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A Study on the Prevalence, Risk Factors and Financial Lose of Cattle, Sheep and Goats Fasciolosis in Debrezeit Town, Ethiopia

Zemene Lakew and Atnaf Alebie

University of Gondar, Faculty of Veterinary Medicine, Department of Veterinary Pharmacy and Biomedical Science, P.O. Box, 196, Gondar, Ethiopia

Abstract: The study was designed with the aims of estimating the prevalence and risk factors and to assess the economic significance of fasciolosis in cattle, sheep and goats slaughtered from December 2014 to March 2015 at ELFORA Ethiopian Livestock and Meat Export industrialized abattoir in Debrezeit town, Ethiopia. 838 animals comprising of cattle (343), sheep (283) and goats (212) were subjected to routine post mortem examination for fasciolosis. The overall prevalence of fasciolosis in the study was 21.8%. The prevalence of fasciolosis in young cattle, sheep and goats were 22.6%, 13% and 6.8%, respectively and in adult cattle, sheep and goats it was 38.3%, 26.9% and 12.8%, respectively. Significantly higher ($p<0.05$) prevalence of fasciolosis was seen in adult cattle, sheep and goats when compared to younger ones. The prevalence of fasciolosis was variable in different body condition scores and significantly higher ($p<0.05$) prevalence of fasciolosis was observed in poor body condition cattle, sheep and goats. The high level of fasciolosis in ruminants in the present study represents high rate of infection and immense economic losses to the country, Ethiopia. In this study, the total economic losses due to condemnation of infected livers and carcass weight loss from the study animals were estimated to be 17,239,862ETB/861,993.1USD. Therefore, it is recommended that farmers who rear cattle, sheep and goats should improve provision of feeds to their animals; be able to regularly treat their animals with the appropriate anthelementics and awareness should be created on the prevention and control methods of fasciolosis.

Key words: Prevalence · Fasciolosis · Cattle · Sheep and Goats · Debre Zeit

INTRODUCTION

Ethiopia is a home for many livestock species and suitable for livestock production and believed to have the largest livestock population in Africa. An estimate indicates that the country is a home for about 54 million cattle, 25.5 million sheep and 24.06 million goats. From the total cattle population 98.95% are local breeds and the remaining are hybrid and exotic breeds. 99.8% of the sheep and nearly all goat population of the country are local breeds [1].

Cattle, sheep and goat production are important components of agriculture and rural development program in many countries; therefore, useful small scale efforts have been made to encourage sheep and goat intervention throughout the world. Ruminants have an enormous contribution to Ethiopia's national economy and livelihoods of many Ethiopians and still promising to really round the economic development of the country [2]. Small ruminants play vital roles in generating income to farmers, creating job opportunities, ensuring food security, providing services, contributing to asset, social, cultural and environmental values and sustain livelihoods [3]. This subsector contributes about 16.5% of the national Gross Domestic Product (GDP) and 35.6% of the agricultural GDP [4]. It also contributes 15% of export earnings and 30% of agricultural employment [5]. The livestock subsector currently support and sustain livelihoods for 80% of all rural population. The GDP of livestock related activities valued at birr 59 billion [4].

Despite high cattle, sheep and goat population and existing favorable environmental conditions, the current output of the country is little. This is associated with a number of complex and inter-related factors such as widespread diseases including helminthes, inadequate feed and nutrition, poor genetic potential of local breeds,

Corresponding Author: Atnaf Alebie, University of Gondar, Faculty of Veterinary Medicine, Department of Veterinary Pharmacy and Biomedical Science, P.O. Box, 196, Gondar, Ethiopia.

market problem and inefficiency of livestock development services with respect to credit, extension, marketing and infrastructure [6, 7].

Helminthes are major obstacles in the growth and development of livestock and have great economic importance in terms of retarded growth, lowered productivity and mortality [8, 9]. Helminthes infection of ruminants can reduce meat or milk production and can lead to death or destruction of the animals, all of which diminishes the supply of available food for man [10]. These diseases are also an obstacle for international trade, as well as a serious financial drain for cattle farmers and, more broadly, for a community's or a country's economy, which can have wide repercussions for a society's health [11, 12].

Among helminthes, fasciolosis is an economically important parasitic disease, which is caused by trematodes of the genus *Fasciola* that migrate in the hepatic parenchyma and establish in the bile ducts [13]. *Fasciola* is commonly recognized as liver flukes and are responsible for wide spread morbidity and mortality in ruminants characterized by weight loss, anemia and hypoproteinemia [14, 15]. It causes a substantial economic loss which includes death, loss in carcass weight, reduction in milk yield, condemnation of affected liver, decline production and productive performances, exposure of animals to other diseases due to secondary complications and cost of treatment expenses [16, 17].

