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Prevalence of Bovine Fasciolosis; Coprological, Abattoir Survey and its Associated Financial Losses Due to Liver Condemnation at Hawassa Municipal Abattoir, Southern Ethiopia

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Abstract: A cross-sectional study was carried out from November, 2010 to April, 2011 with the aim of determining the prevalence, financial significance of fasciolosis and to determine the most prevalent species of liver fluke in cattle slaughtered at the study abattoir. Out of the total 316 cattle examined during the study period, 101 (31.96%) were positive with fasciola infection on postmortem examination and 86 (27.22%) were positive on coprological examination. The prevalence based on body condition of the animal was 63.33% in poor body condition, 25.62% in medium body condition and 20.75% in good body condition on abattoir survey and 61.67% in poor body condition, 22.17% in medium body condition and 7.55% in good body condition on coprological study. *Fasciola hepatica* was found to be the predominant fasciola species affecting cattle slaughtered in the study area, 61.37% of the total livers positive for bovine fasciolosis where infected by *F. hepatica* while 10.89% livers had *F. gigantica*, 15.84% were infected with both species and 11.88% were infected with the immature fluke. Out of the total positive livers, 38.61% were affected lightly, 46.53% were affected moderately and 14.85% were affected severely. A direct economic loss identified in cattle due to liver condemnation by fasciolosisat Hawassa municipal abattoir was estimated 291,635.00 Ethiopian Birr per annum. Hence, stakeholders should be able to regularly treat their animals with the appropriate anthelementics and awareness should be created on the prevention and control methods of fasciolosis.

Key words: Bovine Fasciolosis · Economic Significance · Hawassa Abattoir · Prevalence

INTRODUCTION

According to CSA [1] report Ethiopia has an estimated of 53.99 million cattle population. Even though, Ethiopia has large cattle population, their production is much lower than that of the fast-growing human population of the country. The livestock resources represent only 19% of the export earning of the country over 30% to the agricultural gross domestic product. This low productivity is attributed to a number of constraints of which feed and nutrition, disease, breeding and marketing are the major one in their list of priority. Among the many livestock disease helminthiasis is considered as one of the major constraints in the livestock improvement program in Ethiopia. One of the helminthes that cause direct and indirect loss especially, in domestic ruminants is fasciolosis. It is a serious hazard to efficient production of cattle particularly in its sub-clinical form [2].

Bovine fasciolosis is an economically important parasitic disease of domestic ruminants caused by fasciolidae trematodes of the genus *Fasciola*. The two most important species of this genus, *F. hepatica* and *F. gigantica*, are commonly known as liver flukes. Generally the distribution of fasciolosis is worldwide, however, the distribution of *F. hepatica*, is limited to temperate areas and high lands of the tropical and sub-tropical regions and *F. gigantica* predominate in tropical area [3].

The two most important species of *Fasciola* (*F. hepatica* and *F. gigantic*) are found in many parts of Ethiopia where there is suitable ecological condition for growth and multiplication of intermediate host snails [4].

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The intermediate host of *F. hepatica* is *L. truncatula*, an amphibious snail living in shallow water and wet lands with a wide distribution throughout the world. In Ethiopa the presence of both *Lymnaea truncatula* and *L. natalensis* have been reported [5]. Areas with seasonally flooded pasture, grazing areas of lake shores, slowly flowing water ways and banks of rivers are among the conducive environments for breeding of snails vectors of the fasciola [6].

Fasciolosis has zoonotic importance and in human causes malaise, intermittent fever, weight loss, pain under right coastal margin and often peritonitis with eosinophilia [7]. Man is an accidental host. Human fasciolosis caused by *F. hepatica* has been found mainly in Australia, Bolivia, Cuba, Ecuador, England, Egypt, France, Iran, Peru and Portugal. The largest epidemic on record was in France, near Lyon in 1956-1957, with some 500 cases and in the lot valley in 1957, with about 200 cases. The common source of infection was watercress contaminated with metacercariae. The frequency of the parasite in animal does not appear to be closely correlated with its occurrence in man [8].

