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Prevalence of Bovine fasciolosisinfectionin Hossana municipal abattoir, Southern Ethiopia

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Abstract
A cross-sectional study was carried out from November 2013 to June 2014 to determine the overall abattoir based prevalence of fasciolosis infection, and to assess direct economic loss due to liver condemnation. Postmortem examination and abattoir retrospective data were retrieved and analyzed. A total of 422 cattle were selected randomly and examined during the study period. The prevalence rate of fasciolosis was foundto be 27.25% (115). Age, species and body condition score were taken into consideration, whereby 34.67and 20.62% prevalence were recorded for young and adult animals, respectively. Similarly, 57.30, 19.89, and 18.25 % prevalence have been registered for poor, medium and good body condition score, respectively. Also, the dominant *Fasciola* species showed50.58, 29.57, 14.78 and 6.09% prevalence for *F. hepatica, F. gigantica*, mixed infection and immature species, respectively. There was a significant difference at ($P < 0.05$) value among age, body condition scores and species, and between coprological and postmortem examination ($P= 0.00$). Depending on the current local price of a liver, the total annual financial loss encountered due to the condemnation of infected liver to fasciolosis was estimated to be 66,370.10 ETB or 3,493.16 USD. The result of the study confirmed that bovine fasciolosis infection was found to be one of the major diseases and brings a significant economic loss in Hossana municipal abattoir.
Keywords: Fasciolosis infection, cattle, prevalence, liver condemnation, Hossana

1. INTRODUCTION

Animal production has considered as the main component of agricultural development in most parts of sub-Saharan Africa. Ethiopia has an estimated livestock population of approximately 49.3 million cattle, 25.02 million sheep, 27.88 million goats, which stands first in Africa and tenth in the world [10]. Livestock and its products constitute one of the major export resources of the country and play a vital role in the country's economy. Even though the livestock sub-sector contributes much to the national economy, its production in Ethiopia is functioning under several constrained factors: diseases, feed shortage, institutional and policy-related constraints [28].

Fascioliasis has the widest geographic spread of any emerging snail-borne zoonotic diseaseoccurring in more than 51 countries worldwide [16].Fasciolosis is mainly a disease of sheep, cattle, goat and occasionally human beings and thus considered a zoonotic infection [4, 29]. The disease caused by *Fasciola hepatica* and *Fasciola gigantica* is one of the most important parasitic diseases in the world. Animal fasciolosis has a worldwide distribution, and its prevalence in ruminants is estimated ranging up to 90% in some countries [18]. It is a major constraint in the development of livestock industry causing massive economic losses, and reduction in productivity of animal regarding lowered growth rate, meat and milk production, fertility, feed efficiency and draught power [5].

Condemnation of liver and cost of control measures are other sources of economic loss. The financial losses due to fascioliasis reached up to US$ 2 billion per year worldwide [16]. Distribution of both species of *Fasciola*depends on the ecology of snails of genus *Lymnaea* (L) which serves as intermediate host of the parasite. Therefore, the research aimed to assess the overall prevalence of the disease, evaluation of the diagnostic efficiency of direct sedimentation method and the direct economic loss of illness due to liver condemnation in the study area.

2. MATERIAL AND METHODS

2.1. Study Area

The study conducted in Hossana municipal abattoir, Hadiya central zone; Southern Nations, Nationalities and People Regional State. Hosanna town is located 232 Km away from Addis Ababa, in the south direction. Topographically, the zone lies within an elevation range of 1,500 to 3,000 masl. Hosanna has a latitude and longitude of 7°33′N 37°51′E. The annual average temperature of the zone is 22.02^{o}C, and the mean annual rainfall is 1260 mm. The main rainy season is from June to the end of September, and the living style of the people depends on agriculture, using mixed livestock-crop production. Livestock is their dominant, and often the sole asset, their principal means to accumulate wealth, and the mainstay of their livelihoods in the area.

2.2 Sample size and techniques

The subjects included in the study were cattle slaughtered at Hossana Municipal Abattoir. The desired sample size determined by Thrusfield [26] with 95% confidence interval and at 5% absolute precision. Total sample size determined by the estimated prevalence of variables of interest which is 50% taken into consideration and the desired level of confidence and the acceptable margin of error as follows:

$$n=\frac{Z^2*p\,(1-p)}{m^2}$$

Therefore, a total of 384 samples plus 10% contingency, a total of 422 study subjects selected from the Hossana municipal abattoir.

