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Prevalence and Economic Significance of Bovine Fasciolosis in Shambu Municipality Abattoir, Ethiopia

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Abstract: A cross sectional study was conducted from March 2015 to October 2015 to determine the prevalence rate and the economic significance of bovine Fasciolosis in shambu municipality abattoir, by using ante-mortem examination (feces) and post- mortem examination of liver of each slaughtered animal in particular. The objectives of the study were to determine the prevalence rate and economic significance of bovine fasciolosis in shambu municipality abattoir. From the total number of cattle slaughtered (449) during the study period, 384 cattle liver examined (post mortem examination) 51.6% (198) of them were found to be positive for Fasciolosis. *Fasciola hepatica* was found to be the most liver fluke species affecting cattle slaughtered in the study area. 24.3 % of the total livers found to be positive for bovine Fasciolosis were infected by *F. hepatica* whereas *F. gigantica* and unidentified or immature forms of fasciola species recovered were 10.4 % and 12.8 % respectively. Associated risk factor wise analysis revealed that origin (P=0.034) and body condition (P=0.001) were statistically significantlyassociated with the prevalence of fasciolosis during coprological examination. However sex and age wise analysis indicated that the prevalence of fasciolosis wasn't statistically significantly (P>0.05) associated with both age and sex. For fecal examination 65 cattle selected and examined and 20 (30.8%) of them were positive for fasciola eggs. In line to the economic importance of bovine Fasciolosis in the study area, the problem caused loss of an average of 186.97 and 68244.48 Ethiopian birr per day and annum, respectively and thus found to have significant economic importance.

Key words: Economic Significance · Fasciolosis · Shambu Municipal Abattoir · Prevalence and Bovine

INTRODUCTION

The livestock sector globally highly dynamic contributes 40% of the global value of agricultural output and support the lively hoods and food security of almost a billion people [1]. Beyond their direct role in generating food and income, livestock are a valuable asset, serving as store of wealth, collateral for credit and an essential safety net during times of crises [2].

Ethiopia has the largest live stock population in Africa, which plays an important role in daily lives of the people [3].In Ethiopia livestock production is an integral part of the agricultural system. The livestock subsector accounts 40% of the agricultural growth domestic product (GDP) and 20% of the total GDP without considering other contribution like traction power, fertilizing and mean of transport [4].

Livestock and livestock's products are the major foreign exchange earns. Only second to coffee; with hides and skins contribute in the most. However, currently the overall livestock production constraints in Ethiopia are feed shortage, livestock diseases and low genetic potential of indigenous livestock and lack of marketing infrastructure and water shortages [5].

Not only these, a significant loss results from death of animals, inferior weight gain and condemnation of edible organs and carcass at slaughter each year. These production losses to the livestock industry

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estimated at more than 900 million USD annually [6]. The main causes of organ condemnation during postmortem inspection are diseases originated by parasites, bacteria and virus. Similarly like many others tropical countries of Africa, it is well known that parasitic diseases are among the major factors responsible for the low productivity of livestock in Ethiopia. These infections not only cause clinical diseases and mortalities but also economic losses through production losses and condemnation of specific organs at slaughter [7].

Parasitic diseases in the tropics are responsible for great losses in the meat industry than any other infectious or metabolic disease [8]. Like many other African countries, it is known that Fasciola species, Hydatid cyst and Cysticercusteniucollis are major parasites responsible for low productivity in Ethiopia livestock industry due to imposing poor weight gains, condemnation of organs and carcass and lower milk yield in different livestock's [9].

Among many prevalent parasitic disease, Fasciolosis is one of the most striking disease of ruminates. Fasciolosis disease caused by the Trematode helminthes of genus fasciola, commonly members of these are known as liver flukes and the primary host are sheep and cattle. However, other domestic animals and human are infected [10]. Fasciolosis is one of the major parasitic disease that infect an enormous loss to cattle and sheep production through mortality, reduction in weight gain, loss of meat and milk and reduction in working power. Fasciolosis accounts for series economic losses particularly in Africa through productivity and condemnation of large number of infected livers as the conditions suitable for the survival and multiplication of snail intermediate host which exist mostly in the tropical countries [11].

The parasite lives parts of its life in intermediate host mainly snails of the genus Lymnaea. This is found in and around wet areas, such as water holes, farm animals are likely to pick up the parasite; if they drink from these sources [12]. Fasciolosis occurs worldwide in acute, sub acute and chronic forms. Large number of young flukes causes acute swelling and congestion of the liver producing an acute paranchymatous hepatitis in which the serous capsule of the liver may be sprinkled with hemorrhages and covered with fiber. In chronic Fasciolosis of sheep, the liver becomes irregularly lobulated and distorted, but the bile ducts and of bluish color [13].

