Research Article

Study of Prevalence and Associated Risk Factors of Bovine Fasciolosis in Jimma Horro District of Kellem Wollega Zone, Western Ethiopia

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Abstract

Fasciolosis is a parasitic disease of cattle that cause a significant economic loss in cattle production in Ethiopia. A cross-sectional study was conducted with aim of assessing prevalence and associated risk factors of bovine fasciolosis in Jimma Horro district from November 2016 to November 2017. Fecal samples from randomly selected 384 cattle of different age group, sex and body condition were collected and examined with parasitological techniques (sedimentation technique). The prevalence of bovine fasciolosis as determined from coprological examination was highest in Une (31.3%), followed by Makanisa (29.2%), Abono (26.1%) and Ilu Kitaye (24.0%) peasant associations. The overall prevalence of bovine fasciolosis was 27.6% (106/384) in the study areas. Multivariable logistic regression analysis identified season (OR= 4.6), sex (OR= 6.1), age groups (OR= 32.4) and body condition (OR= 5.8) of cattle as risk factors (P<0.05) for fasciolosis in the study area. However, there were no statistically significant differences observed between herd size, species composition and origin of cattle (P> 0.05). The present finding shows that fasciolosis in cattle is the most economically important parasitic disease affecting cattle and common in Jimma Horro district. Hence, there is a need to create awareness about impact of disease on cattle production and appropriate control methods of fasciolosis should be designed and implemented. Further epidemiological investigation should be carried out in the study area.

Keywords: Cattle; Jimma Horro district; Risk factors; Prevalence; Bovine fasciolosis

1. Introduction

Ethiopia has the largest livestock population in Africa, with a total cattle population of 59.9 million [7]. In spite of the presence of huge ruminant population, Ethiopia fails to optimally exploit resources due to a number of factors such as diseases, poor nutrition, poor husbandry practices and lack of government policies for disease prevention

and control [12]. Among the animal diseases that hinder the animal health are parasitic infections that have great economic impact [1]. Among many parasitic problems of farm animals, fasciolosis is a major disease which imposes economic impact on livestock production particularly of cattle and sheep [27]. *Fasciola hepatica* and *Fasciola gigantic* are the two liver flukes commonly reported to cause fasciolosis in cattle. The life cycles of these parasites requires snail as an intermediate host [23]. The spread of the fasciolosis largely depends on the intermediate host's ecology (genus Lymnaea). *Lymnaea natalensis*, aquatic snails is important for *F. gigantica* whereas *L. truncatula*, an amphibious snail with wide distribution throughout the world, is an intermediate host for *F. hepatica* [14]. *Fasciola hepatica* has a worldwide distribution but predominates in temperate zones while *F. gigantic* is found on most continents, primarily in tropical regions [24]. The presence of fasciolosis due to *F. hepatica* and *F. gigantica* in Ethiopia has long been known and its prevalence and economic significance has been reported by several workers [18]. However, few attempts have been made to study the epidemiology of this parasitic problem in various parts of the country with the specific aim of determining the parasitic burdens, especially in relation to months of the year, rainfall, temperature, humidity, altitude and other related factors. This information is very important in planning control programs and also estimating the economic burden to the country as the result of this parasite [15].

Bovine fasciolosis has direct economic impact in increasing condemnation of liver, but far more effects are decreased animal productivity, lower calf birth weight and reduced growth in infected animals and cost of animal treatment [14]. Moreover, the economic losses due to fasciolosis are included mortality, morbidity and increased susceptibility to secondary infections and the expenses of control measures [33]. These Losses from parasitic diseases including fasciolosis expected to be high in tropical countries like Ethiopia where strategic and most effective disease control programs are lacking. Therefore, a study on the prevalence and associated risk factors of the disease is crucial before planning and instituting a control program [22]. Several studies have reported the presence and economic significance of fasciolosis in Ethiopia. The prevalence of the disease is known to be relatively high causing considerable economic losses in livestock production [8].

Jimma Horro district is generally considered as one of the most affected and endemic area of fasciolosis in the country region, Veterinary practitioners and animals owners complain of huge annual losses from it. However, there are practically no dependable detailed studies that have been conducted on the prevalence the seasonal variations in the prevalence of the disease and other related parameters so as to design relevant control strategies that can be implemented against the disease in the area. The information regarding the prevalence and associated risk factors of bovine fasciolosis in the district is scanty. Therefore, the aim of this study is to determine the prevalence and associated risk factors of fasciolosis in cattle owned by smallholder farmers located in Jimma Horro district, Western Ethiopia.

