Causes of abattoir condemnation in apparently healthy slaughtered sheep and goats at HELMEX abattoir, Debre Zeit, Ethiopia

T. JIBAT1, G. EJETA 2,5, Y. ASFAW3, and A. WUDIE4

1 Faculty of Veterinary Medicine, University of Gondar, P. O. Box 196, Gondar, ETHIOPIA.
2 Department of Microbiology and Veterinary Public Health, Faculty of Veterinary Medicine, Addis Ababa University, P.O. Box 34, Debre Zeit, ETHIOPIA.
3 Department of Clinical Studies, Faculty of Veterinary Medicine, Addis Ababa University, P.O. Box 34, Debre Zeit, ETHIOPIA.
4 HELMEX Slaughter house, Debre Zeit, ETHIOPIA.
5 Department of Farm Animal Health, Faculty of Veterinary Medicine, Utrecht University, Marburglaan 2, 3584 CN, Utrecht, THE NETHERLANDS.

*Corresponding author : E-mail: getahun_ejeta@yahoo.com

SUMMARY

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. This study was conducted from December 2005 to June 2006 to determine the rate of organs and carcasses condemned and the associated annual financial loss at HELMEX abattoir. Out of 2688 sheep and goats examined 1347 (50.1%) livers, 1153 (42.9%) lungs, 214 (7.9%) hearts, 184 (6.8%) kidneys, 105 (6.5%) brains, and 188 (7%) carcasses were condemned. The major causes of condemnation were parasites (48.6%), hepatitis (19.5%) and mechanical damage (10.2%) for liver; pneumonia (63.2%) and emphysema (16%) for lung; pericarditis (63.5%), calcification (12.6%), Cysticercus ovis (5.6%), abscess (4.2%) and other causes (14%) for heart; nephritis (48.4%) for kidneys; coenurus (85.7%) for brain; and bruising (52.7%) and poor body condition for carcasses. Fasciola species, Stelesia hepatica, Cysticercus tenuicollis, hydatidosis and Coenurus cerebralis were found to be the major parasitic conditions responsible for organ condemnation. Rate of condemnations due to Hydatidosis was higher in the lungs (3.3% in sheep and 2.7% in goats) than in the liver (0.9% in sheep and 1.7 % in goats). Significantly higher rate of livers, kidneys, and lungs were condemned in adults than the young in both sheep and goats (p<0.05). However, significant difference in the rate of organs and carcasses condemned were not observed by origin of animals and abnormality (p>0.05). Total annual financial loss due to organ and carcass condemnation was estimated at 2.7 million Ethiopian Birr (312,555 USD). From this, about 40% (124,686.4 USD) was attributed to human mistakes either during transportation of animals to the slaughterhouse or in the slaughterhouse during slaughter operation. Results of the present work warrant immediate need for the prevention of causes of 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: Organ, carcass, abattoir condemnation, sheep, goats, financial loss.

RÉSUMÉ

Causes of saisies chez les chèvres et les moutons abattus apparemment sains à l’abattoir de HELMEX, Debre Zeit, Éthiopie

