Journal of Biology, Agriculture and Healthcare
ISSN 2224-3208 (Paper) ISSN 2225-093X (Online)
Vol.7, No.7, 2017

Study on the Prevalence of Bovine Fasciolosis and Estimated Financial Losses Due to Liver Condemnation: Incase of Angacha Woreda, Kambata Tembaro Zone, Southern Ethiopia

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Abstract
A cross sectional study was carried out from December, 2015 to June, 2016 with the aims of determining the abattoir prevalence and direct economic loss associated with fasciolosis in cattle at Angacha municipal abattoir, Ethiopia. From a total of 384 examined cattle, 156 (40.62%) were found to be positive for fasciolosis by postmortem liver inspection. From 156 infected livers with *Fasciola* species, *Fasciola hepatica* was found to be the most prevalent species 120 (47%) and *Fasciola gigantic* and mixed infection were proved to be 26 (25.64%) and 10 (17.34%), respectively. Highest prevalence of fasciolosis was observed in poor body condition cattle 104 (43.3%) followed by medium 40 (38.84%) and medium body condition cattle 52 (36.10%), 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 119 (42.5%) prevalence was in adult animals and the lowest 37 (35.57%) was found in young animals. The prevalence of bovine fasciolosis was highest 62(48.43%) in Jaba than Doyo gena 48 (37.5%) and Shino 46 (35.93%) 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 48,744.00ETB Ethiopian birr loss. The results of the present survey showed that the prevalence and monetary loss of fasciolosis in cattle slaughtered at Angacha 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, Angacha, Prevalence

INTRODUCTION

Ethiopia has a large livestock population in Africa, which is estimated to be around 34-40 million, 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).

Abattoirs played an important role in surveillance of various diseases of human and animals. Surveillance at the abattoir allows for all animals passing into human food chain to be examined for unusual signs, lesions or specific diseases (Alton *et al*., 2010). Monitoring and other conditions at slaughter has been recognized as one way of assessing the disease status of herd; however, this source of information is not fully exploited worldwide (Mellau *et al*., 2010), especially in ascertaining the extent to which human is exposed to certain zoonotic diseases in addition to estimating the financial implications of organ condemnations (Jobre *et al*., 1996; Chhabra and Singla, 2009).

Meat inspection is conducted in the abattoir for the purpose of screening animal products with abnormal pathological lesions that are unattractive and unsafe for human consumption. Meat inspection assists in detecting certain diseases of livestock and prevents the distribution of infected meat that could give rise to disease in animal and human being and to ensure competitiveness of products in the local market (Hinton and Green, 1993).Abattoir data can be a source of valuable information on the incidence and epidemiology of animal diseases. This can help to know to what extent the public is exposed to certain zoonotic diseases and estimate the financial losses incurred through condemnation of affected organs (Raji *et al*., 2010; Cadmus and Adesokan, 2009; Singlaand Juyal, 2014). The main causes of organ condemnation during post mortem inspection are diseases originated by parasites, bacteria and viruses. Flukes in liver and hydatid cyst in lung, liver and kidney are mainly involved (Mezegebu, 2003; Teka, 1997; Sirak, 1991). Parasites in the tropics are responsible for far greater loss to meat industry than any other diseases (Jobre *et al*., 1996). Similarly, like many other tropical

countries in Africa, it is well known that parasitic diseases are the major factors responsible for low productivity in livestock in Ethiopia (Jobre *et al*., 1996; Abebe, 1995).

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 distomatosisor 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 regionsthat are endemic for animal fasciolosis, in rural communities in which humans share the water source with theiranimals, 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 Angacha Municipal Abattoir, Kambata Tembaro zone. And therefore, the objectives of the current study were to determine the prevalence of bovine fasciolosis and to estimate the magnitude of direct financial loss attributed due to liver condemnation at Angacha Municipal Abattoir.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted in Angacha woreda, Kambata Tembaro zone, southern Ethiopian. Topographically the woreda lies with in elevation range of 1700-2500m above sea level. The woreda has three agro economical zones, dega (20%), weyna dwga (55%) and kola (25%). The area has bimodal rain season, long rainy season covering from Jun to September and short rain season extending from March to May. The annual average temperature of the woreda is 22.02^0Cand the main annual rain fall is 1300-1600mm. Angacha town is administrative and trading center of the woreda. According to record of angacha agriculture and rural development office (2016) the livestock population of area compress of 9930bovine, 2730 ovine,1107 caprine,4680 equine,6610poultry. The total human population male 41,137, female 39,527 total 80,664 and the main language spoken by the society in the area is kembatigna.

