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The Prevalence and Economic Impact of Bovine Fasciolosis at Lalo Municipal Abattoir, Lalo Kile District, West Wollega, Ethiopia

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Abstract: A cross sectional study was carried out the aims of determining the abattoir prevalence and direct economic loss associated with fasciolosis in cattle at Lalo municipal abattoir, Ethiopia. From the total of 412 examined cattle, 120 (29.13%) were found to be positive for fasciolosis by postmortem liver inspection. From 120 infected livers with *Fasciola* species, *Fasciola hepatica* was found to be the most prevalent species 69 (16.75%) and *Fasciola gigantic*, mixed infection and immature or unidentified form of *Fasciola* species were proved to be 28(6.8%), 16(3.88%) and 7(1.7%) respectively. Highest prevalence of fasciolosis was observed in medium body condition cattle 77 (18.69%) followed by poor and good body condition of cattle 22 (5.34%) and 21(5.1%), respectively. Statistical analysis of the data showed the presence of significant difference ($P<0.05$) on the prevalence of fasciolosis among the different body condition scores. The prevalence of bovine fasciolosis was highest 53(12.86%) in Darimu area than Gobbe 37(8.98%), Lalo kile 18(4.37%) and Aira 12(2.91%) with significant difference ($P<0.05$) in the prevalence of bovine fasciolosis was observed. Analysis of the abattoir data indicated a total annual liver condemnation which resulted in 92, 851.86 Ethiopian Birr ($3438.95) loss. The results of the present survey showed that the prevalence and monetary loss of fasciolosis in cattle slaughtered at Lalo kile municipal abattoir was high and warrants immediate need for prevention and control of the parasite in the study area in particular and in the country at large.

Key words: Abattoir · Cattle · Fasciolosis · Financial Loss · Prevalence

INTRODUCTION

Ethiopia has a large livestock population in Africa, which is estimated to be around 34-40 million TLU out of which 17% and 12% of cattle and small ruminants, respectively, are found in Ethiopia with the largest livestock in Africa including more than 38, 749, 320 cattle, 18, 075, 580 sheep, 14, 858, 650 goats, 456, 910 camels, 5, 765, 170 equines and 30, 868, 540 chickens with live stock ownership currently contributing to the livelihoods of an estimated 80% of rural population [1]. Despite the large animal population, productivity in Ethiopia is low and even below the average for most countries in eastern and sub-Saharan African countries, due to poor nutrition, reproduction insufficiency, management constraints and prevailing animal diseases [2].

Among many parasitic problems of farm animals, fasciolosis is a major disease which imposes economic impact on livestock production particularly of cattle and sheep [3].

Fasciola hepatica and *Fasciola gigantic are* the two liver flukes commonly reported to cause fasciolosis in ruminants. The life cycles of these parasites requires snail as an intermediate host [4]. *F. hepatica* has a worldwide distribution but predominates in temperate zones while *F. gigantic is* found on most continents, primarily in tropical regions [5].

In Ethiopia both *F. hepatica* and *F. gigantica* have the greatest risk occurred in areas of extended high annual rainfall associated with high soil moisture and surplus water, with risk diminishing in areas of shorter wet season and or lower temperatures. For *F. gigantica* regions in the

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high lands of Ethiopia and Kenya were identified as unsuitable due to in adequate thermal regime. Average annual mean temperatures of 23°C or above were found to correspond to areas below the 1200m elevation limit of *F. hepatica* in Ethiopia [6].

The disease is responsible for considerable economic losses in the cattle industry mainly through mortality, liver condemnation, reduced production of meat, milk and wool and expenditures for anthelmintics [7]. Regarded as one of the major setbacks to livestock productivity incurring huge direct and indirect losses in the country; Available published reports have indicated that bovine fasciolosis causes economic losses of roughly 350 million Birr per annum due to decreased productivity alone [8].

Several abattoir surveys conducted in various parts of Ethiopia have demonstrated the presence of fasciolosis, due to *F. hepatica* and *F. gigantica*, in ruminants. Some studies tried to demonstrate the economic losses associated with liver condemnation and evaluation of the economic loss due to fasciolosis differ in different parts of Ethiopia [9-11].

Apart from its veterinary and economic importance throughout the world, fasciolosis recently been shown to be a re-emerging and wide spread zoonosis affecting many people [12]. Hepatic distomatosis or fasciolosisis a parasitic disease affecting herbivorous mammals and humans that is caused by the trematode *F.hepatica* [13]. The records of natural infection in humans are mostly correlated with regions that are endemic for animal fasciolosis, in rural communities in which humans share the water source with their animals, or areas in which raw vegetables cultivated in endemic regions are consumed [14].

