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ORIGINAL ARTICLE

Bovine Fasciolosis: Prevalence and its economic loss due to liver condemnation at Adwa Municipal Abattoir, North Ethiopia

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ABSTRACT

A total of 768 cattle were randomly selected among those animals slaughtered at Adwa municipal abattoir to determine the prevalence and the economic loss due to liver condemnation. Following post-mortem examination, 248 (32.3%) cattle were positive for fasciolosis. According to the intensity of pathological lesions, 84 (33.8%) constituted severely affected livers; the rest, 81 (32.7%), 55 (22.2%) and 28 (11.3%) were moderately affected, lightly affected and undifferentiated, respectively. The number of fluke recovered in moderately affected livers was higher (Mean = 91) than that of either severely (Mean = 60) or lightly (Mean= 38) affected livers. There was a statistically significant association (P<0.05) between the different levels of intensity of pathological lesion and fasciolosis prevalence. Species identification revealed that *Fasciola hepatica* was more prevalent (13.9%) as compared to *Fasciola gigantica* (7.7%); certain proportion of animals (6.0%) harbored mixed infection and others unidentified immature fluke (4.7%). Statistically significant variation was observed in the prevalence of fasciolosis among animals with poor, medium and good body conditions (*P*<0.05). The direct economic loss as a result of liver condemnation was on average 57,960 Ethiopian Birr (4,674.2 USD) per annum indicating that the disease is economically important. Finally, the abattoir based prevalence recorded in the study area and the loss incurred suggests that a detailed epidemiological study as well as assessment of the overall economic loss due to fasciolosis is required to implement systematic disease prevention and control methods.

Keywords: Abattoir, Adwa, Bovine Faciolosis, economic loss, North Ethiopia

INTRODUCTION

Among many parasitic problems of farm animals, fasciolosis is a major disease, which imposes direct and indirect economic impact on livestock production, particularly of sheep and cattle (Keyyu *et al.*, 2005; Menkir *et al.*, 2007). *Fasciola hepatica* and *Fasciola gigantica* are the two liver flukes commonly reported to cause fasciolosis in ruminants. The life cycle of these trematodes involves snail as an intermediate host (Walker *et al.,* 2008). Infected cattle can exhibit poor weight gain and dairy cattle have lower milk yield, and possibly metabolic diseases (Mason, 2004). For example, losses due to fasciolosis in the United Kingdom and Ireland alone are greater than £18 million a year (Mulcahy and Dalton, 2001); a Swiss study estimated the economic loss due to bovine fasciolosis, largely attributable to sub-clinical infection, as €52 million a year or €299 per infected animal (Schweitzer *et al*., 2005); Kithuka *et al.* (2002) reported up to 0.26 million USD annual losses attributable to fasciolosis-associated liver condemnations in cattle slaughtered in Kenya. A study conducted by Keyyu *et al.* (2006) reported up to 100% liver condemnation rates in some slaughter slabs in Iringa region in Tanzania due to liver flukes in cattle.

Apart from its veterinary and economic importance throughout the world, fasciolosis has recently been shown to be a re-emerging and widespread zoonosis affecting many people (Esteban *et al.,* 2003). Although a number of studies have been undertaken with regard to abattoir based prevalence and evaluation of the economic loss due to fasciolosis in different parts of Ethiopia (Tadele and Worku, 2007; Jibat *et al*., 2008; Fufa *et al*., 2009; Gebretsadik *et al*., 2009), very little has been done in northern parts of the country particularly Adwa area. This study therefore aimed at determining the prevalence and the economic loss due to liver condemnation in cattle slaughtered at Adwa municipal abattoir.

MATERIALS AND METHODS

Study area

The study was conducted at Adwa which is located in the central zone of Tigray region (Fig. 1). According to the information obtained from Adwa district agricultural office, cattle are predominant species among domestic animals raised in the area. Adwa is located at an altitude of 1870 meter above sea level with mean annual rainfall of 600-800mm and mean annual temperature of 27^0C. Geographically it is located at 14^0 10′ 0′′N latitude and 38^0 54′ 0′′ E longitude.

