Acta Parasitologica Globalis 6 (3): 231-237, 2015
ISSN 2079-2018

DOI: 10.5829/idosi.apg.2015.6.3.96159

Prevalence of Bovine Fasciolosis in and Around Gondar, Northwestern Ethiopia

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Abstract: A cross-sectional study was conducted from November, 2013 to April, 2014 to determine the prevalence of bovine fasciolosis and to assess the associated risk factors in and around Gondar, Northwestern Ethiopia. Of the total 384 cattle examined coprologically, 90 (23.44%) were found positive for fasciolosis. The prevalence of bovine fasciolosis in the study sites was significantly ($P<0.05$) affected by sex and body conditions where, the prevalence was 32.42% in male and 15.35% in female cattle, while it was 30.65%, 21.80% and 17.81% in medium, poor and good body conditions, respectively. However, its prevalence was not significantly ($P>0.05$) affected by age, breed and study sites. The prevalence of fasciolosis in young and adult cattle was 26.96% and 22.37%, respectively, while that of local and cross breed cattle was 25.84% and 23.44%, respectively. The present study showed that bovine fasciolosis was prevalent, thus posing major economic loss in the study area, hence, control strategies targeted on the parasite and the intermediate host as well as implementation of appropriate grazing management in the study area is warranted.

Key words: Bovine · Coprology · Ethiopia · Fasciolosis · Gondar · Prevalence

INTRODUCTION

Ethiopian livestock productivity, despite its huge population size, remains marginal due to various diseases, malnutrition and management constraints [1]. Parasitism is the major problem that affects the productivity of livestock worldwide [2]. Among many parasitic problems of domestic animals, fasciolosis is the most important parasitic disease in domestic ruminants throughout the world. 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 *F. hepatica* and *F. gigantica* [3].

F. gigantica and *F. hepatica* can infect a wide variety of domesticated animals, wildlife and people [4] and the most prevalent helminth infections of ruminants in different parts of the world including Ethiopia [5, 6]. *F. hepatica* has a cosmopolitan distribution [2]. Infection with *F. gigantica* is regarded as one of the most common single helminth infection of ruminants in Asia and Africa. Its economic importance is mostly obvious when the disease causes mortality, but even subclinical infections have been shown to cause high losses from reduced feed efficiency, weight gains, milk production, reproductive performance, carcass quality and work output in draught animals and from condemnation of livers at slaughter [7, 8].

Active infections of *F. gigantica* in cattle are common in lower altitude settings but appear to diminish with increasing elevation [4]. In Ethiopia, *F. hepatica* and *F. gigantica* infections occur in areas above 1800 meters and below 1200 meters above sea level, respectively, which have been attributed to variations in the climatic and ecological conditions such as rainfall, altitude and temperature and livestock management system. In between these altitude limits, both species coexists where ecology is conductive for both snail hosts and mixed infections prevail [9].

Both *F. hepatica* (high land) and *F. gigantica* (low land) type of liver flukes cause severe losses in Ethiopia where suitable ecological conditions for the growth and multiplication of intermediate host snails are available [10]. The disease is found in vast water lodged and marshy grazing field condition anticipated to be ideal for the propagation and maintenance of high prevalence of fasciolosis. In Ethiopia, the highlands contain pockets of water logged marshy areas. These provide suitable habitats year round for the snail intermediate hosts [11]. Its prevalence has shown to range from 11.5% to 87% [1].

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F. hepatica was shown to be the most important fluke species in Ethiopian livestock with distribution over three quarter of the nation except in the arid northeast and east of the country. The distribution of *F. gigantica* was mainly localized in the western humid zone of the country that encompasses approximately one fourth of the nations [12]. The incidence of the disease in bovines has increased worldwide in recent years as a possible consequence of global climate changes [13].

The disease can present as subclinical, acute, or chronic based on the number of metacercariae ingested. The acute forms of the disease are primarily due to mechanical damage caused by simultaneous migration of immature flukes in the hepatic parenchyma [14, 15]. Chronic fasciolosis develops when the adult parasites migrate to the bile ducts and cause cholangitis, biliary obstruction and fibrosis [2]. Fasciolosis is not lethal in cattle and bovines rarely acquire the acute form of the parasitosis [14].

