

Parasitic Cause of Organ and Carcass Condemnation in Small Ruminant Slaughtered at Helmex Abattoir, Debrezeit, Ethiopia

Mohammed Hussien, Said Hussien, Gebeyow Chali and Mukarim Abdurahaman

School of Veterinary Medicine, College of Agriculture and Veterinary Medicine (JUCAVM), Jimma University, Jimma Town, Ethiopia

Abstract: *The study was under take from November 2007 to April 2008 at Debrezeit, HELMEX Abattoir. The aim of this study was to identity and determines the parasitic cause of organ and carcass condemnation and to estimate the magnitude of the direct economic losses attributed to the condemned organs and carcasses from sheep and goats slaughtered in the abattoir. Standard ante mortem and post mortem inspection procedure were followed throughout the study period. A total of 140 small ruminants were inspected for ante mortem in the lair age and abnormalities encountered were recorded. In addition to this post mortem examination was also conducted on 589 animals to detect parasitic causes that rendered each organ and carcass to reject from local and international market. During the study period the total of 1536 small ruminates organs and carcasses were examined and revealed that 377(24.5%)liver, 197(12.8) lungs,15 (0.97%) hearts ,0(0%) ,kidney and 0(0%) carcasses were rejected due to parasitic causes: Fasciolosis (10.28%) ,Hydrated cyst (9.75%), Cysticercus tenuicollis (13.51%), Stellesia hepatica (21.34%), lung worm (19.78%),and Cysticercus Ovis (0.97%) were found to be the parasitic causes responsible for the rejection of respective organs . From the total organs inspected 38.34% organs of sheep and goats were rejected from the market and the annual losses due to the rejection of organs from small ruminants slaughtered in the abattoir is estimated to be 47272.5USD. Finally conclusions are drawn and recommendations are forwarded:*

Keywords: *Monitory loss, Organ condemnation, small ruminants*

1. INTRODUCTION

Ethiopian owns about 24 million sheep and 18 million goats (LMA, 2001). Sheep and goats cover more than 30% of all domestic meat, edible organ and skin (Fletcher and Zelalem, 1991). An increase in small ruminants production could contribute to the attainment of food self sufficiency for the growing human population as well as to enhances export earnings. However, this great livestock potential is not properly exploited traditional management methods limited genetic potential, government polices and rampant diseases mortality inferior weight gain, condemnation of edible organs and carcass at slaughter. This production loss to the livestock industry is estimated at more than 900 millions USD annually (Jacob, 1997, Abebe, 1995, Jobber *et al.*, 1996).

It is necessary to be aware of the extent to which the public is exposed to certain zoonotic diseases detected in abattoir and the financial losses that incur through condemnation of affected organ and carcass (Nit and Alonge, 1987). As meat is the main sources of protein it should be free from zoonotic diseases like Hydatidosis, Cysticercosis' (Sirank, 1991).

Similarly like many other tropical African countries it is well known that the parasitic diseases are among the major factor for the low productivity of livestock in Ethiopia (Jobre *et al*, 1996: Abebe 1995).

Some parasitic diseases of food producing animals are zoonotic and veterinarian have a vital role in ensuring that these diseases are controlled in animal herds so that spread to human population does not occur (Radostits *et al.*, 1994). It has been suggested that government or other program to control or eradicated diseases across Africa and to be monitored taking as a references the information obtained from abattoir (Alonge and Fasamni, 1979).

Export abattoir including HELMIX, ELFORA, Metahara, Modjo and Luna export abattoirs have been established in Eastern Showa Zone of Oromia Region, Ethiopia to export red meat and edible offal to

international market. This enhances the economic development of the country through economical exploitation of the livestock base of the country (Jibat, 2006).

Various investigation have been conducted through abattoir survey to determine the prevalence of diseases and economic losses in which incurred due to condemnation of organs and carcass in Ethiopia (Jembere, 2002; Yimam, 2003; Assefa, 2005). However, most of the survey paid more attention to parasitic causes in cattle. Hence, there are particularly nonexpendable and precise information available with regards to small ruminants.

In view of this, proper evaluation of economic loss due to organs and carcass condemnation in sheep and goats at abattoir is needed. Therefore, the present study was under taken with the following objectives

- To identify the parasitic causes of organ and carcass condemnation of sheep and goats slaughtered at HELMEX abattoir.
- To estimate the magnitude of direct economic loss attributed to the condemned organs and carcass.

