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Prevalence of Bovine Fasciolosis in Municipal Abattoir of Haramaya, Ethiopia

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Abstract
A cross sectional study was carried out from November, 2013 to March, 2014 with the aims of determining the abattoir prevalence and direct economic loss associated with fasciolosis in cattle at Haramaya municipal abattoir, Ethiopia. From the total of 480 examined cattle, 117 (24.4%) were found to be positive for fasciolosis by postmortem liver inspection. From 117 infected livers with *Fasciola* species, *Fasciola hepatica* was found to be the most prevalent species 69(58.974%) and *Fasciola gigantic*, and mixed infection were proved to be 30(25.64%) and 18(15.38%), respectively. Highest prevalence of fasciolosis was observed in poor body condition cattle 50(64.1%) followed by medium 40(38.84%) and good body condition cattle 27(9.03%), respectively. Statistical analysis of the data showed the presence of statistical significant difference ($P<0.05$) on the prevalence of fasciolosis among the different body condition scores. There was also a statistically significant difference ($P<0.05$) in the prevalence of bovine fasciolosis in different age groups considered. The highest 50(73.5%) prevalence was in young animals and the lowest 67(16.3%) was found in adult animals. The prevalence of bovine fasciolosis was highest 71(30.9%) in Haramaya area than Kersa 38(26.7%) and Dawe 8(7.4%) with statistically significant difference ($P<0.05$) in the prevalence of bovine fasciolosis was observed. Analysis of the abattoir data indicated a total annual liver condemnation which resulted in 86, 083.2 Ethiopian birr (4414.523 USD) loss. The results of the present survey showed that the prevalence and monetary loss of fasciolosis in cattle slaughtered at Haramaya municipal abattoir was high and warrants immediate need for prevention and control of the parasite in the study area in particular and in the country at large.
Keywords: Abattoir, Cattle, Fasciolosis, Financial loss, Haramaya, Prevalence

Introduction

Ethiopia has a large livestock population in Africa, which is estimated to be around 34-40 million TLU out of which 17% and 12% of cattle and small ruminants, respectively, are found in Ethiopia with the largest livestock in Africa including more than 38,749,320 cattle, 18,075,580 sheep, 14,858,650 goats, 456,910 camels, 5,765,170 equines and 30,868,540 chickens with live stock ownership currently contributing to the livelihoods of an estimated 80% of rural population (CSA, 2009). Despite the large animal population, productivity in Ethiopia is low and even below the average for most countries in eastern and sub-Saharan African countries, due to poor nutrition, reproduction insufficiency, management constraints and prevailing animal diseases (Bekele et al., 2010).

Among many parasitic problems of farm animals, fasciolosis is a major disease which imposes economic impact on livestock production particularly of cattle and sheep (Menkir et al., 2007).

Fasciola hepatica and *Fasciola gigantic* are the two liver flukes commonly reported to cause fasciolosis in ruminants. The life cycles of these parasites requires snail as an intermediate host (Walker et al., 2007). *F. hepatica* has a worldwide distribution but predominates in temperate zones while *F. gigantic* is found on most continents, primarily in tropical regions (Wamae et al., 1998).

In Ethiopia 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. For *Fasciola gigantica* regions in the high lands of Ethiopia and Kenya were identified as unsuitable due to in adequate thermal regime. Average annual mean temperatures of 23^{o}C or above were found to correspond to areas below the 1200m elevation limit of *Fasciola hepatica* in Ethiopia (Malone et al., 1998).

The disease is responsible for considerable economic losses in the cattle industry mainly through mortality, liver condemnation, reduced production of meat, milk and wool and expenditures for anthelmintics (Dargie, 1987). Regarded as one of the major setbacks to livestock productivity incurring huge direct and indirect losses in the country; Available published reports have indicated that bovine fasciolosis causes economic losses of roughly 350 million Birr per annum due to decreased productivity alone (Gemechu, and Mamo.1979).

