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Prevalence of Bovine Fasciolosis and its Associated Risk Factors in Haranfama Municipal Abattoir, Girja District, South-Eastern Ethiopia

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Abstract

A cross-sectional study was conducted from June, 2017 to February, 2018 with the aim of determining the prevalence of bovine fasciolosis and assessing its associated risk factors in Haranfama municipal abattoir, Girja district, South-Eastern Ethiopia. A postmortem examination was used as a diagnostic tool for this research to detect any adult liver fluke found in the bile ducts of the slaughtered cattle. Parasites were identified into species level by using standard parasitological techniques. A total of 384 randomly selected indigenous and cross breed cattle slaughtered during the study period were examined and 321 (83.6%) of them were found to be positive for one or both of the fasciola species. Fasciola hepatica was the most prevalent species with the prevalence rate of 31.8% (122), followed by F. gigantica and mixed infections with the prevalence rates of 29.2% (112) and 22.6% (87), respectively. There was statistically significant difference ($P<0.05$) among the different species of fasciola in the positive animals. In this study, different variables or associated risk factors such as breed, body condition, origin, sex and age of the study animals were considered. There were no statistically significant differences ($P>0.05$) in the prevalence of the parasite among those associated risk factors. Finally, in the present study higher prevalence of bovine fasciolosis was obtained when compared with the prevalences reported by different researchers at different areas of the country. Therefore, strictly different measures should be practiced in the study area to control the parasite and thereby it is possible to avoid its negative impacts in the animals.

Introduction

Ethiopia has the largest livestock herd in sub-Saharan Africa, with an estimated cattle population of 52 million, sheep population of 25.5 million, and goat population of nearly 24 million. Cattles are the most economically important livestock species with high estimated population and the majorities are indigenous zebu breed. In spite of the presence of huge number of 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, and shortage of trained man power and lack of government policies for disease prevention and control [1].

Parasitism represents a major obstacle to the development of the livestock resource. Especially fasciolosis is one of the most prevalent helminth infections of ruminants in different parts of the world inducing significant morbidity and mortality [2] and can cause significant economic losses in African livestock [3].

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 [4]. The members of this genus (Fasciola) are commonly known as liver flukes. Fasciola hepatica and Fasciola gigantica are the two liver flukes commonly reported to cause fasciolosis in ruminants and they are responsible for widespread mortality and morbidity in cattle and characterized by weight loss, anemia and hypoproteinemia [5].

The complex nature of the lifecycle and epidemiology of this snail-borne disease presents challenges for predictive mapping at the herd level, as well as disease management and animal husbandry at the individual level [6]. Fasciola gigantica and Fasciola hepatica can infect a wide variety of domesticated animals and wildlife [7]. In addition, fasciolosis is now recognized as an emerging human disease. The World Health Organization (WHO) has estimated that 2.4 million people are infected with fasciola species and 180 million are at risk of infection [8].

Fasciola hepatica has a cosmopolitan distribution, mainly in temperate zones and infects cattle and other mammalian species and is endemic in many parts of the world. On the other hand Fasciola gigantica is the most common liver fluke in sub-Saharan Africa and Asia being adapted to warmer conditions likely due to the widespread distribution of its intermediate host Lymnaea

(Radix) natalensis [9]. Thus, the two fasciola species overlap in many African and Asian countries. They occur especially where there is high snail habitats converge with increasing altitude as in the highlands of Ethiopia, although in such cases the ecological requirements of the flukes and their snail intermediate host are distinct [10].

In Ethiopia, the prevalence of bovine fasciolosis has shown to range from 11.5% to 87%. Fasciola 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 Fasciola gigantica was mainly localized in the western humid zone of the country that encompasses approximately one fourth of the nations [11].

Bovine fasciolosis is an economically important parasite disease of cattle which can imposes direct and indirect economic impact on the livestock production and productivity; particularly of sheep and cattle [12]. Though the problem due to fasciolosis in cattle was reported from different parts of the country by different researchers, but there is no available information on the current status of bovine fasciolosis in Girja district of South-Eastern Ethiopia. Therefore, the objectives of this study were:

- Determining the prevalence of bovine fasciolosis in cattle slaughtered at Haranfama municipal abattoir of Girja district, South-Eastern Ethiopia.
- Assessing the associated risk factors in the prevalence of bovine fasciolosis.