On the other hand, fasciolosis is an emerging zoonotic infection of humans associated primarily with the eating of water cress contaminated with metacercaria and affecting more than 600 million animals, in articles reported a decade ago. This would probably not accurately take into account losses due to the implications and consequences of zoonotic disease and it have been reported that 2.4 million humans are affected. Studies of the effect of F. hepatica infection on live weight gain in cattle have produced results ranging from no significant effect to severe weight loss and death. The geographic distributions of trematode species are dependent on the suitable species of snails. The genus Lymnaea in general and Lymaea of snails' trancatula in particular is the most common intermediate hosts for F.hepatica. This species of snail was reported to have a worldwide distribution [14].

The presence of fasciolosis due to *F.hepatica* and *F.gigantica* in Ethiopia has long been known and its prevalence and economic significance has been reported by several workers, different works so far conducted [15]. The aims of the study were to determine the prevalence of bovine fasciolosis in Shambu municipal abattoir and to assess the economic importance of bovine fasciolosis at the study area.

MATERIALS AND METHODS

Description of Study Area: Shambu is a town and separate woreda in western Ethiopia, located in Oromia regional state, HoroGuduruwollega Zone, west of Lake Fincha. And found at 305 km from Addis Ababa, located at a longitude of about 37° '05 "-37° '45" East and 9° '00 "-9° '25" North latitude and at an elevation of 2,500m above sea level. The study area receives a mean annual rainfall of 126.4 mm which is high and small during rainy seasons and mean of annual temperature of 15.7 °C. The climatic condition is Dega and the mixed farming system is conducted in the area [16]. The town has the total population of 14,995. The livestock population of the area include 61,901 (Cattle), 10.112 (Sheep), 11,000 (Goats), 4925 (Equines) and 30,749 (Poultry) [17].

Study Animals: The study animals were indigenous cattle brought from different markets and localities surrounding Shambu town, includes Sekele, Homi, Gabarobi and also Shambu area are the source of cattle brought to the abattoir of the study area.

Sample size Determination and Sampling Method: The desired sample size for this study was 384 cattle and simple random sampling method used but in order to increase the precision, 449 sample size used. Sample size calculated by using the formula given by the

Thrus field [18]. With 95% confidence interval 5% absolute precision and at 50% expected prevalence. In this study, 50% prevalence was considered to calculate the sample size using the following formula.

n= Z2Pexp (1-Pexp) / d2
= 1.962 PexP (1-PexP) / d 2=1.962X 0.5(1-0.5)/0.052
=3.8416 X 0.5 X 0.5 / 0.0025
= 0.9604/ 0.0025 =384

where
n -sample size required
1.96-the value of Z at 95% confidence level
Pexp- expected prevalence
D -desired absolute precision

Accordingly, the estimated sample size was 384 animals, but in order to increase precision 449 animals were included in the study.

Study Design and Methods

Study Design: Across sectional study type was conducted to determine the prevalence and economic significance of bovine fasciolosis by using ante mortem examination (Fecal examination) and postmortem examination of different organs in general and liver of each slaughtered animal in particular. In this study animals were proposed as into age (<3years, 3-5years, >5years), sex (male and female) and body condition (Good/medium/poor) and origin of cattle (Shambu, Sekela, Homi and Gebarobi).

Study Methods: Ante mortem examination was conducted while the animals brought from different origins at standing position in abattoir place, feces were collected for some animals for laboratory examination using sedimentation technique and post mortem examination of organs (Liver) manipulated by visualization, palpation and transverse incision across the left lobe [19] and questionnairessurvey/ un interview made with butchers for assessment of cost of liver.

Collection: Appropriate data were collected by using post-mortem examination of the organs to be infected by fasciolosis and ante mortem examination. An interview was made with retailers of offal (Liver) produced at Shambu municipality abattoir to obtain information on the average price of a liver in the study area during the study time. According to the response of the retailers the price of a liver was found to be seventy five (50) Ethiopian birr on average. During ante mortem examination detail records about the species, breeds, sexes, origins and body conditions of the animals were performed. The origin of the animal recorded by asking retailers and the age grouping was based on dentition [20] while body condition scoring based on Mari Heinon [21]. During post-mortem inspection, each liver visually inspected, palpated and incised based on routine meat inspection by FAO [22]. All livers having *Fasciola* species condemned were registered and flukes were conducted for species identification.

