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Bovine Fasciolosis: Prevalence and Economic Significance in Southern Ethiopia

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Abstract: A cross-sectional study was carried out from January to May 2013 on *Bovine* fasciolosis in and around WolaitaSoddo, Southern Ethiopia. Coprological and postmortem examinations were used at Soddo municipal abattoir to assess its prevalence and economic importance. From the total of 384 cattle examined 15.9% (61) and 20.3% (78) were found positive by coprological and postmortem examinations, respectively. The prevalence of *Bovine* fasciolosis in the study area was significantly ($p<0.05$) affected by sex, breed and body conditions. However, its prevalence was not significantly ($p>0.05$) affected by origin and months of the year. Examination of the liver and the bile-duct of animals during postmortem inspection were the most reliable methods to discover liver fluke infection. *Fasciola hepatica* was found to be the predominant (42.3%) species in the study area. The economic significance of *Bovine* fasciolosis was also assessed from condemned liver and carcass weight loss. The total annual economic loss from fasciolosis was estimated to be 3,711,246 ETB ($201,111.5). Therefore, it can be concluded that fasciolosis is highly prevalent and economically important disease in the area. Implementation of control and prevention strategy is mandatory.

Key words: *Bovine* · Economic Loss · Fasciolosis · Coprology · Postmortem

INTRODUCTION

Ethiopia owns huge number of ruminants having high contribution for meat consumption and generates cash income from export of live animals, meat, edible organs and skin. In spite of the presence of huge ruminant population, Ethiopia fails to optimally exploit these resources due to a number of factors such as recurrent drought, infrastructures problem, rampant animal diseases, poor nutrition, poor husbandry practices, shortage of trained man power and lack of government policies for disease prevention and control [1]. Among the animal diseases that hinder the animal health are parasitic infections that have great economic impact, especially in developing countries.

Fasciolosis is one of the most common economically important parasitic diseases of domestic livestock, in particular cattle, sheep, goat and occasionally man. The disease is caused by digenean of the genus *Fasciola* commonly referred to as liver flukes. The two species most commonly implicated as the etiological agents of fasciolosis are *Fasciola hepatica (F. hepatica)* and *Fasciola gigantica* (*F. gigantica)*. In Europe, Americas and Oceania only *F. hepatica* is a concern, but the distributions of both species overlap in many areas of Africa and Asia [2].

In Ethiopia each year, great economic loss results from death of animals, poor weight gain and condemnation of edible organs at slaughter. This production loss in livestock industry is estimated at more than 900 million USD annually [3]. A recent study in Ethiopia, Jimma had shown 54.5% prevalence in cattle by postmortem examination of liver and $151, 200 total annual monetary losses due to fasciolosis [4]. The disease is not only important in cattle but also causes significant economic loss in small ruminants. A study conducted in south western Ethiopia, Jimma had shown, 24% prevalence by postmortem examination and $1, 238 annual monetary losses due to liver condemnation in sheep and goats [5]. Among many prevalent parasitic diseases, fasciolosis is one of the most striking diseases of ruminants [6, 7].

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In spite of the aforementioned prevailing situation and the presence of a number of problems due to fasciolosis, there is scarcity of well-documented information on the occurrence of fasciolosis among cattle in Wolaitasoddo, Ethiopia. So this study was designed with the aims to: determine the prevalence of cattle fasciolosis in Wolaitasoddo municipal abattoir, compare the diagnostic efficiencies of fecal and postmortem examination, estimate the magnitude of direct and indirect economic loss incurred due to liver condemnation and carcass weight loss.

MATERIALS AND METHODS

Study Area: This study was conducted in Wolaita Zone Soddo district which is found in South Nation Nationalities and People Regional State, Ethiopia. It is located 360km from Addis Ababa along Butajira-Hossana road. The area is bounded with Damot Gale Woreda to the North, Humbo Woreda to the South, DamotWoide Woreda to East and Damot Sore Woreda to the West. Its altitude ranges from 1650 to 2980 m.a.s.l. It receives an annual rainfall of 1000-1200mm and an annual temperature of 25-35°C. The livestock population of the area comprises about 128,919 cattle, 29,191 sheep, 4,606 goats, 4,124 equines and 55,278 poultry.

Study Design: The study population was indigenous adult Zebu cattle brought for slaughter from different localities and livestock markets in the vicinity. The study was conducted between January to May, 2013. A cross sectional study was carried out to determine the prevalence and the economic importance of fasciolosis among cattle using coprological (sedimentation techniques) and postmortem examination of liver, respectively.

