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Prevalence and Economic Losses of Bovine Fasciolosis in Dessie Municipal Abattoir, South Wollo Zone, Ethiopia

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Abstract: A cross sectional study was carried out from October 2010 to March 2011 with the objectives of determining the prevalence, risk factor and economic importance of bovine fasciolosis in Dessie municipal abattoir. Over all prevalence of 25.2% (126 of 500) was observed. Based on origins of animals, prevalence rates of 30.51%, 28.4%, 25.81% and 19.77% were recorded in Kutaber, Worehimmenu, Dessie Zuria and Tewulederae, respectively. There was no statistically significant difference ($p>0.05$) between the four study areas. Young animals were found with high prevalence (33.33%) followed by old animals (26.11%) and adult animals (24.7%). However, there was no statistically significant difference between the prevalence in the different age groups of animals. Prevalences of 63.29%, 18.62% and 17.75% were observed in animals of poor body condition, good body condition and medium body condition, respectively. The difference between the prevalence of bovine fasciolosis in animal of different body conditions was statistically significant ($p<0.05$). Of 126 infected livers, 65.9%, 18.25%, 9.5% and 6.34% were infected with *F.hepatica*, *F.gigantica*, mixed and immature flukes, respectively. The prevalence of *F*asciola species is different in different study areas and the highest prevalence of *F. hepatica* was observed in Kutaber (20.34%) followed by Dessie Zuria (17.74%) and the highest prevalence of *F.gigantica* was observed in Worehimmenu (9.88%) followed by Kutaber (2.54%). The direct and indirect losses incurred due to fasciolosis in Dessie municipal abattoir were estimated about 2,495,346.13 ETH Birr. It is concluded that fasciolosis is prevalent in cattle in the study area. Hence, this disease disserves serious attention by the various stake holders in order to promote the beef industry in the study area in particular and in general in the country.

Key words: Bovine · Dessie Municipal Abattoir · Economic Loss · Fasciolosis · Prevalence

INTRODUCTION

Among many parasitic problems of farm animals, fasciolosis is a major disease, which imposes direct and indirect economic impact on livestock production, particularly of sheep and cattle [1, 2]. *Fasciola hepatica* and *Fasciola gigantica* are the two liver flukes commonly reported to cause fasciolosis in ruminants. The life cycle of these trematodes involves snail as an intermediate host [3]. 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 [4, 5]. Apart from its veterinary and economic importance throughout the world, fasciolosis has recently been shown to be a re-emerging and widespread zoonosis affecting many people [6].

A review of available literature strongly suggests that fasciolosis exists in almost all parts of Ethiopia. It is 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 [7]. More recently, Tolosa *et al*. [8] and Fufa *et al*. [9] have reported financial losses of 6300 USD and 4000 USD per annum, respectively due to liver condemnations at slaughter houses in Ethiopia.

Although a number of studies have been undertaken with regard to abattoir based prevalence and evaluation of the economic loss due to fasciolosis in different parts of Ethiopia [10-13], very little has been done in south Wollo zone of the Amhara regional state of the country particularly Dessie area. Therefore, the objectives of the

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current study were to determine the prevalence, to assess the risk factors and to determine the economic loss due to liver condemnation and carcass weight loss in cattle slaughtered at Dessie municipal abattoir.

MATERIALS AND METHODS

Description of the Study Area and Origins of Animals: The study was conducted at Dessie municipal abattoir, in Dessie town, which is found in South Wollo administrative zone of Amhara National Regional State in North Eastern Ethiopia from October 2010 to March 2011. The study area is located at $11^0$08' North latitude and $39^0$38' East longitude which is 401km far from the capital city of Ethiopia, Addis Ababa. The study animals were brought from four different district areas, namely, Tewulederae, Dessie zuria, Kutaber and Worehimmenu in and around Dessie town and the animals were slaughtered at Dessie municipal abattoir. The North and South zones of Wollo experience bimodal rain fall with a short rainy season occurs usually from March to May and long rainy season extends from June to September. The annual rain fall of the areas ranges from 800-1000mm. The average elevation of Tewulederae, Dessie zuria, Kutaber and Worehimmenu is 2164, 2400, 2607 and 2500 meters above sea level (m.a.s.l) respectively. Similarly the average monthly minimum and maximum temperature of the areas were computed to be 12.37°C and 26.27°C respectively. The cattle population is 99,128 in Dessie zuria, 71,234 in Kutaber, 136,519 in Worehimmenu and 56,850 in Tewulederae.