Study population

Virtually all cattle presented for slaughter were male adults that originated from different zones of Tigray region as well as neighboring Afar and Amhara regions. The sample size was calculated according to Thrusfield (2005). The expected prevalence in the study area was 50%. To increase precision, twice that of the calculated sample size was cosidered. Accordingly, a total of 768 animals of local zebu breed were selected by simple random sampling technique.

Study design

A cross-sectional study was conducted from October 2008 up to February 2009 to determine the abattoir based prevalence, fluke burden and intensity of pathological lesions in cattle using ante-mortem and post-mortem examination of each slaughtered animal. Moreover, the direct economic loss due to liver condemnation was assessed through questionnaire and by using retrospective and perspective secondary data.

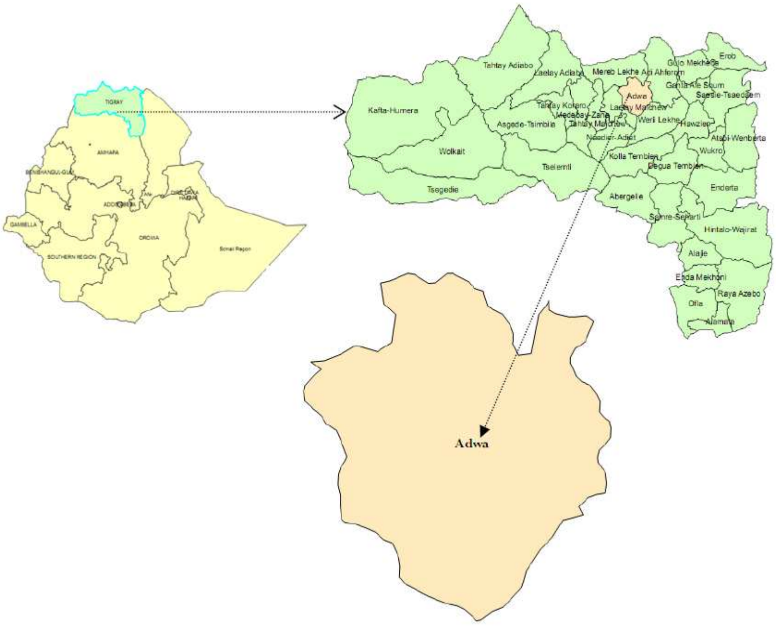

Figure 1. Map of Adwa.

Ante-mortem inspection and body condition scoring

Complete ante-mortem examination of the animals was carried out a day before or shortly prior to slaughter. Inspection of the animals was made while at rest or in motion for any obvious sign of disease. Body condition for each cattle was estimated based on Nicholson and Butterworth (1986) ranging from score 1 (emaciated) to score 5 (obese). For our case, three classes of scoring were used, Lean (Score 2), medium (Score 3 and 4) and fat (score 5). There was no any animal slaughtered at score 1.

Fluke burden and intensity of pathological lesions

Post mortem examination of liver and associated bile duct was carefully performed by visualization and palpation of the entire organ followed by transverse incision of the organ across thin left lobe in order to confirm the case (Urquhart, 1996). Fluke burden was determined by counting the recovered Fasciola parasite whereas pathological lesion categorization of the affected livers was undertaken on the basis of the intensity of lesions. Hence, affected livers were grouped into three categories as per the criteria previously described by Ogunrinade and Adegoke (1982): l*ightly affected*: a quarter of the organ is affected, and only one bile duct is prominently enlarged on the visceral surface of liver, m*oderately affected*: half of the organ is affected and two or more bile ducts are hyperplastic and s*everely affected*: almost the entire organ is involved, liver is cirrhotic and triangular in outline as the right lobe is often atrophied.

Fasciola species identification

Species identification of the recovered Fasciola was also conducted based on morphological features of the agents and classified in to *Fasciola hepatica*, *Fasciola gigantica* and unidentified or immature forms of liver fluke (Urquhart, 1996).

