

Prevalence of Bovine Fasciolosis and Associated Risk Factors in Cattle Slaughtered at Zefine Town Municipal Abattoir, Boreda District of Gamo Zone, Southern Ethiopia

Gedion Daniel Kunta

Boreda District office of Agriculture, Department of livestock and Fishery Resources.

***Corresponding Author:** David Vinyes, Boreda District office of Agriculture, Department of livestock and Fishery Resources.

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Abstract:

Fasciolosis is among the important parasitic diseases in tropical and subtropical countries which limit productivity of ruminants in particular cattle. A cross-sectional study was conducted from February to September 2024 at Zefine town municipal abattoir to determine the prevalence, associated risk factors and estimate economic importance of fasciolosis. A total of 384 cattle consisting of 354 males and 30 females were systematically selected and postmortem liver inspection for adult liver flukes was made. Out of the total 384 cattle slaughtered 93 animals were infected by fasciolosis and an overall prevalence of 24.2%. During the investigation Age of animals showed a significant association with disease prevalence ($P < 0.05$), while sex, body condition score, breed and origin of animals showed a non-significant association ($P > 0.05$). In present investigation the estimated economic loss caused by bovine fasciolosis was 580,800 ETB (5808 USD) annually. Hence, implementation of control and prevention strategy like, grazing managements, reducing the population of the intermediate host, diagnosis and treating sick animals using anthelmintic, is crucial.

Key words: boreda; cattle; economic loss; fasciolosis; prevalence; risk factor

1. Introduction

Ethiopia is one of the nations with highest population of livestock. The livestock production is an integral part of the agricultural system, which accounts 40% of the agricultural growth domestic product (GDP) and 20% of the total GDP without considering other contribution like traction power, fertilizing and mean of transport (Kulunde and Feyera, 2022). In spite of the presence of huge livestock 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, shortage of trained man power and lack of government policies for disease prevention and control (Bizuneh, 2005).

However, the presences of widely prevalent livestock diseases are major constraints to Ethiopian livestock development. Among the animal diseases, Parasitism represents a major obstacle to the development of the livestock resource (Tesema, 2017). Fasciolosis is an important parasitic disease of domestic ruminants caused by digenean trematodes of the genus *Fasciola* commonly referred as liver flukes. *Fasciola hepatica* and

Fasciola gigantica are the two most important species all over the world, that are transmitted between mammalian hosts such as, cattle, sheep and other wild ruminants (or humans) as definitive hosts, and freshwater lymnaeid snails as intermediate hosts (Biniam *et al.*, 2018).

Fasciola infection in cattle occurs mostly through ingestion of contaminated water or pastures in wetland areas. The disease in ruminants manifests as acute, sub-acute or chronic phases. The disease associated with liver damage and hemorrhage due to migration of flukes through the liver parenchyma (Adane *et al.*, 2019). Changes in the liver due to chronic fasciolosis involve thickening of the bile duct, fibrosis and calcification of hepatic tissues. There is also haematophagic activity of the adult flukes and damage to the bile duct mucosa by their cuticular spines due to fluke residence in the bile duct (Addy *et al.*, 2020).

Lymnaeid snails are known to be the intermediate hosts of *Fasciola* spp., play a vital role in the epidemiology and distribution of fasciolosis. Different factors are contributing for the outbreaks of fasciolosis such as availability of suitable snail habitats as trunculata prefers wet mud to free

water, and permanent habitats include the banks of ditches or streams and the edges of small ponds. Following heavy rainfall or flooding, temporary habitats may provide by hoof marks, wheel ruts or rain ponds. Fields with clumps of rushes are often suspect sites. In addition, a slightly acid pH environment is optimal for *L. truncatula*, excessively acid pH levels are detrimental, such as occur in peat bogs, and areas of sphagnum moss (Afera, 2012).

Bovine fasciolosis is an economically important parasitic disease of cattle in tropical and subtropical countries responsible for considerable economic losses in the cattle industry, mainly through mortality, morbidity, reduced growth rate, condemnation of fluke infected liver, increased susceptibility to secondary infections and expense due to control measures (Foustine, 2021; Kassie *et al.*, 2019). According to study report of Adane *et al.* (2019), the economic loss associated with affected liver condemnation due to fasciolosis in different area of Ethiopia is ranging from 86,083.2 ETB (\$2459.52) to 1,751,432 ETB (\$50040.91). It 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 (Fayisa, 2023).

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 (Kibruyesfa and Ture, 2018). Both *Fasciola hepatica* and *Fasciola gigantica* have the greatest risk occurred in areas of extended high annual rainfall associated with high soil moisture and surplus water, with risk diminishing in areas of shorter wet season and or lower temperatures. *Faciola hepatica* was shown to be the most important fluke species in livestock population with distribution over three quarter of the nation except in the arid northeast and east of the country (Mohammed *et al.*, 2016); Whereas the distribution of *Fasciola gigantica* was mainly localized in the western humid zone of the country that encompasses approximately one fourth of the nations (Adane *et al.*, 2019).