2.3 Study Methodology

Abattoir based prevalence was used to determine positivity of the animals for the parasites and laparoscopy used to compare the diagnostic efficiency of the disease with postmortem examination. Fecal samples were collected directly from the rectum of each animal, using disposable plastic gloves and placed in a clean universal bottle and each sample clearly labeled with animal identification, sex, age, and body condition score. Fecal samples were preserved with 10% formalin solution to avoid the eggs developing and larvae. In the laboratory, microscopic examination was conducted to detect the presence of *Fasciola* eggs using the standard sedimentation techniques as recommended [2, 30].

2.4.1 Abattoir survey

Active abattoir survey was conducted based on a cross-sectional study during routine meat inspection on randomly selected cattle slaughtered at Hossana municipal abattoir. Antemortem inspections carried out on individual animals, while the animals are entering into the lairage and after they came into the lairage in mass. During antemortem examination detail records about the species, breeds, sexes, ages and body conditions of the animals performed.

2.4.2 Postmortem examination

The prevalence of fasciolosis was conducted by postmortem examination technique from liver parenchyma and primary bile ducts to recover the young flukes and adult parasites, respectively. The previously identified animals and their livers were carefully supervised and examined, so as to avoid mixing up of the organs to be inspected with the fecal samples [13]. All condemned livers having *Fasciola* species were registered, and flukes took for species identification.

2.4.3 *Fasciola* species identification

For *Fasciola* species identification, worms collected from condemned livers which have an active infection. After making a precise incision on the liver, flukes were gathered in the universal bottle containing 10% formalin in preservative and examined to identify the involved species. Species identification was conducted on recovered Fasciola based on morphological features of the agents and classified into *F. hepatica*, *F. gigantica* and unidentified or immature forms of liver fluke [27].

Fecal samples for parasitological examination were collected directly from the rectum of each animal and freshly defected feces into plastic bottles with a gloved hand. The samples clearly labeled with universal bottles preserved with 5% formalin and each sample clearly indicated with animal's identification and date of collection. A sedimentation-flotation technique evaluated the presence of *Fasciola* eggs in fecal specimens. The samples microscopically investigated under 100X magnification [9, 30]. Identification of eggs and fluke was carried out using standard parasitological keys as described by [25].

2.4.4 Direct economic loss due to liver condemnation

Many parameters were used to estimate the losses attributable to liver condemnations in slaughtered cattle. Conviction rates of cattle liver due to fasciolosis and the average selling price of livestock liver, was established through a survey from various meat shops at Hossana town. The economic losses due to condemnation were estimated by the formula set [26]. Accordingly,the total annual financial loss incurred as a result of liver condemnation and carcass weight loss due to fasciolosis was estimated by the following formula.

The annual cost of condemned liver =NAL×%COND. ×CL

Where NAL = Average number of cattle slaughtered in Hossana Municipal Abattoir per year

% COND. = Percentage of liver doomed due to fasciolosis

CL = Mean cost of one organ in Hossana town

2.5. Data analysis

All raw data generated from the study coded and entered in MS Excel database system. SPSS version 20.0 computer program was used to analyze data. The prevalence of fasciolosis calculated as the number of infected individuals divided by the number of sampled x 100. Categorical data analyzed with the Pearson's Chi-square ($\chi 2$) test for independence. Identification of the dominant *Fasciola* species calculated using percentage. Statistical significance was set at $P< 0.05$ to determine whether there are significant differences between the parameters

measured.

3. Results

3.1. The overall Prevalence rate of Fasciolosis:

Out of the total, 422 male indigenous cattle breeds that slaughtered at Hossana municipal abattoir 115 (27.25%) were found to be positive for fasciolosis.

3.1.1. Prevalence by species

Out of 115 infected animals, 57 (49.57) harbored *F. hepatica,* 34 (29.57%) F. *gigantica*, 17 (14.78%) mixed infection and 7 (6.09%) infected with unknown species of immature liver flukes (Table 1).

Table 1: Species based prevalence of Bovine Fasciolosis (November, 2013 to May, 2014)

Species	Total positives	No. of positives for each species	Prevalence (%)	X^2	P – value
F. hepatica	115	57	49.57		
F. gigantica	115	34	29.57	51.97	0.00
Mixed infection	115	17	14.78		
Immature	115	7	6.09		

3.1.2. Prevalence by Animal's Age

The study animals grouped into two age groups; young (4 years old) and adult (greater than four years old). Of the total 422 examined animals, 199 (34.67%) and 223 (20.62%) were young and adult cattle respectively (Table 2).

