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Full Length Research Article

Prevalence of Bovine Fasciolosis, Amplitude of Liver Condemnation and its Economic Impact in Slaughtered Cattle at Municipal Abattoir of Mekelle, North Ethiopia

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A study was carried out to determine the prevalence, the amplitude of liver condemnation, and to estimate the economic impact of bovine fasciolosis at Mekelle Municipal Abattoir. Out of 1000 cattle examined, 352 (35.2%) were found positive for fasciolosis. Based on severity of tissue damage the liver is categorized in to three: lightly affected 80 (22.7%), moderately 118 (33.5%), and 154 (43.7%) were severely affected. From the fluke count made on 50% of examined livers a minimum of 2 and a maximum of 193 flukes an overall mean load of 62 flukes per infected liver observed. There was a strong relationship between body condition and fluke burden. Comparing moderately and severely affected livers shows that less fluke burden (Mean = 73) in severely-affected liver and higher in moderately affected livers (Mean = 91). The species were identified on all the 352 livers and revealed the presence of *Fasciola hepatica* in 52%, *F. gigantica* in 21.9%, mixed infection by both species in 14.5% and immature fluke in 11.6%. Economic loss assessment was carried out on the basis of liver condemnation rates and carcass weight loss of slaughtered animals. Fasciolosis is of significant economic importance as the resultant liver condemnations caused an average loss of 2245 USD per annum. Hence, this disease deserves serious attention by the various stakeholders in order to improve livestock productivity of the study area in particular and the country at large. Finally, changing the livestock production system and strategic application of ante-helminthes were recommended.

Key words: liver condemnation, liver fluke, Fasciolosis, Abattoir, Mekelle

INTRODUCTION

Fasciolosis is a cosmopolitan's disease, its occurrence being dependent on the presence of biotypes suitable for the parasites as well as the snail intermediate host (Kithuka et.al 2002). Both *Fasciola hepatica* and *F. gigantica* are the two liver flukes commonly reported to cause fasciolosis in cattle. The life cycle of these flukes involves an intermediate host snail *L. truncatula* and *L.natalensi* respectively (Walker et.al.2008). Bovine fasciolosis due to *f. hepatica* and *f. gigantica* in Ethiopia has long history and its incidence and several workers have reported economic significance. *F.hepatica* is wide spread in area with altitude above 1800 to 2000 meter above sea level while *F.gigantica* appears to be the most common species in areas below 1200 meters above sea level. Both species co-exits in area with altitude ranging between 1200 to 1800 meters above sea level. The studies show the incidence of fasciolosis to be in the range of 15.7 – 81.6 % (Yilma and Malone 1998).

A study conducted in southern highlands of Tanzania reported up to 100% liver condemnation rates on cattle due to fasciolosis in some slaughter slabs (Keyyu et.al 2005). The economic significance of fasciolosis is considered by its death, carcass weight loss, reduced milk yield, liver condemnation, decrease productivity, reduction of diseases resistance, and additional cost due to treatment expense (Tadele and Worku 2007). Loss of livers by condemnation due to fasciolosis alone was estimated 4000 USD per annum, in Soddo municipal Abattoir (Fufa et.al 2009). So far, little information is available on the magnitude of fasciolosis in this region. This study therefore, aimed to determine the prevalence of the disease and its economic impact associated to liver condemnation in the Mekelle municipal abattoir, and also to compare the intensity of infection with the gross liver damage and identify the commonly involved fluke species.

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MATERIALS AND METHODS

Study area and Animals

The study was carried out in Mekelle which is a capital city of Tigray regional state and located about 783 km North of Addis Ababa. The production system of cattle in the region is mainly characterized by an extensive management system that includes sedentary which is a feature of the highlands, and transhumance in the lowlands. The study was conducted from November 2007 to march 2008 and the study animals comprised indigenous cattle slaughtered at Mekelle Municipal Abattoir. Purposefully selected by age, body condition, and area of origin 1000 local zebu cattle breed were examined following the customary antimortem and post mortem meat inspection procedure to determine the impact of these factors on the disease picture.

