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An Abattoir Survey on the Prevalence and Monetary Loss of Fasciolosis among Cattle in Wolaita Sodo Town, Ethiopia

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Abstract: A cross sectional study was carried out between October, 2011 and April, 2012 with the aims of determining the abattoir prevalence of fasciolosis, calculating the monetary loss associated with fasciolosis and comparing coproscopy and postmortem techniques for the examination of fasciolosis among cattle slaughtered at Wolaita Sodo municipal abattoir, Ethiopia. Out of the total 300 cattle examined, 47(15.67%) and 76(25.33%) were positive for fasciolosis through coprological and postmortem examination, respectively. From this result, examination of the liver of animals during post mortem inspection was the most reliable method to detect fluke infection. *Fasciola hepatica* was found to be the most prevalent species in the study accounting for 42.1% where as *F. gigantica*, mixed and immature or unidentified forms of *Fasciola* species were found to be 26.31%, 29.73% and 11.84%, respectively. Statistically significant variation ($P<0.05$) on the prevalence of fasciolosis was observed among months and body conditions. The economic loss incurred due to condemned liver and carcass weight loss due to fasciolosis was estimated to be 1,574,482 Ethiopian birr (87,471 USD) per annum. Thus, fasciolosis was proved to be widely distributed disease with relatively high prevalence and great impact on the economy. Therefore, more detailed study on ecology and biology of the snail and its effective control measures should be planned.

Key words: Abattoir · Prevalence · Monetary loss · Fasciolosis · Cattle · Wolaita Sodo · Ethiopia

INTRODUCTION

Ethiopia has the largest livestock population in Africa. Ruminant livestock are important source of income for rural communities and are one of the nation's major sources of foreign currency earning. However, this great potential is not properly exploited mainly due to poor nutrition, inadequate disease and parasite control, poor management and low genetic potential of indigenous animals, shortage of trained man power and lack of proper governmental policies [1]. Each year, great economic loss results from death of animals, poor weight gain and condemnation of edible organs at slaughter. This production loss in livestock industry is estimates at more than 90 million USD annually. Among many prevalent parasitic disease fasciolosis is one of the most striking disease of ruminants [2, 3].

Fasciolosis in cattle is a chronic wasting disease caused by presence in the liver and bile ducts, respectively, of immature and adult trematode of the genus *Fasciola*. The disease is found in vast areas of the world, with the smaller *F. hepatica* (3.5x 1cm) in temperate countries and the larger *F. gigantica* (7.5x1cm) in tropical regions is the commonest species. Calves and yearlings are most commonly affected but any age of animals may be susceptible. Although it may take place at any time of the year, infection is most prevalent during autumn in temperate areas, with the resultant effects of disease becoming apparent in winter and spring [4]. The members of this genus are commonly known as liver flukes. They are responsible for the widespread morbidity and mortality in sheep and cattle characterized by weight loss, anemia and hypoproteinaemia. Lymnaeid mud snails are intermediate host and release the infective form, the metacercaria, on to herbage [5].

In spite of the aforementioned prevailing situation and the presence of a number of problems due to fasciolosis there is paucity of well-documented information on the occurrence of fasciolosis among cattle in Wolaita Sodo, Ethiopia. Therefore, this study was designed with the aims to:

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- Determine the prevalence of cattle fasciolosis in Sodo municipal abattoir.
- Compare the diagnostic efficiencies of fecal and post-mortem examination.
- Estimate the magnitude of direct economic loss incurred due to liver condemnation and carcass weight loss.

MATERIALS AND METHODS

Study Area: This study was conducted in Wolaita Sodo town which is found in South Nation Nationality and People Regional State, Ethiopia. It is located 383km form Addis Ababa, the capital of Ethiopia. The area is bounded with Damot Gale Woreda to the North, Humbo Woreda to the South, Damot Woide Woreda to East and Damot Sore Woreda to the West. Its altitude ranges from 1650 to 2980 m.a.s.l. It receives an annual rainfall of 1000-1200mm and an annual temperature of 25-35°C. The area is categorized under Woina Dega agro ecological climate. The livestock population of the area comprises about 128919 cattle, 29191 sheep, 4606 goats, 4124 equines and 55278 poultry [6].

Study Population: The study population for the study were indigenous adult male Zebu cattle brought for slaughter from different localities and livestock markets in their vicinity.