2. MATERIALS AND METHODS

2.1. Study Area

The study was conducted at Hashim abattoir, Debre Zeit from November 2007 to April 2008. The abattoir is privately owned abattoir exporting mutton, lamb, goat meat and edible organ like liver, kidneys and brain of sheep and goat to Middle East countries.

The abattoir is found in the Debre Zeit town, which is located at 9 N⁰ and 40⁰ E with altitude of 1880 meter above sea level in the central highland of Ethiopia 47 km south east of Addis Ababa. It has annual rainfall of 1151.6mm of which 84% fall down during the long rainy season that extends from March to May. The mean annual minimum and maximum temperature are 8.5⁰C and 30.7⁰C respectively, and the mean annual minimum and maximum humidity is 61.3 % (NMSA, 2003). The animals originate from different part of the country with different agro- ecological zones: high land and low land. These areas are Arsi, Bale, Afar, East, Showa, Ogaden, Wallo, Omo and Borena.

The abattoir has holding pens in each of these region purchased animals are congregated in the holding pens before being transport to the abattoir by vehicle and on foot. The holding pens are found in Negele bornea, Yabello, Awasa, Wonji and Awash.

2.2. Study Animals

A total of 1536 animals (equal sheep and goats) destined for slaughter was inspected. The study was performed on edible organs (liver, lungs heart and kidneys) and carcass in both sheep and goats. The animal were grouped in to young (under one year of age in goat and one year and three month in sheep), and adult based on eruption of one or more incisor teeth according to (Gatenby, 1993 and Steele, 1996).

2.3. Study Design

The study type is cross sectional, lungs, liver, kidney, heart and carcass of both sheep and goats are selected randomly as presented for postmortem inspection and inspected.

2.4. Sample Size

Sample size was determined according to the formula, proposed by Thrusfield (1995) as indicated below.

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

Where n= required sample size

P_{exp}= expected prevalence (50%)

D= desired absolute precision (5%)

at 95% Confidence interval

$$N = \frac{1.96^2 \times 0.5(1-0.5)}{(0.05)^2}$$

N= 384 for each groups

One group consists of 384 animals were taken in this study to calculate the sample size within each group i.e 384 for each of the four group was summed up to give the total sample size of 1536- sheep and goats.

2.5. Study Methodology

2.5.1. Ante Mortem Examination

The animals were examined on both sides for their behavior, posture, conformation, gait and any discharges encountered with in twenty four hours of slaughtering. The animals with poor body condition, depressed, staring hair coat, and nasal discharge were slaughtered under special follow up during post mortem examination

2.5.2. Postmortem Examination

During meat inspection liver, lungs, heart, a kidneys and carcasses were thoroughly examined by visual inspection, palpation and making systematic incision, where necessary for the presences of cysts, adult parasites and other abnormalities. Pathological lesion was differentiated and judged based on (FAO, 1994) guideline on meat to developing countries.

2.5.3. Assessment of Direct Economic Loss

All affected organs and carcasses were condemned to enhance the international market; partial approval is not practiced in the abattoir. In assessing the economic loss, only the direct economic loss due to rejection of the organ and carcass from international market was considered. The analysis was based on annual slaughter capacity of the abattoir, average market prices of organ on the international market and Debre Zeit town and rejection rate of specific organ and carcass. The annual slaughter rate was estimated from retrospective market price of each organ and carcass was determined from interview made with personnel of the abattoir marketing department. Information obtained was subjected to mathematical computation by modifying the formula suggested by (Ogurinade and Ogurinade, 1980) for liver rejection.

$$EL = \sum Srxcoy \times Roz$$

Where, EL= estimated annual economic loss due to organ carcass condemnation from international domestic market.

\sum = Summation

Srx = Annual sheep/ goats slaughter of the abattoir

Coy= Average cost of each sheep/goats liver/lung/heart/carcass

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

2.6. Data Management and Statistical Analysis

Data generated from post mortem meat inspection was recorded in the Microsoft excel 2000 program (annex 1).

Description statistic such as percentage was used to determine the level of organ and a carcass condemnation rate which was define as the proportion of condemned organ and carcass to the total number of organ and carcass examined. The variation between condemnation rate of specific organ and carcass, age group differences were statistically evaluated for significant p- value less than 0.05 using STATA 7.0 (2001).

3. RESULT

3.1. Abattoir Survey

3.1.1. Ant mortem Examination

The abnormalities found during conducting ante mortem inspection out of the total 1536 animals (equal sheep and goats) are 58(7.5%) sheep and 82(10.6%) goats (table). Nasal discharge was the

highest abnormality detected in sheep (5.6%) and (7.85%) goats under gone ante mortem examination at HELMEX abattoir. However these animals were posses for slaughter with precaution of through post mortem examination as judged by the meat inspectors.