Sampling Method and Sample Size: Simple random sampling method was employed for determining the prevalence of fasciolosis among cattle and the magnitude of direct monetary loss due to liver condemnation and indirect carcass loss at W/Soddo municipal abattoir, Ethiopia. To calculate the total sample size, the following parameters were used: 95% level of confidence (CL), 5% desired level of precision, with the assumption of 50% expected prevalence of fasciolosis [8]. Based on this, a total sample size of 384 were included.

Study Methodology

Ante-mortem Inspection and Body Condition Scoring: Complete ante-mortem examination of the animals was carried out shortly prior to slaughter. Inspection of the animals was made while at rest for any obvious sign of disease. Body condition for each cattle was estimated ranging from score 1 to 3 [9].

Coprological Examination: Prior to sampling; an identification number was given to each animals presented to the abattoir for the routine meat inspection. Fecal sample was collected directly from rectum of animals. The faeces were collected by hands protected by rubber gloves, using two fingers. The samples were taken to the laboratory in tightly closed universal bottles and examined for *Fasciola* eggs by using sedimentation technique. To differentiate between eggs of *Paramphistomum* species and *Fasciola* species, a drop of methylene blue solution was added to the sediment where eggs of *Fasciola* species showed yellowish colour while eggs of *Paramphistomum*s pecies stained by methylene blue [10]. During sampling, information on sex, breed and origin of individual animals was recorded.

Post mortem Examination: During meat inspection, the previously identified animals and their livers were carefully supervised and examined. The fluke recovery was conducted as follows: the gall bladder was removed and washed to screen out mature flukes. The liver was cut into slices of about 1cm thick and was put in a metal trough of warm water to allow mature flukes lodged in smaller bile ducts to escape and then the heads of the flukes were counted [11]. Identification of the fluke species involved was carried out based on the morphological features of the agent and classified in to *F. hepatica, F. gigantica*, mixed and unidentified or immature forms of liver fluke [12, 13].

Determining the Direct Loss Due to Liver Condemnation: Direct economic loss was calculated from liver condemnation as the result of fasciolosis. Generally all infected livers with fasciolosis were unfit for human consumption. Through interview made with local butcher men in Soddo town, the average weight of *Bovine* liver and price of one liver was calculated to be 3kg and 150 Ethiopian Birr, respectively. The direct loss was thus computed according to the formula [14] as follows:

EL = ΣCS X Coy X Roz; where:
EL = Annual loss estimated due to liver condemnation
ΣCS = annual slaughter rates at the abattoir (estimated from retrospective abattoir record)
Coy = Average cost of each cattle liver
Roz = Condemnation rates of cattle liver due to fasciolosis

Determining the Indirect Loss Due to Body Loss: Indirect annual economic loss due to reduction of meat (IAL) was calculated according to the formula [15] as follows:

NAL = X CLX PA X Prev Where:
NAL = Average number of cattle slaughtered per year at WolaitaSoddo abattoir
CL = Carcass weight loss in individual cattle due to fasciolosis
PA = Average price of one kilogram of beef in WolaitaSoddo town
Prev = Prevalence rate of fasciolosis at WolaitaSoddo municipal abattoir

Data Management and Analysis: The collected data was entered in MS Excel and analyzed by SPSS 17 for windows program.Pearson's chi-square ($\chi 2$) was used to evaluate the association between the prevalence of fasciolosis and different factors.

RESULTS

Coprological Finding: From a total of 384fecal samples examined, 61 (15.9%) samples were found positive for fasciolosis. The prevalence of *Bovine* fasciolosis between the two sexes in the current study (Table 1) revealed 69.2% (female) and 12.0% (male); and statistically significant difference was observed ($p<0.05$). The result has shown the presence of statistical significant difference ($p<0.05$) with different body condition scores. Higher prevalence (41%) was observed with cattle that body conditions were poor and the lowest prevalence (26.23%) was recorded for cattle that body conditions were good.

Variability in the prevalence of *Bovine* fasciolosis between the five different origins was observed (Table 1). The highest (29.5%) and the lowest (13.1%) prevalence of *Bovine* fasciolosis were observed from cattle came from Soddozuria and Sidama, respectively.The prevalence of *Bovine* fasciolosis in each month of the study periods was indicated in Table 1. The Table showed the absence of significant difference ($p>0.05$) in the prevalence of *Bovine* fasciolosis between each month of the study periods. However, the highest (27.9%) and the lowest (13.1%) prevalence were observed in March and February, respectively. The prevalence of *Bovine* fasciolosis between the two breeds in the current study (Table 1) revealed 13.6% (local) and 36.8% (Cross) and statistically significant difference was observed ($p<0.05$).

Table 1: Coprological prevalence of *Bovine* fasciolosis by origin, sex, breed, body condition and month of slaughter of the animal.