The presence of fasciolosis due to *F. hepatica* and *F. gigantica* at abattoir surveys in some parts of the country has long been known and its prevalence and economic significance have been reported by several workers [2, 18]. But there is still a gap for many potential sites of the country and information is not available to review country wide prevalence and economic significance of fasciolosis in ruminants especially in small ruminants.

Therefore, the objectives of the study are:

- To estimate the prevalence and risk factors of fascolosis.
- To assess the economic significance of cattle, sheep and goat fasciolosis at ELFORA Ethiopian Livestock and Meat Export industrialized abattoir.

MATERIALS AND METHODS

Description of the Study Area: The study was conducted from November 2014 to April 2015 at ELFORA Ethiopian Livestock and Meat Export industrialized abattoir in Debre Zeit town, Ethiopia. Debre Zeit is located about 45 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 1,850 meters above sea level in the central high lands of Ethiopia. It has a human population of about 117,000 [1]. It experiences a bimodal pattern of rainfall with the main rainy season extending from June to September (Out of the annual rain fall 84% of rain is expected in this season) and a short rainy season from March to May with an average annual rainfall of 800 mm. 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% [19].

Study Population: The study populations were cattle, sheep and goats of different ages and body conditions brought from different parts of the country to the abattoir for the purpose of meat production. All slaughtered animals were males and in this study, ruminants were categorized into two age groups; young (<5years) and adult (> 5years) for cattle; for sheep and goat <2 years as young and >2 years as adult based on dentations [20, 22]. It was difficult to know the exact origin of the animals since they were not registered by the supplier merchants because they collect the animals from different local markets.

Study Design: A cross sectional study was used to determine the prevalence, risk factors and financial loss of fasciolosis in cattle, sheep and goats slaughtered at ELFORA Ethiopian Livestock and Meat Export industrialized abattoir from November, 2014 to March, 2015.

Sample Size and Sampling Technique: A systematic random sampling procedure was conducted to carry out this study. The sample size was proportionate among cattle, sheep and goats based on population size. The sample size for abattoirs survey was determined using the formula described in Thursfield [23] by using 95% confidence interval and 5% absolute precision. In this study, the previous prevalence was considered to calculate the sample size using the following formula:

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

where: N = required sample size,
P_{exp} = expected prevalence
d = desired absolute precision.

Therefore, for cattle (n= 1.96^2 0.286(1-0.286)/ $(0.05)^2$=313), for sheep (n= 1.96^2 x 0.208(1-0.208)/ $(0.05)^2$= 253), for goat (n= 1.96^2x 0.136(1-0.136)/ $(0.05)^2$=182) were obtained from the previous expected prevalence [24] from Hashim nur's export abattoir and I added 30 animals for each species for precision. Therefore 838 animals (343 cattle, 212 goats and 283 sheep) were examined.

Abattoir Survey: Ante mortem examination was made to classify the animal in to poor, medium and good body condition by observing the spinous process and ribcage. Routine post mortem inspection of liver and gall bladder of each animal were carried out to check for the presence of *Fasciola*. Livers and gallbladders were dissected carefully. Liver was inspected by making multiple deep incisions of the lobes and making a deep cut with a number of small sub cuts. Gall bladders were opened using a knife and thoroughly investigated for the presence of *Fasciola* and the carcass was routinely examined for the purpose of weight loses due to fasciolosis, in the abattoir.

Economic Losses of Fasciolosis: Direct economic losses refer to the losses due to condemnation of liver infested by *Fasciola* but indirect loss is due to carcass weight losses.

In the study, it was indicated that liver was the common organ usually infested and condemned due to fasciolosis. As a result, economic assessment was computed for this organ as well for weight losses. Therefore, for indirect and direct losses, the estimated annual loss form carcass weight loss and organ condemnations were calculated according to the formula described by Swai and Ulicky [25] and Dawit and Adem [26] which were, ALC = ASR X LC X P and ERM = AS R X CM X BC X P X AWA

where:

ALC = Total annual liver condemnation,
ASR = Average number of animal slaughtered per year in the abattoir,
LC = Mean cost of one liver,
P = Prevalence of totally condemned liver and
ERM = Economic loss due to reduction of Meat,
CM = Cost of 1kg meat,
BC = Carcass weight loss in individual animal due to fasciolosis in percentage,
P = Prevalence rate of fasciolosis,
AWA = Average weight of animals.