Table1. Abnormalities Encountered During Ante Mortem Examination

Abnormalities	Sheep			Goats			Total
	Young	Adult	Total	Young	Adult	Total	
Lameness	0(0)	2(0.07)	2(0.07)	1(0.03)	2(0.07)	3	3(0.01)
Poor Condition	3(0.01)	4(0.14)	2(0.24)	6(0.21)	4(0.14)	10	10(0.35)
Local Swelling	6(0.21)	3(0.10)	9(0.31)	7(0.25)	6(0.21)	13	13(0.46)
Nasal Discharge	11(0.91)	29(1.03)	40(0.42)	19(0.67)	37(1.32)	56	56(1.99)
Total	20(0.71)	38(1,34)	58(2.05)	33(1.16)	49(1.75)	82	82(2.99)

3.1.2. Postmortem Examination

Out of 1536 animals (sheep and goats) slaughtered, 377(24.5), 197(12.8%), 15(0.97%) 0(0) and 0(0%) of liver, lung heart, kidney and carcass were condemned from gross abnormalities as unit for international and domestic

Market Significances differences was observed in condemnation rates among organs (P<0.05) (Table-2)

Table2. Organs/Carcass Condemnation rates of sheep and goats

Animal Species	No of animal Examined	Organ/Carcass Condemned				
		Live	Lung	Heart	Kidney	Carcass
Sheep						
Young	384	82	29	1	-	-
Adult	98	98	79	4	-	-
Total	768	180	108	5	-	-
Goats						
Young	99	99	23	3	-	-
Adult	98	98	66	7	-	-
Total	768	197	89	10	-	-
Total	1536	377	197	15	-	-

The overall liver condemnation due to parasitic causes was 24.5% (Stellesia hepatic, cysticercus tenuicollis, fasciola species and hydatid cysts). There was no statically significant differences between sheep and goats (P>0.05) and also between young and adult age group of both species (table 3)

Table3. Parasite Causes of Liver Condemnation

Abnormalities	Sheep			Goats		
	Young	Adult	Total	Young	Adult	Total
Fasciola	20	32	52	13	14	27
Stellesia Hepatica	39	33	72	44	48	92
cysticercus tenuicollis	17	22	39	38	27	65
Hydrated cysts	6	11	17	4	9	13
Total	82	98	180	99	98	197

Hydatidosis followed by lung worm were the major causes of lung rejection. There was no statistically significant differences between sheep and goats (P>0.05) but statistically significant difference was observed (P< 0.05) between the young and adult age group of both species (table 4)

Table4. Parasite Causes of Lung Condemnation

Abnormalities	Animal Species					
	Sheep			Goats		
	Young	Adult	Total	Young	Adult	Total
Hydrated cysts	6	18	24	5	16	21
Lung worm	23	61	84	18	50	68
Total	29	79	108	23	66	89

Out of the 15 total hearts condemned due to parasite cause, cysticercus ovis contribute (0.97%). There was significant differences between the age groups young and adult (P>0.05) while no significant difference between the two animals (P>0.05) (able-5).

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Table5. Causes of Heart Condemnation

Abnormalities	Animal Species					
	Sheep			Goats		
	Young	Adult	Total	Young	Adult	Total
C. ovis	1	4	5	3	7	10
Total	1	4	5	3	7	10

3.2. Assessment of Direct Economic Loss

Using all the necessary information in the formula set by Ogurinate and Ogurinate (1980) the annual direct economic loss from international and domestic market of organs and carcass at HELMEX abattoir was estimated to be 47,272.5 USD.

Table6. Finding of the Study Used in the Direct Economic Analysis

Organ/Carcass	Species of animal rejection rates		Average annual slaughter rate		Average price of organ/ carcass on market
	Sheep (%)	Goat (%)	Sheep(n)	Goat(n)	
Liver	24.4	25.6	30,000	40,000	2.75 UD/kg
Lung	14.0	11.5			0.1 ETB
Heart	0.65	1.3			0.1 ETB
Kidney	-				2.75 USD/kg
Carcass	-				2.75 UD/kg

4. DISCUSSION

Meat inspection is conducted in the abattoir for the purposes of screening and removing animal products with abnormal pathological lesion that are unattractive and unsafe for human consumption. Meat inspection assists to detect meat that could give rise to disease of livestock and prevent the distribution of infected meat that could give rise to disease in animals and human being and to ensure competitiveness of the product in the local and global market (EVA, 2002; Graney *et al.*, 1999; Hinton and Green, 1997, Vanlongestigin, 1993).