Because epidemiology of fasciolosis is dynamic and may change with years [15] it is important to monitor its development to determine trends in prevalence. Furthermore, study of bovine fasciolosis not so far conducted in Lalo Municipal Abattoir .Therefore, the objectives of the current study were to determine the prevalence of bovine fasciolosis and estimate the magnitude of direct economic loss attributed due to liver condemnation at Lalo Municipal Abattoir.

MATERIALS AND METHODS

Description of the Study Area: The study was conducted at Lalo municipal abattoir, in Lalo town, which is found in west wollega administrative zone of Oromia Regional state, kellem wollega zone and lies at 035°26E longitudes and 08°45 to 08°59 latitude and north of equator. Altitude of area ranges from 500-1800 m.a.s.l. The climatology alternates with long summer rain fall (June-Sep), short rainy seasons (March-April) and winter dry seasons (December-February). The district has 32° maximum temperature and 15° minimum temperature and 1000 to 1500 mm rain fall. The main livestock types kept in the area includes bovine, ovine, caprine and equine. The livestock population of bovine 91723, ovine 29378, caprine 2538 and equine 10254. Agriculture is the main stay of livelihood of people with a mixed farming system and livestock plays an integral role for agriculture [16].

Sample Size Determination: Since there was no previous study in Lalo at own to establish the prevalence and economic significance of bovine fasciolosis, the sample size was determined by taking the prevalence of 50% fasciolosis using the formula given by Thrusfield [17].

$$n = \frac{(1.96)^2 P_{exp}(1 - P_{exp})}{d^2} = \frac{(1.96)^2 0.5(1 - 0.5)}{(0.05)^2}$$

$$n = 384$$

where, n = required sample size, Pexp = expected prevalence, d^2= desired absolute precision at 95% Confidence level. According to the above formula 384 animals were sampled. However to increase the level of accuracy of determining the prevalence the sample size has been increased to 412.

Study Design and Sampling Method: A cross sectional study was employed to examine animals which were slaughtered in the abattoir and observation of every individual animal were both ante-mortem and postmortem examination. Complete ante-mortem examination of the animals was carried out a day before or shortly prior to slaughter. Inspection of the animals was made while at rest or in motion to observe for any obvious sign of disease like emaciation, submandibular edema and each and every animal were tagged with identification number before the slaughter commences. During postmortem examination, the liver of the animals were examined for detection of the presence of adult fluke parasites from the bile ducts in the abattoir.

Active Abattoir Survey: Active abattoir survey was conducted based on cross sectional study during routine meat inspection of slaughtered animals in abattoir.

During ante-mortem examination detail records about the species, sexes, origins and body conditions of the animals were recorded. Prevalence was determined through grouping the study animals in their body condition, age and origin. The animals examined was also grouped in to two age group (<5) as young and (>5) years as adult by dentition according to the modified method described by De-Lahunta and Hable [18]. Body condition was scored following the guidelines set by Nicholson and Butterworth [19]. Accordingly, animals were classified into poor, medium and good categories of body conditions. During post-mortem inspection, each liver visually inspected, palpated and incised based on routine meat inspection. All livers having *Fasciola* species condemned were registered and flukes were conducted for species identification [20].

Species Identification: After making systematicincision on liver parenchyma and bile ducts, flukes were collected in the universal bottle containing 10% formalin in preservative and examined to identify the involved species. In many studies, gross morphology is used to differentiate the two species. *F. gigantic* is typically longer at approximately 28-52 mm and has a narrower body while *F. hepatica* has more pronounced 'shoulders' and is considerably shorter at around 12-29 mm [21].

Direct Financial Loss Analysis: The total financial loss incurred due to fasciolosis in Lalo Municipal abattoir was estimated based on liver condemnation. The economic loss due to liver condemnation was estimated through interview made with local butcher men in Lalo town, the average price of each cattle liver was calculated to be 75 Ethiopian Birr. The direct loss was thus computed according to the formula adopted by Ogunrinade and Ogurinade [22]. Using the market price of a bovine liver, the monetary loss occasioned by condemnation of *Fasciola* infected livers was calculated as follows.