Study methodology

Antimortem inspection was made on selected animals based on origin, age, and body condition and fecal examination was done on 20 % of the selected animals randomly and registered for further comparison during postmortem examination. During every visit, each animals was identified based on the enumerated marks on its body tagged before slaughter and assessment of body condition was carried out using a modified method described by (Mari Heinonen, 1989). Accordingly Animals with body condition scored poor as 1,

medium as 2, and good as 3. The animals examined was also grouped in to two age group <5 and >5 years by dentition according to the modified method described by (De - Lahunta and Hable, 1986). During postmortem examination of the liver following palpation, systematic incision of each liver bile duct and parenchyma and thorough visual inspection, flukes were collected in universal bottles and then examined to identify the involved Fasciola species. Species identification was made using criterion provided by Soulsby (1986). To determine the fluke burden all livers condemned due to flukes was registered. To count the number of flukes present in it livers were purposive selected by the intensity of tissue damage the lightly, moderately, and severely affected and counting was done by slicing the liver in to 1.5 cm pieces and immersing in saline water squeezed to remove the fluke from ducts. The fluid containing the flukes sieved by mesh wire and counted.

Gross liver lesion

The gross lesion encountered on the infected liver was recorded as light, moderate and severely affected liver depending on the severity of the lesion described by (Ogunrinade and Adegoke, 1982). According to this method 352 affected livers were classified in to three groups.

1. **lightly affected livers:-** If the quarter of the liver was affected or if one bile (80 livers) duct was prominently enlarged on the ventral surface of the liver.
2. **Moderately affected:-** If half of the organ was affected or if two or more bile passages (118 livers) were hyper plastic.
3. **Severely affected:-** If the entire organ was involved or if the was cirrhotic (154 livers) and triangular in out line and when the right lobe was atrophied.

Assessment of Economic loss

The total economic loss due to fasciolosis at Mekelle municipal abattoir was estimated from the summation of Annual whole and partial liver condemnation (ALC) and carcass weight loss (ACW). All livers affected due to fasciolosis were not totally condemned partial condemnation of liver was a common practice in the abattoir. The annual liver condemnation rate was assessed considering slaughtered animals. Annual slaughter rate was estimated from the retrospective abattoir record of the last three years while retail market price of an average sized zebu liver was determined from the interview made with the butcheries in Mekelle town. Information obtained was then subjected to mathematical computation using the formula set by Ogunrinade and Ogurinade (1980)

a) Total Annual liver condemnation (ALC) = MCS X MLC X I

Where ALC = Annual loss from liver condemnation
MCS = Mean annual cattle slaughtered at Mekelle Abattoir
MLC = Mean cost of one liver in Mekelle town
I = Incidence of totally condemned liver at the abattoir

b) Annual Partial liver condemnation (PLC)

Where: PLC = Annual loss from partial liver condemnation
MCS = Mean annual cattle slaughtered at Mekelle Abattoir
½ MLC = Mean cost of half liver in Mekelle town
I = Incidence partially condemned liver at the abattoir

c) Carcass weight loss due to fasciolosis: An average carcass weight loss due to bovine fasciolosis was then assessed using the following formula .

Annual loss from carcass weight loss (ACW) = CSR X CL X BC X I

Where: ACW = Annual loss from carcass weight loss.
CRS = Average number of cattle slaughtered per Annum at Mekelle Abattoir.
CL = Carcass weight loss in individual cattle due to fasciolosis
BC = Average price of 1kg beef in Mekelle town.
I = Incidence rate of fasciolosis at Mekelle Abattoir

Total annual economic loss = a + b + c

Statistical Analysis

Descriptive statistics were computed using the Excel spread sheet program of the computer and that of incidence determination and testing the different associated factors was calculated with strata 7.0 Software. Factors that influence the incidence of fasciolosis included in this study were age; body condition and animal origin were tested using the chi-square. The infection rate and incidence rate of fasciolosis during coprological and postmortem examination was calculated by percentage.

