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Prevalence, Risk Factors and Economic Losses Associated with Bovine Fasciolosis in Elfora Debreziet Export Abattoir, Debreziet

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Abstract: Bovine fasciolosis is one of the most important parasitic diseases of cattle causing mortality and production losses in which it is the priority disease in the highland as well as lowland areas of Ethiopia. Thus, a cross-sectional study design was conducted from November, 2018 to April, 2019 at ElforaDebreziet Export Abattoir to estimate the prevalence, identify the associated risk factors and determine economic losses. Cattle that were slaughtered were grouped by sex, breed, body condition score and origin. A total of 400 cattle were examined and 25% (100) were found to be positive for fasciolosis based on postmortem examination. The prevalence of bovine fasciolosis was significantly affected by origin and body condition ($p<0.05$). The prevalence was *Fasciola hepatica* 59%, *Fasciola gigantica* 18 %, immature parasite 13 % and mixed infection 10% causing bovine fasciolosis by fluke examination. Worm count on the 100 infected livers revealed mean fluke count of 8.15 per liver, with maximum and minimum fluke count of 18 and 1 respectively. During the five years period out of 11, 464 livers inspected 23.98% (N = 2749) were condemned due to fasciolosis. The total economic loss encountered due to liver condemnation in this study was found to be 4, 439, 743.528ETB or 153, 094.604 USD. It is concluded that fasciolosis is prevalent in areas which supply slaughter cattle to ElforaDebreziet Export Abattoir and the financial loss associated with liver condemnation due to fasciolosis is significant.

Key words: Bovine Fasciolosis · Debreziet · Economic Loss · Fasciola · Prevalence · Risk Factors

INTRODUCTION

Livestock are the main stays of the livelihood of the majority of the human population by giving draft power, income to farming communities, means of investment and important source of foreign exchange earning to the nation. Moreover, livestock are important cultural resources, social safety nets and means of saving and are also supply for crop production and transport, as source of meat, milk and egg and source of income [1]. Ethiopia is believed to have the largest livestock population in Africa. An estimate indicates that the country is a home for 59.5 million cattle, 30.7 million sheep, 30.2 million goats and 56.53 million poultry. Similarly, the country has the highest draft animal population in the continent. It accounts 4.19% of global camel population, 34.5% of total Africa's and 3.45% of global horse populations and the largest donkey population in the world. In generalnearly 40% of Africa's equine population presents [1].

Although there is a huge number of ruminant population, Ethiopia fails to optimally export these resources due to a number of factors such as recurrent drought, infrastructures problem, animal diseases, poor nutrition, poor husbandry practices and shortage of trained man power and lack of lack of government policies for disease prevention and control [2].

Bovine fasciolosis is one of the most important parasitic diseases of cattle causing mortality and production losses in various parts of Ethiopia. Fasciolosis is the priority disease in the highland as well as in lowland areas of the country [3].

Fasciolosis is one of veterinary important parasitic diseases of ruminants' caused by digenaen trematodes of the genus Fasciola commonly referred as liver flukes. As etiological agents, *Fasciola gigantic* and *Fasciola hepatica* are the common species of Fasciola. The disease is responsible for considerable economic losses to cattle industry, mainly through mortality, liver condemnation, reduced meat and milk and wool production as well as

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from treatment cost [4]. Even if immense research works are done by different researchers in the area of bovine fasciolosis in different parts of Ethiopia, the disease is still continued being a major problem demanding much research and investigation. Therefore, the objectives of this study were to estimate the prevalence, risk factors and the economic loss of bovine fasciolosis in cattle slaughtered at ElforaDebreziet Export Abattoir.

MATERIALS AND METHODS

Study Area: The study was conducted at ElforaDebreziet Export Ebattoir in DebreZeit town, Ethiopia. DebreZeit is located about 47 km South-east of Addis Ababa, just on the escarpment of the Great Rift Valley and the geography of the area is marked by creator lakes. It is found at 9°N latitude and 40°E longitude and at an altitude of 1850 meters above sea level in the central high lands of Ethiopia. It has a human population of about161, 354. It experiences a bimodal pattern of rainfall with the main rainy season extending from June to September (Of which 84% of rain is expected) and a short rainy season from March to May with an average annual rainfall of 800mm. The mean annual minimum and maximum temperatures are 12.3°C and 27.7°C, respectively, with an overall average of 18.7°C. The mean relative humidity is 61.3 % [1].

Study Design: Cross sectional study was conducted from November 2018 to April 2019 to examine animals which were slaughtered in the Elfora Debreziet Export Abattoir and the observation at each and every individual animal with ante mortem and post mortem examination and a five year retrospective study was also done from the record book of Elfora, Debreziet Export Abattoir.

