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Economic Significance of Fasciolosis at Mettu Municipal Abattoir, Southwest Ethiopia

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Abstract

A study was conducted to determine the prevalence and economic significance of fasciolosis in cattle slaughtered at Mettu town municipal abattoir, Southwest Ethiopia. A total of 663 animals were randomly selected from the indigenous zebu cattle brought to the abattoir during October 2008-May 2009. Retrospective assessment, Ante-mortem examinations, body condition scoring and Post-mortem inspections were performed to collect data. Out of the total examined animals 47.1% (312/663) were found positive for Fasciola parasites. Two species of Fasciola: *Fasciola hepatica* and *Fasciola gigantica* were detected with prevalences of 26.9% (178/663) and 11.8% (78/663), respectively, mixed infections by both species were 4.8% (32/663) and immature (unidentified) flukes were 3.5% (24/663) of the total infections. The difference in prevalence of *Fasciola hepatica* and *Fasciola gigantica* was found to be significant (P=0.000). Prevalence of the disease was also determined in relation to body condition score of the sample animals whereby 319 and 344 animals were categorized under Good and Medium body condition score sub-groups, respectively. It was found that 41.7% (133/319) of the Good score animals and 52% (179/344) of the medium score animals were positive for Fasciola parasites, and the difference in prevalence between the two sub-groups was statistically significant (P=0.008). The annual direct economic loss due to liver condemnation and the annual indirect economic loss due to carcass weight reduction were estimated to be 4,757.00 USD (47,570.00 birr) and 46,615.00 USD (466,150.00 birr), respectively; hence, the total economic loss due to fasciolosis in cattle slaughtered at Mettu municipal abattoir was estimated to be 51,372.00 USD (513,720.00 birr). In conclusion, bovine fasciolosis due to *Fasciola hepatica* and *Fasciola gigantica* was observed to be an economically important disease in Mettu and its surrounding districts. Further studies on small ruminant species and local epidemiology of the disease are suggested to enable control of the infection in the area.

Keywords: Fasciola hepatica; Fasciola gigantica; zebu cattle; Prevalence.

Introduction

Bovine fasciolosis is an economically important cosmopolitan parasitic disease caused by Fasciolide trematode of the genus Fasciola. Infections occur when livestock graze in snail habitats especially in ditches, marshy areas, edge of water channels and flooded plains (Archi, 1994). Productivity losses attributed to helminth parasites are considerable and fasciolosis is a major factor in this aspect (Mulugeta *et al*., 1989; Goll and Scott, 1978). The direct loss due to fasciolosis includes host mortality and liver condemnation at abattoirs while the indirect loss consist body weight losses, decreased birth weight of lambs and decreased wool production (Scott and Goll, 1977; Behrm and Sangester, 1999). In Ethiopia, the economic loss caused by bovine fasciolosis due to decreased productivity alone was estimated to 350 million birr per annum (Gemechu and Mamo, 1979).The prevalence and economic significance of fasciolosis had been reported from different parts of the country (Tolosa and Tigre, 2007; Gebretsadik *et al*., 2009). A study on fasciolosis in Southwest Ethiopia showed an overall prevalence of 74.8%, (Manyazewal *et al*., 2013). Fasciolosis, locally called 'Balle' had been reported as the most prevalent helminth infestation in large and small ruminant species in Iluababora zone (IluAbaBora LDMHA, 2001), nevertheless,

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the economic importance of the disease has not been quantified so far in the area. Therefore, this study was designed to determine the prevalence of fasciolosis and to estimate the financial losses attributable to the disease in cattle slaughtered at Mettu Municipal abattoir in Southwest Ethiopia.

Materials and methods

Study area

The study was conducted at Mettu town municipal abattoir in Southwest Ethiopia. Mettu is situated at a distance of 600 kms Southwest of Addis Ababa and is located at a latitude of 8^{o} 15'North and longitude of 35^{o} 45' East at an altitude of 1700 m above sea level. The study area receives a mean annual rainfall of 2000 mm and the annual temperature ranges from 18-25^{o}C (Iluababora LDHMA, 2001).

Study Design

Cross-sectional and retrospective study designs were used to collect the required data for the study. The sample size for the cross-sectional study was determined using the formula for simple random sampling by Thrusfield (1995) with 95% confidence and 50% expected prevalence, hence, 663 cattle were randomly selected for sampling from the total cattle brought to the abattoir. Documented data of three years, i.e. 2007-2009, were collected from the record book of Mettu municipal abattoir.