Study Animals

The study animals were consisted of male and female cattle brought to Angacha municipal abattoir from various herds in Angacha and neighboring local areas for local consumption. These animals were kept under extensive production system in which the cattle were allowed to graze freely. The breeds of cattle were local and of different age groups. 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.

Study Design

A cross-sectional study was carried out from December, 2015 to June, 2016 to estimate the prevalence of bovine fasciollosis and to calculate the direct financial loss due to condemnation in cattle slaughtered at Angacha municipal abattoir.

Sampling Methods and Sample Size Determination

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):

$$N = \frac{(1\text{-}96^2 X pexp\ (1\text{-}pexp)}{D^2}$$

Where, N=required sample size; Pex= expected prevalence; D^2= desired absolute prescient (0.05) at 95% Confidence level. According to the above formula 384 calves were sampled.

Study Methodology

Ante-mortem inspection

Active abattoir survey was conducted based on cross sectional study during routine meat inspection on systematically selected cattle slaughtered in Angacha municipal abattoir. During ante-mortem examination

details about the breeds, age, origins and body conditions of the animals were recorded. Prevalence was determined through grouping the study animals in their body condition, sex, age and origin. Ante mortem inspection was carried out in adequate lighting where the animal can be observed both collectively and individual at rest and motion.

Postmortem Examination

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 1cmthick 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 (1982; Urquhart *et al*., 1996).

Fasciola species identification: after collecting the flukes in the universal bottle containing formalin as preservative, fasciola species easily identify based on morphological characters such as shape (size).they were classified as *Fasciola hepatica* (relatively small sized), *Fasciola gigantica* (relatively large sized and more leaf like), mixed forms (*F.hepatica* and *F.giganatica*) and undifferentiated or immature forms of fasciola species (Urquhart *et al*., 1996).

Direct Financial Loss Analysis

The total financial loss incurred due to fasciolosis in Angacha 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 Angacha town, the average price of each cattle liver was calculated to be 100 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 = ΣCS X Coy X 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

Data Management and Analysis

All raw data generated from this study were coded and entered in MS Excel data base system. Using SPSS version 16.0 computer program, data were analyzed. The prevalence of fasciolosis was calculated as the number of infected individuals divided by the number of individuals sampled x 100. Categorical data were analyzed with the Pearson's Chi-square (X^2) test for independence. Identification of the dominant *Fasciola* species was calculated using percentage. Statistical significance was set at $P < 0.05$ to determine whether there are significant differences between the parameters measured.

RESULTS

Overall Prevalence of Bovine Fasciolosis Infection

A total 384 cattle examined and 40.62% (156/384) were found in variably infected with different study sites of the total 62.5 were infected with liver fluck in Jaba while the remaining 48.43% in Doyo gena and 37.5% were infected with fasciolosis in Shino kebeles. There is statically significance difference ($P<0.05$) between each species in overall infection prevalence. The fasciolosis infection in sex was recorded to be 40.3% in the male animals and 36 %in female as shown in table 1. In the study, the species of fasciola was also identified accordingly, 47% (in 120 cases) *F.hepatica* and in 33% (in 26 cases) *F.gigantica* were recorded.

Table-1: Prevalence of bovine fasciolosis based on the different risk factors of animals

Risk factors		No. of animals examined	No of positive	Prevalence	Significance
Study site	Jaba	128	62	48.43%	X^2=27.14;
	Doyo gena	128	48	37.5%	P-value=0.00*
	Shino	128	46	35.93%	
Age group	Young	104	37	35.57%	X^2=32.8213
	Adult	280	119	42.5%	P-value=0.00*
Sex group	Male	240	104	43.3%	
	Female	144	52	36.1%	
Body condition	Poor	240	104	43.3%	
	Medium	144	52	36.1%	
	Good				

Estimation of Economic Losses due to Fasciolosis

The estimation of partial financial loss due to liver condemnation will be determined based average market price of the condemned liver. The average market price of each liver was found from interviews with retails. On the site of study the average annual slaughter level 1200 cattle and the local retail market price of liver is 100ETB birr.

The estimation of partial financial loss due to liver condemnation will be determined based on average market price of the condemned liver. The average market price of each liver was found from interviews made with retail. On the site of study the average annual slaughter level 1200 cattle and the local retail.