Materials and Methods

Description of the Study Area

The study was conducted in Haranfama municipal abattoir of Girja district from June, 2017 to February, 2018. Girja district is 557 km away from Addis Ababa, the capital city of Ethiopia. The district has a temperature and an annual rainfall range of 29.5-34°C and 1200-1800mm, respectively. Livestock population of the district constitutes 148,169 cattle, 5,558 sheep, 108, 612 goats, 4,458 equines and 116,519 poultry. Mixed livestock-crop farming is the dominant form of production system and the dominant plant products in the district are maize, teff, wheat, barley and coffee. The area vegetation includes indigenous type of trees such as wanza, tide, acacia and others [13].

Study Design and Study Animals

A cross- sectional study was conducted on cattle slaughtered at Haranfama municipal abattoir that came from different adjacent areas (kebeles) namely Dida Guda, Barmalk Allati, Dadatu Muja, Wele Megado and Gubo Hema.

Sampling Method and Sample Size Determination

By using simple random sampling method and by considering 50% expected prevalence and 5% accepted error at 95% confidence interval, the sample size was calculated according to Thrusfield [14], using the formula: $N=1.96^2$ *Pexp (1-Pexp)/d^2; where, N=required sample size; Pexp=expected prevalence; d=desired absolute precision. $N=1.962$ * Pexp (1-Pexp)/d^2 $N=1.96^2$ * 0.5(1-0.5)/ $(0.05)^2$ = 384 cattle were considered for the study.

Method of Data Collection

Before slaughter, all cattle at the lairage were physically examined for any abnormalities. Inspection of the animals was made while at rest or while in motion for any obvious sign of disease. Origin, breed, sex, age and body condition scores were recorded. Age (based on dentitions) was recorded according to Johnson [15] and the body condition scoring was determined and recorded as Heinonen [16]. Then postmortem examination of liver and the bile duct was carefully performed by visualization and palpation of the entire organ followed by transverse incision of the organ across the thin left lobe in order to confirm the case. Species identification of the recovered fasciola was also conducted based on the gross morphological features of the agents and classified in to Fasciola hepatica, Fasciola gigantica and unidentified or immature forms of liver fluke according to Urquhart [17].

Data Management and Analysis

The data collected from the study area were entered in to Microsoft Excel 2010 spread sheet and the data were coded appropriately and analyzed using SPSS version 20 statistical software. Descriptive statistics was analyzed and set as frequencies and percentages. Chi-square (χ^2) tests were applied to test the statistical associations exist among the associated risk factors such as origin of animals, breed, sex, age and body condition scoring with that of the presence of the parasites.

Results

Out of the 384 indigenous and cross breed cattle slaughtered and examined at Haranfama municipal abattoir for the presence of any fasciola parasite, 321 animals (livers) were found to be positive for one or both of the fasciola species. Hence, the overall abattoir based prevalence was 83.6% (Table 1). Of the 321 positive livers during the postmortem inspection, 122 (31.8%) harbored F. hepatica, 112 (29.2%) F. gigantica and 87 (22.6 %) had mixed infections. There was statistically significant difference (P<0.05) among the species of fasciola identified (Table 2).

In this study, different variables or associated risk factors such as body condition, origin, sex and age were considered. Accordingly, the prevalence of the parasites in different body conditions was found to be 36.4% (117) in poor, 33% (106) in medium and 30.6 % (98)

Table 1: Overall prevalence of fasciollosis in cattle.

Cattle breed	Number of Examined Animals	Number of Positive Animals	Prevalence (%)	χ^2 (P-value)
Cross breed	196	166	84.7	0.353 (0.555)
Local breed	188	155	82.4	
Total	384	321	83.6	

Table 2: Frequency and percentage of identified fasciola species in cattle.

Fasciola spp. encountered	Frequency	Relative percentage	χ^2 (P-value)
F. hepatica	122	31.8	384.000 (0.000)
F. gigantica	112	29.2	
Mixed infection	87	22.6	
Total	321	83.6	

Table 3: Prevalence of bovine fasciolosis based on different associated risk factors.

