49 (21.4)
calcification	9 (7.9)	0.0421- 0.1432	7 ( 6.1 )	0.0301- 0.1213	16 (14)	0.0883- 0.2159	12 (10.4 )	0.0607- 0.1735	9 ( 7.8)	0.0417- 0.1421	21 (18)	0.1226- 0.2631	37 (16.2)	0.1196- 0.2148
mechanical damage	7 (6.1)	0.0301- 0.1213	7 ( 6.1 )	0.0301- 0.1213	14 (12.3)	0.0746- .01956	5 ( 4.35)	0.0187- 0.0978	3 ( 3 )	0.0089- 0.0739	8 (7)	0.0357- 0.1313	22 (9.6)	0.0643- 0.1412
C.teniucolis	3 (2.60)	0.009- 0.0745	7 ( 6.1 )	0.0301- 0.1213	10 (8.8)	0.0483- 0.1539	6 ( 5)	0.0241- 0.1092	6 ( 5 )	0.0241- 0.1092	12 (10)	0.0607- 0.1735	22 (9.6)	0.0643- 0.1412
Stilesia hepatica	8 (7)	0.036- 0.1324	4 ( 3.5 )	0.0137- 0.0868	12 (11)	0.0613- 0.1751	2 (1.74 )	0.0048- 0.0612	3 ( 3)	0.0089- 0.0739	5 (4.3)	0.0187- 0.0978	17 (7.4)	0.0468- 0.1156
Fasiolosis	4 (3.50)	0.0137- 0.0868	4 ( 3.5 )	0.0137- 0.0868	8 (7)	0.036- 0.1324	2 ( 2)	0.0048- 0.0612	3 ( 3)	0.0089- 0.0739	5 (4.3)	0.0187- 0.0978	13 (5.7)	0.0335- 0.0947
Adhesion	2 (1.8)	0.0048- 0.0617	5 ( 4.4 )	0.0189- 0.0986	7 (6.1)	0.0301- 0.1213	3 ( 3)	0.0089- 0.0739	2 ( 2)	0.0048- 0.0612	5 (4.3)	0.0187- 0.0978	12 (8.3)	0.0302- 0.0893
petication	1 (0.9)	0.0016- 0.0481	1 ( 0.9)	0.0016- 0.0481	2 (1.8)	0.0048- 0.0617	2 ( 2)	0.0048- 0.0612	6 (5.2)	0.0241- 0.1092	8 (7)	0.0357- 0.1313	10 (4.4)	0.0239- 0.0785
Abscessation	1 (0.9)	0.0016- 0.0481	2 ( 1.8 )	0.0048- 0.0617	3 (2.6)	0.009- 0.0745	1 ( 1)	0.0015- 0.0476	4 ( 4)	0.0136- 0.0861	5 (4.3)	0.0187- 0.0978	8 (3.5)	0.0178- 0.0674
Jaundice	1 (0.9)	0.0016- 0.0481	0 ( 0)	0	1 (0.9)	0.0016- 0.0481	0 ( 0)	0	4 (3.4)	0.0136- 0.0861	4 (3.5)	0.0136- 0.0861	5 (2.2)	0.0093- 0.05
cirrhosis	1 (0.9)	0.0016- 0.0481	4 ( 3.5 )	0.0137- 0.0868	5 (4.4)	0.0189- 0.0986	2 ( 2)	0.0048- 0.0612	2 ( 2)	0.0048- 0.0612	4 (3.5)	0.0136- 0.0861	9 (3.9)	0.0208- 0.073
<b>TOTAL</b>	47 (41.2)	0.3262- 0.5041	53 (46.5 )	0.376- 0.5561	100 (87.7)	0.8044- 0.9254	57 (49.6 )	0.4059- 0.5857	19 ( 17)	0.1084- 0.2437	76 (66.09)	0.5704- 0.741	204 (89%)	0.8438- 0.9249