Sample Size Determination: The desired sample size was calculated using the standard formula described by Thrusfield [5]. The expected prevalence was30.6% according to Zemene and Atnaf [6]. Therefore, the sample size in this study was:

$$N = \frac{(1.96)^2 P\exp(1 - P\exp)[5]}{d^2}$$

where N = Sample size P exp = Expected prevalence (30.6%) 1.96 = the value of Z at 95% confidence level d = Desired absolute precision = 5%. Therefore, the sample size was 326 cattle.However, a total of 400 cattle's were taken to increase the precision of the study.

Study Animals: The study animals were cattle that were slaughtered at ElforaDebreziet export abattoir. Cattle slaughtered in the abattoir were collected from different parts of the country which is characterized by different climato-ecological conditions mainly due to altitudinal differences. It is often difficult to trace theage of the animals as they usually pass a chain ofmarkets. Some animals come directly to the abattoir from grazing while others pass through feedlots where they areroutinely de-wormed and fed straw/hay based concentrate. All cattle included in the study, were male and local indigenous breed.

Study Methodology

Ante-Mortem Examination: Data collected during ante-mortem examination includes sex, body condition score and origin of animals. The study animals are also classified in to three groups based on their body condition score (BCS) as poor, medium and good [7].

Post Mortem Examination: The liver of each study animal was carefully examined for the presence of lesions suggestive of Fasciola infection externally and incised for confirmation. Liver flukes were detected by cutting the infected liver into fine, approximately 1 centimeter slices with a sharp knife. Each mature fluke was identified to species level according to its shape and size. Investigation and identification of Fasciola species was done according to their distinct morphological characteristics following the standard guidelines given by [8].

Retrospective Data: A five year retrospective data was collected from January 2014 to December 2018 which is taken from the record book of ElforaDebreziet Export Abattoir and analyzed by using SPSS version 20. 10% estimated carcass weight loss due to fasciolosis was the parameter for calculating carcass weight loss and 126 kilogram is the estimated average carcass weight of Ethiopian Zebu cattle.

Economic Losses of Fasciolosis: Direct economic losses refer to the losses due to liver condemnation infested by Fasciola. Generally all infected livers with fasciolosis are unfit for human consumption. Inthe study abattoir the average annual cattle slaughtered rate was estimated to be 2, 226 while the mean price of bovine liver in Bishoftu town as 80 ETB and a 10% estimated carcass weight loss due to fasciolosis was the parameter used for calculating carcass weight loss. 126 kg is estimated as average

carcass weight of Ethiopian Zebu [9]. The mean retail price of one kilogram of meat was 250 ETB. The economic loss due to liver condemnation was estimated by the formula set by Ogunrinade and Ogunrinade [10] as follows:

Direct annual cost loss of condemned liver:

ALC = CSR x LC x P

where, ALC = Annual loss from liver condemnation.

CSR = Mean annual cattle slaughtered at ElforaDebreziet export abattoir.
LC = Mean cost of one liver in Bishoftu town.
P = Prevalence rate of the disease at the study abattoir.

Indirect Annual economic loss due to loss in meat production:

ACW = CSR x CL x BC x P x 126 Kg

where, ACW = Annual loss from carcass weight reduction.
CSR = Average No cattle slaughtered per annual at the study abattoir.
CL = Carcass weight loss in individual cattle due to fasciolosis.
BC = an average price of 1kg beef at Bishoftu town
P = Prevalence rate of fasciolosis at the study abattoir.
126 kg = Average carcass weight of Ethiopian Zebu.

Data Management and Analysis: The raw data generated from the study were entered into Microsoft Excel database organized and arranged using Microsoft Excel (2007) spread sheet computer program and was imported to be analyzed using SPSS version 20 statistical package. The Pearsons chi-square (x^2) test to determine the variation in infection, prevalence between origin and body condition score. Statistical significance was set at $p<0.05$ to determine whether there is a significant difference between the parameters and the groups.

RESULTS

Prevalence of Bovine Fasciolosis: The current postmortem based study revealed that, out of the 400 indigenous cattle breed slaughtered and examined at Elfora Debreziet Export Abattoir for the presence of Fasciola parasite, 100 animals (Livers) were found to be positive for one or both of the Fasciola species, immature and mixed. Hence, the overall abattoir based prevalence was 25%. Of the 100 positive livers during the postmortem inspection, 59 (59%) harbored *F. hepatica*, 18 (18%) *F. gigantica*, 10 (10 %) mixed infections and 13 (13%) immature (Table 1).

The mean fluke burden was 8.15 rangs between 1 and 18 flukes per infected liver. Mean count was highest in animals with *F. hepatica* followed by those infected with *F .gigantica* (Table 2).