Les petits ruminants (moutons et chèvres) sont les principales sources de viande et d’abats pour l’Éthiopie et sont exportés au Moyen Orient. Cela fournit aussi la matière première à l’industrie de cuir. Cependant, un nombre significatif d’organes et de carcasses sont saisies à l’abattoir à cause de la présence de lésions d’origines diverses. Cette étude, conduite de décembre 2005 à juin 2006, avait pour objectif de caractériser les motifs de saisie des organes et carcasses à l’abattoir Helmex ainsi que la perte économique associée. Sur 2688 moutons et chèvres étudiés, 1347 foies (50,1%), 1153 poumons (42,9%), 214 coeurs (7,9%), 184 reins (6,8%), 105 cervelles (6,5%) et 188 carcasses entières (7%) ont fait l’objet d’une saisie. Les raisons principales étaient la présence de lésions parasitaires (48,6%), d’hépatites (19,5%) et d’altérations mécaniques (10,2%) en ce qui concerne les foies; de pneumonies (63,2%) et d’emphysème (16%) sur les poumons ; de péri-cardite (63,5%), de lésions de calcification (12,6%) de cysticercose (5,6%), d’abcès (4,2%) sur les cœurs, de nécrose (48,4%) pour les reins, de coenurose (85,7%) pour les cervelles et enfin de blessures ou de mauvaise conformation musculaire pour les carcasses entières. Les principaux parasites impliqués dans les saisies sont les espèces de Fasciola, Stelesia hepatica, Cysticercus tenuicollis, l’hydatidose et la coenurose. Le taux de saisie pour hydatidose est supérieur pour les poumons (3,3% pour les moutons et 2,7% pour les chèvres) que pour les foies (0,9% pour les moutons et 1,7% pour les chèvres). Le nombre de saisies est significativement plus élevé chez les adultes que chez les jeunes (p<0.05). Aucune différence significative dans les saisies n’a été observée en fonction de l’origine des animaux (p>0.05). La perte économique annuelle associée à ces saisies a été estimée à 2,7 million de Birr éthiopien (312555 USD). 40% de cette somme peut être attribuée à des erreurs humaines pendant le transport des animaux ou leur préparation à l’abat- toir.

Les résultats de cette étude soulignent l’importance économique des saisies et la nécessité de mettre en place des mesures préventives dans le domaine de la santé animale, des mesures d’hygiène à l’abattoir, de la formation des opérateurs sur le bien être animal et les manipulations à l’abattoir.

Mots-clés : Organes, carcasse, saisie à l’abattoir, mouton, chèvre, perte économique.

Introduction

Small ruminants (sheep and goats) are important domestic animals in the tropical animal production systems [9]. 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 [13, 29].
Ethiopia owns huge number of small ruminants, about 24 million sheep and 18 million goats [21]. 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 [31]. 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 [16].

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 [25, 30]. 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 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.

There is no information describing the causes and associated magnitude of organ and carcass condemnation in slaughtered sheep and goats in Ethiopia. Determination of the cause and magnitude of organ and carcass condemnation in these animals at abattoirs and proper evaluation of associated economic loss are needed where economic realities often determine the type and scope of preventive measures to be used. The objectives of this study, hence, were to determine the causes of organ and carcass condemnation in apparently healthy slaughtered sheep and goats at HELMEX abattoir and to estimate the associated magnitude of economic loss.

**Materials and Methods**

**STUDY AREA**

The study was conducted at HELMEX (Hashim Nurs’ Ethiopian Livestock and Meat Export) abattoir at Debre Zeit, Ethiopia, from December 2005 to June 2006. Beef, mutton, lamb, goat meat and edible organs like liver, kidneys and brain of sheep and goats are exported to the Middle East. Debre Zeit is located at 90° and 400° with an altitude of 1880m above sea level in the central highlands of Ethiopia lying 47 kms south east of Addis Ababa, the capital city. HELMEX abattoir is constructed according to international standard for commercial purpose slaughterhouse.

**STUDY ANIMALS**

A total of 2688 animals (1152 sheep and 1536 goats) were randomly selected and identified by origin, species and age during ante mortem inspection. The animals were all males originating from different areas of the country (Arisi, Bale, Afar, Shoa, Ogaden, Wollo, Omo, and Borena) representing different agro ecological zones (highland, semi arid and arid). Animals were transported to the abattoir using vehicles and on foot. To have a uniform representative sampling, 336 animals were selected from each area. To see the effect of age, animals were classified into two groups: young (goats less than 1 year; sheep less than 1.25 years) and adult (goats more than 1 year; sheep more than 1.25 years), based on eruption of one or more incisor teeth [13, 29]. Out of the 2688 animals, only 1622 (648 sheep and 974 goats) heads were inspected to determine abnormalities of the brain because of the difficulty in removing the organ. Out of 2688 animals examined, 1152 (42.9%) were sheep and 1536 (57.1%) were goats. From 1152 slaughtered sheep examined, 488 (42.4%) were young and 664 (57.6%) were adults and out of 1536 goats examined, 659 (42.9%) were young and 877 (57.1%) were adults.