**Table 4:** Summary of lung condemnation and its rejection rates.

Causes of lung condemnation	Ovine(n=114)						Caprine(n=115)						Total (n=229)	
	Young (n=64)	CI	Adult (n=50)	CI	Total %	CI	Young (n=65)	CI	Adult (n=50)	CI	Total %	CI	Total %	CI
Pneumonia	27 (24)	0.1-0.35	21 (18)	0.07-0.3	48 (42.1)	0.3345-0.5129	25 (21.7)	0.1-0.3	26 (23)	0.1-0.3	51 (44.3)	0.356-0.5347	99 (43.2)	0.36-0.49
Emphysema	3 (3)	0.009-0.0745	6 (5.3)	0.01-0.11	9 (7.9)	0.0421-0.1432	2 (1.7)	0.03-0.05	2 (1.7)	0.02-0.06	4 (3.5)	0.0136-0.0861	13 (5.7)	0.03-0.09
Lung worm	5 (4.4)	0.4-0.52	3 (2.6)	0.02-0.1	8 (7)	0.036-0.1324	5 (4.3)	0.01-0.1	2 (1.7)	0.02-0.06	7 (6.09)	0.0298-0.1204	15 (6.5)	0.14-0.1
Hydatid cyst	2 (1.8)	0.01-0.05	2 (1.8)	0.02-0.06	4 (3.5)	0.0137-0.0868	0 (0)	0-0.0323	2 (1.7)	0.02-0.06	2 (1.7)	0.0048-0.0612	6 (2.6)	0.01-0.15
Marbling appearance	1 (0.9)	0.01-0.03	3 (2.6)	0.02-0.1	4 (3.5)	0.0137-0.0868	2 (0.02)	0.003-0.004	2 (1.72)	0.02-0.06	4 (4)	0.0136-0.0861	8 (3.5)	0.02-0.07
<b>Total</b>	38 (33)	0.01-0.07	35 (31)	0.2-0.4	73 (64)	0.5491-0.7226	34 (29.5)	0.1-0.4	34 (28.2)	0.2-0.4	68 (59)	0.4999-0.6768	141 (61.5)	0.5513-0.6763

A total of 73 (64%) and 68 (59%) lungs in sheep and goats species, respectively, were condemned (Table 4). The major causes of lung condemnation were pneumonia comprising 42.1% and 44.3% in ovine and Caprine species, respectively (Table 4). There is no statistically significance difference ( $p>0.05$ ) for all causes of lung condemnation between age and species of both sheep and goat.

The major causes of heart condemnation were found to be pericarditis, *Cysticercus ovis* and calcification. Out of the total of 47 hearts condemned due to gross abnormalities, pericarditis contributes about 8.8% and 11.3% followed by *Cysticercus ovis* accounting for 5.3% and 5.2%, calcification 6.1% and 4.4% in sheep and goats respectively (Table 5).

Renal problems were observed in 27.5% the kidneys examined (32/229) accounting for 12.3% and 15.6% kidneys in both ovine and caprine respectively, were rejected. Nephritis was the principal cause for kidney condemnation in both species (Table 2 and 6). There is no statistically significance association for the causes of kidney condemnation between age and species of sheep and goat ( $p>0.05$ ).

Out of 229 brains examined 27 (11.8%) were condemned, from which *Coenurus cerebralis* and *Oestrus ovis* accounted for 14 (12.2%) and 13 (11%) in ovine and caprine species respectively (Table 2 and 7). There is no statistically significance association between the causes of brain condemnation and age and species of sheep and goat ( $p>0.05$ ).

The principal pathological lesion that cause carcasses to be rejected from international market were bonny carcass 35.7% (10/28) followed by bruising, 32% (9/28) % of the total carcass rejected during the study (Table 2 and 8). There is no statistically significance difference for all causes of carcass of carcass condemnation between age and species of sheep and goat ( $p>0.05$ ).

