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Prevalence of Bovine Fasciolosis and Associated Financial Loss due to Liver Condemnation at Jimma Municipal Abattoir, Jimma, Ethiopia

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Abstract

A cross-sectional study was conducted at Jimma municipality abattoir fromNovember 2015 to March 2016 with the objectives to estimate the prevalence of liver flukes in local adult cattle slaughtered in the abattoir, to identify the species of Fasciola and to assess the financial loss due to liver condemnation. Livers and feces of a total of 400 randomly selected cattle slaughtered at the abattoir were examined postmortem for liver flukes and their ova respectively. Of the 400 livers and fecal samples examined during the period, 194 (48.5%) and 92 (23.0%) were positive for fasciolosis at postmortem and coprological examinations respectively. Both species of Fasciola were identified during the study. However, *F. hepatica* was the more prevalent (23.0%) liver fluke species affecting cattle slaughtered in the area compared to *F. gigantica* (11.5%). There was strong association (P<0.001) between body condition and *Fasciola* prevalence. Comparison of coprological examination with postmortem examination by taking the later as a gold standard, demonstrated moderate agreement between the two (*kappa* statistic = 0.44). The annual financial loss due to liver condemnation associated with liver flukes at the abattoir was estimated to be 6,905,430 Ethiopian birr. It is concluded that fasciolosis is prevalent in areas which supply slaughter cattle to Jimma municipal abattoir and the financial loss associated with liver condemnation due to fasciolosis is significant.

Keywords: Abattoir, Bovine, Economic loss, Fasciolosis, Jimma, Prevalence,

Introduction

In varied agro-climatic zone of Ethiopia, ruminant livestock are important source of income for rural and urban communities and are one of the nation's major sources of foreign currency from export. However, the rich potential from livestock sector is not efficiently and fully exploited due to several constraints like malnutrition, traditional management practice, poor genetic makeup and prevailing diseases (Daynes and Graber, 1974; Bekele *et al.*, 1992).Bovine fasciolosis is one of an economically important parasitic disease of cattle in tropical and sub-tropical countries that limit productivity of an animal and its cause isFasciolidae, which are trematode of genus Fasciola. The most important species of this genus are *F.hepatica* and *F.gigantica* which are commonly known as liver flukes (Urquhart *et al.*, 1996). Both *F.hepatica* and *F.gigantica* are transmitted by the snail of the family Lymnaesidae. Infestation with fasciolosis is usually associated with grazing wet land and drinking from the snail infested watering places (Payne, 1990). The development of infection in definitive host is divided in to two phases; migratory phase and biliary phase (Dubinsk, 1993).

The distribution of fasciolosis is worldwide however; the distribution of *F.hepatica* limited to temperate areas and highlands of tropic and sub-tropical regions (Soulsby, 1982). The definitive hosts for *F.hepatica* are mostly mammals among which sheep and cattle are the most important ones. The geographic distribution of trematode species is dependent on the distribution of suitable species of snails. The genus lymnaea in genera and *L.truncatula* in particula is the most common intermediate hosts for *F.hepatica*. The species of snail was reported to have a worldwide distribution (Urquhart *et al.,* 1996). The distribution of *F.gigantica* was mainly localized in the wester mid zone of the country that encompasses approximately ¼ of the nation (Malone *et al.*, 1998).According to the WHOreport, fasciolosis infection was limited in the past two specific and typical geographicareas, but is now widespread through the world; with human cased being increasingly reported from Europe, America, Oceania, Africa and Asia. As consequence, fasciolosis and other trematodes should be considered as potential zoonosis of major global and regional importance (WHO, 2007).