The life cycle of these trematodes involves snail as an intermediate host [3]. The complex nature of the lifecycle and epidemiology of snail-borne disease presents challenges for predictive mapping at the herd-level, as well as disease management and animal husbandry at the individual-level [4]. Diagnosis of fasciolosis is may be established based on prior knowledge of the epidemiology of the disease in a given environment; observation of clinical signs, information on grazing history, seasonal occurrence and standard examination of feces in the laboratory [16]. More rational prophylactic programs based on local epidemiological information are needed for sound fasciolosis control strategies in Ethiopia [9].

Considerable work has been done on the prevalence and economic significances of bovine fasciolosis in many parts of Ethiopia [12, 17, 18, 19]. However, no report so far has been published on the level of fasciolosis at coprological examination in the present study area where cattle are important assets to the local farmers. Therefore, the objectives of the current study were to determine the prevalence of bovine fasciolosis and to assess the associated risk factors in and around Gondar, Northwestern Ethiopia.

MATERIALS AND METHODS

Study Area: A cross sectional study was conducted from October, 2013 to April, 2014 in and around Gondar town, capital city of North Gondar zone in Amhara Regional State, Northwest Ethiopia. Gondar town is located 750 km northwest of the capital city of Ethiopia, Addis Ababa. It is situated between 12°36'N and 33°28'E at an altitude of about 2300 mean above sea level (m.a.s.l) with an average temperature of 20°C and an average annual rainfall of 1800 mm. Being a highland area, the city is spread on different mountains, slopes and in valleys and has three small rivers, many streams and a lake. The livestock population in the area comprises of cattle (8,202), goat (22,590), sheep (2,695), horse (1,065) and donkey (9,001) [20].

Study Population: A total of 384 heads of cattle comprised of local (n=267) and cross (n=117) breeds were used for the current study. The selected animals were of different age, sex and body condition groups. Based on dental eruption, those cattle less than or equal to two years of old were grouped under young while those cattle above two years were considered as adults. Body condition scoring was made according to Nicholson and Butterworth [21].

Study Design and Sample Size Determination: A cross-sectional study was conducted to determine the prevalence of bovine fasciolosis and its associated risk factors in the study area. The animals were selected by using simple random sampling method to collect the necessary data from fecal samples. To determine the sample size, an expected prevalence of 50% was taken into considerations since there was no research works on fasciolosis in the study area. The desired sample size for the study was calculated using the formula given by Thrusfield [22] with 95% confidence interval and 5% absolute precision. Accordingly, a total of 384 cattle were sampled.

$$n = \frac{1.96^2 Pexp\ (1\text{-}Pexp)}{d^2}$$

where:
n = required sample size, Pexp = expected prevalence,
d = desired absolute precision

Sample Collection and Examination: About 5 to 10gm of fresh fecal samples were collected directly from the rectum of each sampled animal and then put in 10% formalin containing universal sampling bottle. Each sampling bottle was labeled with the necessary information and transported to Veterinary Parasitology Laboratory, Faculty of Veterinary Medicine, University of Gondar for coprological examination. The fecal samples were kept at 4°C until all were processed and examined. In the

laboratory, the sedimentation technique was used to detect *Fasciola* eggs. For examination, 3gm of feces were crushed using pestle and mortar; 40 to 50 ml of tape water was added and mixed with fork and filtered through a wire mesh sieve into a beaker. The filtered material was poured into a centrifuge tube and centrifuged at about 1500 rpm for three minutes. The supernatant was discarded and mixed the sediment well and taken a small quantity of it using a pipette and bulb, was put on the clean slide, applied a cover slip and observed under a microscope (10x). Identification of *Fasciola* eggs was done from other trematode eggs using identifying keys. All individual samples were analyzed twice through repeated dilution of the fecal suspension and sedimentation of the eggs, which were heavier than most of the fecal particles [23, 24].

Data Management and Analysis: Data were stored in a Microsoft Excel spread sheet and analyzed using Statistical Package for Social Sciences (SPSS) software version 17 and prevalence rates between the parameters like age, breed, sex, sites and body condition were analyzed. Chi-square ($x2$) was used to determine the statistical association between infection rates. A statistically significant association between variables was considered to exist if the calculated p-value is less than 0.05 with 95% confidence level.