In developing countries abattoirs play a major role in providing and serving as sources of information and a references center for diseases prevalence. Alonge and Fasamni (1979) suggested that governments or other program aimed at controlling or eradicating disease across African countries use abattoir survey result in the planning and control of livestock disease.

In the present study thorough post mortem examination was conducted in the abattoir after all the animals in the lair age have passed the ante mortem inspection. The animal to be examined in the lair age at HELMEX export abattoir are not directly bought from the customers in the abattoir but the animals are transported to the abattoir by vehicle after they are congregated in holding pens found in Afar, SNNPR and Oromia regions. The most commonly encountered abnormalities during ante mortem were nasal discharge lameness, localized swelling and poor body condition. Nasal discharge observed were probably due to immune suppression, stress and consequent respiration diseases during transportation and overcrowding in the lair age (Jibat, 2002).

Diseased or animals show sign of abnormality during ante mortem inspection should not be allowed to enter abattoir for slaughter (Teka, 1997).

Postmortem inspection of the carcass of these animals revealed that the swelling were all localized to one area and the lameness was due to trauma to the legs, while being driven to the abattoir. Hence, in both case the affected part were trimmed off and the rest part of the carcass was passed fit for human consumption.

The present study revealed that out of the total 1536 slaughtered small ruminants 377 (24. 5%) , 197 (12.87%, 15(0.97%), 0(0) and 0(0) of liver, lung, heart, kidney and carcass respectively were rejected from market due to their gross abnormalities (table 2). The organs passed for consumption in the HELMEX Export Abattoir are marketed in the Middle east countries based on their requirement, but the majority of the organs, are sold at local market The rejected organs which found pathologically unfit for human consumption are incinerated in the abattoir to break transmission cycle of the diseases.

During the study, 180(23.4%) and 197(25.6%) liver of ovine and caprine, respectively were encountered and rendered the liver to be condemned during the study period are: fasciolosis, *Stellera hepatica*, *Cysticercus tenuicollis* and hydrated cysts

Research conducted by several investigators on ovine fasciolosis prevalence's in different parts of the country revealed 3.6% in Debre Zeit HELMEX(Jibat, 2006), 40.6 in Gondar (Yimam, 2003), 53.3% in eastern Gojam (Beyazen, 1995) and 30% in Ziway (Abdela, 1994) and caprine fasciolosis prevalence's revealed 8.3% in Debre Zeit HELMEX (Seblewengel, 2007).

In Ethiopia, fasciolosis has been reported to be one of the major diseases problems of livestock industry and exist in almost all regions. However the prevalence rate epidemiology and Fasciola species involved vary significantly with locality. This is attributed mainly due to the variation in the climate and ecological condition (Manyazeual, 1995; Lama *et al.*, 1985; Bahiru and Ephraim, 1979).

Cysticercus tenuicollis is the most important and widely prevalent metacestode recorded in small ruminant slaughtered in the study abattoir. The prevalence of *Cysticercus tenuicollis* by species was slightly higher in goats (8.4%) has compared to sheep (5%). However this difference was not found statistically significant. The result in this study is lower than that reported by other workers. Research conducted by several investigators on ovine *Cysticercus tenuicollis* prevalence in different part of the country revealed 25.8% in wolyta (Muktar, 1988), 46.1% in Dessie (Yilkal, 1989), 37.1% in Addis Ababa abattoir (Tekylene *et al.*, 1988) and 32.7% in three export abattoir (ELFORA, Hashim and Luna) by Abdela (2006).

The prevalence of *Cysticercus tenuicollis* found in goats in this study (8.4%) is lower than that reported by other workers, 16.3% in wolyta (Muktar, 1988) and 34.7% in three export abattoir (ELFORA, Luna and Hashim) by Abdela (2006, the relatively lower prevalence of *Cysticercus tenuicollis* recorded in the study could be due to the variation in temperature, environmental condition, the degree of pasture contamination and the way of raising and grazing of these animals, which are may favors the transmission cycle between ruminants and dogs. The age of the animals could also be another factor in this variation. The prevalence by age revealed that slightly higher infection rates was recorded in adult ovine (5.7% in adult and 4.4% in young). But the reverse holds true for caprine (9.8% in young and 8.4% in adults). These differences in prevalence rate between the age of ovine and caprine are not statistically significance ($P>0.05$).