Table 5: Summary of heart condemnation and its rejection rates.

Causes of heart condemnation	Ovine(n=114)						Caprine(n=115)				Total (n=229)			
	Young		Adult		Total %	CI	Young		Adult		Total%	CI	Total %	CI
	(n=63)	CI	(n=50)	CI			(n=66)	CI	(n=50)	CI				
Pericarditis	4 (3.5)	0.0137-0.0868	6 (6.7)	0.0243-0.11	10 (8.8)	0.0483-0.1539	6 (5.2)	0.0241-0.1092	7 (6.1)	0.01-0.13	13 (11.3)	0.067-0.1838	23 (10)	0.06-0.14
<i>C.ovis</i>	3 (2.6)	0.009-0.0745	3 (5.3)	0.009-0.0745	6 (5.3)	0.0243-0.11	1 (0.9)	0.009-0.0745	5 (4.3)	0.01-0.09	6 (5.2)	0.0241-0.1092	12 (5.2)	0.03-0.08
calcification	3 (2.6)	0.009-0.0745	4 (6.1)	0.0137-0.0868	7 (6.1)	0.0301-0.1213	1 (0.9)	0.009-0.0745	4 (3.5)	0.01-0.09	5 (4.4)	0.0187-0.0978	12 (5.2)	0.02-0.08
<b>TOTAL</b>	10 (8.8)	0.0483-0.1539	13 (11.4)	0.0678-0.1853	23 (20.2)	0.1384-0.2846	8 (6.9)	0.0357-0.1313	16 (14)	0.04-0.24	24 (20.9)	0.1444-0.2918	47 (20.5)	0.16-0.26

**Table 6.** Summary of Kidney condemnation and its rejection rates.

Causes of kidney condemnation	Ovine(n=114)						Caprine(n=115)						Total (n=229)	
	young (n=63)	CI	adult (n=50)	CI	Total %	CI	Young (n=66)	CI	Adult (n=50)	CI	Total	CI	Total %	CI
Nephritis	5 (4.4)	0.0189-0.0986	7 (6.1)	0.0301-0.1213	12 (10.5)	0.0613-0.1751	6 (5.2)	0.0241-0.1092	4 (3.5)	0.0136-0.0861	10 (8.7)	0.0479-0.1527	22 (9.6)	0.0643-0.1412
Nephrosis	0 (0)	0-0.0326	2 (1.8)	0.0048-0.0617	2 (1.8)	0.0048-0.0617	6 (5.2)	0.0241-0.1092	2 (1.7)	0.0048-0.0612	8 (7)	0.0357-0.1313	10 (4.4)	0.0239-0.0785
<b>TOTAL</b>	5 (4.4)	0.0189-0.0986	9 (7.9)	0.0421-0.1432	14 (12.3)	0.0746-0.1956	12 (10)	0.0607-0.1735	6 (5.2)	0.0241-0.1092	18 (15.6)	0.1013-0.2339	32 (14)	0.1007-0.1906

**Table 7:** Summary of Brain condemnation and its rejection rates.

Causes of brain condemnation	Ovine (n=114)						Caprine(n=115)						Total shoats(n=229)	
	Young (n=63)	CI	Adult (n=50)	CI	Total %	CI	Young (n=66)	CI	Adult (n=50)	CI	Total%	CI	Total%	CI
<i>c.cerebralis</i>	2 (1.8)	0.0048-0.0617	3 (2.6)	0.009-0.0745	5 (4.4)	0.0189-0.0986	1 (0.9)	0.0015-0.0476	2 (1.7)	0.0048-0.0612	3 (2.6)	0.0089-0.0739	8 (3.5)	0.0178-0.0674
Oestrus ovis	4 (3.5)	0.0137-0.0868	5 (4.4)	0.0189-0.0986	9 (7.9)	0.0421-0.1432	5 (4.3)	0.0187-0.0978	5 (4.3)	0.0187-0.0978	10 (8.7)	0.0479-0.1527	19 (8.3)	0.0538-0.126
<b>TOTAL</b>	7 (6.1)	0.0301-0.1213	7 (6.1)	0.0301-0.1213	14 (12.2)	0.0746-0.1956	6 (5.2)	0.0241-0.1092	7 (6.1)	0.0298-0.1204	13 (11)	0.0672-0.1838	27 (11.8)	0.0823-0.1661

