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Research Article

Prevalence of Bovine Fasciolosis and Its Economical Loss Due to Liver Condemnation at Bishoftu Municipal Abattior, Ethiopia

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Abstract

Fasciolosis is a major parasitic disease that constraints the livestock production and cause great economic loss due to liver condemnation caused by fasciolosis in abattoirs. A cross sectional study was conducted from March 2022 to August 2022 to determine the prevalence of liver fluke of cattle which were presented for slaughtered at Bishoftu municipal abattoir and to assess the direct economic loss due to liver condemnation caused by fasciolosis at this abattoir. The study was based on post-mortem inspection of livers of slaughtered animals at Bishoftu municipal abattoirs. Out of 384 examined cattle livers, 85 (22.1%) were found to be positive for fasciolosis. From of the total 85 (22.1%) fasciola positive liver, the prevalence of *Fasciola hepatica* was 15.88% and *Fasciola gigantica* was 6.25%. However, the difference was not statically significant (P > 0.05). There was significant association among different body conditions for the prevalence of bovine fasciolosis with the highest prevalence in poor body condition group was higher (27.4%) than the animals with medium body condition (25.8%) and good body condition (14.4%. The prevalence of bovine Fasciolosis based on breed, age and origin were statically insignificant (P > 0.05) though higher in local breed (22.5%) than cross breed (16.7%) and exotic breed (0%) as well as higher in adult (24.2%) than old (20.3%) and higher in Hararghe (34.4%) followed by Arsi (25.6%), Bale (18.9%), Adama (17.2%) and lower in Modjo (17.0%). The total annual economic loss of abattoir due to liver condemnation which resulted in, 541,450 ETB. The present study confirmed that bovine fasciolosis was found prevalent and affecting the health and productivity of animals as well as causing direct economical loss in study area. Control of intermediate host snail by biological control or chemical (molluscides), strategic anthelmintic treatment or management practice such as draining, fencing, proper watering and zero grazing in the area which animal come from is recommended.

Keywords: Abattoir; Bishoftu; Bovine; Fasciola; Financial loss; Prevalence

Introduction

Ethiopia has the largest livestock population in Africa, with 65 million cattle, 40 million sheep, 51 million goats, 8 million camels and 49 million chickens in 2020 [1]. Hence an increase in livestock's production could contribute to the attainment of food self-sufficiency in the country particularly in response to the protein requirement for the growing of human population as well as to enhance the export earnings. Moreover, livestock are important cultural resources, social safety nets and means of saving and are also supply for crop production and transport, as source of meat, milk and source of income [2].

In spite of large livestock population in Ethiopia, the productivity remains marginal, and this may be m mainly due to drought, infrastructures problem, poor husbandry practices, malnutrition, management and the most problem of prevalent diseases. Parasites are a major constraint of production (result in enormous both direct and indirect economic losses) through decreased productivity, reduced immunity, lower fertility, general stress, depression of immune function, costs of treatment and deaths [3]. Fasciola species are among the major parasitic diseases that have reduced meat production due to liver condemnation in abattoirs [4]. *Fasciola hepatica* and *Fasciola gigantica* remains economically significant parasite of livestock, mainly through mortality, morbidity, reduced growth rate, increased susceptibility to secondary infections like bacillary hemoglobinuria (red water) in cattle, liver condemnation, reduced meat and milk and as well as from treatment cost [5]. Man is also infected incidentally when infectious metacercariae are in-

gested with contaminated water or undercooked (raw) vegetables [6]. The parasite lives parts of its life in intermediate host mainly aquatic snails of the genus *Lymnaea,* which is found in and around marsh or wet areas, such as vast water lodged, irrigation and water holes, farm animals are likely to pick up the parasite if they are grazing that areas and drink from these sources [7].

The distribution of fasciolosis is totally dependent on the ecology of the snails which act as IH and serve as transmissions to animals. *Lymnaea truncatula* is a wide distribution worldwide, and the most common IH for *F. hepatica,* which spread mainly in temperate zones and cooler area of high altitude [8]. Whereas *Lymnaea natalensis* snail IH which transmission F. *gigantica* mostly found in the tropic's country likes western, sub-Saharan, and eastern Africa [9]. Adult flukes found in the bile duct of final Host and shed eggs into the bile then enter into the intestine to pass outside with feces [10].