RESULT

Prevalence of fasciolosis

A five month (November to March) postmortem examination was carried out on 1000 cattle for fasciolosis at Mekelle municipal Abattoir out of these 352 cattle were found to be positive for fasciolosis during postmortem examination giving a mean incidence rate of 35.2%. Monthly variation of fasciolosis was found to be 42.5 % in November, 40.9 in December, 31.4 in January, 27.5% in February, and 26.4 in March (Table 1).

Table 1. Monthly variation of bovine Fasciolosis in Mekelle Abattoir

Month	Affected animals	Non- affected animals	Total	Monthly distribution in (%)
November	117	158	275	42.5
December	92	133	225	40.9
January	55	120	175	31.4
February	55	145	200	27.5
March	33	92	125	26.4
Total	352	648	1000	35.2

In addition, out of the 200 cattle selected for coprological examination 49 were positive for fasciolosis with over all incidence rates of 24.5%. There is also a marked monthly variation in Fasciola egg finding in which the highest (29%) in November and the lowest (16%) during March was found (Table 2)

Table 2. Result of faecal examination during ante-mortem examination.

Month	No. of animals examined	No. of positive animals	Monthly distribution in (%)
November	55	16	29
December	45	13	28.8
January	35	8	22.8
February	40	8	20
March	25	4	16
Total	200	49	24.5

Infection rate on the basis of age was graded as 1 and 2 were found to be 50.6% and 33.8% respectively (Table 3) and the rate showed significant ($P<0.05$).

Table 3. Incidence of bovine Fasciolosis on age basis on Mekelle abattoir

Age (year)	No. of samples examined	No. of positive cases	No. of negative cases	Infection rate (%)
≤ 5	81	41	40	50.6
> 5	919	311	608	33.8
Total	1000	352	648	35.2

Pearson chi 2 (1) = 9.185 P < 0.05

The incidence of bovine fasciolosis on the basis of body condition score was graded as 1, 2, 3, and were found to be 42.4%, 36.8%, and 21.9% respectively (Table 4). And the rate shows significant (P < 0.05). So, the body condition was inversely related to infection rate.

Table 4. incidence of bovine fasciolosis in different body condition

Body Condition	No. of cattle examined	No. of positive case	No. of Negative case	Infection rate (%)
1 (Poor)	144	61	83	42.4
2 (medium)	696	256	440	36.8
3 (Good)	160	35	125	21.8
Total	1000	352	648	35.2

Pearson chi2 (2) = 16.173 P< 0.05

The incidence rate of fasciolosis based on the animal origin were also assed and the infective rate of bovine fasciolosis in animals slaughtered in Mekelle Municipal abattoir originated from the highland area of the region was higher than that of the lowland (Table 5).

Table 5. Incidence rate of bovine fasciolosis based on the origin of the animals

Origin	No. of cattle examined	No. of positive cases	No. of negative cases	Infection rate (%)
Lowland	397	125	272	31.5
Highland	603	227	376	37.64
Total	1000	352	648	35.2

Pearson chi 2(1) = 3.9811 P<0.05 (statistically significant).

Of a total of 352 infected livers, Fasciola hepatica was the most commonly encountered parasite with incidence rate of 52% while Fasciola gigantica accounted incidence rate of 21.9%, mixed infections due to both F. hepatica and F. gigantica found to be 14.5% and immature flukes accounted 11.6% (Table 6).