Fasciolosis is more apparent in young cattle and usually chronic in nature. Adult fluke in the bile duct cause inflammation, biliary obstruction, destruction of liver tissue and anemia. In this regard, the immature and adult flukes greatly affect growth rate and feed conversion of young animals. Acute hepatic fasciolosis, mainly a condition in sheep, has been described in calves exposed to large number of cercariae may lead to death (Urquhart *et al*., 1996). *F. hepatica* and *F. gigantica* arefound in Ethiopia and are transmitted by *L. truncatula* and *L.natalensis* respectively and various report indicated that it is a serious problem of livestock production in Ethiopia causing considerable economic loss. Recently, small scale traditional irrigation scheme is expanding in many parts of the country. Hence, it is anticipated that implementation of irrigatedagriculture is creating favorable habitat for intermediate snail vector there by influence and the occurrence of fasciolosis (Michael *et al*., 2001).

Several researchers (Abebe, 1992, Abebe, *et al*., 2010, Abunna, *et al.,* 2010, Jobra and Malone, 2000) have reported the prevalence and economic significance of fasciolosis in Ethiopia. It was recorded that it causes wide spread mortality and morbidity in cattle, sheep, and goats throughout the world (Blood and Radostits, 1994, Okewole*et al.,* 2000). *F. gigantica* is similar in shape to *F. hepatica* but is larger (75 mm) with less clearly defined shoulder. It is found in warmer climates (Asia and Africa) in cattle and buffalo, in which it is responsible for chronic fasciolosis, and in sheep in which the disease is frequently acute and fatal. The life cycle is similar to that of *F.hepatica* except for species of snail intermediate host such like *L.natelensis*.The pathology of infection, diagnostic procedure, and control measure are similar to those for *F.hepatica* (Andrews, 1999).

Under Ethiopian condition *F. hepatica* is found at altitudes below 1800m.a.s.l while *F.gigantica* is found at altitudesbetween 1200-2500m.a.s.l and mixed infections can be encountered at 1200-1800 m.a.s.l (Yilma and Maone, 1998). The genus lymnaea are the intermediate host for species of Fasciola whiles the epidemiology of fasciolosis dependent on the ecology of the snail intermediate host. Intermediate hosts of *F.hepatica* are fresh water snails from family Lymnaeidae (Torgerson and Clayton, 1999; Graczyk and Fried, 1999). Snails from family planorbidae act as intermediate hos of *F.hepatica* very occasionally (Mas-coma, *et al*., 2005).

Diagnosis of fasciolosis is based primarily on clinical sign and seasonal occurrence in endemic areas but previous history of fasciolosis on the farm or identification of snail habitats; postmortem examination, hematological tests and examination of feaces for fluke eggs are useful. Coprological analysis is still commonly employed to diagnosis Bovine Fasciolosis, despite the fact that eggs cannot be detected until latent period of infections, when much of liver damage has already occurred (Rokini*et al*., 2003). Even though, it is impossible to detect Fasciola in live animals, liver examination at slaughter or microscopy was found to be the most direct, reliable, and cost effective technique for diagnosis of fasciolosis (Urquhart *et al*., 1996).

The economic loss due to these adult and immature parasite reported by several works in different regions of the country. For instance, a high economic loss was incurred due to Fasciolosis in different municipal abattoirs (Moges, 2003; Zewdu, 1991). A number of individuals reported the prevalence of bovine fasciolosis in different parts of the Country. According to these reports, the prevalence rate are 47.45% in Jimma by Zewdu (1991), 88.57% in Debrebrhan town by (Dagne, 1994) 53.49% in combolcha by (Mulugeta, 1993) and According to the study conducted by Fufa*et al.,* (2009), fasciolosis caused an average loss of 4000 USD perannum at

Soddo municipal abattoir. In general, the presence of fasciolosis due to *F.hepatica* and *F.gigantica* in Ethiopia has long been known and several Workers (Dagne, 1994, Daniel, 1995, Fufa, *et a l*., 2009; and Tadele and Worku, 2007) have reported its prevalence and economic significance. Therefore, the objectives of current study were to estimate the prevalence and economic importance and to identify species of bovine fasciolosis at the study area.