PFL= (NASXPBF cpL); Where,

PFL = partial loss

NAS =average number of cattle slaughtered annually=1200

PBF=prevalence of fasciolosis =50%

CPL =current average price of liver =100%

Therefore, in the present study: PFL=1200x40.62%x100 = 48,744.00ETB

DISCUSSION

The finding of present study revealed the overall prevalence of fasciolosis to be 40.62% based on fecal and post mortem examination. The overall prevalence of bovine fasciolosis 40.62% in the present study was in agreement with the earlier findings that was 27.69% by Kuchai (2011) from Egypt, 30.42% by Yilma and Mesfin (2000) from northwest part of Ethiopia (Gonder). However, the present study was lower than the previous findings of Shiferaw *et al*. (2011) and Fekadu (1998) who reported the prevalence of 45.25%, and 62.2% in around Assela, and around Halaba, respectively. The result of these workers is relatively higher than the present finding and this version might be attributed to the difference in the level of infestation, level of study period of the year/season. During the dry period, the majority of the eggs do not have the opportunity to hatch and develop because they are trapped with the fecal mass and there is no sufficient moisture for the development and hatching as well as for the survival of metacercaria on the herbage and the availability of the moisture, because of the drying of temporary habitats during the dry period. Snails are forced under prevention deep in the mud and only those snails in permanent water source have the opportunity to shed cercaria. Therefore, only minimum metacercaria herbage, which accounts for low infection rate was observed during the dry period (Radosits *et al*., 2007).

The present study also showed higher prevalence of bovine fasciolosis as compared to the (23.96%) reported by Asressa *et al.* (2012) from Andassa livestock research center in north-east of Ethiopia. The variation in overall prevalence of bovine fasciolosis among different areas of the study may depend on some factors such as snail population, size of study population, choice of diagnostic method, 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 own role in such difference (Yildirim *et al*.,2007; Shiferaw *et al.*,2011).Statistical analysis of infection rate on the basis of age indicate that there is a significant difference ($P<0.05$) of prevalence of fasciolosi between age groups, adult cattle have significantly higher prevalence rate (44.45%) of fasciolosis when compared to young ones (2.45%). This may be attributed (most probable) because of few number of young animals presented for postmortem examination.

In relation to body condition, in those with thin, medium and good condition 46.9%,29.4%and 8.08%, respectively and there was significance difference infection rate ($P<0.05$) among different group. These finding was also seen to be in line with the reports of Hagos (2007) who report as 47.7%, 33.1% and 9.1% in (poor), (medium) and (good) body condition animal, respectively. It was seen to be lower than Abie *et al*. (2012), who report as 85.9%, 55.1% and 34.5% for thin, medium, and good body condition cattle, respectively. This variation of infection rate of bovine fasciolosis at various study areas may be attributed to the variation in diagnostic techniques, study methodology of cattle management system. Those cattle with thin body conditions may have less resistance to overcome infection than medium and good due to the various reasons such as scarcity of

animal feed and co-infection with the other parasites (Urquhart *et al*., 1996; Radostitis *et al*., 2007).

This study reveals there is a significance difference of prevalence of fasciolosis between the origins of animals those brought to the abattoir, low prevalence was encountered in high land (17.8%) than lowland (35.7%).This is due to the period of the study period which is dry period, deworming of animals regularly, good management of the animals by the farmers arrantly and most of marshy areas used for grazing. Species identification revealed that *F.hepatica* was more prevalent (55.6%) as compared to *F.gigantica* (19.65%); certain proportion of animals (17.75%) harbored mixed infestation. The finding of this study was in consistence with the earlier investigation by Bekele *et al.* (2012) from Hosanna, Gebretsadik *et al*. (2009) from Mekelle, Abie *et al*. (2012) from Jimma, who report that, *Fasciola hepatica* was predominant fasciola species. The predominant species involved in causing bovine fasciolosis in the study area is *F.hepatica* and is associated to the existence of favorable ecological condition for *L.truncatula* (intermediate host) of *F.hepatica* in the study area such as swampy marshy area around tembaro and different part of the region. And low laying plain and shallow pond provide favorable habitat for *L.truncatula* and allow the excess of *F.hepatica* in area .the lower prevalence mixed infection due to the unfavorable condition for *L.natalesis* and drainage ditches are favorable habitat (Urquhart *et al*., 1996).

CONCLUSION AND RECOMMENDATIONS

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 Angacha municipal abattoir that induces economic losses due to liver condemnation. Organ condemnations cause big economic losses in the cattle industry. Accordingly, in this study, the rate of condemnation of liver was relatively higher and the total financial loss calculated in this study, due to liver condemnation was 48,744.00ETB per annum. From this study, the following recommendations can be forwarded: Strategic antihelminthes treatment with appropriate flukicidal drug should be practical twice a year, i.e. after the end of dry season (March-April) and after the end of rainy season (October-November). Moreover, regularly cleaning of aquatic vegetation, fencing of local snail habitats and irrigation of marshy area for irrigation to destruct the favorable habitat of intermediation host should be done.

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