According to Mason [27] and Edilawit *et al.* [28] BC and AWA were 10% and 126 kg, 14.3 kg and 13.5 kg in cattle, sheep and goats, respectively.

The annual economic loss was determined by considering annual average slaughter rate, the percentage of condemned organ, the average retail market price of the organs of cattle, sheep and goats, the current value of 1 kg of beef, mutton and chevon; average carcass weight of cattle, goats and sheep and percentage of weight losses due to fascilosis. The mean retail price of bovine liver was 40 ETB and the liver of sheep and goats was 8.5 ETB for each and the average price of 1kg beef was 80 ETB and 95 ETB for sheep and goat meat (From record data).

Data Analysis: The data which were recorded during the study period were entered into Microsoft excel sheet. Data were summarized and analyzed using SPSS version 16 computer program. The Pearson's chi-square (x^2) test at a significance level of 5% and 95% CI was used to determine the differences in the prevalence of fasciolosis among different species, age and body conditions of cattle, sheep and goats. The difference was considered as statistically significant if the p- value was less than 0.05.

RESULTS

Prevalence of Fasciolosis and its Risk Factors: The result of the present study conducted on a total of n= 838 animals in ELFORA Ethiopian Livestock and Meat Export industrialized abattoir indicated that, fasciolosis was highly prevalent with the overall prevalence of 21.8%. The specific prevalence of fasciolosis was found to be 30.6% in cattle, 20.1% in sheep and 9.9% in goats and there was statistically significant difference ($P<0.05$) on the prevalence of fasciolosis with respect to the species of the animal (Table 1).

There was statistically significant difference ($P< 0.05$) on the prevalence of fasciolosis between different age groups of animals and the prevalence was 28.0% in adult cattle, sheep and goats and 15.4% in young cattle, sheep and goats (Table 2).

The Result of the present study showed that there was statistically significant variation in the prevalence of fasciolosis with respect to young and adult cattle and their prevalence were 22.6% and 38.3%, respectively. The prevalence of fasciolosis was 13% and 26.9% in young and adult sheep, respectively and 6.8% and 12.8%, in young and adult goats, respectively (Table 3).

Table 1: Prevalence of fasciolosis among cattle, sheep and goats

Species of animal	No. of examined animals	Positive	Prevalence (%)	x^2- value	P-value
Cattle	343	105	30.6%	33.632	0.000
Sheep	283	57	20.1%		
Goat	212	21	9.9%		
Total	838	183	21.8%		

Table 2: Prevalence of fasciolosis among animals of different ages

Age	No. of examined animals	Positive	Prevalence (%)	x^2 - value	P-value
Adult	429	120	28.0%	19.378	0.000
Young	409	63	15.4%		
Total	838	183	21.8%		

Table 3: Prevalence of fasciolosis in cattle, sheep and goat based on age

Species	Age	No. Examined animals	Positive	Prevalence	x^2-value	P- value
Cattle	Young	168	38	22.6%	9.904	0.002
	Adult	175	67	38.3%		
	Total	343	105	30.6%		
Sheep	Young	138	18	13%	8.436	0.005
	Adult	145	39	26.9%		
	Total	283	57	20.1%		
Goat	Young	103	7	6.8%	2.17	0.171
	Adult	109	14	12.8%		
	Total	212	21	9.9%		

Table 4: Prevalence of fasciolosis among animals of different body conditions

Body condition	No. of examined animals	Positive	Prevalence (%)	x^2- value	P-value
Good	220	32	14.5%	17.153	0.000
Medium	341	69	20.2%		
Poor	277	82	29.6%		
Total	838	183	21.8%		

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 29.6%, 20.2% and 14.5%, 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 (Table 4).

There was statistically significance difference ($p<0.05$) for the prevalence of fasciolosis in poor, medium and good body condition cattle with the prevalence rate of 41.6%, 28.6% and 20.6%, respectively. The prevalence of fasciolosis in poor, medium and good body condition sheep was 27.2%, 19% and 13.3%, respectively and in poor, medium and good body condition goats it was 13.9%, 9.8% and 4.2%, respectively. There was no significance difference ($p>0.05$) in the prevalence of fasciolosis in sheep and goats among different body conditions (Table 5).