Risk factors	Number of Examined Animals	Number of Positive Animals	Prevalence (%)	χ^2 (P-value)
Origin (Kebele)				
Dida Guda	48	41	12.8	3.792 (0.435)
Barmalk Allati	53	42	13.1	
Dadatu Muja	61	48	14.9	
Wele Megado	158	138	43	
Gubo Hema	64	52	16.2	
Sex				
Male	209	178	55.5	0.828 (0.363)
Female	175	143	44.5	
Age				
Young	182	150	46.7	0.349 (0.555)
Adult	202	171	53.3	
BCS				
Poor	138	117	36.4	0.225 (0.894)
Medium	128	106	33	
Good	118	98	30.6	

BCS: Body condition score

Table 4: The frequency and percentage of each fasciola species in cattle based on different associated risk factors.

Risk factors	*F. hepatica* Frequency (%)	*F. gigantica* Frequency (%)	Mixed infection Frequency (%)	χ^2 (P-value)
Cattle breed				
Cross breed	56 (33.7)	58 (34.9)	52 (31.3)	3.912 (0.141)
Local breed	66 (42.5)	54 (34.8)	35 (22.6)	
Origin (Kebele)				
Dida Guda	18 (43.9)	15 (36.6)	8 (19.5)	16.686 (0.134)
Barmalk Allati	22 (52.4)	12 (28.6)	8 (19)	
Dadatu Muja	12 (25)	21 (43.8)	15 (31.2)	
Wele Megado	51 (36.9)	53 (38.4)	34 (24.6)	
Gubo Hema	19 (36.5)	11 (21.2)	22 (42.3)	
Sex				
Male	76 (42.7)	58 (32.6)	44 (24.7)	3.760 (0.153)
Female	46 (32.2)	54 (37.8)	43 (30.1)	
Age				
Young	58 (38.7)	49 (32.7)	43 (28.7)	0.686 (0.710)
Adult	64 (37.4)	63 (36.8)	44 (25.7)	
BCS				
Poor	52 (44.4)	34 (29.1)	31 (26.5)	5.093 (0.278)
Medium	33 (31.1)	44 (41.5)	29 (27.4)	
Good	37 (37.8)	34 (34.7)	27 (27.6)	

BCS: Body condition score

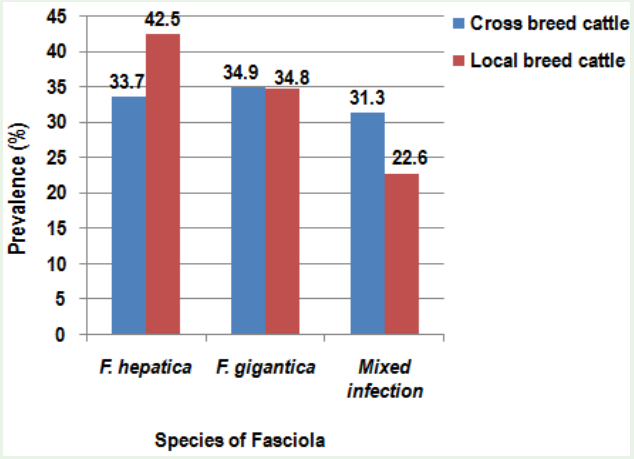

Figure 1: The species of fasciola and their prevalence in cross breed and local breed cattle.

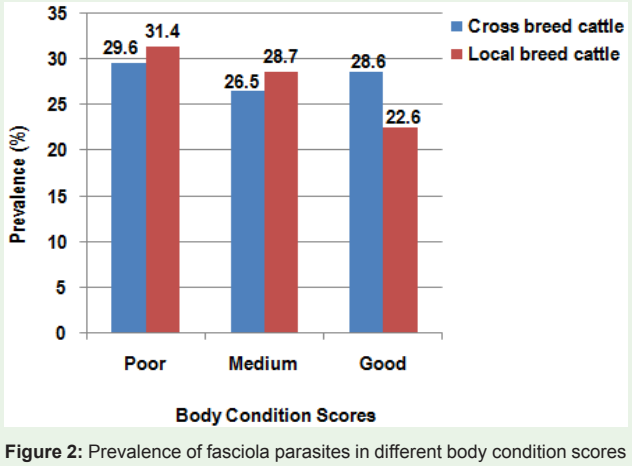

Figure 2: Prevalence of fasciola parasites in different body condition scores of cattle.