Fasciola Species identification is possible grossly at the adult level. *F. gigantica* is longer and narrower than *F*. *hepatica* and is more of leaf like, may vary 30-75mm long, the conical anterior end is shorter than that of *F.hepatica*. On the other hand, *F. hepatica* is a leaf shaped fluke with broader shoulder anterior, measures 20-30 mm long and cone shaped posterior projection. It is grayish brown in color. *F. gigantica* appears to be the most common species in areas below 1200 meters above sea level while *F. hepatica* is widespread in areas with altitude above 1800 to 2000 meters above sea level [11].

Fasciolosis is associated with liver damage and hemorrhage due to migration of flukes through the liver parenchyma and cause liver condemnation at abattoir. The direct and indirect economic loss associated with affected liver condemnation at abattoir due to fasciolosis is reported in different parts of Ethiopia ranges from 86, 083.2 ETB ($2459.52) to 4, 439, 743.528 ETB (153, 094.604 USD) [12;13 14]. Bishoftu municipal abattoir is one of the slaughtering houses where the animal brought for slaughtering from the different altitude and environmental conditions of the area is conducive for the occurrence of Fasciola. However, little information is available about its prevalence and its economic loss due to liver condemnation caused by Fasciolosis at Bishoftu municipal abattoir. Therefore, this study was conducted to determine the prevalence of Fasciola species in liver of cattle slaughtered at Bishoftu municipal Abattoir; and to assess the magnitude of the direct economic losses caused by these parasites as consequence of liver condemnation.

Therefore, the objectives of this study were undertaken:

- To determine prevalence of fasciolosis on liver of cattle slaughtered at Bishoftu municipal Abattoirs.
- To assess the economic importance of liver condemnation due to liver fluke of slaughtered bovine at Bishoftu municipal abattoir.

Materials and Methods

Study area

The study was conducted from March 2022 to August 2022 at Bishoftu municipal abattoir, Oromia Region, Ethiopia. Bishoftu has an altitude of 1850 meter above sea level and experiences a bimodal rainfall pattern with a long rainy season from June to October and a short rainy season from March to May. The average annual rainfall and averages maximum and minimum temperature of the area are 800mm, 26^0C and 14^0C, respectively. The geographical (astronomical) location of Bishoftu town is approximately located at 8° 44' N latitude and 38° 57' E longitudes, 47 km Southeast of Addis Ababa at an altitude of 1950 meter above sea level [15].

Study design

A cross-sectional study was conducted to determine the prevalence of liver fluke of cattle which were presented for slaughtered at Bishoftu municipal abattoir and to investigate the direct economic importance of parasite infectious due to liver condemnation of cattle slaughter at Bishoftu municipal abattoir.

Study Population

The study animals were cattle that presented for slaughter purpose at Bishoftu municipal abattoir with different age, breed, Sex and body condition were used during the study period. The age of animals was determined based on dental eruption pattern and information from the owners, every sampled of cattle was recorded for age and categorized into adult age and old during sampling [16]. The body condition score was determined and fall in any of the three scores (Poor, medium and good) with the criteria for scores [16].

Sample size and sampling methods

A simple random sampling method was used and animals were selected in the lottery method in which all the ID of the cattle that was transported to Bishoftu municipal abattoir written on separate

slips of paper of the same size, shape and color and they were folded and mixed up in a container. The required numbers of slips were selected at random for the desire sample. The desired sample size was calculated using the standard formula described by [17] with 95% confidence interval, at 5% desired absolute precision and by assuming the expected prevalence of 50% used since there is no recently reported studies at Bishoftu municipal abattoir. Hence, the sample size was calculated to 384. The estimated sample size was calculated by the formula:

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

Where, n = Sample size

Pexp = Expected prevalence (50%)

1.962 =the value of Z of 95% confidence level

d = Desired absolute precision = 5%,

n = 384 animals

Study methodology

Active Abattoir Survey was performed

Ante mortem examination

Ante mortem inspection was conducted on individual animals entering in to the lairage and after they entered the lairage in mass. During ante mortem inspection each of the study animals were given identification code with paint on their body and all the necessary independent variables such as origin, age, sex, breed, and body condition score was recorded before the animal's slaughters. The body condition of study animal was classified into three main categories as poor, medium and good based on observation of muscle mass on ribs: hips point, tail head, spine and transverse processes [18]. The age of animals was be determined based on dental eruption pattern and information from the owners, every sampled of cattle was recorded for age and categorized into adult age (below or equal to 5 year) and old age (equal or above 6 year during sampling [16].