Several abattoir surveys conducted in various parts of Ethiopia have demonstrated the presence of fasciolosis, due to *F. hepatica* and *F. gigantica*, in ruminants. Some studies tried to demonstrate the economic losses associated with liver condemnation and evaluation of the economic loss due to fasciolosis differ in different parts of Ethiopia (Tolosa et al., 2007; Fufa et al., 2008; Gebratsadik et al., 2009; Nuraddis et al., 2010 and Kassaye et al., 2012).

Apart from its veterinary and economic importance throughout the world, fasciolosis recently been shown to be a re-emerging and wide spread zoonosis affecting many people (Esteban et al., 2003). *Hepatic distomatosis*

or fasciolosis is a parasitic disease affecting herbivorous mammals and humans that is caused by the trematode *Fasciola hepatica* (Bowman, 2010). The records of natural infection in humans are mostly correlated with regions that are endemic for animal fasciolosis, in rural communities in which humans share the water source with their animals, or areas in which raw vegetables cultivated in endemic regions are consumed (Robinson and Dalton, 2009).

Because epidemiology of fasciolosis is dynamic and may change with years (Mungube, et al., 2006), it is important to monitor its development to determine trends in prevalence. And study of bovine fasciolosis not so far conducted in Haramaya Municipal Abattoir. And therefore, the objectives of the current study were to determine the prevalence of bovine fasciolosis and to estimate the magnitude of direct economic loss attributed due to liver condemnation at Haramaya Municipal Abattoir.

MATERIALS AND METHODS

Description of the study area

The study was conducted at Haramaya municipal abattoir, in Haramaya town, which is found in East Hararghe administrative zone of Oromia Regional in Eastern Ethiopia. The study area has a latitude and longitude of 9°24′N 42°01′E and the area is found at an altitude of 1600-2100 m.a.s.l. with 64.5 relative humidity, is 511Km far from Addis Ababa. The district experience rain fall with a short rainy season occurs usually in February and long rainy season extends from July to September. The annual rain fall of the areas ranges from 118-866mm similarly the average monthly minimum and maximum temperature of the area is 9.4 and 24 c^o, respectively. Mixed crop-livestock farming is the predominant production system in the rural area. The main livestock types kept in the area includes cattle, sheep, goat, camel, donkey and poultry. The total cattle population of Haramaya woreda is about, 98090, 120145 goat, 69950 sheep, 480 camel and 28250 Equine species.

Study population

The study population consisted of male indigenous cattle brought to the abattoir for slaughtering purpose from the 3 districts.

Study design and sampling technique

A cross sectional study was carried to determine the prevalence of bovine fasciolosis. Systematic random sampling technique was the sampling strategy used to collect all the necessary data from abattoir survey of the study animals. The sample size required for this study was determined based on the expected prevalence (50%) of bovine fasciolosis and the 5% desired absolute precision and 95% CI according to the following formula by Thrusfield (2005):

$$n = \frac{(1.96)^2 \, Pexp \, (1-Pexp)}{d^2} = \frac{(1.96)^2 \, 0.5(1-0.5)}{(0.05)^2}$$

$$n = 384$$

Where, n = required sample size, Pexp = expected prevalence, d^2= desired absolute precision at 95% Confidence level. According to the above formula 384 calves were sampled. However to increase the level of accuracy of determining the prevalence the sample size has been increased to 480.

Active Abattoir Survey

Active abattoir survey was conducted based on cross sectional study during routine meat inspection on systematically selected cattle slaughtered in Haramaya municipal abattoir. During ante-mortem examination details about the species, breeds, age origins and body conditions of the animals were recorded. Prevalence was determined through grouping the study animals in their body condition, age and origin. The animals examined was also grouped in to two age group (<5) as young and (>5) years as adult by dentition according to the modified method described by (De-Lahunta and Hable, 1986). Body condition was scored following the guidelines set by Nicholson and Butterworth, 1986. Accordingly, animals were classified into poor, medium and good categories of body conditions.