Judgments on liver condemnation

Pathological lesions were judged to be condemned based on Herenda *et al*. (2000) guidelines on meat inspection for developing countries. Thus, black parasitic debris in the liver, lungs, diaphragm and peritoneum as well as black lymph nodes of the lungs and liver due to fluke excrement are typical post mortem pathological findings. To this effect, judgments on carcass of an animal affected with fascioliasis are *approved* if in good flesh and emaciation and edema are not observed. A heavily infested parasitic liver is *condemned*.

Determining the direct loss due to liver condemnation

Through interview made with local butcher men in Adwa town, the average weight of bovine liver and price per kilogram was calculated to be 3.45 kg and 12.6 Ethiopian Birr, respectively. The direct loss was thus computed according to the formula adopted from Ogunrinade and Ogunrinade (1980) as follows:

EL = ΣCS X Coy X Roz; where:

EL = Annual loss estimated due to liver condemnation

ΣCS = annual slaughter rates at the abattoir (estimated from retrospective abattoir record)

Coy = Average cost of each cattle liver

Roz = Condemnation rates of cattle liver due to fasciolosis

Data analysis

All raw data were recorded and double entered in to Microsoft excel data base system to be analyzed using SPSS version 16. Prevalence of fasciolosis was calculated as the number cattle found infected with Fasciola, expressed as the percentage of the total number of slaughtered (Thrusfield, 2005). Pearson's chi-square (χ^2) was used to evaluate the association between the prevalence of fasciolosis and different factors. P-value less than 0.05 (at 5% level of significance) were considered significant in all analysis.

RESULTS AND DISCUSSION

The study conducted at Adwa municipal abattoir revealed an overall abattoir based prevalence of 32.3%, which is a bit higher than a work reported by Gebretsadik *et al.* (2009) at Mekelle (24.32%) and it was significantly higher than the prevalence of bovine fasciolosis reported by Fufa *et al*. (2009) at Welaita Sodo (12.7%) and Swai and Ulicky (2009) at Hawi, Tanzania (14.05%). This might be attributed to the variation in agro-ecological conditions favorable to both the parasite and the intermediate host. On the other hand, the prevalence of bovine fasciolosis in the present study is lower as compared with the previous reports in different parts of Ethiopia (Tadele and Worku, 2007) at Jimma (46.58%), and (Mulualem, 1998) in South Gondar (83.08%). The variation in climato-ecological conditions such as altitude, rainfall, temperature, livestock management system, and suitability of the environment for survival and distribution of the parasite as well as the intermediate host might have played their own role in such differences. One of the most important factors that influence the occurrence of fasciolosis in a certain area is availability of suitable snail habitat (Urquhart *et al.*, 1996). In addition, optimal base temperature to the levels of 10 ºC and 16ºC are necessary for snail vectors of *Fasciola hepatica* and *Fasciola gigantica*, respectively. These thermal requirements are also needed for the development of

Fasciola with in the intermediate host. 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, miracidiae searching for snails and dispersal of cercariae (Urquhart *et al.*, 1996). Abattoir based monthly prevalence of fasciolosis during the study period is shown in Fig. 2, hence, statistically significant variation in monthly prevalence of the disease was not observed (P>0.05).