RESULTS

From a total of 384 cattle fecal samples examined, 90 (23.44%) were positive for *Fasciola* eggs.

No Significant difference was observed in the prevalence of bovine fasciolosis in between young (26.96%) and adult (22.37%) age groups (P>0.05) (Table 1). There was a statistically significant difference in the prevalence of fasciolosis between female and male animals (P<0.05) where the highest prevalence was recorded in male (32.42%) and the lowest in female animals (15.35%) (Table 1). There was no statistically significant differences between the local (25.84%) and cross (17.95%) breeds of cattle (P>0.05) (Table 1).

The body condition results indicated that there was a statistically significant difference among animals having good, medium and poor body condition (P<0.05). The highest prevalence was in medium body condition (30.65%), followed by poor body condition (21.80%) while the lowest was in good body conditioned cattle (17.81%) (Table 1). There was no statistically significant variation in the prevalence of bovine fasciolosis (P>0.05) between Gondar town (22.86%) and its surroundings (23.92%) (Table 1).

Table 1: Prevalence of fasciolosis in cattle based on age group, sex, breed and body condition scores:

Variable	Nº Examined	Nº of Positive	Prevalence (%)	x^2	P-Value
Age					
Young	89	24	26.96	0.804	0.370
Adult	295	66	22.37		
Sex					
Female	202	31	15.35	15.548	0.00
Male	182	59	32.42		
Breed					
Local	267	69	25.84	2.825	0.093
Cross	117	21	17.95		
Body Condition					
Poor	101	22	21.80	6.712	0.035
Medium	137	42	30.65		
Good	146	26	17.81		
Total	384	90	23.44		

DISCUSSION

The result obtained in this study was an indication that bovine fasciolosis exists in the study area. The overall prevalence of bovine fasciolosis in the present study area was 23.44%. This result was in agreement with the findings of Yeneneh [25] and Rehman *et al*. [26] who reported prevalence of 23.96% and 25.75% in Northwest Ethiopia and Pakistan, Tehsil Sargodha, respectively. This could be attributed to the close similarity in agro-ecology between the study sites.

The overall prevalence of fasciolosis in the current study area was higher than the previous studies done by Fufa *et al*. [27], Mulat *et al*. [19] and Terefe *et al*. [28] who reported the prevalence of 4.9%, 12.4% and 8.94% in Soddo and Kombolcha, Kombolcha, Gondar and Jimma, respectively. The differences in the prevalence might be related to the variation in the agro-climatic condition and management system in the different study areas. The prevalence of fasciolosis was highly related to the favorable ecological factors for snail intermediate host [29]. It might also be depend on the season of the year in which the study was conducted.

High prevalence of bovine fasciolosis had been reported by other researchers such as Bahru and Ephraim [30] in Kaffa (86%), Yadeta [31] in Western Showa (82.5%), Dagne [32] in and around DebreBerhan (80%), Fekadu [33] around Bahir Dar (60.2%), Wondwossen [34]

in Arsi Administration region (53.72%), Tsegaye *et al.* [35] in and around Woreta (41.14%), Woldemariam and Wossene [11] in Mecha and Fogera (37.2%), Aregay *et al.* [36] in and around bahir dar (36.72%) and (33.42%) by Yilma and Malone [37] in Gondar. This lower prevalence of bovine fasciolosis in the present study area might be due to the expansion of animals' health post at peasant association level and the establishment of nearby private veterinary drug shops and pharmacies.

The prevalence of fasciolosis with regard to age was not statistically significant (P>0.05). This result was supported by Tsegaye *et al.* [35] and Yeneneh [25]. This might indicate that age of the animals had no impact in the infection rate if both age groups were allowed to graze and exposed to the infection. However, this finding disagreed with the works of Woldemariam and Wossene [11], Yilma and Malone [37] and Sanchez *et al.* [38] in which their results showed that the detections of *Fasciola* eggs were lower in young than adults. This might be attributed to the fact that calves were not driven with older age groups to grazing and watering points. They were kept at a nearby village where the source of feeding was much limited. This practice naturally reduced the chance of exposure in this age class [39]. Moreover, inverse co-relation of prevalence and age of cattle were also reported by Dagne [32], Rahmato [40], Fekadu [33], Beyazn [41] and Chakiso *et al.* [42].

