

Major Parasitic Cause of Liver Condemnation in Ovine Slaughtered at Debre Birhan Municipal Abattoir

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ABSTRACT

A cross sectional study was conducted from November 2015 to April 2016 to identify and determined the major parasitic causes of liver condemnation on sheep slaughtered at DebreBirhan municipal abattoir and to estimate the financial losses attributed to the condemned livers. A systematic random sampling method was employed and the study animals were recorded based on sex, age, body condition and origin of animals. During the study a total of 421 sheep were examined. From these 221(52.49%) livers were condemned due to parasitic causes. Out of the total liver condemned, 191 (45.37%) were condemned due to fasciolosis, 17 (4.04%) due to h. cyst and 13 (3.09%) due to *Stilesia hepatica*. The result of condemnation of liver based on sex and age of sheep showed the absence of significant variation ($p>0.05$) between the different groups. However, significance variation was observed among body condition and origin of the examined animals due to *Fasciola* and hydatid cyst ($p<0.05$). The annual financial loss due to the condemnation of liver from sheep in the abattoir is estimated to be 22150.78ETB. Because of higher condemnation rate of liver in the study area, appropriate prevention and control measures of the parasites should be applied in sheep to decrease the financialloss.

Key words: Abattoir, DebreBirhan, fasciola, hydatid cyst, liver condemnation, sheep, *Stilesia hepatica*.

1. INTRODUCTION

Ethiopia has the largest livestock and draft animal population in the continent. There are approximately 44,318,877 cattle, 23,619,720 sheep, 23,325,113 goats; 6 million equine, 2.3 million camels and 43 million poultry (CSA, 2008). Small ruminant production is the part of agricultural activity with a huge economical impact in Ethiopia. An increase in small ruminant could contribute to the attainment of food self sufficiency in the country, especially in requirements for the growing human population and to increase export earnings (MOA, 1985). Sheep and goats cover more than 30% of domestic meat consumption and generate cash income from export of meat, edible organs, live animals and skin (Fletcher and Zelalem, 1995).

Meat inspection is conducted in abattoir for the purpose of screening and removing of animal products with abnormal pathological lesions that is unsafe for human consumption and also for aesthetic reason. An important function of meat inspection is to assist in monitoring disease in the national herd and flock by produce wholesome products and to protect the public from zoonotic hazards (Gracey *et al.*, 1991).

The main causes of organ condemnation during postmortem inspection are diseases caused by parasites, bacteria, viruses and mechanical damage. Parasites in the tropics are responsible for far greater losses to meat industry than other diseases similar to many other tropical countries of Africa, it is well known that parasitic diseases are among the major factors responsible for the low productivity of livestock in Ethiopia. These infections not only cause clinical diseases and mortalities but also cause economic losses through production losses and condemnation of specific organs at slaughter. There are many diseases that affect liver frequently. But, the major causes of liver condemnation due to parasitic disease are fasciolosis, hydatid cyst and *Stilesia hepatica* (Doexy, 1971).

Fasciolosis is an economically important parasitic disease, which is caused by the trematode helminthes of the genus *Fasciola*, commonly known as liver fluke and the primary hosts are sheep and cattle (Urquhart *et al.*, 1996). Fasciolosis in sheep is a chronic wasting disease caused by the presence of immature and adult trematode of the genus *Fasciola* in the liver parenchyma and bile ducts respectively. Fasciolosis is characterized by loss of weight, anemia and hypoalbuminemia with submandibular edema. The disease is found in vast areas of the world with the smaller *Fasciola*

hepatica (3.5x1cm) in temperate countries and the larger *Fasciolagigantica* (78.5x1cm) in tropical regions. Infection is most prevalent during autumn in temperate areas with the resultant effects of disease becoming apparent in winter and spring (Smyth, 1997).

Fasciolosis accounts for serious economic losses in Ethiopia and other parts of the world due to condemnation of liver, losses through death, Reduction in productivity (meat, milk, and wool), retarded growth rate and lowered resistant to another disease. Both *F. hepatica* (high land) and *F. gigantica* (low land) types of liver fluke cause severe losses in different part of Ethiopia, where suitable ecological condition for the growth and multiplication of intermediate host snails prevail (Yosef, 2009).