The fluke recovery and count was conducted following the approach of Hammond and Sewell (1974), as follows: the gall bladder was removed and washed to screen out mature flukes. And each liver visually inspected, palpated and incised based on routine meat inspection by FAO (2003). The liver was cut into slices of about 1cm thick and put in a metal trough of warm water to allow mature flukes lodged in smaller bile ducts to escape and then the heads of the flukes were counted. During post-mortem inspection all livers having *Fasciola* species were registered and Species identification was made using criterion provided by Soulsby (1986).

Direct Financial Loss Analysis

The total financial loss incurred due to fasciolosis in Haramaya 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 Haramaya town, the average price of each cattle liver was calculated to be 70 Ethiopian Birr. The direct loss was thus computed according to the formula adopted by Ogunrinade (1980). Using the market price of a bovine liver, the monetary loss occasioned by condemnation of *Fasciola* infected livers was calculated as follows:

$EL = \Sigma CS \times Coy \times Roz$; 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

Statistical Analysis

The recorded raw data were entered in to Microsoft excel data base system to be analyzed using SPSS version 20 statistical software. Descriptive statistics was computed. Pearson's chisquare (x^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.

RESULTS

Overall Prevalence

Out of 480 indigenous male cattle breeds that were slaughtered at Haramaya municipal abattoir 117 animals were found infected with liver fluke. Statistically significant difference ($P < 0.05$) in the prevalence of bovine fasciolosis among three different origins (locations) was observed. The prevalence of fasciolosis was highest in Haramaya district (31%) and the lowest in Dawe district (7.4%) (Table 1).

Table 1: Prevalence of bovine fasciolosis based on origin (districts)

Origin	Number of examined animals	Prevalence (%)	X^2-value	P -value
Haramaya	230	71(31%)	22.369	.000
Kersa	142	38 (27%)		
Dawe	108	8(7.4%)		
Total	480	117(24.4%)		

Of 117 animals infected with liver fluke, 69(59%) livers were harbored *F.hepatica*, 30(26%) livers harbored *F. gigantic*, and 18 (15.4%) livers harbored mixed infection. The distribution and prevalence of *Fasciola* species was different in different origins (districts) of animals. The highest prevalence of *F.hepatica* (18.7%) was observed in Haramaya district and the lowest (3.5%) was observed in Dawe district, whereas the highest prevalence of *F.gigantic* (7.8%) was observed in Haramaya district and the lowest (1.9%) was observed in Dawe district (Table 2).

Table 2: Prevalence and distribution of bovine *fasciola* species with respect to animal origin

Fasciola species	Haramaya (230)	Kersa (142)	Dawe (108)	Total (480)
F.hepatica	43 (18.7 %)	21 (14.8 %)	5(4.6 %)	69 (59 %)
F.gigntica	18 (7.83 %)	10 (7.04 %)	2 (1.9 %)	30 (26 %)
Mixed infection	10 (4.35 %)	7 (4.93 %)	1(0.93 %)	18(15 %)
Total	71	38	8	24.4 %

There was a statistically significant difference ($P<0.05$) in the prevalence of bovine fasciolosis in different age groups. The highest (73.5%) prevalence was in young animals and the lowest (16.3%) was found in adult animals (Table 3).

Table 3: Prevalence of bovine *Fasciola* based on age

Age	Number of examined animals	Prevalence (%)	X^2-value	P -value
Adult	412	67(16.3%)	103.841	.000
Young	68	50(73.5%)		
Total	480	117(24.4%)		

There was a significant difference ($P<0.05$) in the prevalence of bovine fasciolosis within different body condition scores. The highest prevalence (64.1%) was found in animals with poor body condition scores and the lowest prevalence (9.03 %) was found in good body conditioned animals (Table 4).

Table 4: Prevalence of bovine *Fasciola* in association with body condition

Body condition	Number of examined animals	Prevalence (%)	X^2-value	P-value
Good	299	27(9%)	116.660	.000
Medium	103	40(38.8%)		
Poor	78	50(64%)		
Total	480	117(24.4%)		

Financial loss analysis:

The economic significance of fasciolosis was analyzed based on the information obtained during postmortem examination and interview.