Causes of Carcass condemnation	Ovine(n=114)						Caprine(n=115)						Total (n=229)	
	Young (n=63)	CI	adult (n=50)	CI	Total %	CI	Young (n=66)	CI	Adult (n=50)	CI	Total%	CI	Total %	CI
Bruising	2 (1.8)	0.0048-0.0617	3 (2.6)	0.009-0.0745	5 (4.4)	0.0189-0.0986	3 (2.6)	0.0089-0.0739	1 (0.9)	0.0015-0.0476	4 (3.5)	0.0136-0.0861	9 (4.4)	0.0208-0.073
Bonny carcass	4 (3.5)	0.0137-0.0868	1 (0.9)	0.0016-0.0481	5 (4.4)	0.0189-0.0986	3 (2.6)	0.0089-0.0739	2 (1.7)	0.0048-0.0612	5 (4.3)	0.0187-0.0978	10 (8.7)	0.0239-0.0785
adhesion	1 (0.9)	0.0016-0.0481	2 (1.8)	0.0048-0.0617	3 (2.6)	0.009-0.0745	0	0-0.0323	0	0-0.0323	0	0-0.0323	3 (1.7)	0.0045-0.0378
abscess	0	0-0.0326	1 (0.9)	0.0016-0.0481	1 (0.9)	0.0016-0.0481	2 (1.7)	0.0048-0.0612	1 (0.9)	0.0015-0.0476	3 (2.6)	0.0089-0.0739	4 (3.5)	0.0068-0.0441
jaundice	0	0-0.0326	2 (1.8)	0.0048-0.0617	2 (1.8)	0.0048-0.0617	0	0-0.0323	0	0-0.0323	0	0-0.0323	2 (0.9)	0.0024-0.0312
<b>Total</b>	7 (6.1)	0.0301-0.1213	9 (7.9)	0.0421-0.1432	16 (14)	0.0883-0.2159	8 (7)	0.0357-0.1313	4 (3.5)	0.0136-0.0861	12 (10)	0.0607-0.1735	28 (12.2)	0.086-0.1711

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

### 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 152,173.125 USD i.e. approximately million 1,418,253.5 ETB (1USD= 9.32 ETB).

**Table 9:** Findings of the study used in the direct economic loss assessment

<b>Organ/carcass</b>	<b>Average rejection rate of organs and carcass of shoats in the three export abattoirs</b>	<b>Average annual slaughter rates of shoats</b>	<b>Average price of organ and carcass</b>
Liver	76.8%	225,000	3.25USD/kg
Lung	61.5%		2.33USD
Heart	20.5%		3.25 USD/kg
Kidney	27.5%		3.25USD/kg
Brain	11.8%		3.25USD/kg
Carcass	12.2%		3.25USD/kg

#### 4. 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. An important 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 (Gracey *et al.*, 1999).

The most commonly encountered abnormalities during antemortem inspection were nasal discharge, dirty wool lameness, localized swelling and coughing. Diseased animals that show signs of abnormality during antemortem inspection should not be allowed to enter the abattoir for slaughter (Teka, 1997).

All animals that undergo postmortem examination were those which passed antemortem inspection. Both antemortem and postmortem examinations were done by veterinarians working for MOARD in all the three export abattoirs. Postmortem inspection of the carcass of animals with local swelling and lameness at antemortem inspection revealed that the swellings were localized and the lameness was due to trauma while being driven to market places and during transportation to the abattoir by inappropriate vehicles. Hence, in both cases the affected parts were trimmed off and the rest part of the carcasses was passed as fit for human consumption. The nasal discharge was most probably due to lack of feed and water, stress, immune suppression, overcrowding in the holding pens found in Afar, Oromia, SNNPR, and Somali regions, in the lairages of the abattoirs, during transportation and consequent respiratory diseases.