Association in Body Condition and Origin: Body condition based prevalence of bovine fasciolosis was recorded 10. 2%, 31.1% and 72.0% in cattle with good, medium and poor body condition, respectively (Table 3). And origin wise prevalence of bovine fasciolosis was recorded thus, from all areas animals come from highest prevalence was recorded on animals that come from Dessie which was 65.9% (Table 4). The difference in the prevalence of bovine fasciolosis among the body condition and origins of cattle was statistically significant ($p<0.05$).

Economic Loss Assessment: Analyses were made on five year meat inspection records obtained from ElforaDebreziet Export Abattoir. A total of 11, 464 cattle were slaughtered from January 2014 to December 2018 in the abattoir. Of the total livers (N = 11, 464) inspected for liver fluke, 23.98% (n = 2749) of them were found to be positive for fasciolosis and were condemned. Based on the current price an average annual monetary loss was about 4, 439, 743.528 ETB (153, 094.604 USD). A retrospective abattoir survey revealed that the prevalence offasciolosis was 23.98% (Table 5).

Table 1: Percentage of Fasciolaspecies in cattle slaughtered at ElforaDebreziet Export Abattoir

Fasciola species	No of infected liver Percentage	%
F. hepatica	59	59
F .gigantica	18	18
Mixed	10	10
Immature	13	13
Total	100	100

Table 2: Mean liver fluke count per affected liver in cattle by Fasciola species (n=100)

Fasciola species	Mean count
F. hepatica	4.53
F. giagantica	1.59
Mixed	0.94
Immature	1.09
Total	8.15

Table 3: Prevalence based on the body condition score (BSC)

Risk factors	No of examined	No of positive	Prevalence	X^2	p-value
BCS					
Poor	25	18	72.0	52.887	≤ 0.001
Medium	209	65	31.1		
Good	166	17	10.2		
Total	400	100	25		

Table 4: Prevalence of Bovine Fasciolosis based on origin.

Risk factors	No of examined	No of positive	Prevalence %	X^2	p-value
Origin					
Bale	2	0	0	130.261	<0.001
Dessie	41	27	65.9		
Arsi	66	28	42.4		
Kemissie	17	8	47.1		
Borena	187	0	0		
Adama	22	11	50		
Debrebrhan	22	10	45.5		
Hayik	11	4	36.4		
Gonder	32	12	37.5		
Total	400	100			

Table 5: Prevalence rate of fasciolosis from 2014 to 2018

Year	No of cattle slaughtered	No of positive	Prevalence %
2014	3, 488	656	18.807
2015	1, 940	402	20.7
2016	1, 992	481	24.14
2017	3, 081	796	25.83
2018	963	414	42.99
Total	11, 464	2, 749	23.98

DISCUSSION

Fasciolosis is one of the most important and prevalent helminthes infections of ruminants in different parts of the world inducing significant morbidity and mortality [11]. The result revealed that the overall prevalence of bovine fasciolosis (25%). This result was in close agreement with the finding from Dessie South Wollo Zone, Ethiopia who reported a 25.2% [12], from northern Ethiopia, who reported 24.3% prevalence in Bahir Dar [13], 24.32% at Addis Ababa municipal abattoir [14] and 21.9% from Eastern Wollega of Ethiopia, who reported a prevalence of fasciolosis in cattle slaughtered at Nekemte municipal abattoir [15]. However, the present finding was much lower than that of many other studies from different abattoirs in the country and elsewhere in Africa. [16] Reported 90.65% prevalence of fasciolosis in cattle slaughtered at Gondar municipal and industrial abattoir, northwestern part of Ethiopia, while a prevalence of 46.2% recorded at Jimma abattoir [17], 53.9% reported from Zambia [18] and 31.7% from Zimbabwe [19] respectively. However, the prevalence of fasciolosis recorded in this study was higher than that who observed in slaughtered cattle at Soddo municipal abattoir reported 14.0% [20], (16.4%) in Bonga Abattoir, Kafa Zone, Southwestern Ethiopia [29] and 14.4% at Dire Dawa Abattoir [21]. Difference in the prevalence among geographical locations is attributed mainly to the variation in the climatic and ecological conditions such as altitude, amount and pattern of rainfall and temperature. Fasciola species prevalence has been reported to vary over the years mainly due to variation in amount and pattern of rainfall [8].

The present study showed that out of 100 Fasciola infected livers examined during postmortem *Fasciola hepatica* was more prevalent (59%) than *Fasciola gigantica* (18%), mixed infections (10 %) and immature (13%). This finding was in an agreement with Jimma abattoir which was reported with 63.3 % [17] and 60.3 % of liver harbored *F. hepatica* reported at Zeway abattoir [22]. However, higher prevalence (89.70%) of *F. hepatica* was reported at Bahir Dar [23].