Ante-mortem Examination

During ante-mortem examinations identity tag numbers were given to the selected animals and relevant information including source area, history, physical condition and health status were recorded. Body condition score of the sample animals were measured and standard grades given as described by Nicholson and Butterworth (1986).

Post-mortem Examination

During necropsy examinations, the liver and the gall bladder were removed; the gall bladder was then separated from the liver, emptied and washed in to a glass trough and the contents of the trough were checked for adult and immature Fasciola parasites. The bile ducts were opened with scissors and searched for flukes. The liver was then cut into 1 cm thick slices and pressed between the fingers to expose flukes lodged in the small bile ducts. The number of heads recovered in this way were counted and recorded. Species identification was made based on the morphological features of the parasites and classified as *Fasciola hepatica, Fasciola gigantica* and unidentified or immature forms of the liver fluke (Soulsby, 1982; Urquhart, 1996).

Economic loss assessment

The annual economic loss was estimated as the sum total of the direct and indirect economic losses resulting from fasciolosis.

The direct economic loss

It is the loss resulted from liver condemnation at the abattoir and was assessed using the formula set by Ogunrinade and Ogunrinade (1980), considering the overall prevalence of the disease, the average number of animals slaughtered in the abattoir during a year and the average market price of a liver.

ALC = MCS * MLC * P

Where ALC=Annual loss due liver condemnation, MCS= Mean Number of cattle slaughtered per year at Mettu abattoir, MLC= Mean cost of a liver in Mettu town, P= Prevalence of the disease at Metu abattoir.

The indirect economic loss

It is the loss due to reduced carcass weight of Fasciola infected animals and was calculated by the estimated 10% carcass weight loss due to fasciolosis (Hope Cawdery *et al*., 1997). The Average carcass weight of an Ethiopian zebu was taken as 126 kg (ILCA, 1992) and the annual economic loss due to carcass weight reduction was assessed using the formula set by Ogunrinade and Ogunrinade (1980).

ACW = CSR* CL * BC * P*126 kg

Where ACW= Annual loss from carcass weight reduction, CSR= Average number of cattle slaughtered per annum at Mettu abattoir, CL= Percentage of carcass reduction, BC= average price of 1 kg beef in Mettu town, P= prevalence rate of fasciolosis at Mettu abattoir, 126 kg= Average carcass weight of Ethiopian zebu. Annual slaughtered rate

was estimated from the Retrospective abattoir records of the last 3 years (2007-2009), while the retail market price of beef/kg and an average size zebu liver was determined from the butcheries in Mettu town.

Data Analysis

Data collected for the study were entered in to a Microsoft excel worksheet and analyzed using the SPSS 11.5 for windows. Prevalence of fasciolosis was calculated as the number of Fasciola infected cattle divided by the total number of slaughtered cattle and was then multiplied by 100. One-way ANOVA was used for analysis of differences in the prevalence of fasciolosis. P value < 0.05 was considered for significance.

Results

An overall of 663 adult zebu cattle slaughtered at Mettu Municipal abattoir were examined for Fasciola parasites, of which, 47.1 % (312/663), were found positive and 52.9% (351/663) were negative. Of the total animals, 26.9% (178/663), were positive for *F. hepatica*, 11.8% (78/663) were positive for *F. gigantica*, 4.8% (32/663) were mixed infections and 3.6% (24/663) were positive for immature (unidentified) flukes (Table 1). *F. hepatica* was seen to be more prevalent than *F. gigantica* and a significant difference was observed in the prevalence of the two species (P=0.000) (Table 2). The prevalence of fasciolosis was also determined in relation to body condition score of the slaughtered cattle, out of the 663 slaughtered cattle, 319 were Good body condition score and 344 were Medium body condition score animals, Poor body condition scored animals were not observed in this study. Of the total 319 Good body condition scored cattle slaughtered, 41.7% (133/319), were positive for Fasciola parasites, *F. hepatica* being 26% (83/319), *F. gigantica* 7.8% (25/319), mixed infections 4.7% (15/319) and immature flukes 3.1% (10/319) (Table 3). Out of the 344 Medium body condition scored cattle, 52% (179/344) were positive, of which *F. hepatica* accounted for 27.6% (95/344), *F. gigantica* for 15.4% (53/344)), mixed infections for 4.9% (17/344) and immature flukes for 4.1% (14/344) of the infections (Table 3). A significant difference was observed in prevalence of the infec-

Table 1. Prevalence of fasciolosis at Mettu municipal abattoir (Oct./08-May/09) N= 663