Economic losses caused by fasciolosis are due to rejection of affected organs (direct loss) and diminution of the potential productivity of livestock. Infection of domestic ruminant with *F. gigantica* (tropical liver fluke) and *F. hepatica* (temperate liver fluke) causes significant economic loss estimate over 2000 million US dollar per year to the agriculture sector worldwide with over 600 million animals infected [9]. The annual loss due to endoparasites, including fasciolosis in Ethiopia is estimated at 700 million birr [10]. Decreased productivity alone (excluding mortality losses) due to bovine fasciolosis is estimated at 300 million birr [11].

Different works so far conducted in Ethiopia reported variable prevalence rate of bovine fasciolosis in different localities of the country [4] and Mezgebu [12]. In Ethiopia, the prevalence of bovine fasciolosis has shown to range from 11.5 to 87% [13]. In our country, *F. hepatica* is a wide spread in areas with an altitude of 1800-2000 meters above sea level while *F. gigantic* appears to be the most common species in areas below 1200 meter above sea level. Both species co-exist in areas with altitude ranging from 1200-1800 meter above sea level [5]. *Fasciola hepatica* was shown to be the most important fluke species in Ethiopian livestock with distribution over three quarter of the nation except in the arid north-east and east of the country. The distribution of *F. gigantica* was mainly localized in the Western humid zone of the country that encompasses approximately one fourth of the nation [14]. Although the study carried out by Mulugeta [15] reported the prevalence of 28.63% in the study area, studies have not yet been fully studied on the prevalence, coprological examination, species of bovine fasciolosis and financial losses due to liver condemnation in the study area. Hence, the objectives of this study were, therefore, to determine the prevalence of bovine fasiolosis and to identify the fasciola species of bovine and to determine the associated financial loss due to liver condemnation at Hawassa Municipal abattoir.

MATERIALS AND METHODS

Description of the Study Area: The study was conducted at Hawassa town, Southern Nation Nationality and Peoples Regional State, Sidama Zone from November, 2010 to April, 2011. Hawassa is the capital of both Sidama zone and southern region. It is located on the escarpment of the well-known East African rift valley and on the shore of one of the rift valley lakes, Hawassa Lake and found at a distance of 375 km South of Addis Ababa. The geographical location of the town lies between 4°27' and 8°30' latitude North and 34°21' and39°1' longtude East, at the elevation of about 1708 meter above sea level with annual rain fall ranging from 800-1000mm and temperature range from 20.1- 25°C. The abattoir is found 5km away from the town. The total livestock population of Sidama zone including Hawassa is estimated to constitute 1,721,341 cattle, 228,941 goats, 457,465 sheep, 57,643 horses, 54,066 donkeys, 725,540 poultry and 44,492 beehives. Livestock production occupies an enormous share in farm economy of the area. Equine are widely used in pull carts, carrying peoples and goods in the town and nearby villages as income generation for employment opportunity [16].

Study Animals and Study Design: The study animals include systematically selected cattle slaughtered at Hawassa Municipal abattoir. These animals are from different livestock markets from and around Hawassa town. A cross-sectional study was carried out by collecting data on events associated with fasciolosis on cattle slaughtered at Hawassa municipality abattoir. After autopsy the liver was inspected grossly; the fluke recovery and count was aimed to be conducted following the approach Hammond and Swell [17] and identification of the fluke species were carried out by using size parameters described by Soulsby [3]. Fecal samples were taken from the rectum of randomly selected animals and were examined according to the method described by Antonia *et al.* [18].

Sample Size Determination: The sample size for this study was determined by using the formula given by Thrusfield [19] by taking 28.63% expected prevalence that was reported by Mulugeta [15] in Hawassa and 5 % absolute precision using the following formula:

$$n = \frac{1.96^2 p_{exp}(1 - p_{exp})}{d^2}$$

Where, n= Sample size
Pexp= minimum expected prevalence= 28.63%
d= Absolute precision= 5 %

Therefore, at 95% confidence interval, 5% absolute precision and 28.63% expected prevalence, a total of 316 samples were taken.