**ABATTOIR SURVEY**

After evisceration liver, lungs, heart, kidneys, brain and carcass were thoroughly examined by visual inspection, palpation and systematic incisions for the presence of cysts, adult parasites and other abnormalities. Pathological lesions were differentiated and judged based on HERENDA et al. [15] guidelines on meat inspection for developing countries.

**DATA ANALYSIS**

Data collected during inspection were entered into Excel spreadsheet (Microsoft Excel 2000). Descriptive statistics were used to determine organ and carcass condemnation rates, defined as proportion of condemned organs and carcasses to the total number of organs and carcasses examined. The variability between condemnation rates of specific organs and carcasses, by risk factors of age, origin, abnormalities and species were evaluated by Pearson’s chi-square (χ2) and differences were regarded statistically significant if p-value was less than 0.05 using SPSS 12.0 for widows.

To evaluate the economic losses, only the direct monetary losses due to rejection of liver, kidneys, brain and carcass were considered. The analysis was based on annual slaughter capacity of the abattoir considering market demand, average market prices on international and domestic markets, and the rejection rates of specific organs and carcasses. The annual slaughter rates were estimated from retrospective data recorded in the past three years. Financial losses were then computed mathematically by adapting the formula of OGUNRINADE and OGUNRINADE [27] for liver rejection as follows.

\[
EL = \sum Sx \cdot Coy \cdot Roz
\]

Where,

- \( EL \) - estimated annual economic loss due to organ and carcass condemnation from international or domestic market.
- \( Sx \) – Annual sheep/goat slaughter rate of the abattoir.
- \( Coy \) - Average cost of each sheep/goat liver/lung/heart/kidney/brain/carcass.
- \( Roz \) - Condemnation rates of sheep/goat liver/lung/heart/kidney/brain/carcass.

Results

ABATTOIR SURVEY

Out of 2688 sheep and goats studied 1347 (50.1%), 1153 (42.9%), 214 (7.9%), 184 (6.8%), 105 (6.5%) and 188 (7%) of all livers, lungs, hearts, kidneys, brains and carcasses, respectively, were condemned from gross abnormalities as unfit for international or domestic markets (Table 1). The most frequently condemned organ was liver followed by the lungs. Significant difference in the rate of organs and carcasses condemned were not observed by origin of animals and pathological abnormalities (p>0.05).

The frequency of liver condemnation was significantly higher in sheep (6/74/1152, 58.5%) than in goats (673/1536, 43.8%) (P = 0.000), however, statistically significant difference was not observed in the condemnation rates for lungs, hearts, kidneys and carcasses between the two species (p>0.05). Brain condemnation was significantly higher in goats than in sheep (p = 0.000). In sheep, significantly higher (p<0.05) rate of condemnation of liver, kidneys, lungs and carcass were observed in the adults than in the young. In goats, significantly higher number of condemmations of liver, lungs, heart and kidneys were observed in the adults than in the young (p<0.05). No age difference was observed in the heart and brain condemnation rates in sheep and carcasses in goats (p>0.05). However more brain condemnations were observed in the young than adults in goats (p=0.000).

Parasites of Fasciola species, Stelesia hepatica, Cysticercus tenuicollis and hydatid cysts were major causes of livers condemnation with rates of 48.6% (654/1347). Hepatitis at a rate of 19.5% (263/1347) and mechanical damage caused during evisceration at a rate of 10.2% (137/1347) were also found to be significant causes of liver condemnation (Table 2).

Fasciolosis caused a statistically higher liver condemnations in sheep (6.9%) than in goats (3.6%) (p=0.000), and hepatitis was found to be a major cause of liver condemnation in sheep (17.6%) than in goats (3.9%) (p=0.000). Mechanical damage has caused statistically higher rate of liver condemnation in sheep (6.2%) than in goats (4.3%) (p=0.024). However S. hepatica caused higher rate of liver condemnation in goats (12.1%) than in sheep (9.5%) (p=0.01). Similarly, Cysticercus tenuicollis caused significant losses in goats (8.3%) than in sheep (5.2%) (p=0.000). In sheep, there was no statistically significant difference between young and adult age categories regarding the causes of liver condemnation except for mechanical damage where it was significantly higher in the young (9.2%) than in the adults (3.9%) (p=0.000). In goats age difference was observed in liver cirrhosis (0.6% in adults and 3.5% in the young) (p=0.000) and hepatitis (5.4% in adults and 2.0% in the young) (p=0.004). However, mechanical damage caused a significant loss of liver in the young (6.4%) than in adults (2.7%) (p=0.000) in goats (Table 2).