Table 6. Species of Fasciola encountered in affected livers

Species of Fasciola	No. of livers	Percentage (%)
Fasciola hepatica	183	52
Fasciola gigantica	77	21.9
Mixed infection	51	14.5
Immature fluke	41	11.6
Total	352	100.00

Pearson chi2 (3) = 13, 1326 P< 0.05

Gross pathological lesion of liver affected by fasciolosis

Out of the 352 affected livers 80, 118, and154 was found to be lightly, moderately and severely affected livers respectively. (Table 7)

Table 7. Intensity of liver lesion

Severity of infection	No. of livers infected	Percentage (%)
Light	80	22.73
Moderate	118	33.52
Severe	154	43.75
Total	352	100.00

Study carried out on 176 livers to determine the fluke burden versus severity of pathological lesions on the liver (Table 8) indicated that there is no direct relationship between the numbers of flukes recovers. Since the mean number of flukes found in moderately affected livers was higher (91) than the mean number of flukes in either severely affected (73) or lightly affected liver (23).

Table 8. Lesion classification of livers with their respective average fluke burden

Pathological lesion of liver	No. of livers affected	Average fluke burden
Lightly affected	40	23
Moderately affected	59	91
Severely affected	77	73
Total	176	187

Economic loss analysis

Estimation of annual economic loss analysis due to fasciolosis at Mekelle municipal abattoir was estimated from the summation of Annual whole and partial liver condemnation (ALC) and carcass weight loss (ACW).

a. Total Annual liver condemnation (ALC) = MCS X MLC XI

Where ALC = Annual loss from liver condemnation
MCS = Mean annual cattle slaughtered at Mekelle Abattoir
MLC = Mean cost of one liver in Mekelle town
I = Incidence of totally condemned liver at the abattoir
ALC = 7750 X 36 X 0.272 = 75,888 ETH Birr

b) Annual Partial liver condemnation (PLC)

Where: PLC = Annual loss from partial liver condemnation
MCS= Mean annual cattle slaughtered at Mekelle Abattoir
½ MLC= Mean cost of half liver in Mekelle town
I= Incidence partially condemned liver at the abattoir
PLC= 7750 X 18 X 0.08 = 11,160 Birr

C. Carcass weight loss due to fasciolosis (ACW): annual economic loss due to reduction of meat production. Annual loss from carcass weight loss (ACW) =CSR X CL X BC X I

Where: ACW = Annual loss from carcass weight loss.
CRS = Average number of cattle slaughtered Per annum at Mekelle Abattoir.
CL = Carcass weight loss in individual cattle due to fasciolosis
BC = Average price of 1kg beef in Mekelle town.
I = Incidence rate of fasciolosis at Mekelle Abattoir
ACW= 7750 X 0.1 X 126 X 40 X 0.352 = 137, 491. 20

Therefore, the total economic loss due to fasciolosis in the Mekelle municipal abattoir is; Total annual economic loss = a + b + c

= 75,888 + 11, 160 + 137,491.20
= 224,539.20 ETH Birr = (13208.9 USD)

DISCUSSION

The current study revealed that Fasciolosis is the most prevalent parasites disease causing considerable direct and indirect economic losses in the study area. The parasite is primarily important for condemnation of liver and causing significant economic losses. The result of the present study conducted for a period of five month in Mekelle Municipal Abattoir and its incidence rate was 35.2% which is lower when compared with previous reports in different parts of the country, such as 81.6% in west shoa by (Yadeta, 1994), and 83.6%