Hydatidosis is caused by *Echinococcusgranulosus* which is found in the small intestine of carnivores and metacestode (hydatid cyst) is found in liver, lung, heart of sheep. This is the smallest tapeworm being only about 6mm long and composed of a scolex and three segments. The scolex has 30–36 hooks arranged in two rows. The first and second segments are incompletely developed while the last segment, which is gravid and contains up to 5000 ripe eggs, is half the length of the entire worm. The cystic stage is known as hydatid cyst and gives rise to hydatid disease. (William, 2005).

Echinococcus parasites are difficult to detect in faeces of definitive host, due to their small size. Diagnosis will be performed by examination of purge contents for presence of *E. granulosus* even though the techniques have some disadvantage such as poor sensitivity and incomplete purgation (Radostitis *et al.*, 2007). The prepatent period in the final host is around 40-50 days after which only one gravid segment is shed by tapeworm per week. The oncospheres are capable of prolonged survival outside the host, being viable on the ground for about 2 years after ingestion by intermediate host and oncospheres penetrates the gut wall and travels in the blood to the liver or in the lymph to the lungs. There are 2 common sites for larvae development, but occasionally gonophores escape into general systemic circulation and develop in other organs and tissue (Underwood and Cross, 2009).

Stilesia hepatica is extremely common in sheep and other ruminants in Africa and Asia. The life cycle is not completely known but oribatid mites are suspected of transmitted the parasite. *Stilesiaglobipunctate*, another species occur in the small intestine of ruminants in southern Europe as

well as Africa and Asia. The parasite has a predilection site in the bile ducts of sheep slaughter and although they cause neither clinical sign nor significant hepatic pathology, the liver condemnations are a source of considerable economic loss, on an esthetic ground (Taylor *et al.*, 2007). Heavy infestations are frequently seen in apparently healthy ovine with complete occlusions of the bile duct (Urquhart *et al.*, 1996).

A number of researchers have done their work on liver condemnation due to fasciolosis in different area of the country. However, there is lack of information on other major parasitic cause of liver condemnation, intensity of infection and potential risk factors of fasciolosis, hydatidosis and *Stilesia hepatica* particularly in DebreBirhan town and neighboring area.

The objectives of this study were, therefore:

- To study the major parasitic cause of liver condemnation in ovine slaughter at DebreBirhan municipal abattoir.
- To assess direct financial loss as a result of condemnation of liver in the study area.

2. MATERIALS AND METHODS

2.1 Study Area

The study was conducted at DebreBirhan municipal abattoir, 130 km North-east of Addis Ababa. It is located at 9⁰36" North latitude and 39⁰36" East longitude. The area is plateau and found in central Ethiopia at an altitude of 2780 meters above sea level with a bimodal rainfall pattern consisting of long rainy season ("Kiremt") from June to September and short rainy season extending from February to March. The mean annual temperature, rainfall and relative humidity are 12.6⁰C, 956mm and 59.6 % recorded respectively (CSA, 1998).

2.2 Study Animals

The study was conducted on local breed of sheep originated from DeberBirhan & neighboring places (DebreSina, Chacha, ShoaRobit and Menze). A total of 421 sheep distended for slaughter were

examined during ante mortem and postmortem examination and findings were recorded accordingly on a format developed for this purpose.

2.3 Study Design and Sampling Method

Across sectional study was carried out from October 2011 to April 2012 to determine the major parasitic cause of liver condemnation and to assess financial losses at DeberBirhan municipal abattoir. A total of 421 sheep were randomly sampled using systematic random sampling method.

2.4 Sample Size Determination

The total numbers of sheep from the abattoir required for the study was calculated based on the formula given by Thrusfield (1995). In this study, 50% prevalence was considered to calculate the sample size using the following formula.

The relevant formula for a 95% confidence interval is:

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

Where, N =required sample size

P_{exp} = expected prevalence (50%)

d =desired absolute precision

1.96 =value of Z at 95% confidence interval

384 animals from the abattoir were supposed to be sampled, however to increase the precision 421 sheep were sampled.