Coprological Examination: Fecal samples for parasitological examination were collected directly from the rectum of each animal and freshly defected feces in to plastic bottles with gloved hand. The samples were clearly labeled with universal bottles and preserved with 5% formalin and each sample was clearly labeled with animal's identification, date and place of collection. Samples were packed and dispatched in cool box to avoid development of eggs and hatching. In the laboratory, coprospic examination was performed to detect the presence of *fasciola* eggs using the standard sedimentation techniques [23].

Species Identification: After making systematic incision on liver parenchyma and bile ducts, flukes were collected in the universal bottle containing 10% formalin in preservative and examined to identify the involved species. *F.gigantica* (20 - 75 mm x 3.12mm) resembles *F.hepatica* (20 - 30mm x 10mm) but readily recognized by its larger size, the shoulders are not prominent and the body is more transparent. It is grayish- brown in color changed to grey when preserved [24].

Economic Loss Assessment: The total economic loss due to fasciolosis in cattle slaughtered from the summation of annual liver condemnation cost (Direct loss) and cost due to carcass weight reduction (Indirect loss) was assessed [25].

Direct Economic Loss: Direct economic loss was resulted from condemnation of liver affected by fasciolosis. All livers affected with fasciolosis were totally condemned. The annual loss from liver condemnation was assessed by considering the overall annually slaughtered animal in the abattoir and retail market price of an average zebu liver. While retail market price of an average size zebu liver was determined from the information collected from butcheries in Shambu town.

The information obtained was subjected to mathematical computation using the formula set by Ogunrinade and Adegoke [25].

ALC = CSR X LCX P

where
ALC = Annual loss from liver condemnation
CSR = Mean annual cattle slaughtered at municipality abattoir
LC = Mean cost of one liver in Shambu town.
P=Prevalence rate of the disease at the study abattoir.

Indirect Economic Loss: Indirect economic loss was associated with carcass weight reduction due to fasciolosis. A 10% carcass weight loss in cattle is due to fasciolosis. Average carcass weight of an Ethiopian Zebu was taken as 126 kg [21]. The annual carcass weight loss due to bovine fasciolosis assessed using the following formula set by Ogunrinade and Adegoke [25].

ACW = CSR XCL XBC X PX 126 Kg

where ACW = Annual loss from carcass weight reduction.
CSR = Average No. of cattle slaughtered per annual at the study abattoir.
CL = Carcass weight loss in individual cattle fasciolosis
BC = an average price of 1kg beef at shambu town.
P=Prevalence rate of fasciolosis at the study abattoir.
126 kg = Average carcass weight of Ethiopian Zebu.

Data Management & Statical Analysis: The prevalence of fasciolosis is calculated as the number of cattle found to be infected with *Fasciola* expressed as percentage of the total number of cattle slaughtered and analyzed by stata 12 version software. The economic significance of the problem is analyzed based on the information obtained during interview and calculated on daily and annual bases.

RESULTS

Origin: Origin of animal was tasted as risk factor for fasciolosis,the prevalence of 42%, 48.9%, 51.1%, 64.8% and 48.6% was detected in Shambu, Sekela, Homi and Gebarobi respectively was statistically significant ($p<0.05$) (Table 1).

Age: The age wise prevalence of fasciolosis was 37.7%, 46.2% and 53.8% in <3, 3-5 and >5 respectively but the difference was not statistically significant ($p>0.05$) (Table 2).

Body Condition: The prevalence of fasciolosis based on body condition was 38.7%, 50.8% and 76.5% in good, medium and poor respectively was statistically significant ($p<0.05$) (Table 3).

Sex: The prevalence of fasciolosis was 44.8% and 53.3% in male and female but it was not statistically significant ($p>0.05$) (Table 4).

Table 1: Prevalence of bovine fasciolosis based on origin 4 of cattle

Origin	No. of Animal examined	No. of positive cases	No. of negative cases	Prevalence %	P- value	x^2
Shambu	162	68	94	42	0.034	8.652
Sekala	186	91	95	48.9		
Homi	47	24	23	51.1		
G/robi	54	35	19	64.8		
Total	449	218	231	48.6		

Table 2: The prevalence of bovine fasciolosis indifferent age groups

Age	No of animal examined	No of positive cases	No of negative cases	Prevalence%
<3	53	20	33	37.7
3-5	197	91	106	46.2
>5	199	107	92	53.8
Total	449	218	231	48.6

P-value 0.78 x^2 5.089

Table 3: Prevalence of bovine fasciolosis based on body condition.