in Debere Berhane (Zerihun, 2005). This might be due to difference in climate and ecological conditions such as altitude, rainfall, and temperature and livestock management system. The difference in incidence and severity of the disease syndrome are evident in various geographical regions depending on the local climatic condition, availability of permanent water and system of management (Yilma and Malone 1998). Mean while the incidence rate registered in the same study area was relatively higher compared with the same study previously conducted in the same study area by HAGOS (2007) that reported 32.8% incidence rate. The probable reason of increased incidence of the disease could increase irrigated landmasses from the currently constructed dames and ponds and the tendencies of farmers to feed their animals in these marshy and damp areas because of feed scarcity. Grabber (1978) has shown that both *Fasciola hepatica* and *Fasciola gigantica* exist in Ethiopia. Similarly during the study it was found that out of 352 positive cattle for fasciolosis, Fasciola hepatica was found to be the causative agent in 52% (183 cattle) and *Fasiola gigantica* accounted for 21.9% of Fasciolosis (77 cattle), There was also immature and mixed infestation by both species, 41 cattle (11.6%) and 51 cattle (14.5%) respectively. In this study the predominate species causing bovine Fasciolosis in the study was *F. hepatica*. The past result (Hagos, 2007) also reported in the same abattoir indicated that *Fasciola hepatica* was the predominant species which a counts 45%, F. gigantica 25%, mixed infection by both species (13%), immature fluke (27%). The origin of the animal has also a contributing factor on the disease picture. From a total of 1000 examined animals 603 (60.3%) were high land animals, of these 37.6% were found affected with fasciolosis.

Statistical analysis of infection rates on the basis of age indicated significant difference ($P<0.05$) between the two age groups. Higher infection rate occurs in younger animals (less than 5 years old) and was found 50.6% positive out of 81 young animals, while 33.8% from 919 examined older animals this is in agreement with Radostitis, et.al (2000) which, indicates that higher infection rate occurs in young animals. Analysis on the incidence of fasciolosis in relation to body condition of animals showed significant difference ($P<0.05$) indicating an inverse relation incidence rate with body condition score. The incidence rate was found to be 42.4%, 36.8%, and 21.8% for poor, medium and good body condition animals respectively. This is due to poor body condition animals are susceptible to the infectious disease. The reason behind is may be due to reduced performance of the animals created by luck of essential nutrients and poor management by the animal owner. This finding corresponds with Hagos (2007) also reported 37.7%; 33.1% and 29.1% incidence rate in poor, medium and good body condition animals respectively.

The monthly variation in the incidence has been studied for 5 Months November, 2007 to March, 2008 in the study area. The result of the study showed that incidence of fasciolosis was positively correlated with rainfall and humidity. The highest incidence rate was recorded during November (42.5%) during the wet month and the lowest during March (26.4%) which is dry season the rise in the infection rates of fasciolosis during the wet months of the year is attributed to seasonal peak of snail activity in breeding and development of the larval stage flukes with in the snails. Economic importance of bovine Fasciolosis has been the main concern of several workers in Ethiopia. Bahiru and Ephrem (1979) reported an annual loss of 3.6 million USD per annum on national basis. Although it is difficult to evaluate the actual economic losses incurred due to individual parasitic diseases, because of the occurrence of poly-parasitism in the natural cases, economic loss analysis due to bovine fasciolosis was made at the Mekelle municipal Abattoir total annual loss encountered 13208.9 USD.

Conclusion

The current study confirmed that fasciolosis is an important disease and cause considerable economic loss due to organ condemnation in cattle Slaughtered in Mekelle Abattoir. The two species of Fasciolosis (*F. hepatica* and *F. gigantica*) were identified indicating the current availability of favorable climatic situation in the study area for the development of intermediate host. Higher incidence rate of fasciolosis could be due to an increased irrigated land masses from the currently constructed dames and ponds and the tendencies of the farmers to feed their animals in these marshy and damp area because of feed scarcity. The high incidence rates reported in these results clearly indicate luck of plan based control measures against the source of infection of this disease which attributed for increased tendencies in incidence within few years. Furthermore, the following recommendation is forwarded to control the disease.

- Promoting the establishment of intensive livestock farms with zero grazing should be encouraged, since the management system practiced in the region is one factor in predisposing cattle for fasciolosis.
- At this point in time strategic use of ante-helminthes and molluscides treatments based on adequate epidemiological information seems to be the most reliable method in the control of fasciolosis.
- Detailed epidemiological studies on the incidence of fasciolosis should be conducted taking in to consideration agro- ecological situation of the region.

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