ALC = CSR X C X P; where:
ALC = Annual loss from liver condemnation
CSR = Mean annual cattle slaughtered at municipality abattoir
LC = Mean cost of one liver in Lalo town
P = Prevalence rate of the disease at the study area

Data Analysis: The data were collected from the study area and entered in to Micro Soft Excel spread sheet. Data analysis was carried out by using computer based Statistical package for social sciences (SPSS version 20). Descriptive statistics was used to determine the prevalence of the parasite and Chi- square ($x2$) test was used to assess the association of the prevalence of fasciolosis and its associated risk factors. A 95% confidence interval and P-value less than 0.05 (At 5% level of significance) were considered significant in all analysis.

RESULTS

Overall Prevalence: Of the total 412 slaughtered cattle that subjected to detailed postmortem examination at Lalo municipal Abattoir, 70 were positive for fasciolosis with 29.13% prevalence. Statistically significant difference ($P < 0.05$) in the prevalence of bovine fasciolosis among four different origins and body condition of slaughtered animals was observed. The highest prevalence was recorded in Darimu district (12.86%), Adult age (21.36%), male (23.06%), medium body condition (18.69%).

Of 120 animals infected with liver fluke, 69 (57.5%) livers were harbored *F. hepatica*, 28 (23.33%) livers harbored *F. gigantic*, 16 (13.33%) livers harbored mixed and 7(5.83%) unidentified species due to immature flukes infection. The distribution and prevalence of *Fasciola* species was different in different origins of animals. The highest prevalence of *F. hepatica* (19.31%) was observed in Darimu district and the lowest (10.66%) was observed in Aira, whereas the highest prevalence of *F. gigantic* (8.45%) was observed in Lalo kile district and the lowest (2.66%) was observed in Aira district (Table 2).

There was a statistically insignificant difference ($P>0.05$) in the prevalence of bovine fasciolosis in different age groups. The highest (21.36%) prevalence was in adult animals and the lowest (7.77%) was found in young animals (Table 3).

There was a statistically insignificant difference ($P>0.05$) in the prevalence of bovine fasciolosis in sex groups. The highest (23.06%) prevalence was in male animals and the lowest (6.07%) was found in female animals (Table 4).

There was a significant difference ($P<0.05$) in the prevalence of bovine fasciolosis within different body condition scores. The highest prevalence (18.69%) was found in animals with medium body condition scores and the lowest prevalence (5.1%) was found in good body conditioned animals (Table 5).

Table 1: Prevalence of bovine fasciolosis based on origin (districts)

Origin	Number of examined animals	Prevalence (%)	χ^2-value	P –value
Darimu	145	53(12.86%)	10.75	0.01
Lalo kile	71	18(4.37%)		
Gobbe	121	37(8.98%)		
Aira	75	12(2.91%)		
Total	412	120(29.13%)		

Table 2: Prevalence and distribution of bovine *Fasciola* species with respect to animal origin

Fasciola species	Darimu (145)	Lalo kile (71)	Gobbe (121)	Aira (75)	Total (412)
F. hepatica	28(19.31%)	11(15.5%)	22(18.18%)	8(10.66%)	69(16.75%)
F. gigntica	12(8.28%)	6(8.45%)	8(6.61%)	2(2.66%)	28(6.8%)
Mixed infection	9(6.21%)	1(1.41%)	5(4.13%)	1(1.33%)	16(3.88%)
Immature infection	4(2.76%)		2(1.65%)	1(1.33%)	7(1.7%)
Total	53	18	37	12	29.13%

Table 3: Prevalence of bovine *Fasciola* based on age

Age	Number of examined animals	Prevalence (%)	χ^2-value	P –value
Adult	302	88(21.36%)	0.000	0.99
Young	110	32(7.77%)		
Total	412	120(29.13%)		

Table 4: Prevalence of bovine *Fasciola* based on sex

Sex	Number of examined animals	Prevalence (%)	χ^2-value	P –value
Female	85	25(6.07%)	0.004	0.95
Male	327	95(23.06%)		
Total	412	120(29.13%)		

Table 5: Prevalence of bovine *Fasciola* in association with body condition

Body Condition	Number of examined animals	Prevalence (%)	χ^2-value	P -value
Good	139	21(5.1%)	23.55	<0.001
Medium	227	77(18.69%)		
Poor	46	22(5.34%)		
Total	412	120(29.13%)		

Financial Loss Analysis: The economic significance of fasciolosis was analyzed based on the information obtained during postmortem examination and interview.