Study Animals: A total of 500 male indigenous cattle were brought to the abattoir for slaughtering purpose from the four study districts. All animals slaughtered at the abattoir during the six month study period were included in the study.

Study Design, Sampling Method and Sample Size Determination: A cross sectional study design was used. Simple random sampling technique was the sampling strategy used to collect all the necessary data from abattoir survey of the study animals. The sample size required for this study was determined based on the expected prevalence (50%) of bovine fasciolosis and the 5% desired absolute precision and 95% CI according to Thursfield [14]. Accordingly 384 animals were supposed to be sampled but in order to increase the precession a total of 500 study animals were used.

Active Abattoir Survey: Active abattoir survey was conducted based on cross sectional study during routine meat inspection on randomly selected cattle slaughtered in Dessie municipal abattoir. A total of 500 cattle were examined during the study. During ante-mortem examination details about the species, breeds, origins and body conditions of the animals were recorded. The body condition scoring was recorded based on the studies of Nicholson and Butterworth [15], Delahunta and Habel [16] and Mari [17]. During post-mortem inspection, each liver visually inspected, palpated and incised based on routine meat inspection by FAO [18]. All livers having *Fasciola* species were registered and flukes were morphologically identified according to the study of Soulsby [19].

Financial Loss Analysis: The total financial loss incurred due to fasciolosis in Dessie municipal abattoir was estimated based on liver condemnation and reduction in beef production. The mean retail price of one liver and one kilogram of meat was taken as 10 and 52 birr respectively according to the interview obtained from local butcher houses. The average number of cattle slaughtered at the abattoir was 14,886 per year based on two consecutive year recorded data in the abattoir. A 10% estimated carcass weight loss mentioned by German workers and Henderson due to fasciolosis was the parameter used for calculating carcass weight loss. 126 kg is estimated as average carcass weight of Ethiopian zebu ILCA [20].

Therefore the total annual financial loss incurred as a result of liver condemnation and carcass weight loss due to fasciolosis was estimated by the following formula.

- Annual cost of condemned liver =NAL×%COND.×CL

Where,

NAL = Average number of cattle slaughtered in Dessie Municipal Abattoir per year

% COND. = Percentage of liver condemned due to fasciolosis

CL = Mean cost of one liver in Dessie town

- Annual loss due to reduction in meat production

Annual loss due to reduction in meat production $= NAL \times CL \times P_A \times P_{rev}$.

Where,

NAL = Average number of cattle slaughtered in Dessie municipal abattoir
CL = Carcass weight loss in individual animal due to fasciolosis
P_A = Average market price of one kilogram meat in Dessie town
P_{rev} = Prevalence rate of fasciolosis in Dessie municipal abattoir

Statistical Analysis: Using SPSS version-16 statistical software, the data were analyzed by chi-square test to determine the significance of the variation in prevalence rates between body condition, age and origin. A 95% confidence interval and 5% significance level were used to determine whether there was significant difference in the measured parameters.

RESULTS

Over All Prevalence of Fasciolosis: Of the total 500 slaughtered cattle, 126 (25.2%) were found to be positive for fasciolosis.

Prevalence of Bovine Fasciolosis Based on Animal's Origin: The highest prevalence of fasciolosis was found in animals originated from Kutaber district (30.51%) and the lowest in cattle originated from Tewulederae (19.77%) (Table 1). Statistical analysis of the result revealed that there is no significant (p>0.05) difference in prevalence of the disease among the four origins of animals.

Prevalence of Bovine Fasciolosis Based on Body Condition: Animals brought to Dessie Municipal abattoir to be slaughtered were examined and grouped in to three body condition categories. From these categories, the highest fasciolosis prevalence was recorded in poor (63.29%) followed by good (18.62%) and medium body condition (17.75%) as shown in Table 2. This result revealed the existence of statistically significant ($P < 0.05$) difference in the occurrence of Fasciola among the three body condition categories.

Prevalence of Bovine Fasciolosis Based on Animal's Age: The study animals were grouped in to 3 age groups; young (below 2 years old), adult (2 to 7 years old) and old (above 7 years old). Of the total 500 examined animals, 3 were young, 340 adult and 157 old. Fasciola was detected in all age groups and a higher prevalence of *Fasciola* recorded in young animals (33.33%) than the other groups (Table 3). However, statistically significant difference in prevalence of Fasciola was not observed among the different age groups (p>0.05).