Pneumonia was the major cause of lung rejection with a rate of 63.2% (729/1153) followed by emphysema (16%, 185/1153). There was no statistically significant difference between sheep (513/1152, 44.5%) and goats (640/1536, 41.7%) (P>0.05); however, statistically significant difference was observed (p<0.05) between the young and adult age groups of both species in the frequency of lung condemnation from any cause (Table 3). No statistically significant differences was observed between the species on the rate of lung condemnation by specific cause (p=0.05). Significant differences between the age groups in sheep with relation to specific causes was not observed (p>0.05) except for hydatidosis where it was significantly higher in adults than in the young (p=0.000). In goats, pneumonia, hydatidosis and lung calcification were more frequently observed in adults than in young animals (p<0.05).

Rate of condemnations due to hydatidosis was higher in the lungs (3.3% in sheep and 2.7% in goats) than in the liver (0.9% in sheep and 1.7 % in goats) (Tables 2 and 3).

Out of a total of 214 hearts condemned, pericarditis contributed 63.5% (136/214) followed by other unidentified causes (14%), calcification (12.6%), Cysticercus ovis (5.6%) and abscess (4.2%) (Table 4). No statistically significant difference was observed between the two species (p = 0.05) in heart condemnation rate. Significantly higher number of hearts were condemned in the adults than in the young in goats (p=0.000). In goats, significantly higher pericarditis was observed in adults than in the young (p=0.006).

Renal problems were observed in 184 pairs (6.8%) of the total kidneys examined. Nephritis accounting for 48.4% (89/184) was the major pathological lesion. There was statistically significant difference between the age groups, higher in the young in both species (p<0.05).

Out of 1622 brains examined 6.5 % (105) were condemned due to pathological causes. Coenurus cerebralis was found to be the major cause of brain rejection accounting for 85.7% (90/105). Coenurus cerebralis was responsible for higher brain condemnation in goats (7%, 68/974) than in sheep (3.4%, 22/648) (p<0.005). The rate of brains condemned in the young (11%, 39/355) were significantly higher than in the adults (4.7%, 29/619) in goats (p=0.000).

The major pathological conditions for carcass rejection from international market were bruising accounting for 52.7% (99/188) and poor body condition (20.7 %; 39/188).

ASSESSMENT OF DIRECT ECONOMIC LOSS

The annual direct financial loss from international and domestic markets due to organ and carcass condemnations at HELMEX abattoir was estimated at 2.7 million Ethiopian Birr (312,555 USD). This total loss could be partitioned in to the loss incurred due to diseases which amounted to 187, 868.6 USD and the rest, 124, 686.4 USD, was due to human factors either as a result of mishandling of animals during transport to the slaughterhouse or due to faulty slaughter operations in the abattoir.
Animal species | Number examined | Liver | Lung | Heart | Kidneys | Brain† | Carcass
---|---|---|---|---|---|---|---
Sheep  
Young | 488 | 261 (54) | 196 (40.6) | 35 (7.2) | 22 (4.6) | 9 (5.3) | 22 (4.6)  
Adult | 664 | 413 (61.7) | 317 (47.4) | 64 (9.6) | 53 (7.9) | 19 (4.0) | 55 (8.2)  
Total | 1152 | 674 (58.5) | 513 (44.5) | 99 (8.6) | 75 (6.5) | 28 (4.3) | 77 (6.7)  
Goat  
Young | 659 | 259 (39.3) | 184 (27.9) | 25 (3.8) | 26 (3.9) | 44 (12.4) | 46 (7)  
Adult | 877 | 414 (47.2) | 456 (52) | 90 (10.3) | 83 (9.5) | 33 (5.3) | 65 (7.4)  
Total | 1536 | 673 (43.8) | 640 (41.7) | 115 (7.5) | 109 (7.1) | 77 (7.9) | 111 (7.2)  
Overall | 2266 | 1347 (59.1) | 1153 (42.9) | 214 (7.9) | 184 (6.8) | 105 (6.5) | 188 (7)  
† Number of brains examined: sheep=648 (169 young, 479 adult), goat=974 (355 young, 619 adult); Total=1622.