Fasciola Species	*No. Positive*	*Prevalence (%)*	*95% CI for prevalence*	
			Lower Bound	Upper Bound
F.hepatica	178	26.9	23.61	30.39
F. gigantica	78	11.8	9.31	14.22
Mixed	32	4.8	3.19	6.46
Immature flukes	24	3.6	2.07	4.87
Total	312	47.1		

Table 2. Prevalence of Fasciola species at Mettu municipal abattoir (Oct. / 08-May /09)

Fasciola species	Positive	Prevalence (%)	P-Value
F.hepatica	178	26.9	0.000
F.gigantica	78	11.8	

Table 3. Prevalence of fasciolosis by body condition score at Mettu municipal abattoir (Oct/08- May /09)

Grade	No. Examined	Positive	Prevalence (%)	F	P-Value
Good	319	133	41.7	7.161	0.008
Medium	344	179	52		
Total	663	312	47.1		

Table 4. Prevalence of bovine fasciolosis at Mettu municipal abattoir, 2007- 2009

Months	July	Aug.	Sep.	Oct.	Nov.	Dec	Jan	Feb	Mar	Apr	May	Jun	Total
No. slaughtered	124	166	209	216	206	228	274	251	89	63	260	163	2249
No. positive	64	63	86	90	89	85	87	79	44	35	78	74	874
Prevalence (%)	51.6	38.0	41.1	41.7	43.2	37.3	31.8	31.5	49.4	55.6	30.0	45.4	38.9

tion between Good and Medium body condition scored cattle (F=7.161, P=0.008).The difference in the prevalence of *F. gigantica* among the Good and Medium body condition scored cattle was significant (P=0.002), while the difference in the prevalence of *F. hepatica* and mixed infection were not significant. Analysis of the three years retrospective data i.e., 2007- 2009, of Mettu municipal abattoir showed that an average of 2249 indigenous cattle were slaughtered per annum at the abattoir and the mean prevalence of fasciolosis was found to be 38.9% (Table 4).

Assessment of the market value showed that the average price of a kilo gram of beef and a normal cattle liver at Mettu town during the study period was 3.4 and 4.5 USD, respectively (exchange rate 1USD =10 birr). Using the formula set by Ogunrinade and Ogunrinade (1980) and considering an annual slaughter rate of 2249 cattle and prevalence of 47%, the annual direct economic loss due to liver condemnation was estimated to 4,757.00 USD (47,570.00 birr) and the annual indirect economic loss due to carcass weight reduction in the slaughtered cattle was estimated to 46,615.00 USD (466,150.00 birr). Therefore, the total annual economic loss due to fasciolosis in cattle slaughtered at Mettu municipal abattoir was estimated to be 51,372.00 USD (513,720.00 birr).

Discussion

The outcome of this study showed that fasciolosis was a serious problem in cattle slaughtered at Mettu municipal abattoir causing high economic loss due to liver condemnation and carcass weight reduction. The prevalence of fasciolosis observed in this study , 47.1% , appear to be higher than the prevalence of 41%, 24.3% and 29.6% reported by Getachew *et al*. (2006), Gebretsadik *et al*. (2009) and Mulat *et al*. (2012), respectively. It was also higher than the prevalence of 8% from Nigeria (Okoli *et al*., 2000), 37% from Zimbabwe (Pfukenyi and Mukaratirwa, 2004), 26%, from Kenya (Mungube *et al*., 2006), 46% from Zambia (Phiri, 2006) and 14.1% from Tanzania (Swai and Ulicky, 2009). The Result of this study was in agreement with the prevalence report of 46.6% from Jimma (Tolosa and Tigre, 2007), however, it was lower than the prevalence of 91 %, 53.7% and 53.9% reported from Northwest and Southwest Ethiopia and Zambia by Yilma and Mesfin (2000); Abebe *et al*. (2011) and Phiri *et al*. (2005), respectively. The significant variation in the prevalence of fasciolosis was mainly attributable to the variation in the climatic and ecological conditions such as altitude, rainfall, and temperature as well as the livestock management system among the study areas.

In view of the body condition score of the animals, the prevalence was higher in the Medium body condition animals, 52%, as compared to the Good body condition animals, 41.7%. Similar findings were reported from Gondar abattoir 28.4% and 20.4 % (Mulat *et al*., 2012) and from Debrezeit abattoir 30 % and 24 % (Yemisrach and Mekonnen, 2012), respectively. The results prove that the weight of animals increases as the parasitic infection decreases which could be due to acquired immunity in the host. Body condition improves as Fasciola infection decreases since Fasciola worms suck blood and tissue fluid and damage the parenchyma of liver due to the migrating immature worms (Marquardt *et al*., 2000). Chronic fasciolosis is the commonest form of the disease in cattle and one of the characteristic sign is weight loss (Graber, 1978; Urquhart *et al*., 1996; Radostits *et al*., 2007).