Study Methodology

Fecal Examination: Fecal sample was collected directly from the rectum of systematically selected cattle during ante-mortem examination. The collected samples were taken to the laboratory with tightly closed universal bottles and examined for *Fasciola* eggs according to the method described by Antonia *et al*. [18].

Post-Mortem Examination: During meat inspection, the same cattle already examined for coprology and their respective livers were strictly supervised and examined. Post-mortem examination was taken by visual inspection, palpation and incision of liver parenchyma, bile duct and gallbladder for the presence of *Fasciola*. The fluke recovery was conducted by cutting the liver in to slice of about one centimeter for recovery of immature flukes and the bile duct was incised to recover adult *Fasciola* [17].

Fluke Species Identification: From the positive livers adult parasites were collected by squeezing in to universal bottle containing 10% formalin preservative and then examined to identify the involved fluke species by their size and morphological character. *Fasciola gigantica* is distinguished from *F. hepatica* by its larger size (20-75 x 3-12 mm for *F. gigantica* and 20-30 x 10 mm for *F. hepatic)*, smaller cephalic cone, less prominent shoulders and more transparent body [3, 8].

Financial Loss Assessment: All livers affected with fasciolosis were totally condemned. The annual financial loss due to condemnation of liver was assessed by considering the overall prevalence rate of the disease, the total annual slaughtered animal in the abattoir and retail price of an average animal liver. The information obtained was subjected to mathematical compilation using the formula set by Ogurinade and Ogurnrinade [20].

ALC = CSR*LC*P, where
ALC = Annual loss from liver condemnation
CSR = Mean annual cattle slaughtered per year at Hawassa Municipal abattoir
LC = Mean cost of one liver at Hawassa town
P = Prevalence rate of fasciolosis at Hawassa abattoir

Data Analysis: The data collected from the study area were coded and then entered for preliminary analysis in to Microsoft Excel (2007) and was analyzed using STATA 11.0 software [21].

RESULTS

During the study period, all animals that were slaughtered in the study abattoir were bovine, males and local breed. Therefore, factors like sex, species and breed of the animals were not considered in any of the data analysis.

Coprological Examination: Fecal sample were collected from a total of 316 cattle and examined by sedimentation technique for *Fasciola* eggs. Accordingly, 86 (27.22 %) animal were found to be infected with *Fasciola* species. The result is displayed on bases of months, body condition of the animals and age of the animals on figure 1 and table 1 and 2, respectively.

Post-Mortem Examination: Abattoir survey conducted on 316 selected cattle slaughtered at Hawassa Municipality abattoir revealed a mean prevalence rate of 31.96% with condemnation of 101 affected livers. The result of abattoir examination is presented on bases of month, body condition of the animals and age of the animals in figure 2 and table 3 and 4, respectively.

Fluke Species Identification: Both species of *Fasciola* were identified with relative abundance of *F. hepatica* 62 (61.37%), *F. gigantic* 11 (10.89%), mixed species 16 (15.84%) and immature flukes 12 (11.88%), as indicated in table 6.

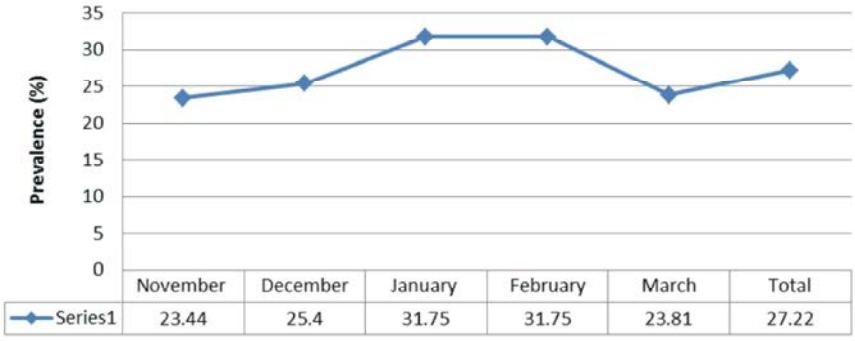

Fig. 1: Result of coprological examination on monthly bases
x^2= 2.1923 P = 0.700