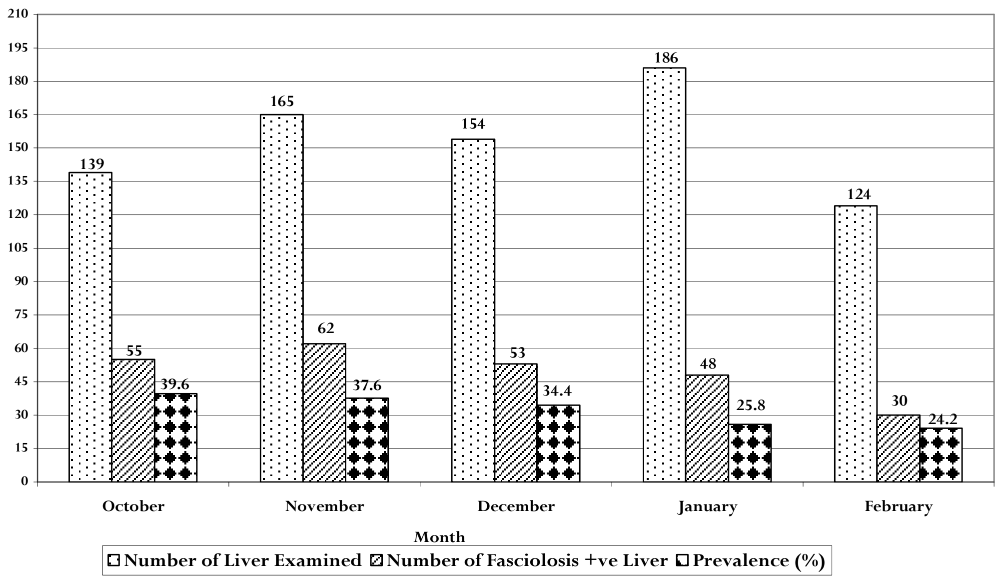

Figure 2. Prevalence of Fasciolosis at Adwa Municipal Abattior from October 2008 to February 2009.

Table 1. Pathological lesions of livers with their respective average fluke burden

Pathological lesions of liver	No of livers affected (%)	Average fluke burden
Severe	84 (33.8)	60
Moderate	81 (32.7)	91
Light	55 (22.2)	38
Undifferentiated	28 (11.3)	0
Total	248 (100.0)	

The presence of snail intermediate host and therefore the distribution of the parasite are limited to geographic areas where appropriate snail species is present and is dependent on season. This study was carried out mainly in dry season. Thus, a higher incidence of fascioliasis would have been recorded at the end of the dry season or beginning of the rainy season.

Table 2. Bovine fasciolosis and the intensity of pathological lesions in liver

Species of Fasciola	Intensity of pathological lesions	No. of Fasciola positives (%)	χ^2 (P-value)
	Severe	41 (38.3)	
Fasciola hepatica	Moderate	34 (31.8)	
	Light	17 (15.9)	180 (0.000)
	Undifferentiated	15 (14.0)	
Total		107 (100.0)	
	Severe	20 (33.9)	
Fasciola gigantica	Moderate	26 (44.1)	
	Light	10 (16.9)	129 (0.000)
	Undifferentiated	3 (5.1)	
Total		59 (100.0)	
	Severe	20 (43.6)	
Mixed	Moderate	14 (30.4)	
	Light	6 (13.0)	78.88 (0.000)
	Undifferentiated	6 (13.0)	
Total		46 (100.0)	
	Severe	3 (8.3)	
Immature	Moderate	7 (19.4)	
	Light	22 (61.2)	158 (0.000)
	Undifferentiated	4 (11.1)	
Total		36 (100.0)	

There was a statistically significant association (P<0.05) between the different levels of intensity of pathological lesion and fasciolosis prevalence (Table 2). It was observed that the number of fluke recovered in moderately affected livers was higher (Mean = 91) than that of either severely (Mean = 60) or lightly (Mean= 38) affected livers suggesting there was no direct proportional relationship between the number of flukes recovered and intensity of pathological lesions (Table 1). The plausible explanation for this observation could be that, severely affected liver bile duct is usually fibrosed and calcified which impair the further passage of young flukes (Roman, 1987).

Species identification revealed that *Fasciola hepatica* was more prevalent (13.9%) as compared to *Fasciola gigantica* (7.7%); certain proportion of animals (6.0%) harbored mixed infection and others unidentified immature fluke (4.7%) (Table 3). The higher prevalence of *Fasciola hepatica* might be associated with the existence of favorable ecological biotopes for the intermediate host *Lymnaea truncatula.* In support of the present study, Gebretsadik *et al*. (2009) reported that 56.42% of cattle were infected with *Fasciola hepatica* and 9.17% with *Fasciola gigantica.* However, in another study, Fufa *et al.* (2009) stated that the most common liver fluke species affecting cattle at Welaita Sodo was *Fasciola gigantica.* Yilma and Malone (1998) indicated that *Fasciola gigantica* in Ethiopia is found at altitudes below 1800 meters above sea level. While *Fasciola hepatica* is found at altitude of 1200-2560 meters above sea level. Mixed infections by both species can be encountered at 1200-1800 meters above sea level. According to Yilma and Malone (1998), such discrepancy is attributed mainly to the variation in climatic and ecological conditions such as altitude, rainfall, and temperature as well as livestock management system.