2. Materials and Methods

2.1 Description of the study area

The study was conducted from November 2016 to November 2017 in four selected peasant associations (Une, Ilu Kitaye, Makanisa and Abono) of Jimma Horro district, Kellem Wollega Zone in Western Ethiopia. This district is bounded by Begi district in North, Gawo Kebe district in East, Yamalogi Wolel district in South and Gidami district

in West. The area is located at about 665km west of Addis Ababa. The area is located at an elevation of 1400-1830m above sea level. The Topography of this district is characterized by Forest of Wolel Mountain and Dati Wolel Park. The main river in this district is Supe, Burar and Kumbabe. The climatic condition alternates with long summer rain fall (June to September), short rainy season (March to May) and winter dry season (December to February). The minimum and maximum annual rain fall and daily temperature range from 800 to 1200mm and 15 to 25 ^{o} c, respectively. Jimma Horro district is characterized by Dega (19.7%), Woyna dega (48.5%) and Kola (31.8%). Livestock population in area is estimated to be about 68,500 heads of cattle, 5,761 mules, 8,786 donkeys, 233 Horses 19,952 sheep, 13,575 goats and 69,975 species of poultry. The farmers in the area practice mixed farming system [13] (Figure 1).

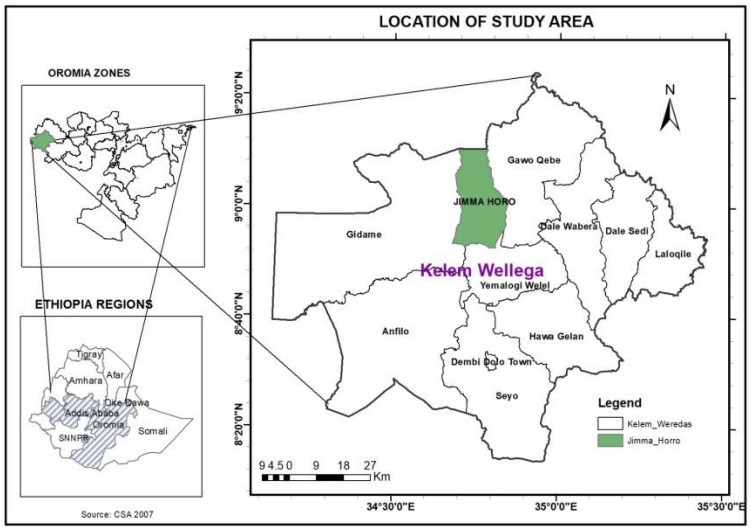

Figure 1: Map of study area.

2.2 Study design

A cross-sectional investigation of the prevalence and associated risk factors of fasciolosis in Jimma Horro district was carried out from November 2016 to November 2017.

2.3 Study animals and sampling technique

Study population comprises of indigenous (local) breed of animals of different age, sex, body conditions and origin category found under the extensive grazing system. All sampled cattle from the selected four peasant association in Jimma Horro district were recorded. Simple random sampling technique was the sampling strategy used to collect all the necessary data from fecal samples of the study animals.

2.4 Sample size determination

Since there was no previous study in Jimma Horro district to establish the prevalence, associated risk factors, bovine fasciolosis, the sample size was determined by taking 95% confidence interval, the prevalence of 50% and 5% absolute precision fasciolosis using the formula given by [20]. Accordingly 384 cattle were supposed to be sampled. It was also considered both sexes and age. Age was classified as young (<4 years) and adult (>4years) [6].