Category	Variable	No. Animals examined	No.of positive	Prevalence (%)	$\chi 2$	P- value
Origin	Humbo	86	11	12.8	0.989	0.912
	Gulgula	70	11	15.7		
	Soddozuria	100	18	18		
	Boditi	78	13	16.7		
	Sidama	50	8	16		
Sex	Male	358	43	12	59.39	0.000
	Female	26	18	69.2		
Breed	Local	346	47	13.6	13.86	0.001
	Cross	38	14	36.8		
Body condition	Good	222	16	7.2	56.39	0.000
	Medium	112	20	17.9		
	Poor	50	25	50		
Month of slaughter	January	94	16	17	0.338	0.987
	February	58	8	13.8		
	March	105	17	16.2		
	April	67	11	16.4		
	May	60	9	15		

Table 2:Species of *Fasciola* identified during post mortem examination of slaughtered animals.

Species of fasciola	No. of livers condemned	Percentage (%)
F. hepatica	33	42.3
F. gigantica	23	29.5
Mixed	15	19.2
Immature	7	9
Total	78	100

Table 3: Morphometry of *F. hepatica* and *F.gigantica*

	F.hepatica	*F.gigantica*
Average length	3cm	6.1cm
Average width	0.9cm	1.3cm
Shape	Leaf shaped	More leaf shaped
Shoulder	Prominent	Less prominent

Table 4: Abattoir prevalence of *Bovine* fasciolosis by origin, sex, breed, body condition and month of slaughter of the animal in the study areas and their statistical significance.

Category	Variable	No. Animals examined	No. of positive	Prevalence (%)	$\chi 2$	P- value
Origin	Humbo	86	15	17.4	1.054	0.901
	Gulgula	70	13	18.6		
	Soddozuria	100	21	21		
	Boditi	78	18	23.1		
	Sidama	50	11	22		
Sex	Male	358	60	16.8	41.23	0.000
	Female	26	18	69.2		
Breed	Local	346	62	17.9	12.37	0.001
	Cross	38	16	42.1		
Body condition	Good	222	23	10.4	50.16	0.000
	Medium	112	28	25		
	Poor	50	27	54		
Month of slaughter	January	94	22	23.4	1.015	0.908
	February	58	10	17.2		
	March	105	20	19		
	April	67	14	20.9		
	May	60	12	20		

Table 5: Comparison of coprological and post mortem examination

Results	Coprological examination (%)	Post mortem examination (%)
Positive	15.9 (61)	20.3 (78)
Negative	84.19 (323)	79.7 (306)

Postmortem Finding: From the total of 384 slaughtered animals, 78 livers were found positive for liver fluke infection (Table 2 and Figure 1) and from these 33 livers (42.3%) harbored with *F. hepatica*, 23 livers (29.5%) harbored with *F. gigantica* (Table 3), 15 livers (19.2%) harbored with mixed infection and the remaining 7 livers (9%) harbored immature liver flukes. The prevalence of *Bovine* fasciolosis between the two sexes in the current study (Table 4) revealed 72.7% (Female) and 5.3% (Male) and statistically significant difference was observed ($p<0.05$).Table 4 showed the presence of statistical significant difference ($p<0.05$) in the prevalence of fasciolosis in cattle with different body conditions. The higher prevalence (34.6%) was observed with cattle that body conditions were poor and the lowest prevalence (29.5%) was recorded for cattle that body conditions were good.

Variability in the prevalence of *Bovine* fasciolosis observed between the five different origins (Table 4). The highest (26.9%) and the lowest (14.1%) prevalence of *Bovine* fasciolosis were observed in cattle which originated from Soddozuria and Sidama, respectively. The prevalence of *Bovine* fasciolosis in each month of the study periods was also indicated in Table 4. The Table showed the absence of significant difference ($p>0.05$) between each month of the study periods. The highest

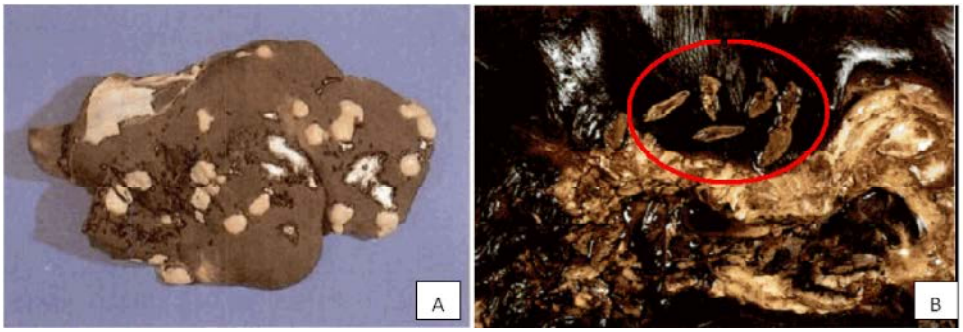

Fig. 1: (A) Fasciola infected liver with calcification and scar formation. (B) Incised bile duct with adult Fasciola indicated inside the circle.