Even though the disease is extensively studied and highly prevalent in different parts of Ethiopia, there was lack of well documented information on this regard in Boreda district in Gamo zone. Therefore the objectives of this study were:-

- To estimate the prevalence of bovine Fasciolosis in Zefine Municipal abattoir, Boreda district of Gamo zone, southern Ethiopia
- To assess the different risk factors that might contribute for fasciolosis.
- To estimate the economic loss due to liver condemnation

2. Materials and Methods

2.1. Description of Study area

Boreda District is found in Gamo Zone, Ethiopia. The name of the town of the District is called zefine and it is located at 96 km from Arbaminch zonal town. There is a rough road that connects the District with zonal towns and the neighboring District. Topographically, Boreda District is situated in plain areas. Besides the agro ecology of the District is characterized by „Woina-dega“, which covers 52% of the total areas followed by “Kola” 34% and the remaining 14% is covered by Dega areas. As a result, the lives of farmer households depend on agricultural products. Most of the farmers generate income from on-farm and off-farm activities (Tariku and Tekle, 2020).

2.2 Study design and Study animals

A cross-sectional investigation of the prevalence, associated risk factors and economic importance of fasciolosis in Zefine municipal abattoir in Boreda district of Gamo zone was carried out from January 2024 to September 2024. The study animals were cattle that presented for slaughter purpose at Zefine town municipal abattoir with different age, breed, and sex and body condition were used during the study period. The age of animals were determined based on dental eruption pattern and information from the owners, every sampled of cattle was recorded for age and categorized in to adult age and old during sampling. Accordingly Nicholson and Butterworth (1986), animals were considered as poor when they show marked emaciation, transverse process project prominent, spines appear sharply, individual dorsal spines are pointed to the touch, hips, tail, head and ribs are prominent. Whereas animals categorized under good body condition score were animals with smooth, well covered and heavy deposits of fat, which is clearly visible on tail, head, brisket, dorsal spines, ribs and hooks and as medium when they are found between the two.

2.3. Sample Size Determination

The sample size for this study was determined by the formula described by Thrusfield (2005). Accordingly, at 95% confidence level and precision of 5% the total sample size was determined to be 384 since there was no research carried out on the title previously in the study area. So, for this particular study the sample size was as following:

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

Where n= sample size required; 1.96=the value of Z at 95% confidence interval; Pexp= expected prevalence; d= desired absolute precision

Hene, 384 cattle were sampled using systematic random sampling method from the study area.

2.4. Study methodology

2.4.1. Ante mortem and postmortem examination

Ante-mortem inspection carried out in adequate lighting where the animals can be observed both collectively and individually at rest and motion. Pre slaughtering, the age, sex, origin and body condition was recorded.

During post mortem inspection, Animals, examined during the ante mortem examination, were further supervised for their livers and bile duct. Careful examination by visualization and palpation of the entire organ, followed by incision along the bile ducts of the lobes, was done Liver parenchyma and major bile ducts were examined for the presence of immature and adult *Fasciola* parasites, respectively.

2.4.2. Estimation of direct economic loss due to liver condemnation

The direct financial loss was analyzed on the basis of liver condemnation due to bovine fasciolosis at Zefine municipal abattoir. It was analyzed by considering the average number of annually slaughtered cattle in the abattoir from retrospective recorded data, the current mean selling price of one healthy liver from at Zefine town and overall prevalence of bovine fasciolosis in municipal abattoir from the present study. The information on the current price of one normal liver was obtained from the different butcher houses in the town. Hence, direct economic loss was calculated

on annual basis according to the formula adopted from Ogunrinade & Ogunrinade (1980).

$$ALC = MCS \times MLC \times P$$

Where **ALC**=Annual loss from Liver Condemnation

MCS= Mean annual Cattle Slaughtered at woreda municipal abattoir

MLC= Mean cost of one Liver at town and

P= current abattoir prevalence of the bovine fasciolosis at Zefine town municipal abattoir

2.5. Data management and Statistical Analysis

The recorded raw data were entered in to Microsoft excel data base system to be analyzed using STATA version 12 statistical software. Descriptive statistics was computed. Pearson's chi-square (χ^2) was used to evaluate the association between the prevalence of fasciolosis and different factors.

A 95% confidence interval and P-value less than 0.05 (at 5% level of significance) were considered significant in all analysis

3. Results

3.1. Prevalence of fasciolosis and associated risk factors

Out of the total 384 cattle slaughtered in Zefine municipal abattoir in Boreda district, 93 animals were infected by fasciolosis and an overall prevalence of 24.2% was recorded for fasciolosis in the study area.