Body condition	No of animal examined	No of positive cases	No of negative cases	Prevalence%
Good	155	60	95	38.7
Medium	260	132	128	50.8
Poor	34	26	8	76.5
Total	449	218	231	48.6

P-value 0.000 x^2 17.132

Table 4: Prevalence of bovine fasciolosis based on sex bases

Sex	No of animal examined	No of animal positive	No of animal negative	Prevalence%
Male	252	113	139	44.8
Female	197	105	92	53.3
Total	449	218	231	48.6

P-value 0.087 x^2 3.167

Table 5: Species of *Fasciola* encountered in affected livers

Fasciola species	No. of livers condemned	Prevalence (%)
F.hepatica	109	28.4
F.gigantica	40	10.4
Mixed form	49	12.8
Total	198	51.6

Fasciola Species Identification: From a total of 384 livers examined, 198 livers (51.6%) found positive. For fluke infection during postmortem inspection of slaughtered animals 109 (28.4) harbored*F.hepatica*, 40 livers (10.4%) *F.gigantica* and 49 livers (12.8%) infected with unidentified species due to immature fluke

Direct Economic Losses: Direct economic loss was resulted from liver condemnation as the result of fasciolosis. Generally all infected livers with fasciolosis are unfit for human consumption. The 198 fasciolosis infected livers of cattle were corresponding to an estimated total loss of about 16350 ETB. In the study abattoir the average annual cattle slaughtered rate was estimated to be 1053 while mean retail price of bovine liver in Shambu town as 50 ETB. Prevalence of fasciolosis in Shambu municipality abattoir estimated as (51.6%). Therefore the estimated annual loss form organ condemnation (liver) is calculated according to the formula: ALC = CSR X LC X P = 1053 X 50 ETB X 51.6% = 1053 X 50 ETB X 0.516 = 27,167.4 ETB.

Indirect Economic Losses: Indirect economic loss was due to carcass weight reduction as result of *Fasciola* infection. In the study area the average price of 1kg beef was 100 ETB. The annual economic loss from carcass weight reduction due to bovine fasciolsis is calculated by using the formula: ACW = CSR X CL X BC X P X 126kg = 1053 X 10% X 90 ETB X 51.6% X 126kg = 1053 X 0.1 X 90 ETB X 0.516 X 126kg = 616,156.63 ETB.

Therefore, the total annual economic loss due to bovine fasciolosis in the study abattoir is the summation of the losses from organ condemnation (Direct loss) and carcass weight reduction (Indirect loss) and thus a total of 643,324.00.

DISCUSSION

An important function of meat inspection is to assist in monitoring the diseases by providing feedback information to the veterinary service to control or eradicate diseases, to produce wholesome products and to protect the public from zoonotic hazards [26].

In the present study, the prevalence of *Fasciola* species and direct economic losses caused by these parasites as consequence of liver condemnation was estimated. The overall abattoir prevalence of fasciolosis in the present study was (51.6%) which is correlates with the study conducted by and Adem [27] with the rate of 47% and 56.6% at Sodo and Ziway municipal abattoir respectively. This is due to similarity of ecology and climatic condition between the localities. Based on Origin of animal the prevalence of bovine fasciolosis was 42%, 48.9%, 51.1%, 64.8% and 48.6% was detected in Shambu, Sekela, Homi and Gebarobi respectively, it was statistically significant ($p<0.05$) (Table1)and higher in Gebarobi,may be due to favorable ecological condition such as altitude, rainfall and temperature and vibration in the climatic condition.

The age wise prevalence of fasciolosis was 37.7%, 46.2% and 53.8% in <3, 3-5 and >5 respectively but the difference was not statistically significant ($p>0.05$) (Table 2).The adult and older cattle have the same risk of infection. Similar risk of infection could be due to the fact that both adult and older cattle were forced to graze on same pasture, exposed to risk of infection by metacercaria of fasciola species. This correlates with other previous findings [28-30].

In this study, higher prevalence of bovine fasciolosis on post mortem examination (51.6%) was obtained when compared with the prevalence reported by Daniel [31] (14.4%) at Dire Dawa municipality abattoir. This is probably due to the ecological and climatic difference between the two localities. Moreover, the management systems in practice could also be the probable reason for the variation.