2.5 Corpological examination

Fecal samples were collected directly from the rectum of each animal and placed in universals bottles and transported to parasitology laboratory by preserving with 10% formalin. Sedimentation technique was used to detect the presence or absence of fluke eggs in the fecal sample collected according to [22]. Two grams of faeces was added to 42 ml of water in a graduated cylinder. The contents were then mixed thoroughly using a glass rod, and were poured through a tea strainer to remove large debris. The solution was then further passed through a sieve (mesh aperture 210 mm) into a conical flask and water was run through the sieve to ensure no eggs remained attached to the sieve. The filtrate was then allowed to sediment for 3 min after which the supernatant was siphoned off taking care not to disturb the precipitated matters. The latter was stained with two drops of methylene blue and the entire sediment placed on slide covered with a cover slip and viewed under a compound microscope (Labomed). Eggs of *Fasciola* species were identified by their characteristic morphology and colour. 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 show yellowish colour while eggs of *Paramphistomum* species stain by methylene blue [11]. Samples that were not processed within 24 hours were stored in a refrigerator at 4°C.

2.6 Body condition scoring

Body condition of the study animals was scored based on the criteria set by [28], which ranged from 0 to 5. Body condition score 0 stands for cows with the poorest body condition while score 5 for cows with the best condition. All cattle under the study their body condition grouped into three groups poor (score 0-1), medium (score 2-3) and good (score 4-5).

2.7 Statistical analysis

Data obtained from this study was recorded and stored in Microsoft® Excel for Windows 2010 and transferred to Statistical Package for the Social Sciences (SPSS) version 20.0. The prevalence of fasciolosis in different variables (peasant association, body condition, herd size, season, species composition, sex and age) was analyzed by using logistic regression model. Associations between outcome (fasciolosis) and explanatory variables (risk factors) for all units of analysis were investigated by using logistic regression model. The strength of the association between outcome and explanatory variables was assessed using the crude and adjusted odds ratios (OR). The explanatory variables ($P \leq 0.25$) were further checked for multicollinearity using the variance inflation factor (VIF) and tolerance factor (TF) before multivariable logistic regression analysis. Variance inflation factor values of greater than 3 or tolerance less than 0.1 were considered the cut-off points [4] for the collinearity diagnostics. Variables were also tested for interaction effects using cross-product terms. For all the analyses, confidence level (CL) is at 95% and $P \leq 0.05$ were set for significance.

3. Results

The overall prevalence of bovine fasciolosis in the study areas was 27.6%. The prevalence in each peasant association was determined to be 31.3% in Une, 29.2% in Makanisa, 24.0% in Ilu Kitaye and 26.1% in Abono of Jimma Horro district (Table 1).

Peasant association	Total of examined cattle	Total of positive cattle	Prevalence (%) (95% CI)
Abono	96	25	26.1 (17.26-34.82)
Ilu Kitaye	96	23	24.0 (15.42-32.50)
Makanisa	96	28	29.2 (20.07-38.26)
Une	96	30	31.3 (21.98-40.52)
Total	384	106	27.6 (23.13-32.08)

CI: Confidence Interval

Table 1: Prevalence of bovine fasciolosis in different peasant associations of Jimma Horro district.

The highest (31.2%) and lowest (24.0%) prevalence of bovine fasciolosis was recorded in cattle from Une and Ilu Kitaye peasant associations, respectively. However, there was no statistical significant difference (P>0.05) between prevalence of fasciolosis and origin of cattle. The prevalence of fasciolosis was higher in male (42.9%) than female (14.5%) cattle. The variation in the prevalence of fasciolosis between the sex was statistically significant (P<0.05). Female cattle was almost four times (OR=4.4) more likely to be infected by fasciolosis than male cattle. The highest prevalence of fasciolosis was recorded in cattle with poor body condition (38.1%). Moreover, variation in prevalence of fasciolosis among the body condition was statistically significant (P<0.05). Poor body condition cattle being almost three times (OR=2.7) more likely to be infected with fasciolosis compared to good body condition of cattle. The prevalence of fasciolosis was 66.7% in young age category than in adult age category (1.1%) of the cattle. Statistically significant (P<0.05) difference in Fasciola infection was observed among age categories. Relatively young and adult cattle were found to be more likely to be infected by fasciolosis than their older counterparts. With regard to season, the highest (47.7%) prevalence of fasciolosis was recoded in wet season. The difference in prevalence of fasciolosis between the seasons was statistically significant (P<0.05) with a wet season almost six times (OR=5.6) more likely to be infected with fasciolosis than dry season. Similarly, statistically significant difference in fasciolosis (P<0.05) was observed in cattle herded with sheep and/ goats; those having close contact with small ruminants were about eight times (OR=7.7) more likely to be infected by fasciolosis than those having less or no contact. There was statistically significant variation (P<0.05) in prevalence of fasciolosis between cattle from different herd sizes. Cattle from large herd size category were almost two times (OR= 2.2) more likely to be infected with Fasciola parasite than cattle from the small herd size category (Table 2).