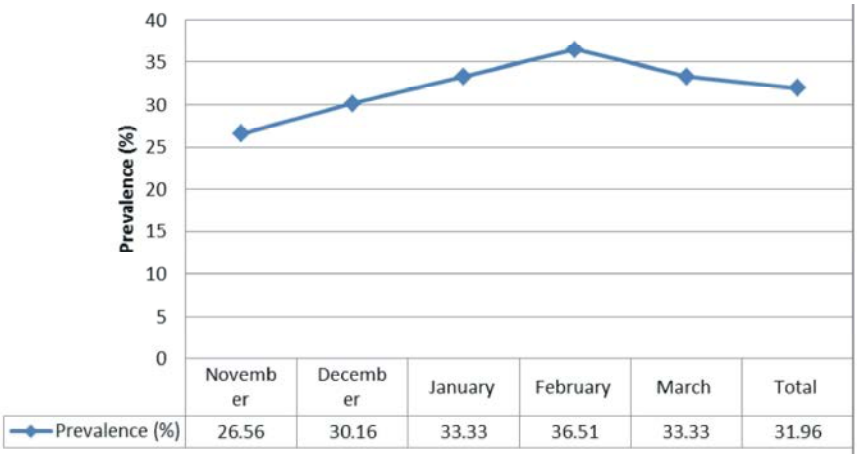

Fig. 2: Result of abattoir survey displayed on monthly base
x^2 = 1.6109 P = 0.807

Table 1: Result of coprological examination based on body condition

Body condition	Total examined animal	Total positive animal	Prevalence (%)
Poor	60	37	61.67
Medium	203	45	22.17
Good	53	4	7.55
Total	316	86	27.22

x^2 = 48.9126 P< 0.001

Table 2: Result of coprological examination based on age

Age group	No. of animal examined	No. of positive animals	Prevalence (%)
≤6 years	112	28	25.00
>6 years	204	58	28.43
Total	316	86	27.22

x^2 = 0.4638 P = 0.496

Table 3: Result of abattoir survey displayed based on body condition

Body condition	Total examined	Total positive	Prevalence (%)	95%CI
Poor	60	38	63.33	49.89-75.41
Medium	203	52	25.62	19.76-32.19
Good	53	11	20.75	10.84-34.11
Total	316	101	31.96	26.85-37.41

x^2= 33.7500 P< 0.001

Table 4: Result of abattoir survey displayed based on age

Age group	No. of examined	No. of animals	Prevalence (%)	95%CI
≤6 years	112	34	30.36	22.02-39.75
>6 years	204	67	32.84	26.44-39.74
Total	316	101	31.96	26.85-37.41

x^2= 0.2323 P = 0.630

Table 5: Abattoir prevalence of bovine fasciolosis from different origins

Origin	No.of examined	No.of positive	Prevalence (%)
Hawassa	129	37	28.68
Tula	94	28	29.79
ArsiNegele	32	16	50.00
Shashemene	10	3	30.00
Dimtu	15	3	20.00
Harar	24	10	41.67
Yirgalem	11	4	36.36
Total	316	101	31.96

x^2= 7.7580 P = 0.256

Table 6: Relative abundance of fasciola species at Hawassa abattoir

Fasciola species encountered	No. of liver infected	Percentage (%)
F. hepatica	62	61.37
F. gigantic	11	10.89
Mixed	16	15.84
Immature	12	11.88
Total	101	100

Table 7: Categorization of affected livers according to degree of infection

Degree of liver damage	No. of liver	Percentage (%)
Lightly infected	39	38.61
Moderately infected	47	46.53
Severely infected	15	14.85
Total	101	100

Degree of Liver Damage: Based on the degree of pathological lesions observed the infected livers were categorized as lightly infected 39 (38.61%), moderately infected 47 (46.53%) and severely infected 15 (14.85%), as described in table 7.