(28.2%) and the lowest (12.8%) prevalence were observed in January and February, respectively. The prevalence of *Bovine* fasciolosis between the two breeds in the current study (Table 4) revealed 17.9% (local) and 42.1% (cross) and statistically significant difference was observed ($p<0.05$).

Economic Loss Assessment

Direct Economic Loss: The 78 infected livers of cattle imposed an estimated total loss of 11,700 ETB. In the study abattoir the average annual cattle slaughtered rate was estimated to be 11,000 while mean retail price of *Bovine* liver in WolaitaSoddo town was 150 ETB. A total of 334,950 ETB ($18,609) annual losses were calculated from organ condemnation using the current abattoir prevalence (20.3%).

Indirect Economic Loss: In the study area the average price of 1kg beef was 120 ETB. The average carcass weight of adult cattle was 126kg. The annual economic loss from carcass weight reduction due to *Bovine* fasciolosis was 3,376,296 ETB. The total annual economic loss was 3,711,246 ETB ($182,502.50). This was summation of the losses from organ condemnation (direct loss) and carcass weight reduction (indirect loss).

Comparison of Coprological and Postmortem Examination: From the total 384 cattle examined for the presence of *Fasciola*, post mortem finding was revealed better result (20.3%) than coprological examination (15.9%) (Table 5).

DISCUSSION

The result of coprological (15.9%) and postmortem (20.3%) examinations was comparable with the findings in Bishooftu [16] which were14.2% and 21.6%, respectively. However, the coprological result was lower than that of thefindings from Woreta (42.5%) and Assela (42.25%), respectively [17, 18]. This could be explained by the fact that ecological difference highly affected the rate of prevalence of the disease. The result of post mortem examination (20.3%) in the present study was lower than that of the findings in Sinnana (47%) prevalence [19]. This could be attributed to ecology, climate and management system differences [20].

The prevalence of fasciolosis was higher by post mortem than by coprological examination. This result was in line with that findings in Sinnana [19] which might be due to the need of longer prepatent period from 8 - 15 weeks after infection for the egg to appear in the feces [21]. Coprological examination included numerous steps that increased the chance of losing eggs.

Furthermore, the detection of *Fasciola* eggs and the appearance of the disease in some areas were difficult to detect during the pre-patent period [22].The results of the present study revealed that sex and breed had significant effect on the prevalence of *Bovine* fasciolosis. However, the findings in Debre-Birhan [22] showed that sex had no impact on the infection rate and hence both male and female were equally susceptible to the disease. The significant effects of sex and breed on the prevalence of *Bovine* fasciolosis might be attributed to the management system (i.e females and exotic breeds were left grazing pasture while local males were mostly kept in farmyards) and exposure of cattle to swampy area. The finding of the overall study showed that there was statistically significance variation in the prevalence of fasciolosis ($P<0.05$) among body conditions; the highest prevalence was observed in poor animals. This result was in line with thefindings in Adigrat [24] which showed the highest prevalence in poor body conditioned animals than good body condition.

The prevalence was found to be 54%, 25% and 18.24% based on post mortem finding for poor, medium and good body condition, respectively. This was due to the fact that animals with poor body condition might be susceptible to the disease, due to reduced performance of the animals created by lack of essential nutrients which could lower immunity. This result corresponded with the finding in Mekele [25], 42.4%, 36.8% and 21.8% for poor, medium and good body condition, respectively. *Fasciola hepatica* was the dominant fluke species in the study animals. This might be associated with the existence of favorable ecological biotopes for *Lymnae trancatula*, the recognized intermediate host of *F. hepatica* in Ethiopia [26].

The total annual economic loss was higher than the findings in Assela 698,700.6 Ethiopian Birr [18]. The difference in the estimated economic losses could be attributed to the increase in the price of liver and meat in the global market in general and in Ethiopia in particular.

Fasciolosis is a serious health problem of cattle which caused liver condemnation in the abattoir and reduced animal production. The current findings showed that fasciolosis is still the major threat for the health and productivity of cattle in Wolaita zone. The financial loss associated with condemnation of infected livers at the abattoir and indirect weight loss is substantial. Therefore, adoption of control and prevention strategy is mandatory.

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