in good body conditioned animals. The infection rates in different origins of animals were recorded as 12.8% (41) in Dida Guda, 13.1% (42) in Barmalk Allati, 14.9% (48) in Dadatu Muja, 43% (138) in Wele Megado and 16.5% (52) in Gubo Hema. Based on the sexes of the animals slaughtered and examined at the abattoir, the prevalence rate of bovine fasciolosis in male was 55.5% (178) and in female 44.5% (143). In different age groups of the study animals, the prevalence was found to be 46.7% (150) in young and 53.3% (171) in adult animals (Table 3). There were no statistically significant differences (P>0.05) in the prevalence of the parasite in different groups of the associated risk factors (Tables 4-6) (Figures 1 and 2).

Table 5: Prevalence of bovine fasciolosis in young and adult cattle.

Fasciola spp. identified	Cross Breed Cattle		Local Breed Cattle		χ^2 (P-value)
	Young	Adult	Young	Adult	
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	
F. hepatica	26 (21.3)	30 (24.6)	32 (26.2)	34 (27.9)	4.262 (0.234)
F. gigantica	27 (24.1)	31 (27.7)	22 (19.6)	32 (28.6)	
Mixed infection	26 (29.9)	26 (29.9)	17 (19.5)	18 (20.7)	

Table 6: Prevalence of bovine fasciolosis in male and female cattle.

Fasciola spp. identified	Cross Breed Cattle		Local Breed Cattle		
	Male	Female	Male	Female	χ^2 (P-value)
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	
F. hepatica	36 (29.5)	20 (16.4)	40 (32.8)	26 (21.3)	4.262 (0.234)
F. gigantica	30 (26.8)	28 (25)	28 (25)	26 (23.2)	
Mixed infection	26 (29.9)	26 (29.9)	18 (20.7)	17 (19.5)	

Discussion

Bovine fasciolosis exists in almost all regions of Ethiopia. However, the prevalence, epidemiology and fasciola species involved vary with locality that were caused by the variation in the climate and ecological conditions such as altitude, rainfall, temperature, livestock management systems [18]. The prevalence of fasciolosis in Ethiopia varies from 11.5% in low land area to 87% in high land area. The low lying areas in the high lands have poor drainage, which favors the development of the parasites [19].

The current study indicated that the prevalence of bovine fasciolosis at the Haranfama municipal abattoir was 83.6 %, which was much higher than the documented prevalence rates of bovine fasciolosis at other municipal abattoirs of Ethiopia. For instance, at Debre Berhan municipal abattoir, North Ethiopia, the prevalence rate was worked out to be 65.25% [20], 60.42% at Andessa municipal abattoir [21]. Much lower prevalence rates were also noted in different parts of Ethiopia. Such as 39.8% at Hashim Nur's Ethiopian livestock and meat export industrialized abattoir in Debre Zeit [22], 31.51% at Ginnir district municipal abattoir [23], 25.2% at Dessie municipal abattoir [24], 22.76% at Mekele municipal abattoir [19], 20.3% at Addis Ababa municipal abattoir [25], 45.3% at the Bahir Dar municipal abattoir [26], 43.25% at Quarit district municipal abattoir [27], 21.9% at Nekemte municipal abattoir [28], and 20.8% at Bedelle municipal abattoir [29].

This could be due to differences in altitude, topography and weather conditions or due to the difference in the awareness of the livestock owners on how to keep their cattle healthy, protect their cattle from reaching infected area, keeping pastures dry and eliminating surrounding contaminated vegetation which could be a suitable medium for fasciola infection and due to the differences in the practice of using anti-helminths to treat infected animals by veterinary health personnels [20].