In the present study, out of the total of 229 (114 sheep and 115 goats) slaughtered, 76.8% liver, 61.6% lung, 20.5% heart, 27.5% kidneys, 11.8% brain, 12.2% carcass were rejected from the international and local (lung) market based on their gross pathological lesions. Even though the lung is not needed at international market but the organ is examined for the purpose of breaking the transmission cycle of animal diseases. The organs and

carcasses passed for consumption in the export abattoirs are marketed in Saudi Arabia United Arab Emirates and Yemen when requirements are fulfilled. The condemned organs having poor aesthetic value and pathologically unfit for human consumption are incinerated in the abattoir so as to break the transmission cycle of the various diseases.

From the total shoats slaughtered, Parasites like *Cysticercus tenuicollis*, *Stilesia hepatica*, and fasciolosis were found to be the major causes that rendered liver rejection from international market. Losses from liver condemnation were assumed to occur since hepatic pathology is associated to infection that might have public health importance (Budke *et al.*, 2006; Radostitis *et al.*, 2000) and aesthetic value. A high number of livers were condemned from sheep (87.7%) and goats (89%) due to various reasons. Previous studies have indicated a higher economic loss resulting from condemnation of edible organs and carcass due to parasitic causes (Aseffa, 2005; Jembere, 2002; Jibat, 2006; Negategize *et al.*, 1993; Abdela, 1994; Ferede, 1995). It has also been shown that significant number of livers could be rejected due to mechanical damages during evisceration (Abdela, 1994; Jobre *et al.*, 1996) that support the result of the present study. Similarly, 73 (64%) and 68 (59%) of lungs were condemned from the total lungs inspected in ovine and caprine species, respectively, from being used as pet food because of reasons like pneumonia, emphysema, lung worm, hydatid cysts and marbling appearance. Pneumonia accounts for 42.1% as a principal cause of lung condemnation. This condition is indicative of violation of animal welfare starting from farm to slaughter.

The main causes of brain rejection were found to be *Oestrus ovis* (8.3%) followed by *Coenures cerebralis* (3.5%) with a higher occurrence in adults. Though brain is not a common dish for Ethiopians, there is a higher demand in the Middle East countries. The reason for higher prevalence of infections in the adult may be due to a longer time of exposure to infection.

Bruising was observed at a rate of 4.4%. It is stated that bruising of animals during transport is the major source of economic loss in Africa and Asia (Mitchell and slough, 1980). Though the abattoir does not export partially approved organ and carcass, loss due

to bruising is more apparent in partially and totally condemned carcasses (Gracey *et al.*, 1999). Apart from affecting carcass value, bruising has also an implication for animal welfare as excessive use of sticks while driving animals to the abattoir is greatly responsible for this phenomenon (Edward *et al.*, 1997).

Furthermore, different lesions of infectious and non-infectious causes like abscess, pericarditis, nephritis, and jaundice were found to be important causes for the condemnation of edible organs like liver, heart, kidney, and brain. Similarly the same causes were found at Gondar (Yimam, 2003) and in goats slaughtered at Nigeria (Ojo, 1992). In addition, Ojo (1992) isolated bacteria with public health significance from these condemned organs with possibility of contaminating the carcass.

The economic loss in the abattoir was relatively high because of its export standard. However, this study analyzed those losses only through condemnation of edible organs and carcass from international market. A total loss of 152,173.125 USD or 1418253.5 ETB was incurred in the abattoir. However, 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 above figure /amount of loss did not include the loss from poor flaying techniques that down grades the quality and quantity of skins which is also the main source of foreign currency of the country, the indirect losses from body weight gain loss due to diseases which is in real term difficult to calculate and the treatment loss due to impact posed to the public health that were explained by works (Ngategize *et al.*, 1993; Ferede, 1995, Jobre *et al.*, 1996, Yilma, 2003 Aseffa, 2005).