One of the most important factors that influence the occurrence of fasciolosis in an area is availability of suitable snail habitat. In addition, optimal base temperature to levels of 10% and 16°C are necessary for snail vectors of *F.hepatica* and *F.gigantica*, respectively. These thermal requirements are also needed for the development of *Fasciola* with in snails. The ideal moisture conditions for snail breeding and development of larval stages with the snails are provided when rainfall exceeds transpiration and filed saturation is attained. Such conditions are also essential for the development of fluke eggs, miracidiae searching for snails and dispersal of cercariae.

Of the total livers (198), 28.4% of them were found to be positive for bovine Fasciolosis infected by *F. hepatica*, whereas *F. gigantica* and unidentified forms of *Fasciola* species were recovered to be 10.4% and 12.8% respectively diagnosed as positive for Fasciolosis. Similar study conducted at Jimma and Bedelle abattoir reported, *F.hepatica* 63.89%, *F.gigantica* 24.07% and immature form 12.4% [32] and *F.hepetica* 64.5%, *F.gigantica* 24.8% and immature form 10.7% [33] respectively. Moreover, Garber & Daynes reported that; in Ethiopia *F. hepatica* and *F. gigantica* infections occur in areas above 1800 m.a.s.l. and below 1200 m.a.s.l. respectively. The high prevalence rate of *F. hepatica* may be associated with the existence of favourable ecological biotops for *L. truncatula*. Relatively small proportion of cattle were found infected with *F. gigantica* alone or mixed infection with both species. This may be explained by cattle coming for slaughter from highland and middle altitude zone flood prone areas, drainage ditches are favorable habitat to *natalensis*.

Fecal examination conducted on 65 cattle during ante-mortem examination revealed that 20 (30.8%) of the animals were positive for fasciolosis.The highest prevalence rate was analyzed during October, when the wet-ecological conditions still prevailed. It has been described that the bionomic requirements for breeding of the *Lymnaea* snails and development of the intramolascan stages of the flukes often reach the optimum threshold during the wet months of the year. During the dry periods, breeding of the snails and development of the larval flukes slow down or stops completely and snails undergo a state of aestivation [34].

The prevalence of fasciolosis based on body condition was 38.7%, 50.8% and 76.5% in good, medium and poor respectively was statistically significant ($p<0.05$) (Table 3). The present study shows that lean body condition animals were with higher infection than animal medium and fat body condition similar finding was also reported by Bekele *et al*. [35]. This implies that fasciolosis causes emaciation of the animals. Low body score was associated with liver fluke infection. However, other than fluke infection inadequate nutrition and concurrent infection 0f the animals with other bovine pathogens could enhance the effect of the flukes for the emaciation of the animals.

Prevalence of fasciolosis was 44.8% and 53.3% in male and female but it was not statistically significant ($p>0.05$) (Table 4). In the present study the infection prevalence of fasciolosis in cattle was not affected by sex of the animals. This is agreement with several previous reports in different parts of the county [36]. This could be associated with similar management given to both male and female cattle and communal grazing areas.

The direct economic loss encountered due to condemnation of infected liver from one year data recorded from abattoir in this study was 27,167.4 birr per annum and indirect loss from carcass weight reduction was 616,156.63 birr and the total economic loss was 643,324.03 ETB. This finding is by far higher than the results reported by a total economic loss of about154, 188 and 215,000 Ethiopian birr per annum in cattle due to fasciolosis at Ziway and Dire Dawa municipal slaughterhouses, respectively. This is probably due to the ecological and climatic difference between the two localities and increment in price of meat as whole.

CONCLUSION AND RECOMMENDATIONS

The present study confirmed that fasciolosis is an important disease entity causing considerable loss of revenue due to condemnation of affected liver and carcass weight reduction at shambu municipality abattoir.

This may be due to the fact that the area has suitable ecological condition to the existence and multiplication of the intermediate host snail (*L.truncatula*). Therefore, based on the aforementioned conclusion, the following recommendations are forwarded:

- Application of good drainage and building of dams at appropriate sites in marshy and low laying areas may reduce the snail problem.
- Locally available control strategies like planting of trees and shrubs that have mollucicidal activity (*phytolociadodecandara)* with local name *Endod*) along streams should be given special emphasis from economic point of view.
- Keeping the animals off from marshy areas inhabited by interimidate host or by fencing of these dangerous zones.

- The 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 at shambu.
- Finally, the farmers should be educated and informed about the importance of the disease control programs and regular deworming of animals before and just after rainy season.

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