The high prevalence rate of *F. hepatica* may be associated with the existence of favorable ecological biotopes for *L. truncatula*. Relatively small proportion of cattle were found infected with *F. gigantica* alone or

mixed infection with both species. This might be explained by cattle coming to abattoir from highlands and flood prone areas and therefore drainage ditches are favorable habitat to natalensis [24]. The finding disagreed in which *F. gigantic* is the most common liver fluke species affecting cattle at Soddo 9.1% [20] which is reported due to the fact that the cattle slaughtered in the abattoir were originated from lowland areas. The overall percentage of mixed infections (10 %) this result was in close agreement with the finding at Hawassa Municipal abattoir, southern Ethiopia 15.84% [24].

The current study revealed that the mean fluke count of 8.15 per infected liver. It is much lower than that of many other studies [25] in Addis Ababa abattoir, Ethiopia reported 73.5 mean burden of flukes and 66.2 flukes per infected liver in northwestern part of Ethiopia [16].

The prevalence rate found in animals from different source origins was Bale (0%), Dessie (65.9%), Arsi (42.4), Kemise (47.1%), Borena (0%), Adama (50%), Debrebrhan (45.5%), Hayik (36.4%) and Gonder (37.5%). This difference might be strongly associated with the difference in the presence of favorable environments for the existence, multiplication and spread of host snail and the parasite in the area and may be due to the presence of good husbandry control and strong cattle management [26]. Higher prevalence of fasciolosis was observed in poor body condition group of animals followed by medium body condition and the lowest prevalence of fasciolosis was recorded in good body condition animals with the prevalence rate of 72.0%, 31.1% and 10.2%, respectively. Statistical analysis of the data showed that, there were significant difference ($p<0.05$) infection on the prevalence of fasciolosis among the three different body conditions of the examined animals. This result was in an agreement with the high prevalence 38.1% of fasciolosis in cattle with poor body condition as compared to medium and good body condition at Debrezeit town Ethiopia [27]. In the study area the average annual cattle slaughtered rate was estimated to be 2, 226 while mean retail price of bovine liver in Bishoftu town was 80 ETB. A total of 44, 520 ETB annual direct losses were calculated from organ condemnation using the current abattoir prevalence of 25.0%. The direct economic loss incurred during this study was by far lower than the result of condemnation of liver of cattle about 66, 420 ETB per annum [28] in Bonga Abattoir, Kafa Zone and Southwestern Ethiopia. In the present study area the average price of 1 kg beef was 250 ETB. The average carcass weight of adult cattle was 126 kg. The annual indirect economic loss from carcass weight reduction due to bovine fasciolosis was calculated (1, 752, 975 ETB or 60, 447.41 USD). Finally the total annual economic loss (direct and indirect economic loss) was calculated to be 1, 797, 495 ETB or 61, 982.59 USD per year. The monetary loss in the present study was in an agreement with the result at Adwa municipal abattoir reported (1, 574, 482ETB or 54, 292.48 USD) [29]. However, it is muchlower when compared to that work in Jimma municipal abattoir, Ethiopia reported 3, 003, 488.1ETB [30] and 3, 711, 246 ETB in southern Ethiopia [31] respectively. However, the total annual economic loss recorded in this study is greater than the work at Hawassa Municipal abattoir, southern Ethiopia which is 106, 400 ETB [32] and at Nekemte Municipal abattoir reported as 63, 072 ETB [15] respectively.

CONCLUSION

The result revealed that the abattoir prevalence of the parasite showed the disease is important and endemic in most parts of the country as most of the animals were originated from the different sites of the country. *F. hepatica* is the most predominant Fasciola species in the study area with the prevalence rate of 59% followed by *F. gigantica* with the prevalence rate of 18%. Mean count was highest in animals with *F. hepatica* followed by those infected with *F .gigantica*. In the current study, different variables or associated risk factors were also considered, however, they were found to be statistically significant for the prevalence of bovine fasciolosis. In addition the study revealed out the total annual economic losses due to liver condemnation and carcass weight loss which was estimated to be 1, 797, 495 ETB (61, 982.59 USD). Finally it is concluded that the risk factors that were significantly associated with the occurrence of fasciolosis as well as the economic loss should be taken into account in designing the control and preventive program. Based on the above conclusion the following recommendations are forwarded:

- Strategic anthelmintic treatment with appropriate fluckicide drug should be practiced in the area in which animals came from.
- A combination of control measures include drainage, fencing and molluscides have to be used to ensure a satisfactory degree of control in the long run.
- Further epidemiological surveillance on the distribution and its economic impact should be conducted for the holistic implementation of bovine fasciolosis control.

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