Annual loss due to liver condemnation = ΣCS*Coy*Roz
= 5040*70*24.4= 86083.2 Ethiopian Birr ($4414.523) was annual lost.

DISCUSSION

The overall prevalence of bovine fasciolosis (24.4%) observed in this study is in close agreement with the reports of Gebretsadik et al. (2009) and Nuraddis et al. (2010) who reported prevalence of 24.3% and 28% at Mekelle area and at Kombolcha Industrial Abattoir, Ethiopia. However, it is much lower than that of many other studies from different abattoirs in the country and elsewhere in Africa. Yilma and Mesfin (2000) reported 90.7% prevalence of fasciolosis in cattle slaughtered at Gondar abattoir, while Tolosa and Tigre (2007) recorded prevalence of 46.2% at Jimma abattoir. Phiri et al. (2005) from Zambia and Pfukenyi and Mukaratirwa (2004) from Zimbabwe reported prevalence of 53.9% and 31.7%, respectively. On the other hand, a lower prevalence of fasciolosis (14.0%) has been observed in slaughtered cattle at Wolaita Soddo abattoir (Abunna et al., 2009). Difference in prevalence among geographical locations is attributed mainly to the variation in the climatic and ecological conditions such as altitude, rainfall and temperature. *Fasciola* spp. prevalence has been reported to vary over the years mainly due to variation in amount and pattern of rainfall.

The result of the current study showed that age has significant effect on the prevalence of bovine fasciolosis; being higher in young animals than the adult. There was a decrease in infection rate (prevalence) as age increased. This may be due to the result of acquired immunity with age which is manifested by humoral immune response and tissue reaction in bovine liver due to previous challenge. There are some additional reports confirming that the increased resistance against fasciolosis (low prevalence) with age is most likely related to the high level of tissue reaction seen in bovine liver. Liver fibrosis which impedes the passage of immature flukes acquired thickening, stenosis and calcification of bile ducts, assumed unfavorable site for adult parasites and consequently fasten their expulsion. These are in agreement with experimental study conducted by Radostits et al. (2007) which confirmed the occurrence of higher infection rate in younger animals. The results of the present study indicated that body condition of the animal has significant association with the occurrence of fasciolosis. The prevalence was higher in poor body conditioned animals than that of medium and good body conditioned animals. 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. The result of present study showed that origin has significant effect on the prevalence of bovine fasciolosis; being higher in Haramaya than the Dawe district.

Postmortem examination on the 117 *Fasciola* infected livers of current results indicated that the prevalence of *F. hepatica* (59%) was higher than that of *F. gigantic* (26%) and certain proportion of animals (15.4%) harbored mixed infection. Similar study 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 Worku (2007). The high prevalence of *F. hepatica* may be associated with the presence of favorable ecological biotypes for its snail vector *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, Abunna *et al.* (2009) stated that the most common liver fluke species affecting cattle at Wolaita 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.

Finally, $4414USD monetary loss per annum incurred due to condemnation of cattle livers infected with *fasciola* spp. in Haramaya municipal abattoir was in agreement with finding of Abunna et al. (2009) who reported 4000 USD loss per annum for Soddo municipal abattoir and lower than report of Tolosa and Worku (2007) who reported 6300 USD loss per annum at Jimma municipal abattoir. The current finding is higher than the report of Mwabonimana et al. (2009) at Arusha abattoir, Tanzania and Nuraddis et al. (2010) at Kombolcha industrial abattoir (1833 USD). 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. To this end, it is economically important disease that warrants due attention.

CONCLUSION

In present study moderate prevalence of bovine fasciolosis was obtained when compared with prevalence reported by different researchers at different area. The dominant *fasciola* revealed was *fasciola hepatica* at Haramaya municipal abattoir that induces economic losses due to liver condemnation. 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.

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CONFLICT OF INTEREST

Authors declare that they have no conflict of interest.

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