2.5 Study Methodology

2.5.1 Ante Mortem Examination

Ante mortem examination was conducted in all animals that are brought to the abattoir. Both sides of the animals were inspected at rest and in motion. Moreover, the general behavior of animals, nutritional status, cleanness, and sign of disease and abnormalities of any type were registered. The ages of animals were determined based on eruption of one or more incisor teeth as indicated by Gatenby(1991).

2.5.2 Postmortem Examination

During post mortem examination liver was examined for the presence of any gross lesion or abnormalities by applying routine meat inspection procedures which consists of observation, palpation and incision.

2.5.3. Financial loss assessment

The total financial loss at DeberBirhan municipal abattoir due to liver condemnation was assessed. Losses from liver condemnation were assumed to occur since hepatic pathology is associated to infections that might have health importance and aesthetic value (Budkeet *al.*, 2008; Radostitiset *al.*, 2000). These financial losses due to liver condemnation were estimated by the formula set by Oqunrinade and Oqunrinade(1980).

$$EL = \sum Srx \times Cop \times Roz$$

Where, EL= *Financial loss* due to liver condemnation

$\sum Srx$ =total annual sheep slaughtered)

Cop =average price of liver at a town

Roz =condemnation rates of sheep liver

2.6. Data Analysis

Data collected from study animals were recorded in a format designed for this purpose (Annex 1). Thus, the data were entered into MS-excel-2007 spreadsheet, and analyzed by STATA 11 statistical software program. The prevalence was calculated by dividing the number of positive animals to the total number of animals examined and multiplied by 100. The risk factors associated with the cause of liver condemnation were determined using Pearson's Chi-square (χ^2). A statistically significant association between variables was said to exist if the calculated level of significance is less than ($p < 0.05$).

3. RESULTS

3.1 Abattoir Survey

All animals examined by ante mortem inspection were subjected to postmortem examination. A total of 421 sheep were slaughtered and thoroughly examined by following standard postmortem procedure. Out of 421 examined sheep 52.49 % liver were condemned. *Fasciola* (45.37%) takes the higher percentage for liver condemnation followed by hydatid cyst (4.04%) and *Stilesia hepatica* (3.09%) (Table 1).

Table 1. Major parasitic causes of liver condemnation in sheep

Major parasitic causes	No of positive	Prevalence (%)
<i>Fasciola</i>	191	45.37
Hydatid cyst	17	4.04
<i>Stilesia hepatica</i>	13	3.09
Total	221	52.49

Parasitic causes of liver condemnation in females were higher (53.25%) than in males (51.41%). However, there was no statistical significance difference ($p > 0.05$) among the two groups (Table 2).

Table 2.Major parasitic causes of liver condemnation based on sex

Major cause	Sex		X ²	p-value
	Female (%) (n=244)	Male (%) (n=177)		
<i>Fasciola</i>	110(45.08)	81(45.37)	0.019	0.890
hydatid cyst	13(5.37)	4(2.26)	2.491	0.114
<i>Stilesia hepatica</i>	7(2.87)	6(3.39)	0.093	0.760
Total	130(53.28)	91(51.41)		

In the current study, the ages of sheep with respect to liver condemnation was higher in adults (57.66%) than young (46.73%), however, no statistical significant (p >0.05) difference was observed.

Table 3.Major parasitic causes of liver condemnation based on age group

Major parasite cause	Age		X ²	p-value
	Adult (%) (n=222)	(Young (%) (n=199)		
<i>Fasciola</i>	110(49.55)	81(40.70)	3.3130	0.069
Hydatid cyst	9(4.05)	8(4.02)	0.0003	0.986
<i>Stilesia hepatica</i>	9(4.05)	4(2.01)	1.465	0.226
Total	128(57.66)	93(46.73)		

In the present study, body condition was the main factor in liver condemnation. It was statistically significant in *Fasciola* and hydatid cyst (p<0.05). However, in the case of *Stilesia hepatica* it was statistically non significant (p>0.05) (Table 5).