Study Period and Study Design: The study was conducted between October, 2011 and April, 2012. A cross sectional study design was carried out to determine the prevalence and the economic importance of fasciolosis among cattle by using post mortem examination of liver of each slaughter animal and coprological examination during ante mortem before the animal allowed for slaughter.

Sampling Method and Sample Size: Systematic random sampling method was employed for determining the prevalence of fasciolosis among cattle and the magnitude of direct monetary loss due to liver condemnation and indirect carcass loss at Woliata Sodo municipal abattoir, Ethiopia. To calculate the total sample size, the following parameters were used: 95% level of confidence (CL), 5% desired level of precision and 25% prevalence of cattle fasciolosis in Woliata Soddo municipal abattoir confirmed by Tegegn [7], the sample size was determined using the formula given in Thrusfield [8].

$$n = \frac{1.96^{2*}\ \text{Pexp}\ (1\text{-Pexp})}{d^2}$$

n = Required sample size, Pexp = expected prevalence, d = desired absolute precision

Therefore, based on the above formula, the total sample size of cattle was calculated to be 300.

Study Methodology

Coprological Examination: Prior to sampling; an identification number was given to each animals presented to the abattoir for the routine meat inspection. Fecal sample were collected directly from rectum of animals. The feces were collected by hands protected by rubber gloves, using two fingers. The samples were taken to the laboratory in tightly closed universal bottles and examined for *fasciola* eggs by using sedimentation technique.

Post mortem Examination: During meat inspection, the previously identified animals and their livers were carefully supervised and examined, so as to avoid mixing up of the organs to be inspected. The fluke recovery was conducted following the approach of Hammond and Sewell [9, 10], as follows: the gall bladder was removed and washed to screen out mature flukes. 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. Identification of the fluke species involved was carried out based on the morphological features of the agent and classify in to *F. hepatica, F. gigantica*, mixed and unidentified or immature forms of liver fluke [11, 5].

Economic Loss Analysis Due to Liver Condemnation: The total economic loss due to fasciolosis in Wolaita Sodo municipal abattoir was estimated from the summation of annual liver condemnation and indirect annual loss due to reduction of meat yield. Partial condemnations of liver were not a common practice in the abattoir. The mean retail price of one liver and one Kilogram of beef in Wolaita Sodo town was taken as 75 Ethiopian birr and 60 Ethiopian birr respectively.

The average numbers of cattle slaughtered in Wolaita Sodo municipal abattoir were 7480 cattle per year based on three year recorded data. A 10% carcass weight loss due to fasciolosis in cattle is reported by ILCA [12]. An average carcass weight of local zebu is estimated to be 126Kg ILCA [12]. The total annual economic loss due to fasciolosis was calculated using the formula:

Total annual liver condemnation (ALC) =
NAL X CL X Prev

Where:

NAL = Average number of cattle slaughtered in Wolaita Sodo municipal abattoir per year
CL = Mean cost of one liver in Wolaita Sodo town
Prev = Prevalence of totally condemned liver due to fasciolosis in Wolaita Sodo municipal abattoir

Indirect annual economic loss due to reduction of meat (IAL) =NAL X CL PA X Prev

Where:

NAL = Average number of cattle slaughtered per year at Wolaita Sodo abattoir
CL = Carcass weight loss in individual cattle due to fasciolosis
PA = Average price of one kilogram of beef in Wolaita Sodo town
Prev = Prevalence rate of fasciolosis at Wolaita Sodo municipal abattoir

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

Data Management and Analysis: Microsoft Excel was used for data management and computation of descriptive statistics. Computation of descriptive statistics was conducted using SPSS version 16.0. Descriptive statistics such as percentages, proportions and frequency distributions were applied to compute some of the data. The prevalence of fasciolosis was calculated by dividing the number of cattle harboring *Fasciola* parasites by the number of cattle examined. Pearson's chi-square (χ^2) to measure association between prevalence of the parasite with the potential risk factors was used as a statistical tool. The difference among risk factors was statistically significant if the p- value was less than 0.05 (P<0.05).

RESULTS

Coprological Examination: Out of 300 fecal samples examined, 47 (15.67%) were positive for fasciolosis. The highest prevalence of fasciolosis was observed during October and November and the lower was seen during January and February. Statistically analysis showed that there was significant difference (P<0.05) in prevalence of fasciolosis among months (Table 1).

During coproscopy examination, the prevalence of fasciolosis was proved to be highest in poor body condition cattle when compared to cattle with good and medium body condition. Statistical analysis showed that there was significant difference (P<0.05) in prevalence of fasciolosis among the three body conditions (Table 2).