Variables	Category	Total cattle examined	Total cattle positive (%)	OR (CI; 95%)	P-value
Origin					0.68
	Abono(Ref)	96	25 (26.1)	-	-
	Ilu Kitaye	96	23 (24.0)	0.9 (0.47-1.72)	0.74
	Makanisa	96	28 (29.2)	1.3 (0.62-2.20)	0.63
	Une	96	30 (31.2)	1.3 (0.69-2.42)	0.43
Sex	Male(Ref)	177	76 (42.9)	-	-
	Female	207	30 (14.5)	4.4 (2.72-7.23)	0.001

BCS					0.001
	Good (Ref)	130	24 (18.5)	-	-
	Medium	112	28 (25.0)	1.5 (0.80-2.73)	0.218
	Poor	142	54(38.1)	2.7 (1.55-4.73)	0.001
Age					0.001
	Old (Ref)	184	2 (1.1)	-	-
	Adult	77	22 (28.6)	36.4 (8.30-159.68)	0.001
	Young	123	82(66.7)	182 (42.99-770.51)	0.001
Season	Dry(Ref)	229	32 (14.0)	-	-
	Wet	155	74 (47.7)	5.6 (3.45-9.17)	0.001
Species composition	Only cattle(Ref)	20	1 (5.0)	-	-
	Mixed with sheep and/ goat	364	105 (28.8)	7.7 (1.02-58.28)	0.048
Herd size	Small(Ref)	160	30 (18.8)	-	-
	large	224	76 (33.9)	2.2 (1.37-3.61)	0.001

OR: Odds Ratio; CI: Confidence Interval, Ref: Reference

Table 2: Univariable logistic regression analysis of fasciolosis associated risk factors in Jimma Horro district.

Variables with a p-value less than 0.25 in the univariable analysis with no multicollinearity were entered into multivariable logistic regression model. No significant interactions between variables were detected. A Hosmer-Lemeshow goodness-of–fit value (P=0.90), indicated that the model was fit the data. The final multivariable logistic regression model showed that body condition, season, sex and age of cattle were independently associated with (P<0.05) fasciolosis in Jimma Horro district (Table 3).

Factors	**Number of cattle examined**	**Total cattle positive (%)**	**Adjusted OR (95% CI)**	**P-value**
Sex				
Male	177	76 (42.9)	-	-
Female (Ref)	207	30 (14.5)	6.1 (1.12-14.08)	0.038
Age				0.001
Old (Ref)	184	2 (1.1)	-	-
Adult	77	22 (28.6)	16.8 (3.48-29.96)	0.001
Young	123	82(66.7)	32.4 (21.53-47.43)	0.001
Body condition				0.001
Good (Ref)	130	24 (18.5)	-	-
Poor	142	54(38.1)	5.8 (1.11-30.04)	0.037
Medium	112	28 (25.0)	0.5 (0.01-0.30)	0.001

Season				
Dry(Ref)	229	32 (14.0)	-	-
Wet	155	74 (47.7)	4.6 (1.15-18.59)	0.031

OR: Odds Ratio; CI: Confidence Interval, Ref: Reference

Table 3: Multivariable logistic regression analysis of potential risk factors of fasciolosis in Jimma Horro district.

4. Discussion

The prevalence of 27.6% of bovine fasciolosis was found in fecal examination in Jimma Horro district. This result is in line with [14] and [3], who reported that 26% and 30% prevalence of bovine fasciolosis in Bahir Dar and Dangila, Ethiopia, respectively. This result was also similar with report of [2] with 27.2% prevalence of bovine fasciolosis in Hawassa; [25] 33.42% in North Gonder and [9] 36.72% in and around Bahir Dar. On the other hand, the prevalence of bovine fasciolosis reported in current study is higher than the values reported by [26] 19.1% in Zenzelma; [17] 12.4% in Kombolcha; [16] with 15.9% prevalence of bovine fasciolosis in Wolega zone; 15.9% prevalence by [21] at Nekemte veterinary clinic and [10] at Welaita Sodo (12.7%). This variation in prevalence of bovine fasciolosis might be due to differences in environmental factors, management system and level of veterinary service.