In the present study, the prevalence of bovine fasciolosis with regard to sex was statistically significant where higher prevalence was recorded in male (32.42%) than female animals (15.35%). This signified that sex had impact on the infection rate and males were more susceptible and exposed to the disease than females. This was probably related to the management system with longer exposure of male outdoor while females were kept in door during pregnancy and lactation. Similar results were reported by Block and Arthur [43] and Opara [44]. However, this result disagreed with the works done in different countries such as Tanzanian [45], Zimbabwean [7] and Egypt [46], in which female cattle exhibited a significantly higher prevalence rates than males. On the other hand, the works done by Rahmato [40], Dagne [32], Woldemariam and Wossene [11], Tsegaye *et al*. [35], Chakiso *et al*. [42] and Aregay *e tal*. [36] concluded that sex had no impact on the infection rate and hence both male and female were equally susceptible and exposed to this disease.

In the present study, there was no significant difference (P>0.05) observed in bovine fasciolosis between local and cross breed cattle. This indicated that there was no difference in acquiring *Fasciola* infection between the two breeds which were equally susceptible and exposed to the disease. This could be due to the absence of differences in the management practices of the farmers. Similar result was worked in Turkey [47] and Ethiopia andasa Livestock Research Center [25]. In contrary to this result, the works of Tsegaye *et al*. [35] and Mousa *et al*. [48] in Ethiopia and South Sudan, respectively, stated that local breeds were more affected than cross breeds. This could be due to differences in the management practices of the owners where the local breeds were reared under traditional husbandry system which maked them to be exposed for different infection sites and owners gave more management attention to cross-breed than local breeds because of their production differences. On the other hand, the works of Aragay *et al*. [36] and Chakiso *et al*. [42] indicated that higher prevalence of fasciolosis (P<0.05) was observed in cross breed cattle as compared to local breeds.

The results of the present study indicated that a statistically significant (P<0.05) higher infection rate of fasciolosis was recorded in cattle with medium body condition (30.65%) than poor (21.8%) and good body (17.81%) condition animals. This result might be due to that medium body condition animals were not treated because of their normal body condition and did not show any sign of illness. This could also be due to that poor body condition might be caused by other factors such as management problems and other parasitic infections. This finding disagreed with the report of Hagos [49] and Terefe *et al*. [28], where the prevalence was higher in those animals with poor body condition than in those with medium and good body conditions. On the other hand, reports by Aregay *et al*. [36] and Woldemariam and Wossen[11] indicated that there was no statistically significant difference (P>0.05) among the different body condition scores.

This study also revealed that there was no significant difference (P>0.05) between study sites with respect to the prevalence of bovine fasciolosis. This could be attributed to the similarity of agro-ecological conditions favoring the development of intermediate hosts and the parasite stages and livestock management system. Similar results were reported by Tsegaye *et al*. [35] and Aregay *et al*. [36].

CONCLUSION

From the present study result, it can be concluded that bovine fasciolosis exists in the study area affecting

the health and productivity of animals. The level of infection observed in this study suggests the existence of conducive climatic conditions throughout the year for the development and survival of the parasite in the study area. The prevalence in the different body condition of the animals also indicate the existence of the parasite which was higher in medium body condition than poor and good body conditions and it is also common in male animals as compared to female. Fasciolosis is one of major problem for livestock development especially cattle by inflicting direct and indirect economic losses and its occurrence is closely linked to the presence of suitable habitat for the development of snail intermediate host. Hence this disease deserves serious attention by various stakeholders in order to promote the livestock production.

ACKNOWLEDGEMENTS

The Authors would like to thank Dr. Basaznew Bogale, Mrs. Meaza Mulatu, Mr. Melkamu Amogne, Gondar Town Veterinary Clinic, University of Gondar Faculty of Veterinary Medicine and Cattle producers in Gondar and its surroundings.

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