Materials and Methods

Study area

The study was carried out in Jimma zone, southwestern part of Ethiopia at Jimma munincipality abattoir in Jimma town. Jimma town is located in Oromia regional administration, 355km south west of Addis Ababa at latitude of about 7^0 13'-8^0 56'N and longitude of about 35^0 52'-37^0 37'E and at an elevation ranging from 880m to 1704m a s l.The study area receives a mean annual rainfall of about 1530 ml, which comes from the long and short rain seasons. The annual minimum and maximum temperature during the study period was 14.4 and 26.7^{o}c respectively (Dereje and Surra, 2018).

Study design

A cross sectional study type was conducted to determine the prevalence rate and the economic significance of bovine fasciolosis by using post mortem examination of different organs in general and liver of each slaughtered animal's particularly. Feces were also collected from the rectum of each study animal for detection of Fasciola eggs.

Study population

The study animals comprised male cattle that were presented for slaughter from different localities in Jimma municipal abattoir.

Sample size and sampling strategy

Systematic random sampling method was employed to generate data for the study. Thus, taking 50% expected prevalence 95% confidence interval and 5% desired absolute precision. The sample size used for the present study was calculated by using the formula;

$$n = \frac{1.96^2[P_{EXP}(1-P_{EXP})]}{d^2}$$

n = required sample size
1.96 = the value of z at 95% confidence interval
Pexp = expected prevalence
d = desired absolute precision the estimated sample size was 382.

Accordingly, the sample size was determined to be 382. However, large numbers of animals were slaughtered at the abattoir and thus, the sample size was maximized to be 400 cattle to increase precession (Thrustfield 2005).

Study methodology

The sampled cattle were examined for the presence of Fasciola interested by coproscopic and post mortem examination. The origin, age, body condition and general health condition of each study animal was recorded.

Coproscopic examination

Fecal sample was collected directly from the rectum by using gloves or from the ground immediately after defecation. The collected fecal sample was placed in clean universal bottle and the universal bottle was labelled with identification number which matched with the detail data recorded using the standard format. The collected sample was transported to Jimma University parasitology laboratory and examined grossly and microscopically.

Ante mortem inspection

Each animal was identified based on enumerate marks on its body marked before slaughter and assessment of body condition was carried out using a modified method. Attention was given to the factors such as age, body condition and origin of the animals to determine the impact of these factors on the disease picture; however, almost all cattle presented for slaughter were local breed and males.

Post mortem examination identification

Liver of each slaughtered animal was carefully examined by visualization and palpation of the entire organ that was followed by transverse incision of the organ across the thin left lobe in order to confirm the case or the problem. Species identification of the recovered Fasciola was also performed based on the morphological features of the agents and classified in

to F. hepatica and F. gigantic, immature and mixed forms of liver fluke.

Calculation of financial loss

The total annual economic loss incurred due to fasciolosis at Jimma municipal abattoir was estimated based on liver condemned and reduction in beef production. The average price of 1 liver and 1kg beef in Jimma town was about 70, 120 Ethiopian birr respectively. The average number of cattle slaughtered at the Jimma municipal abattoir is estimated to be 9000 per year -based on five month of recorded data. A 10% estimated carcass weight loss due to Fasciolosis was the parameter used for calculating carcass weight loss (Mulugeta, 1993). 120 kg is the estimated average carcass weight of Ethiopia Zebu (ILCA, 1982). Therefore total annual economic loss incurred because of liver condemnation and carcass weight loss due to fasciolosis was estimated by the following formula.

Total annual liver condemnation (ALC)

1. Annual estimated value = NALxCLx PRV (percentage)

Where NAL= Average number of cattle slaughtered at Jimma municipal abattoir per year.
CL = mean cost of one liver in Jimma town
Prv= prevalence of liver condemned due to fasciolosis.