Table 1: Organs and carcasses condemnation rates in sheep and goats.

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>Frequency and percentage of condemnation</th>
<th>Sheep (n= 1152)</th>
<th>Goats (n= 1536)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Young</td>
<td>Adult</td>
<td>Total</td>
</tr>
</tbody>
</table>
| Fasciolosis | 25 (5.2) | 55 (8.3) | 80 (6.9) | 22 (3.3) | 33 (3.8) | 55 (3.6)  
Cirrhosis | 13 (2.7) | 23 (3.5) | 36 (3.1) | 4 (0.6) | 31 (3.5) | 35 (2.3)  
Hepatitis | 73 (15.1) | 130 (19.6) | 203 (17.6) | 13 (2) | 47 (5.4) | 60 (3.9)  
Stelesia hepatica | 50 (10.4) | 58 (8.7) | 108 (9.5) | 76 (11.5) | 110 (12.5) | 186 (12.1)  
Cysticercus tenuicollis | 22 (4.6) | 39 (5.9) | 61 (5.2) | 65 (9.9) | 62 (7.1) | 127 (8.3)  
Calcifications | 16 (3.3) | 44 (6.6) | 60 (5.2) | 17 (2.6) | 47 (5.4) | 64 (4.2)  
Mechanical damage | 45 (9.2) | 26 (3.9) | 71 (6.2) | 42 (6.4) | 24 (2.7) | 66 (4.3)  
Hydatid cyst | 3 (0.6) | 7 (1.0) | 10 (0.9) | 6 (0.9) | 21 (2.4) | 27 (1.7)  
Abscess | 7 (1.4) | 19 (2.9) | 26 (2.3) | 10 (1.5) | 28 (3.2) | 38 (2.5)  
Other causes | 7 (1.4) | 12 (1.8) | 19 (1.6) | 4 (0.6) | 11 (12.5) | 15 (0.9)  
Overall | 261 (53.5) | 413 (62.2) | 674 (58.5) | 259 (39.3) | 414 (47.2) | 673 (43.8)  

Table 2: Causes of liver condemnation.

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>Frequency and percentage of condemnation</th>
<th>Sheep (n= 1152)</th>
<th>Goats (n= 1536)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Young</td>
<td>Adult</td>
<td>Total</td>
</tr>
</tbody>
</table>
| Pneumonia | 132 (27.3) | 191 (28.8) | 323 (28) | 122 (18.5) | 284 (32.4) | 406 (26.4)  
Emphysema | 33 (6.8) | 46 (6.9) | 79 (6.9) | 34 (5.2) | 72 (8.6) | 106 (6.9)  
Hydatid cyst | 7 (1.4) | 31 (4.7) | 38 (3.3) | 4 (0.6) | 37 (4.2) | 41 (2.7)  
Abscess | 5 (1.0) | 21 (3.2) | 26 (2.3) | 7 (1.1) | 25 (2.9) | 32 (2.1)  
Calcification | 14 (2.9) | 17 (2.6) | 31 (2.7) | 8 (1.2) | 28 (3.2) | 36 (2.3)  
Others | 5 (1.0) | 11 (1.6) | 16 (1.4) | 9 (1.4) | 10 (1.1) | 19 (1.9)  
Total | 196 (40.6) | 317 (47.4) | 513 (44.5) | 184 (27.9) | 456 (51.9) | 640 (41.7)  

Table 3: Causes of lung condemnation.
CAUSES OF CONDEMNATIONS OF SLAUGHTERED SHEEP AND GOATS AT SLAUGHTERHOUSE