Table 1: Prevalence of bovine fasciolosis based on the animals origin

Origin	Number of examined cattle	Positive for Fasciolosis	Prevalence (%)	95% CI
Tewlederae	177	35	19.77	16.932 - 22.608
Dessie zuria	124	32	25.81	21.356 - 30.264
Kutaber	118	36	30.51	25.096 - 35.924
Worehimmenu	81	23	28.40	25.301 - 31.50
Total	500	126	25.20	23.035 - 27.365

Table 2: Prevalence of bovine fasciolosis based on body condition score

Body condition score	Number of examined animals	Positive	Prevalence (%)	95% CI
Poor	79	50	63.29	49.44 - 77.136
Medium	276	49	17.75	16.712 - 18.788
Good	145	27	18.62	15.672 - 21.568
Total	500	126	25.20	23.035 - 27.365

Table 3: Prevalence of bovine fasciolosis based on animals age

Age	Number of examined animals	Positive	Prevalence (%)	95% CI
Young	3	1	33.33	-3.816 - 70.476
Adult	340	84	24.70	22.128 - 27.272
Old	157	41	26.11	22.105 - 30.115
Total	500	126	25.20	23.035 - 27.365

Table 4: Occurrence and distribution of *Fasciola* species with respect to the animal origin

	Prevalence (%) of *F*asciola species in animals of different origins				
Fasciola species	Tewlederae (n=177)	Dessie zuria (n=124)	Kutaber (n=118)	Worehimmenu (n=81)	Total (n=500)
F. hepatica	26 (14.67)	22 (17.74)	24 (20.34)	12 (14.81)	84 (16.8)
F. gigantica	6 (3.39)	5 (4.03)	3 (2.54)	8 (9.88)	22 (4.4)
Mixed infection	2 (1.13)	2 (1.61)	6 (5.08)	2 (2.5)	12 (2.4)
Immature	1 (0.56)	3 (2.42)	3 (2.54)	1 (1.23)	8 (1.6)
Total	35 (19.77)	32 (25.81)	36 (30.51)	23 (28.4)	126 (25.2)

Species of Identified Fasciola and Their Geographical Distribution: During post mortem examination a total of 126 animals were found infected with liver fluke. Of these, 84 livers (65.9%) were harboured *F.hepatica*, 22 livers (18.25%) harboured *F. gigantica*, 12 livers (9.5%) harboured mixed infection and 8 livers (6.34%) infected with unidentified species of immature flukes.

The distribution and prevalence of Fasciola species was different in different origins of animals. The highest prevalence of *F.hepatica* (20.34%) was observed in Kutaber and the lowest (14.81%) was observed in Wore himmenu. Whereas the highest prevalence of *F. gigantica* (9.88%) was observed in Wore himmenu and the lowest (2.54%) was observed in Kutaber (Table 4).

Financial loss analysis: The economic significance of fasciolosis was analyzed based on the information obtained during post mortem examination and interview. The analysis was done for liver condemnation and body weight reduction due to Fasciola infection.

- Annual cost of condemned liver =NAL×%COND. ×CL

=14,886×25.2%×10
=37,512.72 ETH Birr

- Annual loss due to reduction in meat production= $NAL \times CL \times P_A \times P_{rev}$

=14,886×(126×10%) ×52×25.2%
=2,457,833.41 ETH Birr

The total annual financial loss due to fasciolosis in the abattoir is therefore; 37,512.72+2,457,833.41= 2,495, 346.13 ETH Birr

DISCUSSION

The results of the present study revealed that the overall prevalence of bovine fasciolosis in the four study area was 25.2%. The highest prevalence was observed in Kutaber (30.51%) followed by Worehimmenu (28.4%), Dessie zuria (25.81%) and the lowest prevalence were observed in Tewulederae (19.77%) (Table 1). Statistical analysis of the result indicates that there was no significant difference ($p>0.05$) in prevalence of fasciolosis among the study areas and this may be due to similarity in the ecological and climatic conditions such as altitude, rain fall and temperature which favoured the perpetuation of the organism. The prevalence of bovine fasciolosis recorded in the present study is in agreement with 24.32%, 30.43% and 26% of bovine fasciolosis recorded in Mekelle, Hawassa and Kenya by Gebretsadik *et al*. [12], Hailu [21] and Mungube *et al*. [22], respectively.