2. In direct annual loss due to reduction of meat(IAL) = NAL xCLxPAxPrv

Where; NAL = Average number of cattle slaughtered per year at Jimma municipal abattoir.
CL= Carcass weight loss in individual cattle due to fasciolosis.
PA= Average price 1kg beef in Jimma town
Prv= prevalence rate of fasciolosis at Jimma municipal abattoir.

The total annual economic loss due to fasciolosis at Jimma municipal abattoir is therefore;
=1+2

Data analysis

Data was obtained from history, direct observation, necropsy and coproscopic examination and was recorded on Microsoft excel and analysed with Stata version 11 statistical software.

Results

Postmortem examination

Postmortem examination of livers of 400 cattle slaughtered at Jimma municipal abattoir showed that 194 (48.5%) were infected with *Fasciola*. Both *F. hepatica* and *F. gigantica* were identified in the present study. *Fasciola gigantica* was identified in 46 (11.5 %) of the study animals while *F. hepatica* was recovered from 92 (23.0%) cattle livers (Table 1)

Table 1. Over all postmortem prevalence of bovine fasciolosis in Jimma municipal abattoir

Fasciola spp	Observation	No. positive	Prevalence (%)
F. gagantica	400	46	11.5
F. hepatica		92	23.0
Immature		26	6.5
Mixed		30	7.5
Overall	400	194	48.5

Coprological examination

Out of the total of 400 cattle feces examined for Fasciola eggs 92 (23.0%) were positive. By taking postmortem examination as a gold standard, the result of fecal examination using sedimentation procedure was compared with that of postmortem results of the same animals (400). Accordingly, there was moderate agreement between coprological and postmortem results (kappa statistic = 0.44) (Table 2).

Table 2. Test agreement between coprological and postmortem examination

Examination type		Postmortem examination		Total
		Positive	Negative	
Coprological test result	Positive	88	4	92
	Negative	106	202	308
Total		194	206	400

Kappa= 0.440943

Association between body condition, month, origin and age with *Fasciola* prevalence

There was no significant association between postmortem Fasciola prevalence and age and origin of the animals and month of examination (P >0.05). There was however significant (P <0.001) association between body condition of the animals and *Fasciola* prevalence. Prevalence was highest in animals with poor body condition (76.0%) followed by medium (50.4%) and good body conditioned animals (31.8%) (Table 3).

Table 3. Postmortem prevalence of Fasciola based on body condition, month, origin and age.

Factor	Level	Observation	No. positive	Prevalence (%)	95% CI	P value
Body condition	Poor	96	73	76.0	67.4-84.7	0.000
	Medium	131	66	50.4	41.8-59.0	
	Good	173	55	31.8	24.8-38.8	
Month	November	115	62	53.9	44.7-63.1	0.344
	December	100	50	50.0	40.1-59.9	
	January	80	37	46.3	35.2-57.3	
	February	70	33	47.1	35.2-59.0	
	March	35	12	34.3	18.3-50.3	
Origin	Agaro	42	19	45.2	30.0-60.5	0.195
	Asendabo	62	24	38.7	26.4-51.0	
	Dedo	48	18	37.5	23.6-51.4	
	Kersa	60	34	56.7	44.0-69.3	
	Mena	46	22	47.8	33.2-62.5	
	Seka	84	44	52.4	41.6-63.2	
	Serbo	58	33	57.0	44.0-69.8	
Age	<5	45	18	40.0	25.5-54.5	0.295
	5-9	278	134	48.2	42.3-54.1	
	>9	77	42	54.5	43.3-65.8	

Financial Loss

The monetary loss incurred due to condemnation of infected liver and carcass weight loss was assessed in Jimma municipal abattoir. The average cost of one liver and 1kg beef in Jimma town during study period was confirmed to be about 70 and 120 Ethiopian birr. Based on this information the loss estimated to be 30550 ETB due to liver condemnation and 6599880 ETB due to reduction in meat production. The total annual monetary loss due to fasciolosis was found to be 6905430 ETB in Jimma municipal abattoir.