Post mortem Examination: Post mortem examination was carried out among 300 adult male indigenous zebu cattle, out of 300 cattle slaughtered at Wolaita Sodo municipal abattoir; 76 cattle were positive for fasciolosis, giving a prevalence of 25.33%. The highest prevalence of fasciolosis was recorded during October and November and the lowest was seen during January and February. Statistically analysis showed that there was no significant difference (P>0.05) on prevalence of fasciolosis among months (Table 3).

During postmortem examination, the prevalence of fasciolosis was proved to be highest in poor body condition cattle when compared to cattle with good and medium body condition. Statistical analysis of the data showed that there was significant difference (P<0.05) in prevalence of fasciolosis among body conditions of cattle (Table 4).

Species assignments of the 76 livers infected by *Fasciola* species showed *F. hepatica* to be the most abundant *Fasciola* species in the study with a prevalence of 42.1% (32/76) (Table 5).

Comparison of Coprological and Post mortem Examination: From the total 300 cattle examined for the presence of *Fasciola*, post mortem finding was revealed better result (25.33%) than coprological examionation (15.67%) (Table 6).

Table 1: Monthly prevalence of cattle fasciolosis based on coprological examination

Month	Examined	Positive	Prevalence (%)	Fisher's exact
October	100	22	22	0.027
November	50	12	24	
December	68	6	8.82	
January	49	4	8.816	
February	33	3	9.09	
Total	300	47	15.67	

Table 2: Prevalence of fasciolosis among body condition during coprological examination

Body condition	Examined	Positive	Prevalence (%)	χ^2	P-value
Good	170	18	10.58		
Medium	96	17	17.7	13.5349	0.001
Poor	34	12	35.29		
Total	300	47	15.67		

Table 3: Monthly prevalence of cattle fasciolosis based on post mortem examination

Months	No. Examined	No. Positive	Prevalence	χ^2	P-value
October	100	30	30%		
November	50	18	36%		
December	68	12	17.64%	7.8033	0.099
January	49	10	20.4%		
February	33	6	18.18%		
Total	300	76	25.33%		

Table 4: Prevalence of fasciolosis among body condition during post mortem examination

Body condition	No. Examined	No. Positive	Prevalence	χ^2	P-value
Good	170	31	18.24%		
Medium	96	28	29.17%	0.000	16.22
Poor	34	17	50.00%		
Total	300	76	25.33%		

Table 5: Distribution of *Fasciola* species found in infected liver

Species of *Fasciola*	No of liver infected	Percentage
F. hepatica	32	42.1%
F. gigantica	20	26.31%
Mixed infection	15	19.73%
Unidentified (immature)	9	11.84%
Total	76	100.00%

Table 6: Comparison of coprological and post mortem examination

Results	Coprological examination	Post mortem examination
Positive	47 (15.67%)	76 (25.33%)
Negative	253	224

Economic Losses Analysis Due to Fasciolosis: The average cost of one liver and one Kg beef in Soddo town about 75 and 60 Eth.birr respectively, based on this information to calculate the total economic loss due to fasciolosis using the following formula

Total annual liver condemnation (ALC) =
NAL X CL X Prev

Where:

NAL = average number of cattle slaughtered in Wolaita Sodo municipal Abattoir per year
CL = Mean cost of one liver in Wolaita Sodo town
Prev = Prevalence of totally condemned liver due to fasciolosis in the Wolaita Sodo abattoir
ALC = NAL X CL X Prev
= 7480 x 75 x 25.33%
142101.00 Ethiopian birr

Indirect annual economic loss due to reduction of meat (IAL) =NAL X CL PA X Prev

Where:

NAL = Average number of cattle slaughtered per year at Wolaita Sodo abattoir
CL = Carcass weight loss in individual cattle due to fasciolosis
PA = Average price of one kilogram of beef meat in Wolaita Sodo town
Prev = Prevalence rate of fasciolosis at Wolaita Sodo municipal abattoir
IAL = 7480 X (126 X10%) X 60 X 25.33%
= 1432381.00 Ethiopian Birr

The total annual economic loss due to fasciolosis at Wolaita Sodo municipal abattoir is therefore

1 + 2 = 142101.3 +143238.1
= 1,574,482 Ethiopian birr (87,471 USD) per annum

DISCUSSION

The result of coprological examination (15.67%) on the prevalence of fasciolosis in the present study was lower than that of Getu [13] and Tegegn [7] where they reported a prevalence of 28% and 21.2% respectively in their study conducted at Wolaita Sodo municipal abattoir. This could be explained by the fact that awareness has been created in the area on the control and prevention of fasciolosis.