Postmortem examination

During postmortem inspection the liver of each study animal was carefully inspected by visualization, palpation and making systemic incisions based on routine meat inspection for the presence of Fasciola species. All Fasciola positive liver were condemned and registered for fluke's species identification conducted [19]. Each mature Fasciola was identified to species level depend on its size and shape. Identification of fluke species was done regarding to their morphological characteristics [20].

Direct financial loss analysis

The Direct Annual total financial loss suffered due to fasciolosis infection in Bishoftu Municipal abattoir was estimated based on liver condemnation. The economic loss due to liver condemnation was estimated through interview made with local butcher men in bishoftu town, the average price of each cattle liver was calculated to be 350 Ethiopian Birr. The direct Annual loss was thus computed according to the formula adopted by Ogunrinade [19]. Using the market price of a bovine liver, the monetary loss occasioned by condemnation of Fasciola infected livers was calculated as follows

AELDLC = ANCS * ACL * P

where:

AELDLC= Annual Economic loss estimated due to liver condemnation

ANCS = Annual Average number of cattle slaughtered in Bishoftu municipal abattoirs

ACL= Average cost of each cattle liver

P= prevalence % (Condemnation rates of cattle liver due to fasciolosis)

Data management and analysis.

All information and data that was collected on liver fluke and economic importance of this parasite during the study period was enter to MS excel Sheet and analyzed using SPSS version 20 software. Descriptive Statistics was used to determine the prevalence through percentage and frequency. The significance of association between and among the considered variables was determining using p-value, chi-square ($\chi 2$) test statistics. Association between variables were said to exist if the calculated level of significance is less than 5% ($p < 0.05$) at 95% confidence level.

Result

Out of the total 384 cattle of different age and breed group slaughtered in Bishoftu municipal abattoirs and examined in the study period 85(22.1%) were Fasciolosis positive (Table 1).

On the bases of origin difference Fasciola infection prevalence rate was higher in Hararghe (34.4%) was followed by Arsi (25.6%), Bale (18.9%), Adama (17.2%) and lower in Modjo (17.0%). However, the difference was not statically significant ($P > 0.05$ (see Table 2).

The prevalence of cattle Fasciolosis based on age group was higher in adult (24.2%) and lower in old (20.3%). However, the difference was not statically significant ($P > 0.05$ (see Table 2).

Result	Post-mortem examinations (Prevalence %)
Positive	85 (22.1%)
Negative	299 (77.9%)

Table 1: Overall Prevalence of bovine fasciolosis result.

Based on body condition Infection rate of fasciolosis in poor body condition group was higher (27.4%) than the animals with medium body condition (25.8%) and good body condition (14.4%). Statistical analysis of the data confirmed the presence of significant difference ($p < 0.05$) on the prevalence of fasciolosis in cattle on the basis of body condition score (see Table 2).

The prevalence of cattle Fasciolosis based on breed group was highest in local breed (22.5%) than cross breed (16.7%) and exotic breed (0%). However Statistical analysis of the findings showed that there was no significant difference ($P > 0.05$) on the prevalence of fasciolosis among cattle on the basis of their breed (see Table 2).

The prevalence of cattle Fasciolosis based on Fasciola species out of 85 livers found to contain fluke infection during my study period and at postmortem inspection 61(15.8%) harbored *F. hepatica* and 24(6.3%) was harbored *F. gigantica infection*. The prevalence of postmortem liver examination revealed *F. hepatica* higher than *F. gigantica* infection. However, the difference between the two species was not statically significant ($p > 0.05$) (see Table 3).

Category		No of examined liver	No of positive	No of negative	Prevalence (%)	X^2	P-value
Animal origin	Adama	99	17	82	17.2		
	Hararghe	64	22	42	34.4		
	Arsi	78	20	58	25.6		
	Bale	90	17	73	18.9		
	Modjo	53	9	44	17.0	8.901	0.064
Age	Adult	182	44	138	24.2		
	Old	202	41	161	20.3	0.836	0.361
Body Condition	Poor	62	17	45	27.4	7.066	0.029
	Medium	190	49	141	25.8		
	Good	132	19	113	14.4		
Animal Breeds	Local	373	84	289	22.5	1.558	0.459
	Exotic	5	0	5	0		
	Cross breed	6	1	5	16.7		

Table 2: Prevalence of bovine Fasciola based on origin, age, body condition and animal breed.