Discussion

The result of present study provides the prevalence of fasciolosis in cattle to be 48.5%. The current finding was found to be in line with that ofTadele and Worku (2007) that showed prevalence (46.58%) of fasciolosis in cattle in Jimma and with Zewdu (1991), Moges (2003) and Shimeles (2009) that reported 47.5%, 58.24% and 54.5% respectively.

The prevalence of fasciolosis in this study was lower than that reported by Amsalu (2008), Fekadu (1988) and Yohannis (2008) that reported prevalence of cattle fasciolosis to be 61.38%, 61.97% and 84.7% in Bahrdar respectively. The reason for these differences in prevalence might be due to variations in geographical regions depending on the climatic condition, availability of permanent and temporary water availability, system of management, humidity, temperature, soil, moisture and elevation from sea level that may favors multiplication of intermediate host (Losos, 1986). From the total livers infected by Fasciolosis (48.5%), 23.0% of them were found to be infected by *F.hepatica* whereas *F.gigantica*, immature or unidentified and mixed flukes of Fasciola species were recorded to be 11.5%, 6.5%and 7.5% respectively. Amsalu (2008) reported infection rate of cattle with *F. hepatica* (49.78%), *F.gigantica* (29%) and mixed infection (20.9%) at Bahr Dar municipal abattoir. Wakuma (2009) showed Prevalence of *F.hepatica* (64.5%), *F.gigantica (*24.8%) and mixed (10.7%) at Bedele municipal abattoir. Tadele and Worku (2007) at Jimma abattoir recorded prevalence of *F.hepatica* (63.8%), *F.gigantica* and mixed to be recorded (24.8%) and (16.5%) respectively. Abie *et al.* (2012) at Jimma municipal abattoir showed prevalence of *F. hepatica* (65.4%) , *F.gigantica*, mixed and immature flukes of Fasciola species were recorded to be 36.0%,11.5% and 10.1% respectively. This difference might be attributed to variation in season of study and geographical differences of the study area.

The prevalence of fasciolosis was found to be 76%, 50% and 31.8% in poor, medium and good body conditioned animals, respectively. The results of the present study indicated that infection in poor body condition animals were significantly higher ($p<0.05$) than that of medium and good body conditioned animals. This may indicate the importance of fasciolosis in causing weight loss and emaciation to be a characteristic sign of the disease. Additionally, this high prevalence of fasciolosis in poor body condition animals could be justified by the fact given by Devendra and Marca (1983) who indicated that cattle of poor body condition are vulnerable to parasitic diseases.

At the present study, total annual economic losses due to liver condemnation and carcass weight loss was estimated at Jimma municipal abattoir to be 6,905,430 ETB. The economic loss in present study was higher than the result of Roman (1987) who estimated the economic loss to be about 497,752 Ethiopian birr at Gondar abattoir and Amsalu (2008) and Yohannes (1994) who estimated about 2,472,535.4 and 200,000 Ethiopia birr at Bahir Dar respectively. Zewdu (1991), Tadele and Worku (2007), Shimeles (2009) and Abie *et al*., (2012) reported the economic loss that estimated to be about 480,789.0, 54,063.34 and 2, 44,500.84 Ethiopia birr in the same study area. This variation may be due to difference in price or cost of the liver and beef from time to time in the study area and country in general.

Conclusion and Recommendation

The present study confirmed that there is a high prevalence of Fasciola infection in cattle in districts of Jimma zone which supply the town with slaughter cattle. It also demonstrated the existence of the two species of liver fluke namely *Fasciolahepatica* and *Fasciola gigantic* in areas supplying slaughter cattle for Jimma town. From the high prevalence of Fasciola recorded in the study it can be concluded that there is a lot of loss in productivity of cattle in the study areadue to fasciolosis. Therefore, emphasis should be given to the design and implementation of appropriate control strategies of the parasite in different agro ecologies of the country and to educate farmers about the lifecycle and impact of the disease.

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