Financial Loss of Fasciolosis

Direct Economic Loss: In the study abattoir the average annual cattle, sheep and goats slaughtered rate was estimated to be 36,000, 59,000 and 288,000 while the mean retail price of bovine liver was 40 ETB and the liver of sheep and goats was 8.5 ETB for each. Prevalence of fasciolosis in ELFORA export abattoir estimated as 30.6%, 20.14% and 9.9% for cattle, sheep and goats, respectively. Therefore the estimated annual loss form organ condemnation was calculated according to the formula: ALC = CSR X LC X P. A computed direct economic loss from condemned livers was 784,477 ETB /39,223.85 USD (Table 6).

Indirect Economic Loss: Indirect economic loss was due to carcass weight reduction as result of *Fasciola* infection. In the study area the average price of 1kg beef was 80 and 95 ETB for sheep and goat meat each. The indirect economic loss due to bovine fasciolosis is calculated by using the formula:

Table 5: Prevalence of fasciolosis in cattle, sheep and goat based on body condition.

Species	Body condition	No. of examined animals	positive	prevalence	x^2-value	P- value
Cattle	Poor	113	47	41.6%	11.236	0.04
	Medium	133	38	28.6%		
	Good	97	20	20.6%		
	Total	343	105	30.6%		
Sheep	Poor	92	25	27.2%	5.090	0.08
	Medium	116	22	19%		
	Good	75	10	13.3%		
	Total	283	57	20.1%		
Goat	Poor	72	10	13.9%	3.053	0.233
	Medium	92	9	9.8%		
	Good	48	2	4.2%		
	Total	212	21	9.9%		

Table 6: Computed economic losses due to fasciolosis

Cattle, sheep and goat	Computed values	Ethiopian Birr (ETB)	United States Dollar (USD)
Liver(cattle, sheep, goats)	ALC=36,000X40ETBX0.306=440,640ETB, ALC = 59,400 X 8.5 ETB X 0.201 = 101,485 ETB and ALC = 288,000 X 8.5 ETB X0.099 = 242,352 ETB for cattle, sheep and goats respectively.	784,477	39,223.85
Cattle carcass	36,000X 30.6% X 126 kg X 10% X80 ETB	11,104,128	555206.4
Sheep carcass	59,400X 20.14% X 14.3 kg X 10% X95 ETB	1,694,593	84,729.65
Goats carcass	288,000X 9.9% X 13.5 kg X 10% X95 ETB	3,656,664	182833.2
Total		17,239,862	861,993.1

ACW = CSR X CL X BC X P X AWA.

Therefore, the total monetary loss incurred through carcass yield of losses in cattle, sheep and goats were 16,455,385 ETB /822,769.25USD (Table 6).

DISCUSSION

The overall prevalence of fasciolosis in the study was 21.8%. The specific prevalence of fasciolosis was found to be 30.6% in cattle, 20.14% in sheep and 9.9% in goat. Statistical analysis of the data showed that there was significant difference ($P<0.05$) on the prevalence of fasciolosis among cattle, sheep and goats. The variation in the prevalence of fasciolosis among species might be explained by the fact that cattle and sheep have indiscriminate type of grazing behavior and goats are selective grazers which reduced the chance of exposure to infective stage of *Fasciola* which is commonly found on grasses around marshy areas.

This result was in agreement with the finding of Yemisrach and Mekonnen [24] and Henok and Mekonen [29] who reported as 28.6%, 20.8% and 13.6% in cattle, sheep and goats and 14.6% and 8.8% in sheep and goats, respectively. However, the overall prevalence in the present study was lower than the results of previous study conducted by Tigre and Tolossa [30] and Abebe *et al*. [31] who reported a prevalence of 46.58% and 53.68% fasciolosis on postmortem examination of livers from Jimma and Agaro municipal abattoirs, respectively. Similarly, prevalences were recorded as high as 80% and as low as 4.9% by Abunna *et al*. [18] and Dagne [32] from Debre Berhan (Central highland areas) and Wolaita Soddo (Southern highland), respectively. The reason for these variations in the prevalence of fasciolosis might be due to the differences in temperature, moisture, humidity, soil that might favor multiplication of intermediate host (Snails), the difference in parasitological techniques used and differences in the origin of the samples and/or geographical differences.

The Result of the present study showed that there was statistically significant variation in the prevalence of fasciolosis with respect to young and adult cattle and their prevalence were 22.6% and 38.3%, respectively. This result was disagreeing with the findings of Yemisrach and Mekonnen [24] from Helimex abattoir, who reported 39.8% and 23.3% in young and adult cattle respectively. This might be due to implementations of control strategies over the periods in the study areas and difference in ecology of animal origin.