In relation to body condition of the animals, the prevalence was higher in those animals with poor body condition than in those with medium and good body conditions. There was a statistically significant association between body conditions of the animals and the prevalence of Fasciola infection (P<0.05) (Table 3). In support of this finding, a study conducted in Mekelle (Yohannes, 2008) indicated that the association between the prevalence of fasciolosis and body condition of the animals was also statistically significant. Obviously, this could be due to the fact that animals with poor body condition are usually less resistant and are consequently susceptible to infectious diseases.

Pathological lesions caused by fasciolosis are the culprit of a considerable economic loss due to condemnation of the affected livers. Considering the number of liver condemned during the study period and from the retrospective and perspective secondary data, the direct economic loss as a result of liver condemnation due to fasciolosis was estimated to be on average 57,960 Ethiopian Birr (4,674.2 USD) per annum (1USD~ 12.4 Ethiopian Birr by the time when the study was undertaken). Liver with any degree of pathological lesion is doomed to condemnation and it is not usual to process such organ in local set up to be approved fit for human consumption. To this end, it is economically important disease that warrants due attention. Finally, the abattoir based prevalence recorded in the study area and the loss incurred suggests that a detailed epidemiological study as well as assessment of the overall economic loss due to fasciolosis is required to implement systematic disease prevention and control methods.

Table 3. Distribution of Fasciola species according to different body condition

Species of Fasciola	Body condition	No. of animals tested	No. of Fasciola positives (%)	χ^2 (P-value)
Fasciola hepatica	Poor	117	27 (23.1)	
	Medium	470	68 (14.5)	
	Good	181	12 (6.6)	16.32 (0.000)
Total		768	107 (13.9)	
Fasciola gigantica	Poor	117	14 (11.9)	
	Medium	470	38 (8.1)	
	Good	181	7 (3.9)	6.85 (0.03)
Total		768	59 (7.7)	
Mixed	Poor	117	6 (5.1)	
	Medium	470	30 (6.4)	
	Good	181	10 (5.5)	0.35 (0.84)
Total		768	46 (6.0)	
Immature	Poor	117	10 (8.5)	
	Medium	470	18 (3.8)	
	Good	181	8 (4.4)	4.70 (0.09)
Total		768	36 (4.7)	

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REFERENCES

Esteban, JG, Gonzalez, C, Curtale, F, Mun˜oz-Antoli C, Valero MA, Bargues MD, El Sayed M, El Wakeel A, Abdel- Wahab Y, Montresor A, Engels D, Savioli L and Mas-Coma S. 2003. Hyperendemic fascioliasis associated with schistosomaisis in villages Nile delta of Egypt. *American Journal of Tropical Medicine and Hygiene* **69:** 429-437.

Fufa Abunna , Loma Asfaw, Bekele Megersa and Alemayehu Regassa. 2009. Bovine fasciolosis: coprological, abattoir survey and its economic impact due to liver condemnation at Soddo municipal abattoir, Southern Ethiopia. *Tropical Animal Health and Production* **42(2):** 289-292.

Gebretsadik Berhe, Kassahun Berhane and Gebrehiwot Tadesse. 2009. Prevalence and economic significance of fasciolosis in cattle in Mekelle Area of Ethiopia. *Tropical Animal Health and Production* **41(7):**1503-1504.

Herenda, D, Chambers PG, Ettriqui A, Seneviratna P, da Silvat JP. 2000. Manual on meat inspection for developing countries, Food and Agricultural Organization of the United Nations (FAO), Rome, Italy.

Jibat, T, Ejeta, G, Asfaw, Y., and Wudie, A. 2008. Causes of abattoir condemnation in apparently healthy slaughtered sheep and goats at HELMEX abattoir, Debre Zeit, Ethiopia. *Revue Médicine Véterinary* **159(5):**305-311.