Table 2: Age-based prevalence of Bovine Fasciolosis(November 2013 to May 2014)

Age	No. of animals examined	No. of positives	Prevalence (%)	X^2	P – value
Young	199	69	34.67		
Adult	223	46	20.62	4.60	0.032
Overall	422	115	27.25		

3.1.2. Prevalence of Bovine fasciolosis by body condition score

Animals slaughtered at Hossana Municipal Abattoir examined and grouped into three body condition categories. The highest fasciolosis prevalence recorded of poor body conditions (57.30%) followed by standard body conditions (19.90%) and good body conditions (18.25%) as described in Table 3. The study revealed that there is statistically significance difference among the body condition scores of the animals ($P<0.05$).

Table 3: Prevalence of Bovine Fasciolosis by body condition score, November 2013 to May 2014

BCS	No. of animals examined	No. of positives	Prevalence (%)	X^2	P – value
Poor	89	51	57.30		
Medium	196	39	19.90	8.84	0.012
Good	137	25	18.25		
Overall	422	115	27.25		

3.2. Financial loss analysis:

The total financial loss encountered due to the condemnation of infected liver during the one year period was calculated based on a year data record from Hossana municipal abattoir. The direct annual loss from liver condemnation assessed by considering the overall prevalence rate of the disease, the total annually slaughtered animals in the abattoir and the retail market price of a zebu liver. Annual sacrificed rate was estimated from historical abattoir records of the last years, while the retail market price of an average size zebu liver determined from the butcheries in Hossana town. The information was subjected to mathematical computation using the formula set [19].

The annual cost of condemned liver =NAL×%COND. ×CL

=6089×27.25%×40 = 6,637,010 ETH/22 = 301,682 USD

4. Discussion

Fasciolosis is a widespread ruminant health problem and causes significant economic losses to the livestock industry in Ethiopia. The results of the present study indicated that the overall prevalence of bovine fasciolosis in Hossana Municipal Abattoir is 27.25%. The result of the present study showed that bovine fasciolosis relatively spread with a moderate prevalence of 27.25% in the study area as compared to the high prevalence of 86% in Keffa [6]. The relatively higher result than the current finding might attribute to the difference in the infestation, level of the study area and the present study conducted during the dry period of the year when the infections rate of fasciolosis is expected to be low which is probably due to the ecological and climatic difference between the two localities such as temperature, humidity, altitude, grazing land and water availability.

The result of the present study showed that age has a significant effect on the prevalence of bovine fasciolosis; being higher (34.67%) in young animals than the adult (20.62%) ($P< 0.05$). Similarly, a higher prevalence rate recorded in younger animals as compared to adult ones is in agreement with data registered in

Kenya, [12] in South Wollo Zone, and different countries of the world. These data means that there was a decrease in infection rate or prevalence as age increased. The reason behind this observation may be the fact that younger animals are more susceptible to infections than adults. Similarly, other reason may be due to the result of acquired immunity with age which manifested by the humoral immune response and tissue reaction in the bovine liver due to the previous challenge.

Adult animals may gain immunity to parasites through constant challenge and expel the ingested parasite before they establish infection [15]. Adult cattle are likely exposed to frequent attacks of fasciolosis and develop acquired resistance hence have a lower prevalence of bovine fasciolosis although, chemotherapy was not used to halt previous infections. Some additional reports are confirming that the increased resistance against fasciolosis (low incidence) with age is most likely related to the high level of tissue reaction seen in the 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 [19]. Moreover, inverse co-relation of prevalence and age of cattle was reported [22].

The present study shows that there is a significant difference ($p = 0.012$) in the prevalence of bovine fasciolosis among different body condition score groups. This result indicated that body condition of the animal has a significant association with the occurrence of fasciolosis. The highest prevalence observed in a bad body condition scored animals which are indicated by (57.30%). The prevalence of fasciolosis was greater in the animals with poor body condition because this body condition in cattle manifested when fasciolosis reaches its chronic stage [19]. Besides this may be associated with less resistance due to malnutrition, management system of the animals.Similarly, other infections (parasitic or non-parasitic) might make poor body condition animals susceptible to fasciolosis. Their existence along with fasciolosis might have an impact on body condition and body weight of the animals. This result is in agreement with 63.29% [12] in South Wollo Zone and slightly higher than the result of 46.7% [14] in Adigrat.