Abnormality Frequency and percentage of condemnation

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>Sheep (n=1152)</th>
<th>Goats (n=1536)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Young (n=488)</td>
<td>Adult (n=664)</td>
</tr>
<tr>
<td>Pericarditis</td>
<td>27 (5.6)</td>
<td>36 (5.4)</td>
</tr>
<tr>
<td>Calcification</td>
<td>1 (0.2)</td>
<td>10 (1.5)</td>
</tr>
<tr>
<td>Cysticercus ovis</td>
<td>1 (0.2)</td>
<td>4 (0.6)</td>
</tr>
<tr>
<td>Abscess</td>
<td>0 (0)</td>
<td>3 (0.4)</td>
</tr>
<tr>
<td>Other</td>
<td>6 (1.2)</td>
<td>11 (1.6)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>35 (7.2)</strong></td>
<td><strong>64 (9.6)</strong></td>
</tr>
</tbody>
</table>

Table 4: Causes of heart condemnation.

Discussion

Government and other programs in Africa can use abattoirs as source of data to assist in monitoring diseases, provide feed back to the producer, to produce wholesome products and to protect the public from zoonotic hazards [4, 14].

The present study revealed that parasites and poor management practices are the major causes of organ and carcass condemnations. Parasitic causes like STELESTIA hepatica, Cysticercus tenuicolis, Fasciola species, hydatidosis and Coenurus cerebralis were found to be the major parasitic conditions responsible for organ condemnation. The absence of difference in the rate of organ and carcass condemnation from pathological abnormalities by origin indicates that parasitic diseases of sheep and goats are widely distributed throughout the country. The major management practices that rendered organs and carcasses unfit for consumption were faulty evisceration and bruising of the carcass mainly brought about by mishandling of animals during transportation to the slaughter houses. In addition, the higher rate of occurrence of pneumatic lungs and poor meat quality are related to mishandling.

Losses from liver condemnation are generally associated with infections of public health importance [6] and for aesthetic reasons. More than half of livers were condemned due to parasites. The rate of livers condemned in this study was relatively higher than a report in Kenya where 5.2% was recorded [24]. These authors have also reported frequency of liver condemnation due to Fasciola gigantica in goats at a rate of 6.6% which is higher than our present finding (3.6%). The higher rate of fasciolosis observed in sheep in comparison with goats could be due to their feeding behaviour where sheep are usually grazers and goats tend to be more of browsers making them less exposed to the parasite. MUNGUBE et al. [24] have also reported cumulative incidence of liver condemnation due to S. hepatica at 28% and 22% in sheep and goats, respectively, which is higher than the result obtained in this study (9.5% and 12.1% in sheep and goats, respectively). The epidemiology of S. hepatica and C. tenuicolis was not well established in sheep and goats, hence, it may be difficult to explain why significantly more livers were condemned in goats than in sheep. However, BEKELE et al. [5] have reported a prevalence rate of 37.1% C. tenuicolis in slaughtered sheep in Addis Ababa abattoir.

The presence of small ruminant hydatidosis at slaughterhouses has been documented in Ethiopia. BEKELE et al. [5] reported a prevalence rate of 16.4% in sheep which is higher than the finding in this study. Similarly JOBRE et al. [17] reported prevalence rates of 11% and 6% from South Omo and Debre Zeit slaughterhouses, respectively, in sheep and goats. The low occurrence in this 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. A report of the prevalence of Echinococcus granulosus (adult stage of the hydatid cyst) in dogs indicated 15.45% [17].

The presence of hydatidosis was also reported in man in south-west Ethiopia [12, 17, 20, 22]. Hydatidosis is maintained as a major zoonotic disease in the country because small ruminants are mainly slaughtered at the backyard for home consumption without any veterinary inspection, the absence of rigorous and enforced meat inspection legislation and the long standing habit of feeding offal to dogs. The prevalence of large number of stray dogs exacerbates the problem.

In our present study, hydatid cysts were more frequently observed in the lungs than livers of small ruminants. Similar findings were also reported [5, 7, 8, 17, 19]. However, the most common site for hydatid cyst was the liver followed by the lungs in the Middle East (1, 18).