In the present study, species identification revealed that Fasciola hepatica was more prevalent (31.8%) than Fasciola gigantica (29.2%) and mixed infections (22.6 %). Unlike the present study, Geneti et al. [30] reported that 56.42% of cattle were infected with F. hepatica and 9.17% with F. gigantica. In another study, Fufa et al. [31] stated that the most common liver fluke species affecting cattle at Welaita Sodo were F. gigantica. However; Gebretsadik et al. [32] reported that 56.42% of cattle were infected with F. hepatica and 9.17% with F. gigantica. Malone and Yilma [33] indicated that F. gigantica in Ethiopia is found at altitudes below 1800 meters above sea level. While F. hepatica is found at altitude of 1200-2560 meters above sea level. Mixed infections by both species can be encountered at 1200-1800 meters above sea level. According to Malone and Yilma [33], such discrepancy is attributed mainly to the variation in climatic and ecological conditions such as altitude, rainfall and temperature as well as livestock management systems.

The prevalence rate of fasciolosis based on the sexes of the slaughtered cattle was statistically insignificant (P>0.05), this could be due to the exposure of male and female bovines to similar ecological condition and practices of similar management system without considering their sex [20]. As it is indicated in Table 3, the prevalence of bovine fasciolosis was 55.5% and 44.5% in male and female cattle, respectively. This was lower than the finding of Feleke and Girma [20] with 65.07% in male and 66.67% in female cattle at Debere Berehan municipal abattoir. However; it was higher than the finding of Yosef et al. [29] at Bedelle municipal abattoir with the infection rate in the population of males was 20.88% and in that of females was 20.79%. This might be due to the economic importance given by the local society for female cattle by keeping in protected areas and due to the reason that the abattoirs' rule prohibited to slaughter young fertile females without the permission of veterinary personnels [20].

The result of the current study showed that age has insignificant effect on the prevalence of bovine fasciolosis; but it was higher in young animals (28.7%) than the adult (25.7%). There was a decrease in infection rate (prevalence) as age increased. This agrees with the finding of Mohammed et al. [34]. This may be due to the result of acquired immunity with age which is manifested by humoral immune response and tissue reaction in bovine liver due to previous challenge. There are some additional reports confirming that the increased resistance against fasciolosis (low prevalence) with age is most likely related to the high level of tissue reaction seen in bovine liver. Liver fibrosis which impedes the passage of immature flukes

acquired thickening, stenosis and calcification of bile ducts, assumed unfavorable site for adult parasites and consequently fasten their expulsion. These are also in agreement with experimental study conducted by Radostits et al. [35], which confirmed the occurrence of higher infection rate in younger animals.

In the current study, there was a statistically insignificant association (P>0.05) between the different categories of body conditions of the animals and the prevalence of fasciola infection. Unlike the finding of the present study, a study conducted in Debre Berehan by Feleke and Girma [20] indicated that the association between the prevalence of fasciolosis and body condition of the animals was also statistically significant. The result of present study showed that origin has also insignificant effect on the prevalence of bovine fasciolosis. This could be due to the similarities in the topographical locations of the study areas, epidemiology of the parasites and managemental factors.

Conclusion and Recommendations

Fasciolosis is a major disease which imposes direct and indirect economic impacts on livestock production, particularly of sheep and cattle in Ethiopia. Some of the economic losses in the cattle industry induced by fasciolosis are: mortality, liver condemnation, reduced production (meat, milk) and expenditures of different costs for treatment, prevention and control. In this study higher prevalence of bovine fasciolosis was obtained when compared with the prevalences reported by different researchers at different areas of Ethiopia. The dominant fasciola species revealed in the study area was Fasciola hepatica with the prevalence rate of 31.8% and followed by Fasciola gigantica with the prevalence rate of 29.2%. Those fasciola species had significant difference in their prevalence. In this study, different variables or associated risk factors were also considered, however, they were found to be statistically insignificant for the prevalence of bovine fasciolosis. Therefore, based on the above conclusion; the following recommendations are forwarded:

1. Community based control programs or practices such as regular de-worming of animals, drainage of swampy areas and fencing of watering points should be implemented in the study area.
2. Further detailed epidemiological studies as well as assessment of the overall economic impact of the problem should be performed in order to implement appropriate disease investigation and control strategy in the district.

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