Annual loss due to liver condemnation = CSR*LÑ*P= 4250*75*0.2913= 92851.86 Ethiopian Birr ($3438.95) was annual lost.

DISCUSSION

Fasciolosis is an important parasitic disease of domestic ruminants caused by two liver fluke species: *F. hepatica* and *F. gigantica* (Trematoda). *Fasciola hepatica* has a cosmopolitan distribution, mainly in temperate zones, while *F. gigantica* is found in tropical regions of Africa and Asia. Bovine fasciolosis exists in almost all region of Ethiopia. However, the prevalence, epidemiology and *Fasciola* species involved vary with locality. This is mainly attributed to the variation in the climate and ecological condition such as altitude, rainfall, temperature and livestock management system [23].

The overall prevalence of bovine fasciolosis (29.13%) observed in this study is in close agreement with the reports of Nuraddis *et al*. [24] and Pfukenyi and Mukaratirwa [25] who reported prevalence of 24.3% and 28% at Mekelle area and at Kombolcha Industrial Abattoir, Ethiopia. However, it is much lower than several study conducted at different abattoirs in the country 46.58% at Jimma abattoir [26] 90.65% at Gondar abattoir [27] 56.2% at Chora Wereda [28] 83.6 % at the Haranfama municipal abattoir [29] and 56.6% at Ziway abattoir [30]. In other African countries, higher prevalence is also reported by different researchers such as 64.2% from Lake

Victoria basin in Kenya [31] 53.9% from Zambian abattoirs in Zambia [32] and 52.6% from Arusha region in Tanzania [33]. This difference might be due to the geographical variation which is important for the multiplication of the intermediate host. Similarly, variation in climatic-ecological conditions such as altitude, rainfall, temperature, livestock management system and suitability of the environment for survival and distribution of the parasite as well as the intermediate host might have played their own role in such differences.

On the other hand, a lower prevalence of fasciolosis (15.58%) has been observed in the Mizan-Aman municipal abattoir [34] 16.4% in Bonga Abattoir [35] and 9.88% at Halaba municipal abattoir [36]. Difference in prevalence among geographical locations is attributed mainly to the variation in the climatic and ecological conditions such as altitude, rainfall and temperature. *Fasciola* spp. prevalence has been reported to vary over the years mainly due to variation in amount and pattern of rainfall.

The prevalence rate of fasciolosis based on the sexes of the slaughtered cattle was statistically insignificant ($P>0.05$), this could be due to the exposure of male and female bovines to similar ecological condition and practices of similar management system without considering their sex.As it is indicated in Table 4, the prevalence of bovine fasciolosis was 23.06% and 6.07% in male and female cattle, respectively. This was lower than the finding of Feleke and Girma [37] with 65.07% in male and 66.67% in female cattle at DebereBerehan municipal abattoir. This might be due to the economic importance given by the local society for female cattle by keeping in protected areas and due to the reason that the abattoirs' rule prohibited to slaughter young fertile females without the permission of veterinary personnels [38].

The result of the current study showed that age has insignificant effect on the prevalence of bovine fasciolosis; but it was higher in adult animals (21.36%) than the young (7.77%). This may be due to long and frequent exposure to infection and other related factors.

The results of the present study indicated that body condition of the animal has significant association with the occurrence of fasciolosis. The prevalence was higher in medium body conditioned animals than that of good and poor body conditioned animals because the animal with medium body condition is greater number from the selected animal for slaughter. The result of present study showed that origin has significant effect on the prevalence of bovine fasciolosis; being higher in Darimu than the other three district.

Postmortem examination on the 120 *Fasciola* infected livers of current results indicated that the prevalence of *F. hepatica* (16.75%) was higher than that of *F. gigantic* (6.8%) and certain proportion of animals (3.88%) harbored mixed infection (Table 2). The high prevalence of *F. hepatica* may be associated with the presence of favorable ecological biotypes for its snail vector *Lymnaeatruncatula*. In support of the present study, [39] reported that 56.42% of cattle were infected with *Fasciola hepatica* and 9.17% with *Fasciolagigantica*.

CONCLUSION

In present study moderate prevalence of bovine fasciolosis was obtained when compared with prevalence reported by different researchers at different area. The dominant Fasciola revealed was *fasciola hepatica* at Lalo municipal abattoir that induces economic losses due to liver condemnation. The abattoir based prevalence recorded in the study area and the loss incurred suggests that a detailed epidemiological study as well as assessment of the overall economic loss due to fasciolosis is required to implement systematic disease prevention and control methods.

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