From the total infected livers, 50.58% harbored *Fasciola hepatica*. Whereas the remaining distribution occurred in 29.57%, 14.78% and 6.09% were *Fasciolagigantica*, mixed infection and immature species respectively. The result demonstrated that the dominant species of bovine fasciolosis in Jimma and Bedele municipal abattoir is *F.hepatica*(63.89%, 64.5%), for *F.hepatica* and confirm with *F. gigantica* (24.07%, 24.8%) and then the immature forms (12.04%, 10.7%). The high proportion rate prevalence of *F. hepatica* may associate with the existence of favorable ecological biotypes for *Lymnaea*the intermediate snail host [25].

The relatively small percentage of cattle were found infected with *F. gigantica*alone or mixed infection with both species which explained by the fact that most animals for slaughter came from highland and mid-altitude.

The current finding is lower than the study conducted by [21] with the prevalence of 58.9% for *F. hepatica* and higher for *F. gigantica* 10.6%, due to the geographical variation which is essential for the multiplication of the intermediate host [14] in Adigrat. Similarly, change in climate-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 role in such differences. There is the statistically significant difference (P <0.05) in the distribution of Fasciola species in the study area.

The lower prevalence of fasciolosis reported using laparoscopy (11.62%) than the abattoir result (27.25%) indicated the lower sensitivity of this technique in detecting fasciolosis. The detection of Fasciola eggs can be unreliable as the eggs are expelled intermittently, depending on the evacuation of the gallbladder into the digestive tract [8]. This result is in agreement with [3] in which fecal egg examination failed to detect 33.5% of the positive samples which may be due to small numbers of egg in the fecal samples, possibly as a result of low worm burden or occlusion of the gastrointestinal tracts by debris. Low prevalence in coprology could also be as a consequence of the inability of the method to detect of Fasciola eggs in animals at the early stages of infection.

Also, the present study correlated with the finding of [23] which indicated by 20.55% prevalence rate lower than the liver inspection or 37.67% in Pakistan attributed to long prepatent period and intermittent shedding of eggs [2]. *The* coprological examination cannot detect Fasciola eggs until 8-15 weeks after infection, by which Fasciola matures into an adult and reaches bile duct.

The economic losses due to fasciolosis throughout the world are enormous, and these losses associated with mortality, morbidity, reduced growth rate, condemnation of liver, increased susceptibility to secondary infections and expense due to control measures.

Considering the number of liver condemned during the study the direct economic loss due to fasciolosis was estimated to be on average *66,*370.10Ethiopian Birr (*3,*493.16USD) per annum (1USD~ 19.45 Ethiopian Birr) lost. This result showed that fasciolosis causes significant losses in the study area at large.Fasciola infection produced loss 106,400 Ethiopian birr (8312.5 USD) per annum at Hawassa [21], 4000 USD at Soddo [2], 57,960 Ethiopian Birr (4,674.2 USD) at Adwa [7] and 270,211.88 Ethiopian Birr or equivalent to 27, 572.64 USD at Mekelle [9] in cattle. On the other hand, fasciolosis brings a loss accounting 63072 ETB ($1,182,600) per annum at Nekemte [19] and 37,767.6 ETB per annum at Asella [24] which is slightly lower than the present study. The

present finding is by far smaller than the results reported by [1] and [11] who reported a total economic loss of 154,188 and 215,000 ET ($2,891,025 and $4,031,250, respectively) annually in cattle due fasciolosis at Ziway and Dire Dawa municipal abattoir, respectively. The total economic loss encountered due to the condemnation of infested liver from one-year data recorded from Jimma municipal slaughterhouse was 3,003,488.1408 ETB per annum [27] which is far higher than the current findings.

The difference in the financial loss estimated in various abattoir and parts of Ethiopia would be due to the variations in the prevalence of disease, mean annual number of cattle slaughtered in the different abattoirs and also the change in the retail market price of organs. In the current finding, the abattoir prevalence of the parasites showed the disease is common in most parts of the zone as most of the animals originated from the different sites of the region. The most dominant Fasciola in the zone was *F. hepatica* which might be due to the suitability of the environment for multiplication of the intermediate hosts and shows the disease is common in the region due to different activities such as irrigation and ponds which merit attention by the responsible bodies to control the parasites.

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