The prevalence of hydrated cyst found in this study was 5.3% and 4.4% in sheep and goats respectively. The prevalence rate recorded in this study is less than that reported by other investigator in other abattoir of this country. The prevalence of these workers are 8.7% ovine and 4.6% caprine in Gondar (Tamene, 1987), 40.6% ovine and 70% caprine in Addis Ababa abattoir (Gemed, 1988), 16.4% ovine in Addis Ababa abattoir (Tekylene *et al.*, 1988), 9.3% ovine and 6.5% caprine in Hararghe region (Weber, 1987) and 6% ovine in Wolyta (Muktar, 1988).

The lower prevalence found in both species in the study may be ascribed to the origin of the slaughtered animals, which in majority of cases, is from low land areas where the environmental condition such as high temperature and low humidity exist. The other reason could also be due to the fact that most of the animals presented for slaughtered in this export abattoir are young it is established fact that prevalence of Hydrated cyst

Increase as the age of animal increases (WHO, 1994). There for the highest prevalence rate is expected in older animals. The general trend of age prevalence data was the infection rate increases with age, for the two animal species as a result statistical significance was observed ($P<0.05$) between the young and adult of both species.

The prevalence of *Cysticercus ovis* recorded in the study (0.65% and 1.3% in sheep and goat respectively) . There is no enough documented report on this parasite, only reported by Abdela (2006). Therefore, they could not discuss the result of the finding in comparison to other workers in the country due to lack documented information in the subject.

The prevalence of lung worm found in this study was 10.9% and 8.8% in sheep and goats respectively. The prevalence of lung worm by species was slightly higher in sheep (10.9) as compared to goats (8.8%). However this difference was not found statistically significant. Similar reports in goats were made in same abattoir 7.5% in Debre Zeit Hashim abattoir by (Eschew, 2007). The prevalence recorded in this study is higher than that of Eschew. The higher prevalence in this study

may be due to origin of examined animals and the presence of close association between intermediate host and final host.

The prevalence by age revealed that higher infection rates was recorded in animals with adult age (15.8% in sheep and 13% goats) and recorded in animals with young age (5.9% in sheep and 4.6% in goats) and these was statistically significant differences was observed ($P < 0.05$) between the young and adult age group of both species.

The prevalence of *Stellessia hepatica* found in this study was 9.3% and 11.9% in sheep and goats respectively. The prevalence of *Stellessia hepatica* by species was slightly higher in goats (11.9%) and as compared with sheep (9.3%). However this difference was not statistically significant.

The prevalence of this study is similar with that of other investigators, 9.3% ovine in Debre Zeit by Jibat(2006).The prevalence of this study on caprice *Stellessia hepatica* slightly lowers, 12.1% in Debre Zeit by (Jibat, 2006) and relatively lowers, 44% in Debre Zeit by Eschew(2007) . The lower prevalence may be due the origin of animal examined, where the intermediate host prevalence is lower.

The threat of these parasites that poses to the small ruminants meat industry in Ethiopia is evident due to the present situation of improper disposal of offal's being practiced and free access of condemned organs to stray dogs (Jibat, 2006). This study revealed that in relation to other organs liver and lung are most commonly affected and rejected from international and local market prices and costing to much loss to the livestock industry of the country. The rejection rate of kidney, heart and carcass was however not significant.

The economic losses incurred during this study as a result of condemnation or rejection of edible organs of ovine and caprice specious was estimated approximately about million ETB per annum in HELMEX export abattoir from international and domestic market.

5. CONCLUSION AND RECOMMENDATION

According the result of present study fasciollosis, Hydatidosis *Cysticercus tenuicollis*, *Stellessia hepatica* and lung worm are the most and major causes for respective organs to be rejected and this result extensive financial wastes about 47272.5USD. The proper management practices of animals on farm or at home and improper disposal or handing of offal's in control of parasitic diseases result in severe economic losses and consequently exclude the country from attractive international market there by greatly redacting the country; foreign exchange earnings. In line with finding of this study the following recommendation are forwarded so as to resolve and reduces the significant economic loss incurred.

- Enhances the awareness of the animal attendants, farmers, customers, abattoir works and butchers about the public health significances of the disease, and proper disposal of condemned offal's by giving them country wide education in collaboration with the government and prohibit the sale of contaminated offal's and condemned head as pet food
- Government should be prohibit backyard slaughtering in different localities and encourage investors who have the capacity to build modern abattoir in different area of the country.
- Dog owners should be regularly deform their animals with Anthelmintics to break perfect life cycle of parasites that might have public health importance.
- Cooperation between veterinary and medical personnel is important in order to control most meat born zoometric diseases and thus provide safe and wholesale meat to the consumers

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