Acta Parasitologica Globalis 10 (1): 07-13 2019
ISSN 2079-2018

DOI: 10.5829/idosi.apg.2019.07.13

Prevalence of Fasciollosis in Cattle Slaughtered in Dessie Municipal Abattoir and Associated Economic Losses

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Abstract: A cross sectional study was carried out to determine the prevalence, severity and economic significance of fasciolosis at Dessie municipal abattoir from October 2013 to March 2014. Out of 446 cattle randomly sampled and examined, 154 (34.5%) were positive for Fasciola.The occurrence of fasciolosis in Haik, Dessiezurea, Kutaber and Worehimeno was 9.7%, 44.9%, 48.6% and 46.4% respectively. Higher prevalence (63%) was observed in old animals. The occurrence of fasciolosis was significantly affected by origin of animals ($P<0.05$) but not by age ($p>0.05$). Depending on the degree of pathological lesions, (22.7%), (44.9%) and (27.9%), were lightly, moderately and severely affected respectively. *Fasciola hepatica* was found to be the most prevalent species accounting for 66.2% of the recovered flukes and origin of animals significantly affect the occurrence of the species ($P<0.05$). The annual loss was estimated at 6, 360, 472.4 Ethiopian birr per annum. The disease was prevalent in the area and has considerable economic impact. Further studies should focus on the implementation and evaluation of control measures that reduce the prevalence of Fasciola infection and the economic losssin the area.

Key words: Cattle · Dessie · Economic Losses · Fasciolosis · Prevalence

INTRODUCTION

Ethiopia has the largest livestock population in Africa with 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 livestock ownership currently contributing to the livelihoods of an estimated 80 percent of the rural population [1].

In Ethiopia, farm animals kept on pasture throughout the year, climatic conditions are favorable for the development and survival of infective stages of parasites. Helminthosis rank as the major constraint to animal production causing anemia, diarrhea and emaciation resulting in reduced weight gains, increased production cost and mortality [2]. Among highly prevalent and economically important parasitic diseases is fasciolosis, which affects all domesticated animals as well as man, inducing significant morbidity, mortality and economic losses mainly in domestic animals [3, 4]. Bovine fasciolosisis caused by the trematode *Fasciola.* The two most important species are *Fasciola hepatica* and *Fasciola gigantica* [5]. Both *F. hepatica* and *F. gigantica* are transmitted by the snails of the family Lymnaesidae. Infection with Fasciola is usually associated with grazing wet land and from drinking in snail infected watering sites [6].

In developed countries, the incidence of fasciolosis can reach up to 77%. However, in tropical regions, it is considered the single most important parasitic infection of cattle with prevalence 30% to 90% in Africa, 25% to 100% in India and 25% to 90% in Indonesia [7]. The incidence in Ethiopia is known to be relatively high [8, 9]. Availability of suitable definitive host, snails intermediate host, altitude, temperature and soil types are important factors for Fasciola species existence [10]. Generally, *F. hepatica* is found at an altitude of above 2000 meters above sea level (Masl) while *F.gigantica* found below 1200 masl [11, 12].

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The pathogenesis of fasciolosis may vary depending upon the development of the parasite in the liver and the species of the host involved. Most commonly, the pathogenesis of fasciolosis has two phases: the first phase occurs during immature fluke migration in the liver parenchyma while the second phase occurs when the adult parasite establishes in the bile ducts. The first phase is associated with liver tissue damage and causes hemorrhage while the second phase results by the haematophagic activity of adult flukes and damage to the biliary mucosa, which causes cholangitis by their cuticular spines [11].

Diagnosis of fasciolosis both in animals and in human may involve considerations of various aspects such as history, clinical findings and general epidemiology of the disease. Confirmation in all cases can be made by either faecal examination or recovery of the worms at postmortem examination [13].

Drug of choices are diamphenethide and triclabendazole, which removes the developing stages over one week old. Two other drugs, rafoxanide and nitroxynil, which at increased dosage rates will remove flukes over four weeks old are in common use. Control of *Fasciola* species infection is based on strategically applied chemotherapy [14].

Human infection by Fasciola has not been given due attention; however, it is a disease of public health importance. Reports estimate that as many as 2.4 to 17 million people are infected and 180 million people are at risk worldwide [15]. It is worth mentioning that the numbers of reported clinical cases and of infected people identified during epidemiological surveys have been increasing since 1980 [16].