## 5. CONCLUSION AND RECOMMENDATIONS

Disease is the major concern to the livestock industry as it causes extensive financial waste as a result of direct and indirect economic losses. According to the result of this study hepatitis, pneumonia, pericarditis nephritis *Coenurus cerebralis* and bruising are the most and major causes for respective organs and carcass of shoats to be rendered from international and local market and this results extensive financial loss about 1,418,253.5 ETB per annum. 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 and consequently of economic significance as most of the observed conditions leading to condemnation of organs and carcasses in this survey are not accepted by those importers. So as to reduce these losses the following recommendations are worth mentioning:

- ✓ Immediate, safe and controlled elimination of all condemned abattoir materials and the sloe of contaminated offal and heads as dog's feed should be prohibited by law.
- ✓ Back yard Slaughter mall ruminants should strictly be prohibited controlled by the government.
- ✓ Regular deworming of dogs and elimination of stray dogs should be practiced and training of abattoir workers on procedures and cares during flaying and evisceration should be done.
- ✓ Standard regulations and functional meat inspection policies should be formulated for organs and carcass approval/ rejection for abattoirs in order that a positive relation with importing countries and profitable and sustainable international meat trade relationships to continue.

- ✓ Different workshops should be prepared to enhance the awareness of the animal attendants, farmers, customers, abattoir workers and butchers pertaining the public health significance of the diseases, and proper disposal of condemned offals and carcasses.
  
- ✓ 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.

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## 7. ANNEX

### Annex 1: Antemortem and post mortem examination format.

<b>Animal ID.</b> _____			Date _____
Sex: _____	Age: _____	SPP. _____	
Breed: _____	Origin: _____		
<b>AMI:</b>			
T <sup>0</sup> : _____	Skin/surface _____		
HR: _____	Demeanor _____		
RR: _____	Gait and posture: _____		
Others: _____	Discharged/diarrhea _____		
Judgment : _____			
<b>PMI:</b>			
Lung/Bronchi _____	Brain _____		
Liver: _____	GIT: _____		
Heart: _____	Others: _____		
Kidney: _____			
Judgment: _____			

## Annex 2. Age estimation in Sheep and goats

### Estimation of the age of sheep from incisor teeth

None	Less than 1yr 3 months
1 pair	1 yr 3 months to 1 yr 1 month.
2 Paris	1 yr to months to 2 yrs 4 months
3 Paris	2 yrs 4 months to 3 yrs
4 pairs	more than 3 yrs

Source : (Gatenby, 1991)

### Estimation of the age of goats

<u>Age group</u>	<u>Teeth condition</u>
Under 1 year	eight sharp incisors
(1-2 years)	central pair of baby teeth replaced by permanent ones
2-3 years	4 permanent teeth
3-4 years	6 permanent teeth
4-5 years	8 permanent teeth
Over 5 years	worn teeth and some missing

Source :( Steele, 1996)

**Annex 3:** Lesions encountered in during the study



**A :**Tick infested sheep(antemortem)



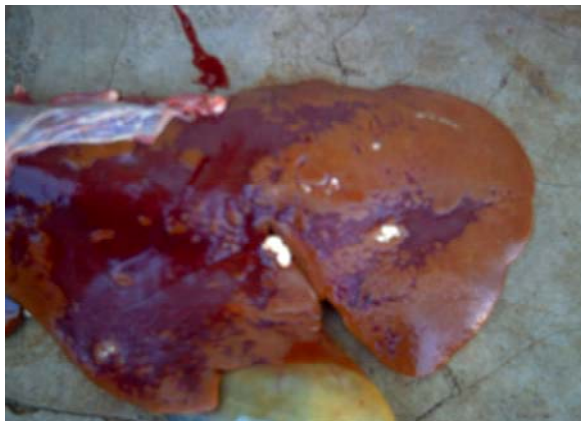
**B :**Fungal like lesion on scrotal surface of goat (antemortem).