Financial Loss Assessment: Estimation of financial loss resulted from liver condemnation due to fasciolosis. The average annual cattle slaughtered rate was estimated to be 18,250, average price of bovine liver was 50 ETB and prevalence of bovine fasciolosis in this study was found to be 31.96%. Therefore, it is calculated as:

ALC=CSR x LC x P
ALC=18,250 x 50 x 31.96%
ALC=291,635.00 ETB

DISCUSSIONS

Both *F. hepatica* and *F. gingantica* have been reported to exist in many parts of Ethiopia. The prevalence of bovine fasciolosis in Ethiopia based on coproscopy result varies from 11.5% in Buno province [22] to 87% in DebreBrahan [23] and abattoir studies have also reported up to 88.57% prevalence of fasciolosis in Debre Brahan [23].

The overall prevalence of bovine fasciolosis in cattle slaughtered at Hawassa municipal abattoir during the study period was 31.96% and this result was almost similar to the earlier prevalence reported in this area, 30.43% by Hailu [24] and 28.63% by Mulugeta [15]. As the result of this study showed that the prevalence is closely similar with that of Roman [25] at Gonder abattoir,

Hailu [24] at Hawassa abattoir and Wassie [26] at Nekemte abattoir, reported the prevalence of 33.40, 30.43 and 29.80%, respectively. The result was lower when compared with higher prevalence reported by Fekadu [27] at Bahar Dar abattoir, Mulugeta [28] at Kombolcha abattoir, Tsegaye [23] at Debre Birahan abattoir and Abduljebar [29] at Bale abattoir, who found a prevalence of 61.97, 53.50, 88.57 and 49%, respectively. The result of this study was higher compared to the prevalence reported by Getu [30] at Wolaita abattoir, Haimanot [31] at Eastern Harerrghe abattoir and Seyoum [22] at Buno province, who found a prevalence of 18, 12.1 and 8.1%, respectively. This difference may be due to the variation in the ecological and climatic conditions such as altitude, rainfall and temperature for the presence of their intermediate snail hosts over mass of areas on the origins of animals slaughtered at study abattoir or due to expansion of veterinary services, awareness created among the people about the advantage of periodically deworming of animals or due to local husbandry condition.

The relative abundance of *Fasciola* species in the study area was studied. From the total of 101 *Fasciola* infected livers examined during post-mortem examination, 61.37% of them were infected by *F. hepatica*, 10.89% were infected by *F. gigantica* and 15.84% were infected by immature flukes. The predominant species involved causing bovine fasciolosis in the study abattoir was *F. hepatica*. The high prevalence of *F. hepatica* may be associated with the existence of favorable ecological conditions for the intermediate host of *F. hepatica (Lymnaea truncatula)* in the source origins of cattle presented to the study abattoir. Swampy areas around lakes, marshy areas in low-lying plane areas, temporary ponds and highlands provides favorable habitat for *L. truncatula* [32]. These might have contributed to the frequent occurrence of *F. hepatica* in cattle. The low prevalence of *F. gingantica* in the study abattoir may be associated with the presence of intermediate host (*L. nataliensis*), due to favorable conditions like border of lakes, flood prone areas and lowlands [3].

Mixed infection by both species of *Fasciola* (15.84%) may occur in the liver of the same animal was attributing to the existence of ecological conditions conducive for replication of both species of intermediate snail hosts and intermingling of cattle from different grazing areas. Graber [5] reported coexistence of both species of fasciola in areas with an altitude range of 1200-1800 m.a.s.l. which support the finding of this study.