Several workers in Ethiopia have recorded the occurrence and economic significance of Fasciolosis in different regions [17-19]. The disease causes a substantial economic loss, which includes; death, loss in carcass weight, reduction in milk yield, condemnation of affected liver, reduce production and productive performances, predispose animals to other disease and incur treatment cost. Both *F. hepatica* (High land) and *F. gigantica* (Low land) cause severe losses in Ethiopia in areas where there exist suitable ecological conditions for the growth and multiplication of the intermediate host snails [20]. Estimation of the economic losses due to Fasciolosis is insufficiently notified by lack of accurate information of the disease prevalence, complexity in disaggregating and quantifying the direct and indirect effects of the disease and lack of a common methodology for assessing the economic loss [21]. Therefor, the objective of this study was to estimate the prevalence of Fasciola infection in cattle slaughtered at Dessie Municipal abattoir and economic loss associated with it.

MATERIALS AND METHODS

Study Area: The study was conducted from October 2013 to March 2014 at Dessie municipal abattoir. Dessie town is situated at the North east part of Ethiopia at a distance of 400 km away from Addis Ababa and has an elevation of 2600 meter above sea level. The area gets 1936 to 1070 mm rainfall annually. The mean monthly minimum and maximum temperatures were 12.37°C and 26.27°C, respectively. The livestock population of the area comprises of 18, 724 cattle, 22, 248 sheep, 2572 goats, 1879 horses, 833 mules, 3762 donkeys and 37, 557 heads of chickens [22].

Study Design and Sample Size: The study was cross sectional and all indigenous cattle that originated from different localities of south wollo (Haik, Dessiezuria, Kutaber and Wrehimeno) and slaughtered at Dessie municipal abattoir were considered. Sampling was random and sample size was determined by using the formula Z^2 p exp (1-pexp)/d^2 according to Thrusfield [23] where p exp (Expected prevalence) = 25.2% [29] and d (Absolute precision (d) = 0.05 and a 95% confidence interval. Accordingly the sample size (n) was calculated to be 289. To increase the precision of the estimate, a total of 446 animals were considered in the study. Age of cattle, was determined according to the methodologies described by FAO [24].

Parasitological Examination Method

Postmortem Examination: Post mortem examination of liver and associated bile duct was performed by visual inspection and palpation of the entire organ followed by transverse incision of the organ across thin left lobe [5]. The severity of infection was determined according to Ogunrinade and Adegoke [21]. A liver was considered as lightly affected if only a quarter of it is affected and only one bile duct is prominently enlarged on the visceral surface of liver; moderately affected if half of it is affected and two or more bile ducts are hyperplasic and severely affected if almost the entire organ is involved, it is cirrhotic and triangular in outline as the right lobe is often atrophied. Fasciola species were identified on the basis of their morphological features and classified in to *F. hepatica*, *F.gigantica* and unidentified or immature forms [5].