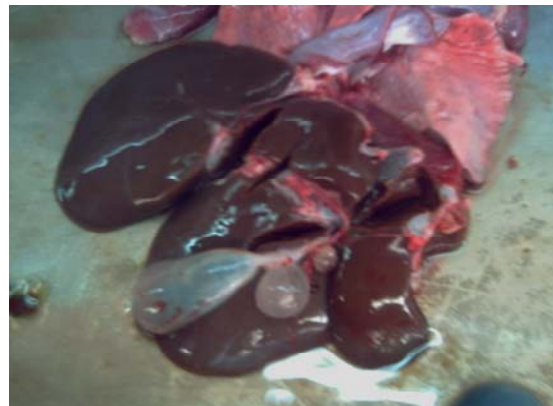
**C:** Identification number that has been used during Antemortem



**D:** Liver affected with fasciolosis



**E :** Calcifications on the liver



**F:** *Cysticercus tenuicollis* on visceral surface of Liver



**G:** Adhesion of diaphragm to diaphragm surface liver



**H:** Lung worm infected lung



**I:** Lung infected with pneumonia



**J:** Marbling appearance on diaphragmatic Lung (CCPP suspected)



**K:** Hydatid cyst on the pericardium of heart.



**L:** *Cysticercus tenuicollis* pedunculated on kidney



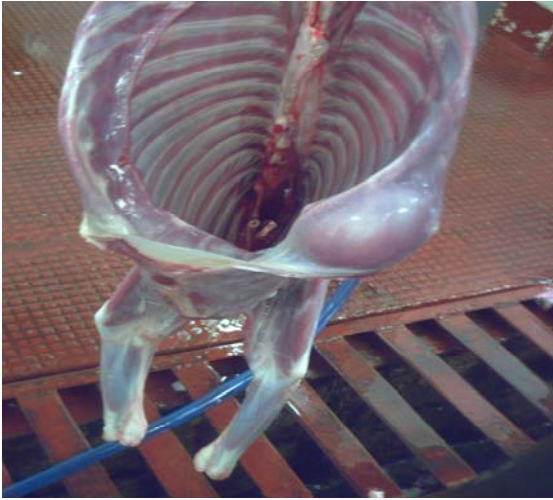
**M:** -kidney nephritis



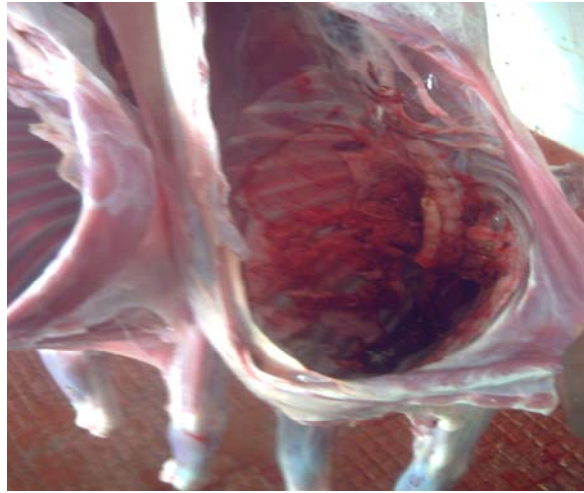
**N:** *Cysticercus tenuicollis* on the abdominal wall of carcass



**O:** Jaundiced carcass



**P:** Localized abscess on the carcass carcass



**Q:** Adhesion of the lung to the thoracic wall of the carcass



**R:** Bruising on carcass



**S:** Partially trimmed carcass due to bruising



**T:** *Coenurus cerebralis* in the brain of sheep.