The results of post mortem examination (25.33%) in the present study was lower than that of Abdul [14] who reported 47% prevalence of bovine fasciolosis in Wolaita Sodo municipal abattoir. This could be attributed to ecological and climatic condition difference from where the animals were brought to the abattoir. Management system practice could also be the probable reason for the variations. The prevalence of cattle fasciolosis found in this study was lower when compared to the result of other workers in other parts of the country such as 53.5% in Kombolcha abattoir by Mulugeta [15], 46.15% in Jimma by Tadele and Worku [16], 56.6% prevalence of cattle fasciolosis reported in Zeway abattoir by Adem [17] and .54.5% prevalence of fasciolosis in Jimma municipal abattoir reported by Abie *et al*. [18]. The lower prevalence of fasciolosis among cattle in Wolaita Sodo town and the differences in the prevalence of the present study among other researchers finding could be attributed the different techniques used in these studies and differences in the origin of the samples or by geographical differences.

The prevalence of fasciolosis found in the present study was higher by post mortem finding than the coprological examination. This finding was in line with that of Abdul-Jabbar [19] who reported that the post mortem prevalence was higher than that of coprological examination, this may be due to need of longer period from 8 -15 weeks after infection for the appearance of *Fasciola* egg in the feces [20]. Coprological examination includes numerous steps that increase the chance of losing eggs, as demonstrated by the lower number of positive result recorded in this work. Eggs may remain in the debris while filtering the feces through gauze or may get fixed on the bottom and wall of the container and with in the pipette when taking the sediment for microscopic observation. Furthermore the detection of *Fasciola* eggs and the appearance of the disease in some areas were difficult to detect during the prepatent period because eggs are expelled intermittently depending on the evacuation of the gall bladder and life cycle of *Fasicola* [21].

The finding of the present study showed that there was statistically significance variation in the prevalence of fasciolosis ($P<0.05$) among months; the highest prevalence was observed during October and November when the wet ecological conditions still prevailed. This result was in line with the report of Wakuma [22] who showed the highest prevalence was observed during October and November this fact has been described that the bionomic intera molluscan stages of flukes often reach the threshold during the wet months of the year. During the dry period, breeding of the snails and development of the larval flukes slow down or stops completely and snails undergo a state of aestivation [23].

Analysis on the prevalence of fasciolosis in relation to body condition of animal showed statistically significance differences ($P< 0.05$) indicating an inverse relation in prevalence with body condition score. The prevalence was found to be 50%, 29.17% and 18.24% based on post mortem finding for poor, medium and good body condition respectively. This is due to the fact that animals with poor body condition are susceptible to the disease. The reason behind is may be due to reduced performance of the animals created by lack of essential nutrients and poor management by the animal owner. This finding corresponds with Yohannes [24] in Adewa municipal abattoir, who reported 42.4%, 36.8% and 21.8% for poor, medium and good body condition respectively. The total annual economic losses due to liver condemnation and carcass weight loss was estimated to be 1,574,482 Ethiopian birr (87,471 USD). The monetary loss in the present study was higher than the results of Tadele and Worku [16] who calculated monetary loss of cattle fasciolosis to be 54,063 Ethiopian birr (3180 USD) in their study conducted in Jimma municipal abattoir. Abie *et al*., [18] estimated monetary loss of cattle fasciolois to account for 2,570,396 Ethiopian birr (151,200 USD). The difference in the estimated economic losses could be attributed to the increase in the price of liver and meat in the global market in general and in Ethiopia in particular.

CONCLUSION

The present study showed higher prevalence of fasciolosis and confirmed that fasciolosis to be an important disease entity causing considerable loss of revenue at Wolaita Sodo municipal abattoir. The total annual economic losses due to liver condemnation and carcass weight loss due to fasciolosis was estimated to be 1,574,482 Ethiopian birr (87,471 USD). Additionally, the finding indicated that coprological examination for parasite eggs has significant limitation in detecting the presence or absence of fasciolosis, while; examination of the liver of animals during post mortem is the most reliable method to detect fluke infection. During the study months and body condition were identified as important risk factors for the occurrence of fasciolosis in cattle.

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