The distribution of Fasciola species with respect to animal origin with *F. hepatica* (15.2%) and *F.gigantica* (2.0%) Adama, *F. hepatica* (23.4%) and *F.gigantica* (10.9%) Hararghe, *F. hepatica* (17.9%) and *F. gigantica* (7.7%) Arsi, *F.hepatica* (11.0%) and *F.gigantica* (7.8%) Bale, *F. hepatica* (13.2%) and *F. gigantica* (3.8%) Modjo. However, the difference was not statically significant ($P > 0.05$) (see Table 3).

Direct financial loss analysis

The direct Annual economic significance of fasciolosis was analyzed based on the information obtained during postmortem examination and local butcher man interview. For any fluke positive livers, total condemnation. Prevalence of totally condemned liver due to Fasciolosis and the selling price of the livers expressed as Ethiopian Birr. Annual economic loss due to liver condemnation was calculated, by.

AELDLC = ANCS * ACL * P = 7000*350*22.1% = 541,450 ETB

Discussion

The main pillars of meat inspection are to monitoring the diseases by providing feedback information to the veterinary service to prevention, control and eradicate diseases to increase products and to protect the public health from zoonotic [21]. Bovine Fasciolosis is endemic in whole of Africa as well as widespread

Fasciola species	No of detected	Animal Origin					Prevalence (%)	X^2	P-Value
		Adama	Hararghe	Arsi	Bale	Modjo			
F.hepatica	61	15(15.2%)	15(23.4%)	14(17.9%)	10(11.0%)	7(13.2%)	15.88	4.012	0.404
F. gigantica	24	2 (2.0 %)	7(10.9%)	6(7.7%)	7(7.8%)	2(3.8%)	6.25		
Total	85	17(17.2%)	22(34.3%)	20(25.6%)	17(18.9%)	9(17.0%)	22.1		

Table 3: Prevalence and distribution of Fasciola species with respect to animal origin.

and causes significant economic losses to the livestock industry of Ethiopia. But the prevalence rate and Fasciola species involved vary from place to place. The prevalence has been varying over the years mainly due to variation in amount and pattern of rainfall which suitable for IH production.

The overall prevalence of bovine fasciolosis (22.1%) observed in this study is close agreement with the reported by Petros., *et al*. [22], Afera B [23], Berhe., *et al*. [24], Yusuf *et al*. [25] and Belay., *et al*. [26] who reported prevalence of 21.6%, 21.5%, 24.3%, 24.4%, 25.2% at Nekemte Municipal Abattoir, municipal Abattoir of Adigrat, in Mekelle Area, Municipal Abattoir of Haramaya and Dessie Municipal Abattoir, Ethiopia. This result also closed agreement with the reports of Nuraddis., *et al*. (2010) who reported prevalence of 28% at Kombolcha Industrial Abattoir, Ethiopia and with the prevalence (27.1%) reported by Rahmeto [27] in Woliso and (28.63%) by Birhane [28] at Hawassa as well as Pfukenyi and Mukaratirwa [29] from Zimbabwe reported prevalence of 31.7%. This may be due to agro-ecological conditions such as altitude, rainfall and temperature favouring for the development of intermediate hosts and the parasite stages.

However, the result of the current studies much lower than that of many other studies from different abattoirs in the country and elsewhere in Africa. Tolosa and Tigre [30] recorded prevalence of 46.2% at Jimma abattoir, Moges E [31] recorded prevalence of 57.58% in Jimma municipal abattoir, Yilma and Mesfin [32] recorded prevalence of 90.7% in Gondar abattoir, Manyazewa., *et al*. [33] recorded prevalence of 47.1% in Mettu abattoir, Ethiopia and Phiri., *et al*. [34] from Zambia reported prevalence of 53.9% and 63.8% recorded prevalence from Tanzania by keyyu., *et al*. [35]. This great variability shown is probably due to the ecological and climatic differences between different locations throughout the country. Unlike others which has no marshy area and rivers along the side of grazing areas which unsuitable for intermediate host.