The prevalence of fasciolosis was 13% and 26.9% in young and adult sheep, respectivelywith statistically significant difference and 6.8% and 12.8%, in young and adult goats, respectively. Even if the present study according to age groups in goat had no significant difference ($P > 0.05$), the higher prevalence of fasciolosis

in adults could be best explained by the fact that young animals are usually kept in door or around the home and are not allowed to go far with adult animals for grazing so that they have reduced chance of exposure to infective parasitic stages when compared to adults.

There was statistically significance difference ($p<0.05$) for the prevalence of fasciolosis in poor, medium and good body condition cattle with the prevalence rate of 41.6%, 28.6% and 20.6%, respectively. The prevalence was higher in poor body conditioned animals followed by medium and good body conditioned animals. This result agreed with the report of Yemisrach and Mekonnen [24] in Hashim Nur's export abattoir and Alemu and Mekonnen [33] in Dangila municipal abattoir who reported 38.1%, 30% and 24.2% and 46.5%, 38.5% and 22.5% in poor, medium and good, respectively. The probable reason could be due to the fact that animals with poor body condition are usually less resistant and are consequently susceptible to various diseases including fasciolosis and due to reduced performance of the animals created by luck of essential nutrients and poor management by the owners. Furthermore, the poor body condition of animals may come from the high parasite load in those animals.

The prevalence of fasciolosis in poor, medium and good body condition sheep were 27.2%, 19% and 13.3%, respectively and in poor, medium and good body condition goats was 13.9%, 9.8% and 4.2%, respectively. There was no significance difference ($p>0.05$) in the prevalence of fasciolosis in sheep and goats among different body conditions. Even though there were no significance variations, there was higher prevalence variation among different body condition accounting poor body condition the first followed by medium and good body condition in small ruminants which agreed with the finding of Henok and Mekonnen[29] in around Hirna town and Yemisirach and Mekonnen[24] in helimex abattoir, who reported 16.4% in poor and 2.3% in good body conditioned small ruminants and 28.8%, 20.5%, 14.3% and 13.6%, 11% and 7.2% in poor, medium and good body conditioned sheep and goats, respectively. This finding confirmed the importance of fasciolosis in causing weight loss and emaciation as a characteristic sign of the disease and the high prevalence of fasciolosis infection in poor body conditioned animal might be also because of to poor body condition animals were vulnerable to parasitic diseases.

The direct monetary loss as a result of condemnation of liver of cattle and indirect monetary loss due to carcass weight reduction incurred during this study was estimated to be 784,477 ETB /39,223.85 USD and 16,455,385 ETB /822,769.25USD per annum, respectively. Therefore, the total annual monetary loss due to fasciolsis in the study abattoir was the summation of losses from organ condemnation and carcass weight reduction which was 17, 239, 862 ETB/861,993.1USD per annum.

The monetary loss in the present study was higher than the results of Edilawit *et al*. [28] in Jimma municipal abattoir, Mihreteab *et al*. [34] at Adwa municipal abattoir and Rahmeto *et al.* [35] at Hawassa municipal abattoir who calculated monetary loss of fasciolosis to be 1,574,482 ETB/87,471 USD, 4,672 USD and 106,400 ETB, respectively. 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.

CONCLUSSION

Results of the present study showed that; the overall prevalence of fasciolosis in all slaughtered animals was 21.8% with the specific prevalence of 30.6%, 21.1% and 9.9% in cattle, sheep and goats, respectively, which was conducted at ELFORA Ethiopian Livestock and Meat Export industrialized abattoir in Debre Zeit town, Ethiopia. There was significant difference in the prevalence of fasciolosis among different species and body condition scores of examined cattle, sheep and goats and it was shown that *Fasciola* parasites were proved to be more prevalent in ruminants with poor body condition scores and adults than medium and good body conditioned and young animals. The high level of fasciolosis in cattle, sheep and goats in the present study represented high rate of infection and immense economic losses to the country.

Recomendations: In line with the results of the present study; farmers who rear cattle, sheep and goats should improve provision of feeds to their animals so that the animal can have good body condition that confers some level of resistance against fasciolosis; they also should be able to regularly treat their animals with the appropriate anthelementics; the abattoirs which buy the animals from different part of the country should have well documented profile of the animal where they originate which helps to control the disease and education and awareness creation about the effects of fasciolosis and the associated financial losses should be extended to farmers.

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