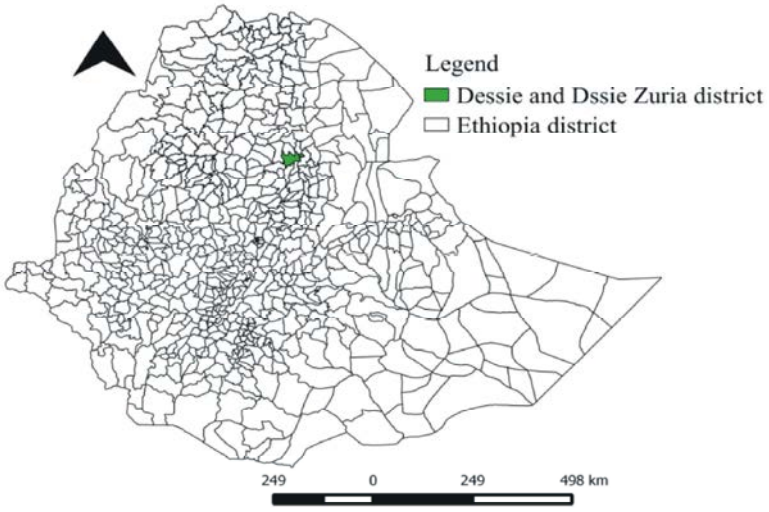

Fig. 1: Map of study the area

Assessment of Economic Significance: The economic assessment was done by considering the overall prevalence of the disease as a function of the total number of animals slaughtered annually. Liver loss and weight loss were considered in the assessment. The losses were calculated by using the model developed by Ogunrinade *et al*. [25]. In the assessment information on the number of animals slaughtered per year was obtained from the slaughter house records and the average number of animals slaughtered per year was estimated at 11956 cattle. Based on interviews with personnel working in restaurant and butcheries, the retail market price of an average size zebu liver was 30 Ethiopian birr and that of carcass was 120 Ethiopian birr per Kg. Average carcass weight of an Ethiopian zebu is taken as 126 kg [26]. According to Henderson [27] and Thornton and Gracey [28] 10 % carcass weight loss was considered in the estimation. The loss due to liver loss was calculated by the formula: ALC= CSR x Lc x P, where ALC= annual loss from liver condemnation, CSR= annual cattle slaughter in study area, Lc = cost of one liver in the slaughter area, P= prevalence of the disease. The economic loss due to weight loss was estimated by the following formula: ACW= CSR x CL x BC x P, where ACW = annual loss from carcass weight; CSR= number of cattle slaughtered per year in the study area; CL= carcass weight loss in individual cattle due to fasciolosis; BC = average market price of beef in the study area and P = prevalence rate of fasciolosis in the study area. The total economic loss due to fasciolosis in the study area was estimated by summing the direct and indirect losses.

Data Analysis: Data were entered in to SPSS version 20. Descriptive statistics was used to summarize data. Pearson's chi-square (χ^2) was used to test associations and the p-value was set at 0.05.

RESULTS

Prevalence of Fasciolosis: From the total examined animals, 154 (34.5%) were positive for fasciolosis (Table 1). The occurrence of the parasite was significantly affected by origin of cattle ($p < 0.05$) with the highest in Kutaber (48.6%) and the lowest in Haik (9.7%) (Table 1). Age did not affect the occurrence of Fasciola ($p > 0.05$) (Table 1). Moderately affected lesions were encountered in 49.4% of the livers followed by severely affected livers (27.9%) (Figure 1). The severity of the lesions was affected by origin with a highest proportion of severely affected livers in animals that originated from Dessie Zuria compared to other locations (Figure 2). *F. hepatica* was the most commonly encountered species (66.2%) (Table 2). The occurrence of the species was significantly affected by origin and *F. gigantica* occurred more frequently in cattle that originated from Kutaber compared to animals from Dessie Zurea (Table 3).

Annual Economic Loss: The loss due to liver condemnation was estimated at 123, 744.6 Ethiopian birr. The loss due to carcass weight reduction was 6, 236, 727.8 Ethiopian birr. The overall annual economic loss due to bovine Fasciolosis was estimated at 6, 360, 472.4 Ethiopian birr.

Table 1: Occurrence of fasciolosis by risk factors

Factor		Number examined	Number positive (%)	χ^2	P. value
Origin	Haik	145	14 (9.7)		
	Dessie zurea	147	66 (44.9)	59.18	<0.001
	Kutaber	109	53(48.6)		
	Worehimeno	45	21(46.4)		
Age	Young	151	57(37)	1.05	0.18
	Old	295	97(63)		
	Total	446	154(100)		

Table 2: Species of *Fasciola* encountered in affected livers

Fasciola species	Number of livers	Percent	χ^2	p- value
F. hepatica	102	66.2	24.3	<0.001
F. gigantic	36	23.4		
Mixed infection	10	6.5		
Immature	6	3.9		
Total	154	100		

Table 3: Distribution of Fasciola species by origin of animal

Origin	*F. hepatica*	*F. gigantica*	Mixed	Immature	χ^2	P- value
Haik	8	2	1	3	17.7	0.04
Dessie zurea	46	12	6	2		
Kutaber	33	16	3	1		
Worehimeno	15	6	0	0		
Total	102	36	10	6		

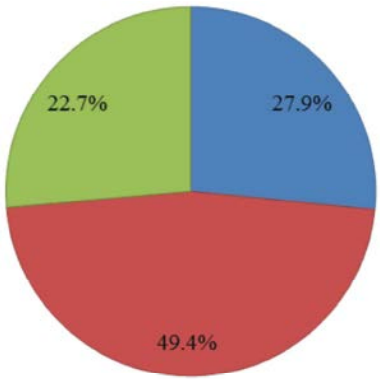

Fig. 1: Proportions of light, moderately and severely affected liver lesions
Key: = Severe ? = Moderate ? = Light