There was statistically significant association among age of the cattle and prevalence of fasciolosis ($P<0.05$). Adult and younger age group were almost seventeen (OR=16.7) and thirty-two times (OR=32.4) respectively more likely to acquire Fasciola infection compared to their adult counterparts. This may be to due to increased resistance as age increases is most likely related to the high level of tissue reaction seen in bovine livers, severe fibrosis which impairs the passage of immature flukes, acquired resistance. Stenosis and calcification of bile duct, assumed unfavorable site for adult parasites and consequently fast their expulsion [22]. Similarly, several studies in Ethiopia [3, 5, 18, 19, 25] reported age as one of the important risk factors influencing bovine fasciolosis in cattle.

This study shown that sex was statistically significant variations with prevalence of bovine fasciolosis with the female cattle was six times (OR=6.1) more likely to be infected by fasciolosis compared to male cattle. This might be due to female animals had spent most of their time on grazing the pasture, so that they had higher chance of getting infection, besides the stress due to pregnancy and lactation [31]. This study finding is in line with reports of [1, 31, 32], who reported that significant association between prevalence of bovine fasciolosis and sex of cattle in Ethiopia. This study was also in agreement with the reports of [29, 30], who reported that statistically significant association between prevalence of fasciolosis and sex of cattle in South Africa and Bangladesh, respectively.

Prevalence of bovine fasciolosis was statistically association with body condition of cattle in the study area. Poor body condition are almost six (OR= 5.8) times more likely to be infected by fasciolosis than good body condition cattle. This could be due to differences in their resistance for concurrent infection and also fasciolosis itself. Concurrent infection and chronic disease on animals with poor body condition may result the animals to be susceptible for fasciolosis. This shows fasciolosis causing weight loss and is the characteristic sign of the disease. Chronic fasciolosis commonest form of the disease in cattle and one of the sign is weight loss (emaciation) [22].

This finding is consistent with some previous studies in Ethiopia [3, 14], who stated that prevalence of fasciolosis was statistically significantly associated with body condition in cattle.

The present result also indicated that season was significantly associated (P<0.05) with fasciolosis in cattle. Cattle were almost five times more likely (OR=4.6) to acquire Fasciola infection in wet season compared to dry season. This may be due to in wet season cercariae develop from the snail and swim until they find and attach to vegetation, sheds it tails and secrete a protective coat, forming the encysted infective stage called metacercariae. Cattle become infected primarily by ingesting the metacercarial cysts on the soil, forage and contaminated drinking water [22]. This result agrees with the report of [18], who reported that season was risk factor for occurrence of fasciolosis in cattle. The association between season and prevalence of bovine fasciolosis is also in line with report from South Africa [29].

Higher prevalence of fasciolosis was found in large herd size (33.9%) than small herd size (18.8%). However, no statistically significant variation was observed in prevalence of fasciolosis between herd sizes. Similarly, statistically significant difference in prevalence of fasciolosis (P>0.05) was not observed in cattle herded with sheep and/ goats. The prevalence of bovine fasciolosis was also no statistical significant difference (P>0.05) among peasant associations. This may be due to similar management system, equal chance of exposures for contaminated grass of cattle to the fasciolosis and even distribution of the parasite in the district.

5. Conclusion and Recommendations

The present study indicated that bovine fasciolosis is the most wide spread and prevalent parasitic disease affecting the health and productivity of cattle with an overall prevalence of 27.6%. Body condition, season, sex and age groups of cattle were statistically significance difference with prevalence of bovine fasciolosis in the study area. However, species composition, herd size and origin of cattle were not showed statistically significance difference. Fasciolosis is the disease of a primary concern in study area and that is should be remarked in priority list in any animal disease control program to be investigated in the area. Therefore, based on the above conclusion the following recommendations were forwarded:

- Strategic use of antihelmintics should be performed to reduce pasture contamination with fluke eggs.
- Further study on epidemiology of the disease, the ecology and biology of intermediate host snail should be carried out for better control of disease.
- Integrated control approach using selected antihelmitics therapy and snail control should be conducted to reduce magnitude of the problem.

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