On the other hand, (22.1) or the present research was slightly higher than prevalence of fasciolosis (14.0%) has been observed in slaughtered cattle at Wolaita Soddo abattoir (36), (16.4%) in Bonga Abattoir, Kafa Zone, Southwestern Ethiopia [37] and 14.4% at Dire Dawa Abattoir [38]. The present study also higher prevalence than other reports such as 12.5% at Aira and Gulliso District, Western Wollega Zone [39], 4.9% in Soddo Abattoir [36] and 11.09% in Iran [40]. This variation of prevalence is due to variation in the climatic and ecological conditions such as altitude, humidity, rainfall, temperature, management system and level of veterinary service. The occurrence of fasciolosis in area is based on three main factors which comprise host (final and intermediate), availability of Fasciola parasite and environmental effect. So, this research unlike others which has may be high marshy area and rivers along the side of grazing areas and around irrigation area which comfortable for intermediate host.

Postmortem examination on the 85 (22.1%) Fasciola infected livers of current results indicated that the prevalence of *F. hepatica* 61 (15.88%) was higher than that of *F. gigantic* 24 (6.25%). This is Similar study within conducted at Jimma municipal abattoir reported 60.3%; of liver harboured *F.hepatica*, 23.85% of liver harbored *F. gigantica* species were recorded by Tolosa and Tigre [30]. The higher prevalence of F. hepatica related with the availability of favorable ecological condition for snail vector *Lymnaea truncatula* and the parasite itself at the origin of animals brought to the abattoir for slaughter. Moreover, in Ethiopia *F. hepatica* and *F. gigantica* infections occur in areas above 1800 m.a.s.l. and below 1200 m.a.s.l. respectively. This has been attributed to variations in the climatic and ecological conditions such as altitude, rainfall, temperature, and livestock management system [41].

The prevalence of bovine fasciolosis being higher in hararghe (34.4%), Arsi (25.6%), Bale (18.90, Adama (17.2%) and lower in Modjo (17.0%), this due to the ecological and climatic difference, however Statistical analysis of the findings showed that there was no significant difference ($P > 0.05$) on the prevalence of fasciolosis and animal origin. There was no statistical difference ($P > 0.05$) in prevalence between animal age group which adults (24.2%) and old animals (20.3%). This shows that age groups do not problem for the prevalence of fasciolosis in bovine and hence both age groups are susceptible to the diseases as well. The prevalence of

fasciolosis was higher in poor body conditioned animals followed by medium and lower in good body conditioned animals with fasciolosis prevalence rate of 27.4%, 25.8%, 14.4%, respectively. The prevalence of fasciolosis was higher in the animals with poor body condition because this body condition in cattle is manifested when fasciolosis reaches at its chronic stage and due to differences in their resistance for concurrent infection. Statistical analysis of the data showed the presence of significant difference ($p < 0.05$) infection on the prevalence of fasciolosis among the three different body conditions of the examined animals. This finding is in agreement with study conducted by Alula., *et al*. [42].

The economic loss caused by bovine fasciolosis of these abattoirs was vast annually. The direct economic loss contracted (incurred*)* annually as a result of liver condemnation of cattle was estimated about, 541,450 ETB per annually. The total annual economic loss recorded in this study is higher than at Hawassa Municipal abattoir, southern Ethiopia, which is 106, 400 ETB recorded by Rahmeto., *et al*. [27].

Conclusion and Recommendation

The present study confirmed that bovine fasciolosis was found prevalent and affecting the health and productivity of animals with an overall prevalence rate of (22.1%) in the study abattoirs. The occurrence of fasciolosis is linked within the presence of ecological and environmental condition which suitable for the development of snail intermediate host and parasite itself. The study confirmed that there was significant difference in the prevalence of fasciolosis within animal body condition or it's more prevalent in cattle with poor body condition scores than medium and good body conditioned animals. As this abattoir study explained that bovine fasciolosis causing great economic losses as a result of condemnation of affected livers.

Based on the above conclusion the following recommendations are forwarded

- Control intermediate host snail by biological control or chemical(molluscides) or management practice such as draining, fencing, proper watering and zero grazing in the area which animal come from.
- Give awareness for the farmers how to control diseases and regular deworming of animal because prophylaxis is better than curative treatment.
- Strategic anthelmentic treatment with appropriate flukicidal drugs.

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