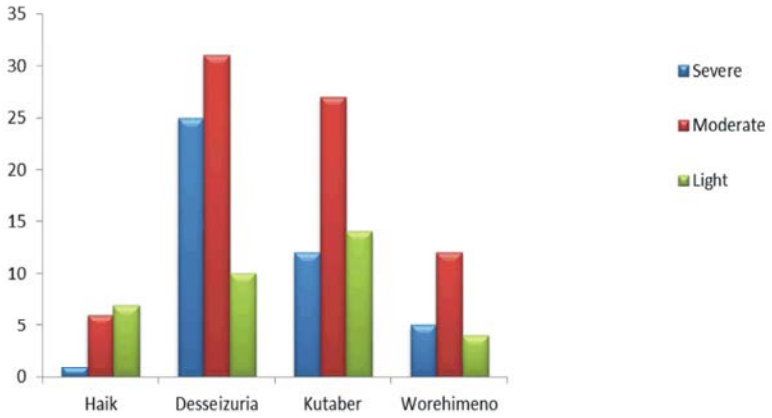

Fig. 2: Severity of liver lesion of animals from different locations

DISCUSSION

The overall prevalence estimate of Fasciola was higher than previously estimated (25.2%) by Ephrem [29] at Dessie. The higher prevalence recorded in this study could be due to increase in irrigated land masses from the currently constructed damps and ponds and the tendency of farmers to feed their animals in these marshy and damp areas. Besides, the estimate was significantly higher than estimate reported by Fufa *et al*. [30]. At Welaita Sodo (12.7%) and Swai and Ulicky [31] at Hawi, Tanzania (14.05%). On the other hand, the prevalence of bovine fasciolosis in the present study is lower as compared with the previous reports in different parts of Ethiopia: 53.3 % at Kombolcha [32], 88.57% at Debre Birhan [33], 56.8% at Zeway [34], 46.58% at Jimma [19] and 83.08% in South Gondar [35]. The variation in climato-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. One of the most important factors that influence the occurrence of fasciolosis in a certain area is availability of suitable snail habitat [5].

Fasciola hepatica was more prevalent as compared to *F. gigantica.* The higher prevalence of *F. hepatica* might be associated with the existence of favorable ecological biotopes for the intermediate host *Lymnaea truncatula.* The present estimate is comparable with that of Gebretsadik *et al*. [18] who reported that 56.42% of cattle were infected with *F. hepatica* and 9.17% with *F. gigantica*. However, Fufa *et al*. [30] reported that the most common liverfluke species affecting cattle at Welaita Sodo was *F. gigantica*.

Whilst about a quarter of the liver samples were severely affected, about half were moderately infected. The variation in degree of liver pathological lesions in different geographical areas might be associated with variation in climato-ecological conditions such as altitude, rainfall, temperature and suitability of the environment for survival and distribution of the parasite as well as the intermediate host. This might be also due to difference in use of anthelmentics. This could be due to the fact that the severely affected liver bile duct is fibrosed and calcified which impaired the further passage of young flukes [36].

The prevalence observed in this study with respect to age agrees with Cowdery [37] reported that cows and bulls have higher condemnation rate of livers than younger bullock and heifers. In different parts of Ethiopia, similar results indicated inverse correlation of fasciolosis incidences and age of cattle [38, 39]. This study showed that as the age increases, the magnitude of infection increased. This may be because as age increases movement of animals for grazing increases, which leads to an exposure to fluke-infected pasture lands and watering points. On the contrary other authors reported that as the age of cattle increases the incidence decreases due to resistance development [3, 40].

The total annual economic losses due to liver condemnation and carcass weight loss was estimated at 6, 360, 472.4 Ethiopian birr. The monetary loss was considerably higher than the report of Ephrem [29] who estimated a loss of 2, 495, 346.17. In Jimma municipal abattoir Tadele and Worku [19]. Calculated the monetary loss of 54, 063 Ethiopian birr (3180 USD) and Abie *et al*. [41] estimated a loss of 2, 570, 396 Ethiopian birr. The differences in the losses due to this disease might be due to the variation in the prevalence of the disease, differences in the number of slaughtered animals and the variations in prices across locations.

CONCLUSION AND RECOMMENDATIONS

This study demonstrated that bovine fasciolosis is prevalent in cattle slaughter at Dessie municipal abattoir. The two *Fasciola* species, *F. hepatica* and *F. gigantica*, were detected indicating the existence of favorable environment in the study areas for the development of the intermediate host. Bovine faciolosis causes considerable economic losses as result of condemnation of infected livers and carcass weight reduction at the abattoir. Integrated control approach using selective anthelmintic therapy combined with environmental friendly snail control methods should be implemented to reduce magnitude of the problem. Farmers should aware and informed about the importance of disease control programs and good management system if bright future and for improvement of livestock production.

ACKNOWLEDGMENTS

The authors would like to thank the workers in Dessie municipal abattoir especially for Dr. Ahmed Yasin, for their material and intellectual support during the work of this study.

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