Among the 384 animals, investigated during antemortem examination 299 animals examined with good body condition score, 74 animals were observed with medium body condition and 11 animals were observed with poor condition. The prevalence of fasciolosis in these groups was found to be 22.4%, 32.4% and 18.2% respectively. However there was no statistical difference ($P=0.311$) was observed between age groups and fasciola infection (Table-1).

Variables	Categories	No. Examined	No. affected	% Prevalence	P-Value
BCS	Good	299	67	22.4	0.311
	Medium	74	24	32.4	
	Poor	11	2	18.2	
Total		384	93	24.2	

Table 1: Prevalence of Fasciolosis based on body condition score

As indicated in below table (table -2) the occurrence of bovine fasciolosis was found relatively the same in all areas where the animals originated. The results of investigation showed that 27/112 (24.1%), 28/116(24.2%),

21/73(28.8%) and 17/83(20.5%) animals were found positive from Zefine zuria, Gocho, Wolaita and Mirab Abaya sites respectively. There was no significant association ($P=0.980$) among origin of animals and Bovine fasciolosis infection (Table 2).

Variables	Sites	No. examined	No. positive	Prevalence (%)	P-Value
Origin	Zefine zuria	112	27	24.1	0.980
	Gocho	116	28	24.2	
	Wolaita	73	21	28.8	
	Mirab Abaya	83	17	20.5	
Total		384	93	24.2	

Table 2: Prevalence of bovine Fasciolosis based origin of animals

The investigation of prevalence of fasciolosis in cattle based on breed category indicated a non-significant association ($P=0.070$), so that, about 91 /358(25.4%) local zebu cattle and 2/26(7.8%) cross bred cattle were affected by fasciolosis. Relatively higher infection rate was observed in local cattle (Table-3).

Variables	Categories	No. Examined	No. affected	% Prevalence	P-Value
Breed	Local	358	91	25.4	0.070
	Cross	26	2	7.8	
Total		384	93	24.2	

Table 3: Prevalence of Fasciolosis in cattle based on breed.

The study revealed a significant association ($P=0.000$) between age and the occurrence of fasciolosis in animals with high prevalence 54/141(38.3%) was seen in young animals than 39/243(16.0%) adult animals (Table-4).

Variables	Categories	No. Examined	No. affected	% Prevalence	P-Value
Age	Young	141	54	38.3	0.000
	Adult	243	39	16.0	
Total		384	93	24.2	

Table 4: Prevalence of bovine Fasciolosis on age basis.

This study indicated that the relatively higher prevalence was recorded in male 86/354(24.3%) were male animals that found positive and 7/30(23.3%) were females animals examined positive for fasciola infection but there was no significant association ($P=0.831$) was observed between sex and prevalence of fasciolosis as indicated in (Table -5).

Variables	Categories	No. Examined	No. affected	% Prevalence	P-Value
Sex	Male	354	86	24.3	0.831
	Female	30	7	23.3	
Total		384	93	24.2	

Table 5: The prevalence of Fasciolosis with sex

3.2. Economic analysis

Economic significance of fasciolosis was analyzed based on the information obtained during post mortem examination and interview of abattoir workers and butcher houses. In the study abattoir the average annual cattle slaughtered rate was estimated to be 4000 while mean retail price of bovine liver in Zefine town was 600 ETB. Current prevalence of fasciolosis in the study area was 24.2%. There fore a total annual loss from organ condemnation due to fasciolosis is:

$ALC = MCS \times MLC \times P = 4000 \times 600 \times 24.2\% = 580,800 \text{ ETB (5808 USD) annually.}$

4. Discussion

Fasciolosis, caused by *F.hepatica* and *F.gigantica* is one of the most prevalent helminth infections of ruminants in different parts of the world causing significant morbidity and mortality (Chala and Alemu, 2019). The current investigation revealed that out of the total 384 cattle slaughtered in Zefine municipal abattoir in Boreda district 93 animals were infected by fasciolosis with overall prevalence of 24.2%.

The current investigation was comparable with prevalence of 23.4% in Gondar Berhanu et al. (2019); 27.6%, in Jimma Horro District according to report of Dereje and Surra, (2018); 24.4% at Haramaya municipal abattoir according to report of Yusuf et al. (2016) and 25.2% at Dessie municipal abattoir based on report of Ephrem et al. (2012).