Another important parasite responsible for organ condemnation was Coenurus cerebralis. ACHENEF et al. [2] observed the cyst from all the brains of 37 clinical cases and 2.7% of apparently healthy sheep examined at the International Livestock Research Institute (ILRI) research station. A similar prevalence rate of 7.21% was reported from goats in Bangladesh [3]. Generally, it is assumed that coenurosis is a disease of sheep; however, in this study the prevalence was higher in goats and the cyst was more frequently observed in young animals than adults. The reason for the lower occurrence in older sheep and goats may be early culling of infected animals by slaughtering before they reach adult age. In Ethiopia, the heads of sheep and goats are given to dogs without prior inspection thereby maintaining the Coenurus cerebralis - Taenia multiceps cycle.

Pneumonia was the major cause of lung condemnation both in sheep and goats. It is observed that animals transported on foot suffer from transportation stress and lack of feed and water en route. Those which were transported on open trucks

are overcrowded. Furthermore, animals are suffocated at the lairages and there was short resting time before slaughter for the animals to recover from physical stresses. These conditions were causes of pneumonia and emphysema as observed at a higher magnitude in this study. This indicates also violation of animal welfare stretching from farm to slaughter. Pneumonia might be also a result of endemic diseases of sheep and goats such as pasteurellosis, which is triggered by stress, contagious caprine pleuropneumonia and des petits ruminants.

One-tenth of the total condemned livers were due to mechanical damage that was caused by faulty practices during evisceration. Higher frequencies of mechanical damages were observed in young animals than adults which might be related to the difficulty associated with the removal of liver from the former.

Bruising caused more than half of all carcasses condemned. Bruising occurs due to beating of animals during transportation and the use of rough vehicles. Apart from affecting carcass value, bruising has also animal welfare implications as excessive use of sticks while driving to the abattoir, mishandling of animals during loading and unloading, improper transport vehicle and at slaughter could be responsible causes [10]. Bruising could also result in the slaughterhouses when animals struggle during slaughter [14] as stunning of small ruminants was not practiced at HELMEX abattoir in particular and in other abattoirs in general in Ethiopia. It has been suggested that bruising during transportation is the major source of economic loss in Africa and Asia [23].

Abscess, pericarditis, nephritis, and calcifications were important causes for the condemnation of edible organs like liver, kidneys and brain. OJO [28] reported similar cases in Nigeria and was able to isolate bacteria with public health significance. EJETA et al. [11] reported Salmonella serotypes in 14.1% of mutton samples examined from various super markets in Addis Ababa.

Though Cysticercus tenuicollis, Cysticercus ovis, and Stelesia hepatica do not have public health importance, they are considered as important cause of economic loss in the meat industry since viscerca 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. ovis, C. tenuicollis, C. cerebralis and hydatidosis.

The financial loss in the abattoir is considered high. However, realization of the total (true) economic loss from organ and carcass condemnation is difficult and complex. The indirect losses from 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. NGATEGIZE et al. [26] have reported a financial loss associated with liver condemnation due to ovine fasciolosis alone in the central highlands of Ethiopia amounting to be 2.3 million Ethiopian Birr (460, 000 USD). Similarly JOBRÉ et al. [17] have estimated a total annual loss of 1.3 million Ethiopian Birr (260 000 USD) resulting from offal condemnation and carcass weight loss.

In conclusion, parasitic diseases, other pathological conditions, mechanical damage during evisceration, and bruising were the major causes of financial loss through organ and carcass condemnation at HELMEX abattoir, which may also reflect the same scenario in other slaughterhouses in Ethiopia. To mitigate the economic and public health impacts of diseases of small ruminants, proper disposal of offal, prohibition of backyard slaughter of small ruminants, construction of slaughterhouses, better disease control strategies, enhancing animal welfare, adequate training of abattoir personnel on the slaughtering operation and regular deworming of dogs are suggested. Furthermore, the total (true) economic impact of the diseases of small ruminants at depth should be investigated.

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References