Table 4. Major parasitic cause of liver condemnation by body condition

Major parasitic causes	Body condition			X ²	p-value
	Good (%) (n=115)	Medium (%) (n=255)	Poor (%) (n=51)		
<i>Fasciola</i>	43(37.39)	113(44.31)	35(68.63)	14.198	.001
Hydatid cyst	2(1.74)	10(3.92)	5(9.80)	5.953	0.041
<i>Stilesia hepatica</i>	3(2.61)	8(3.14)	2(3.92)	0.2088	0.901
Total	48(41.74)	131(51.37)	42(82.35)		

The origins of animals have their own effect on the liver condemnation. It was statistically significant in *Fasciola* (p <0.05). However, in the case of *Stilesia hepatica* and hydatid cyst it was statistically non significant (p >0.05) (Table 7).

Table 5. Major parasitic cause of liver condemnation by origin

Major parasitic causes	Origin							X ²	p-value
	A (%) (n=50)	C (%) (n=82)	D/B (%) (n=58)	D/S (%) (n=28)	M (%) (n=175)	S/R (%) (n=28)			
<i>Fasciola</i>	21(42.00)	39(47.56)	32(55.17)	8(28.57)	86(49.14)	5(17.68)	15.38	0.009	
Hydatid cyst	1(2.00)	3(3.66)	2(3.45)	1(3.57)	9(5.14)	1(3.58)	1.20	0.94	
<i>Stilesia hepatica</i>	1(2.00)	2(2.44)	2(3.45)	3(10.71)	5(2.86)	0(0.00)	6.70	0.24	
Total	23(46.00)	44(53.66)	36(62.07)	12(42.86)	100(57.14)	6(21.43)			

NB: A- Anchober, C- Chacha, D/B- DebreBirhan, D/S- DebreSina, M- Menze and S/R- ShosRobit

3.2. Financial Loss Assessment

All affected 221 livers were totally condemned in DeberBirhan municipal abattoir. The annual slaughter rate of the abattoir was estimated to be 4220. The average price of liver at DeberBirhan town is 10 birr and the percentage of major parasitic causes of liver condemnation in DeberBirhan municipal abattoir was estimated as 52.49%. The financial losses due to liver condemnation were estimated by the formula set by Oqunrinade and Oqunrinade (1980). Therefore, the annual direct financial loss from DeberBirhan municipal abattoir due to parasitic causes of liver condemnation is estimated to be 22150.78 ETB.

4. DISCUSSION

The present study revealed that, out of the total 421 sheep slaughtered at DeberBirhan municipal abattoir 221 (52.49%) livers were condemned due to parasitic causes. This finding is in agreement with the finding of Beyazen (1995) in Eastern Gojjam who reported 53.3% condemnation rate. On the other hand it is greater than the reports of Yimam (2003) (40.65%) at Gonder, Mohammed (2008) (4.5%) at Addis Ababa, Adem (1994) (30%) in Ziway and Shiferaw (2010) (19.19%) at Haramaya. This difference is due to environmental conditions, husbandry system and degree of pasture contamination which favor the production of intermediate host.

In the study area higher number of liver was condemned due to *Fasciola* (45.37%) which is greater than the findings of Solomon (2008), Ezana (2008) and Shiferaw (2011) who reported 17.88%, 7% and 10.94% respectively. The condemnation rate of liver with hydatid cyst was (4.04%), which is similar with Solomon (2008) who reported 4.12%. However, the condemnation rate due to *Stilesia hepatica* is (3.09%) which is lower than the finding of Andualem (2010) (9.83%). This higher rate of rejection of liver is due to the area of cool highland which is suitable for growth and multiplication of the *fasciola* and their intermediate hosts.

Condemnation rate of 53.25% and 51.41% was recorded in female and male respectively. The statistical analysis of the result shows that there was no significant variation ($p > 0.05$) between the two sexes. This signifies sex seems have no impact on the infection rate and both female and male are

equally susceptible and exposure to the disease. This may be due to the grazing of both sexes in similar contaminated area by those parasites. This finding agrees with the result of Bahiru (2000).