Out of the total 316 animals examined on examined on coprological study 86 (27.22%) were positive whereas 101 (31.96%) were positive on abattoir survey of the same cattle's. Therefore, this indicates there were 15 false negative results on coproscopy. This may be due to eggs are not detected until 13-15 weeks after infection when much the liver damage has already occurred. In addition, detection of fasciola eggs can be unreliable during the patent period because the eggs are expelled intermittently depending on the evacuation of the gallbladder [33]. The prevalence of bovine fasciolosis in the study abattoir was statistically analyzed on monthly bases. The result of the present study indicated that occurrence of fasciolosis has no significant variation ($P>0.05$) in relation to different months of the study. This may be due; the study was conducted on the dry season.

Prevalence of bovine fasciolosis was statistically analyzed relatively on the bases of body condition score to determine the impact of the disease in animals with different body condition scores, 61.67% prevalence in poor body condition, 22.17% in medium body condition and 7.55% in good body condition of animals was found on abattoir survey and 61.67% in poor body condition, 22.17% in medium body condition and 7.55% in good body condition on coprology was found. The result of the present study indicated that occurrence of fasciolosis has significant difference ($P<0.05$) in relation to body condition of the animals. This signifies the importance of fasciolosis in causing weight loss and the characteristic signs of fasciolosis are weight loss and emaciation [32]. Statistical analysis of the effect of age on prevalence of fasciolosis are indicated no significant variation ($P>0.05$) among different age groups of animal in this study.

The prevalence of fasciolosis was statistically analyzed based on the source origin of the animals. The prevalence rate found in animals from different source origins was Hawassa (28.68%), Tula (29.79%), ArsiNegele (50.00%), Shashemene (30.00%), Dimtu (20.00%), Harar (41.67%) and Yirgalem (36.36%). This difference is strongly associated with the difference in the presence of favorable environments for the existence, multiplication and spread of host snail and the parasite in the area and may be due to the presence of good husbandry control and strong cattle management [2].

The annual financial loss due to condemnation of liver in this study was 291,635.00 ETB. The economic loss at the study abattoir was high compared to losses reported by Adem[4] reported 154,188.00 ETB at Ziway

abattoir, Abera[34] reported 249,000.00 ETB at Dembidolo abattoir, Mulugeta[28] reported 266,714.37 ETB at Kombolcha abattoir and Hailu[24] reported 122,775.45 ETB at the same abattoir. The variation of financial loss may be due to the number of mean annual slaughtered cattle differs in different abattoir and variation in retail market price of liver and the difference in the prevalence of the disease.

CONCLUSION

It can be concluded as fasciolosis significantly prevalent parasitic disease affecting the health and productivity of the animals and the disease remains an important health problem to the animals in the study area. The study indicates presence of significant infection on the study area which indicates the existence of conducive environmental conditions for the development and survival of the parasite in the areas of the source origin of the animals. In addition, the annual financial loss due to fasciolosis is critical to the economy of livestock industry to the study area inparticular and to the nation in general. The process of choosing the best control strategy for fasciolosis would be difficult as the biological complexity is associated with the disease. Therefore, based on the above conclusion, the following points are recommended:

- Identification and mapping of snail habitats may enable grazing plans to be devised that avoid danger areas at times of high risk where habitats are restricted in size and clearly defined, it may be possible to exclude stock by fencing.
- Strategic anthelmenthics treatment with appropriate flukicidal is most suitable measures if supported by detailed local epidemiological study on the seasonal dynamics of infection in particular area.
- Providing best long term method of reducing population of the intermediate snail host either by draining of water lodged areas or using application of mulluscides combined with anthelmenthics treatment to remove existing fluke populations and thus the contamination of habitats with eggs.
- Further studies should be conducted on the epidemiology, biology and ecology of intermediate host snail in the area, to help the planning and implementation of disease control strategies and husbandry measures.

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