The present finding revealed that *F. hepatica* was more prevalent than *F. gigantica* at the study abattoir. In favor of this finding, prevalence of 45.2% and 26.5% and 56.4% and 9.2% were reported by Dechasa *et al*. (2012) and Gebretsadik *et al*. (2009) for *F. hepatica* and *F. gigantica*, respectively. Similar findings had also been reported by

other researchers in the country (Tolosa and Tigre, 2007; Mihreteab *et al*., 2010). In Tanzania, the causative agents of fasciolosis were reported to be both *Fasciola gigantica* and *Fasciola hepatica* (Walker *et al*., 2008; Swai and Ulicky. 2009). On the other hand, Fufa *et al*. (2009) affirmed that *F. gigantica* was the most common liver fluke species affecting cattle at Welayta Soddo municipal abattoir in Southern Ethiopia. Similarly studies conducted in Zambia, (Phiri *et al*., 2005), Kenya (Wamae *et al*., 1998; Mungube *et al*., 2006) and Europe (Mage *et al*., 2002) reported *F. gigantica* as the most common species infecting cattle. One of the most important factors that influence the occurrence of fasciolosis in an area is the availability of a suitable habitat for the snail intermediate hosts (Urquhart *et al*., 1996).In addition, optimal base temperature to levels of 10^{o}C and 16^{o}C are necessary for the snail vectors of *Fasciola hepatica* and *Fasciola gigantica*, respectively. The ideal moisture conditions for snail breeding and development of larval stages within the snails are provided when rainfall exceeds transpiration and field saturation is attained. Such conditions are also essential for the development of fluke eggs and miracidae searching for snails and dispersal of cercariae (Urquhart *et al*., 1996).

The annual economic loss estimated due to liver condemnation and carcass weight reduction in this study, 45, 283.00 USD, was higher as compared to the annual loss of 27, 573 USD reported by Gebretsadik *et al*. (2009) from Mekele abattoir but it was lower than the 3,003,488 USD report from Jimma abattoir (Dechasa *et al*., 2012). A similar study carried out in Tanzania revealed an annual loss of 1,780 and 5, 943 USD due to liver condemnation and carcass weight reduction, respectively (Swai and Ulicky, 2009). The financial loss per slaughtered animal obtained in this study i.e. 22.8 USD, was comparable to the loss of 12-23 USD reported in yearling Friesian and Boran cattle experimentally infected with *F. gigantica* metacercariae in Kenya (Wamae *et al*., 1998) but was higher than the 4.6 USD reported by Swai and Ulicky (2009). The difference in the estimated financial losses among the three localities could be due to the difference in the annual slaughter rate, disease prevalence and the price, per kg, of beef and liver at the study localities. Monitory loss estimates, merely based on losses due to liver condemnation ranging from 4,000-8313 USD, were reported from different abattoirs in the country (Tolosa and Tigre, 2007; Fufa *et al*., 2009; Mihreteab *et al*., 2010; Rahmeto *et al*., 2010; Abebe *et al*., 2011; Yemisrach and Mekonnen, 2012).

Fasciolosis had also been reported to have great economic importance in ovine species in Ethiopia, the annual financial loss due to ovine fasciolosis was estimated to 48.4 million Ethiopian birr, of which, 46.5%, 48.8% and 4.7% were losses due to mortality, productivity and liver condemnation, respectively (Ngategize *et al*., 1993). The report revealed that the loss due to liver condemnation was minute as compared to the losses due to mortality and productivity.

Conclusion

Fasciolosis, due to *F. hepatica* and *F. gigantica*, was found to be a highly prevalent and economically important disease of cattle at Mettu town municipal abattoir. The annual economic loss of 51,372.00 USD obtained in this study was relatively very high yet, this estimate was likely to be at variance with the true losses in cattle since, some vital parameters to accurately evaluate economic losses such as, mortality rates, chronic ill effects and anthelmintic treatment costs, were not included due to scarcity of data. Outcomes of the study signified severity of the problem and the need for effective control measures that should be supported through studies on the economic importance of the infection in small ruminant species and local epidemiology of the disease.

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