The 25.2% prevalence of bovine fasciolosis in the study area is lower than the findings of Mulugeta [23] in Kombolcha (53.5%), Tadelle and Worku [10] in Jimma (46.58%), Tsegay [24] in Debre Brehan (88.57%) and Getachew *et al.* [25] in Wondogenet and Kemissie (39.7% and 41% respectively). Difference in prevalence of fasciolosis in different areas may be attributed mainly to variation in the ecological and climatic conditions such as altitude, rain fall and temperature in addition to differences in live stock management system. The study revealed that there is significant difference ($p<0.05$) in prevalence of bovine fasciolosis among different body condition score groups. The highest prevalence was observed in poor body condition animals (63.29%). This might be associated with less resistance as a result of malnutrition; poorly nourished animals appear to be less competent in getting ride off infection although it is not unusual for well fed animals to succumb to the disease. Similarly, other infections (parasitic or non parasitic) might make poor body condition animals susceptible to fasciolosis. Their existence along with fasciolosis might have impact on body condition and body weight of the animals.

This study indicates a prevalence of 33.33%, 24.7% and 26.11% in age groups of young, adult and old animals, respectively. Statistical analysis, however, showed the absence of significant variation in the occurrence of fasciolosis among the different age groups of animals. High level of bovine fasciolosis (33.33%) in young animals than the other age groups might be

associated with the apparent inability of the host to develop acquired immunity; so that young animals have the heaviest infection and the highest prevalence [26]. Adult cattle are likely exposed to frequent attack of fasciolosis and develop acquired resistance hence have lower prevalence of bovine fasciolosis. This finding is in agreement with the study of Hansen *et al*. [27], Abebe [28], Getu [29], Haymanot [30] and Parr and Gray [31].

Of the total infected livers, 65.9% were infected with *Fasciola hepatica*. Whereas *Fasciola gigantica,* mixed infection and immature form of Fasciola species were recorded to be 18.25%, 9.5% and 6.34% respectively. The present study corroborate with findings of Tadele and Worku [10] and Wakuma [32] who demonstrated that the predominant species of bovine fasciolosis in Jimma and Bedele municipal abattoir is *F.hepatica* (63.89%, 64.5%), followed by *F. gigantica* (24.07%, 24.8%) and then the immature forms (12.04%, 10.7%). The high proportion rate of *F. hepatica* may be associated with the existence of favourable ecological biotypes for *Lymnaea truncatula*. Relatively small proportion of cattle were found infected with *F. gigantica* alone or mixed infection with both species. This may be explained by the fact that most cattle for slaughter came from high land and mid altitude zones.

The prevalence of Fasciola species varies among the study area. The highest prevalence of *F. hepatica* was observed in Kutaber (20.34%) followed by Tewulederae and the highest prevalence of *F. gigantica* was observed in Worehimmenu (9.88%). This may be due to variations in the climatic and ecological condition such as altitude, rain fall and temperature and livestock management system among the study areas. According to Yilma and Malone [33], in Ethiopia, *F. gigantica* is found at altitudes below 1800 m.a.s.l, while *F. hepatica* is found at altitude between 1200-2560 m.a.s.l; mixed infections by the two species can be encountered at 1200-1800 m.a.s.l. this can be associated with the existence of favourable ecological conditions to the intermediate host and for the parasite.

A sum of money amounting 37,512.72 ETH birr was lost due to liver condemnation and 2,457,833.41 ETH birr as a result of reduction in meat production with a total loss of 2,495,346.17 ETH birr annually due to fasciolosis in the present study. This result showed that fasciolosis causes significant losses in the study area at large. These findings were by far higher than the results reported by Adem [34] and almost quite similar with Daniel [35] but lower than Terefe *et al*. [36]. A total economic loss of about 154,188 ETB, 215,000 ETB and 3,003,488.1408 ETB per annum in cattle due to fasciolosis were recorded in Ziway, Dire Dawa and Jimma municipal abattoir, respectively. This is probably due to the ecological and climatic difference between localities.

In conclusion, the present study confirmed that fasciolosis is an important disease causing considerable loss of revenue due to condemnation of affected liver and carcass weight reduction at Dessie municipality abattoir. Hence, demanding the attention of all stakeholders to mitigate the huge financial losses incurred due to the disease.

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