In the current study the liver condemnation rate between the age groups are not statistically significant ($p > 0.05$) in all major parasitic causes. *Fasciola* 110(45.55%) in adult and 81(40.07%) in young, Hydatid cyst 9(4.05%) in adult and 8(4.02%) in young, and *Stilesia hepatica* 9(4.05%) in adult and 4(2.01%) in young. This may be due to the management system that is both age groups are grazing in a similar area. But some workers found higher liver condemnation rate in adult than in young animals, these might be attributed to the fact that young are not often driven with older age groups for grazing and watering points. This parasite naturally reduces the chance of exposure in young age class. (Radotitset *et al.*, 2007).

Over all liver condemnation rate based on body condition, 41.74%, 51.37% and 82.35% is found in good, medium and poor body conditions of animals respectively. There is a statistically significant difference in infection rate in body condition of the sheep with fasciolosis and hydatidosis ($p < 0.05$). Animals having poor body condition are more susceptible to infection than those having good body condition. That is poor body condition animals have low immunity to resist any kind of disease. Other factors such as nutrition and small ruminant pathogens should also be considered as the cause of loss of body condition (Urquhart *et al.*, 1996).

Origins of animals coming from different areas to be slaughtered have their own effect on the abnormality of (condemnation) liver. The liver condemnation rate due to *Fasciola* is higher in those sheep coming from DebreBirhan (55.17%), Menze (49.14%) and Chacha (47.56%) than those sheep coming from Anchober(42.00%), DebreSina(28.57%) and Showa Robit(17.06%). There is a statistically significant difference ($p < 0.05$) in infection rate among animals coming from different origins. This is due to the geographical location of the area that is suitable for the growth and multiplication of the fluke and their intermediate hosts.

The condemnation rate of liver due to origins (hydatid cyst liver) in Menze, DebreBirhan and Chacha were 5.14%, 3.45% and 3.66% respectively. While in DebreSina and Showa Robit the prevalence of liver condemnation rate with hydatid cyst was the same (3.57%). But in Anchober it was the lowest

(2.0%). The higher condemnation rate was found due to the origin of slaughtered sheep in which the majority of animals coming from Menze where the environmental conditions and relationship between large numbers of stray dogs found in the area may contribute to the contamination and transmission of the eggs of *Echinococcus granulosus* to the animals. For this reason, small ruminants and other intermediate hosts are mostly affected by cystic echinococcosis infection. But higher condemnation rates were also reported by numerous workers such as, Wubet(1987)(9.38%) in Hararge, Abduljawad(1988) (10.1%) in Jimma and Kosket(1999) (9 %) in Addis Ababa.

Liver condemnation rate due to *Stilesia hepatica* is higher in those sheep coming from DebreSina(10.71%). This finding is similar with the finding of Andualem (2010) (9.83%) and Zewdnes(2010) (11.2%). But sheep coming from Menze (2.86%), Chacha (2.44%) and Anchober(2.00%) were very closely similar and no significant difference ($p > 0.05$). This may be due to the managemental and climatic conditions of the area.

5. CONCLUSION AND RECOMMENDATIONS

Parasites are the major cause of liver damage that leads to condemnation of liver. According to this study, *Fasciola* is the major parasitic cause of liver condemnation followed by hydatid cyst and *Stilesia hepatica* in sheep slaughtered at DeberBirhan municipal abattoir. In general parasitic diseases were the important causes of liver condemnation. This is due to improper disposal of offals contribute for the higher prevalence rate. Highland is suitable for the growth and multiplication of the parasite and their intermediate hosts to which higher condemnation rate is recorded in the study area.

Based on the above conclusion the following recommendations are forwarded:

- ✓ All condemned livers should be properly disposed.
- ✓ There should be cooperation between veterinary and medical personnel in order to control Zoonotic diseases.
- ✓ 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.
- ✓ Appropriate prevention and control measures of the parasites should be applied.

- ✓ Workshops should be organized to enhance the awareness of abattoir workers and butchers on the public health significance of condemned offals.

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