However, this finding was lower than reports of Adanech (2020) who reported 41.92% at Jimma abbatoir, Gebrie Yitayal and Wondmnew (2020) reported 56.4% prevalence at Bahirdar Municipal abattoir, Ayele et al. (2018) 58.6% at Debre birhan; Abdi et al. (2015) reported 50.79% prevalence in Ada'a Bega Woreda; and Kibruyesfa and Ture (2018) who reported 83.6% in Girja district. The current prevalence was relatively higher than the prevalence's such as 16.4% recorded in Bonga abattoir Wondimu et al. (2016), 20.3% in Tarcha Municipal Abattoir Mesfin et al. (2023), 20.2% in Wolaïta sodo (Adane et al. (2019). The variation in prevalence rate, epidemiology and Fasciola species involved vary with locality. Variations in the origin of the samples, ecological and climatic conditions such as altitude, rainfall, and temperature; animal management systems, sample size, and the inspector's ability to detect the infection

may all play a role in the difference of the prevalence of the current study among other researchers' findings across the country (Ababayehu and Wondimagegn, 2023; Abdi et al., 2015).

The result of the current study showed that age has significant effect ($P<0.05$) on the prevalence of bovine fasciolosis. There was a decrease in infection rate (prevalence) as age increased. Animals in young age categories proportionally highly infected than adult ones. This investigation is in agreement with Mohammed et al. (2016), Dereje Tulu and Surra (2018). The decrease in infection rate (prevalence) as age increase is the result of acquired immunity which is manifested by humeral respond and tissue reaction in bovine liver due to previous challenge and also reported that the increase resistance (low prevalence) as age increase is most likely related to the high level of tissue reaction seen in bovine liver, server fibrosis which impedes the passage of immature fluke, acquired resistance, thickening, stenosis and calcification of bile ducts, assumed unfavorable site for adult parasites and consequently fasten their explosion (Shiferaw et al., 2011; Nkurunziza et al., 2024).

This study indicated that the relatively similar prevalence was recorded between male and female animals. However, there was no significant difference ($P > 0.05$) observed between sexes. This suggesting that sex had no influence in contracting of disease. Similar reports support the current findings were Yitayal et al. (2015), Wakgari (2023), Seid et al. (2018), Kibruyesfa and Ture (2018) and Adane et al. (2019). The likely explanation might be that cattle (both male and female) in the study area graze in the same communal grazing land with similar agroecological condition so that the chance of contracting infections would be similar (Yosef et al., 2014).

Association of origin of animals with disease prevalence indicated that there was no significant association ($P<0.05$ among origin of animals and Bovine fasciolosis infection but the proportion varies among sites of animals originated. Similar reports from different parts of country; Negesse et al. (2014), Seid et al. (2018), Mesele (2022) and Kibruyesfa and Ture (2018); suggesting that the diseases prevalence was not associated with origin of animals though there was difference in prevalence rate. The variation in prevalence between the different locations was also likely due to the differences in landscape, such as

swampy areas, agricultural irrigation practices and deworming practice of farmers (Ahmed *et al.*, 2007).

According to body conditions, there was no statistical difference ($P>0.05$) was observed between age groups and fasciolosis infection. This finding is consistent with Seid *et al.* (2018), Kibruyesfa and Ture (2018), Tizazu and Ahmed (2017), Tizazu *et al.* (2017), and Yosef *et al.* (2014). The investigation of prevalence of fasciolosis in cattle based on breed category also indicated a non-significant association ($P>0.05$) with disease prevalence.

In present investigation the economic loss caused by bovine fasciolosis was estimated from the condemnation of the liver due to fasciolosis-inflicted abnormality. In the abattoir, all defective livers due to fasciolosis were considered unfit for human consumption and condemned. The annual financial losses attributed to the liver condemnation were estimated from the total number of animals (cattle) slaughtered in the study abattoir and the average price of the single liver in the abattoir and retail market. For the estimation, the prevalence rate of fasciolosis in the current investigation was used. Accordingly the annual estimated economic loss due to bovine fasciolosis was 580,800 ETB. This total estimated loss was lower than the reports from different country Adane *et al.* (2019), Mohammed *et al.* (2016), Asefa and Tegegne (2018). The reason behind may be lower number of cattle slaughtered in the study area annually. The ecological conditions and the number of intermediate host found around the area may also be another factor contributing to the decrement of the economic loss.

5. Conclusion and Recommendations

Bovine fasciolosis is a major problem in animal production, which causes decreases production, fertility, emaciation and disease and finally death. The result of this study indicates fasciolosis is 24.2% prevalent in study district. The occurrence is closely associated with presence of suitable environmental conditions for the development of snails also due to lack of strategic control measures against the disease. In general, this study indicated that fasciolosis is an important infection to livestock development in the study area. Based on the conclusion, the following recommendations are forwarded:

- Awareness creation on the preventive strategies such as drainage of marshy areas, clearing of aquatic vegetation's and seasonal strategic deworming of animals should be practiced.
- Draining or fencing of marshy areas, utilization of swampy areas for crop production, to protect the animals from infection during grazing.
- Detail epidemiological study should be carried out on biology and ecology of the intermediate host so as to develop a substantial planning and implementation on the control strategies of the disease.
- Expansion of animal health care delivery in the area including drug supply, prophylactic and other disease control strategies.

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