Keyyu, JD, Monrad, J, Kyvsgaard, NC and Kassuku, AA. 2005. Epidemiology of *Fasciola gigantica* and Amphistomes in cattle on traditional, small-scale dairy and large-scale dairy farms in the Southern Highlands of Tanzania. *Tropical Animal Health and Production* **37:** 303-314.

Keyyu, JD, Kassuku, AA, Msalilwa, LP, Monrad, J and Kyvsgaard, NC. 2006. Cross-sectional prevalence of helminth infection in cattle on traditional, small-scale and large-scale dairy farms in Iringa district, Tanzania. *Veterinary Research Communications* **30:** 45-55.

Kithuka, JM, Maingi, N, Njeruh, FM and Ombui, JN. 2002. The prevalence and economic importance of bovine fasciolosis in Kenya—an analysis of abattoir data. *Journal of Veterinary Research* **69:** 255–262.

Mason, C. 2004. Fasciolosis associated with metabolic disease in a dairy herd, and its effects on health and productivity. *Cattle Practice* **12:** 7-13.

Menkir, MS, Uggla, A and Waller, PJ. 2007. Prevalence and seasonal incidence of nematode parasites and fluke infections of sheep and goats in eastern Ethiopia. *Tropical Animal Health and Production* **39(7):** 521-531.

Mulualem, E. 1998. Epidemiology of bovine fasciolosis in weredas of South Gonder administrative Zone bordering Lake Tana. *Journal of Ethiopian Veterinary Association* **2:**1-14.

Mulcahy, G and Dalton, JP. 2001. Cathepsin L proteinases as vaccines against infection with *Fasciola hepatica* (liver fluke) in ruminants. *Research Veterinary Science* **70:** 83-86.

Nicholson, MJ and Butterworth, MH. 1986. A guide to condition scoring of zebu cattle. International Livestock Center for Africa-ILCA, Addis Ababa, Ethiopia.

Ogunrinade, A and Ogunrinade, BI. 1980. Economic importance of fasciolosis in Nigeria. *Tropical Animal Health and Production* **12:**155-160.

Ogunrinade, A and Adegoke, GO. 1982. Bovine fascioliasis in Nigeria. Inter current parasitic and bacterial infection. *Trop. Anim. Hlth. Prod.* **14:**121-125.

Roman, T. 1987. Study on the economic significance of bovine fasciolosis and hydatidosis at Gonder abattoir. D.V.M. Thesis, F.V.M. Debrezeit.

Schweitzer, G, Braun, U, Deplazes, P, Torgerson, P. 2005. Estimating the financial losses due to bovine fasciolosis in Switzerland. *Veterinary Research.* **13:** 188-193.

Swai, ES and Ulicky, E. 2009. An evaluation of the economic losses resulting from condemnation of cattle livers and loss of carcass weight due to Fasciolosis: a case study from Hai town abattoir, Kilimanjaro region, Tanzania. *Livestock Research for Rural Development* **21(11):** 186.

Tadele, T and Worku, T. 2007. The Prevalence and Economic Significance of Bovine Fasciolosis at Jimma, Abattoir, Ethiopia. *International Journal of Veterinary Medicine* **2:** 1-7.

Thrusfield, M. 2005. *Veterinary Epidemiology* second edition, University of Edinburgh, Black well science. 180-188.

Urquhart, GM, Armour, JL, Dunn, AM, Jenning, W and Duncan, L. 1996. *Veterinary Parasitology* 2nd ed. Blackwell, London.

Yilma, JM and Malone, JB.1998. A geographic information system forecast model for strategic control of fasciolosis in Ethiopia. *Vet. parasitol*. **78(2):** 103-127.

Yohannes, E. 2008. Prevalence and Gross pathological lesions of Bovine fasciolosis in Mekelle municipal abattoir. D.V.M. Thesis, *JUCA VM*. Jimma, Ethiopia

Walker, SM, Makundi, AE, Namuba, FV, Kassuku, AA, Keyyu, J, Hoey, EM, Prodohl, P, Stothard, JR and Trudgett, A. 2008. The distribution of *Fasciola hepatica* and *Fasciola gigantica* within southern Tanzania-constraints associated with the intermediate host. *Parasitology* **135(4):**495-503.