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Prevalence and Economic Importance of Fasciolosis in Cattle Slaughtered at Maichew Municipal Abattoir, Northern Ethiopia

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Abstract: The present study was conducted from January2019 to April2019 to determine the prevalence and investigate on the economic importance offasciolosis in cattle slaughtered at Maichew municipal abattoir. Accordingly, a total of 140 cattle were slaughtered during the stated period of time and were sampled for the study. Ante-mortem examinations for indicating signs of fascioliasis, body condition scoring and post-mortem inspections were the tools used to carry out the study. Accordingly, 16.4% (23/140) of the cattle examined were found to have different types of abnormalities associated with fasciolosis. Paleness of the mucus membrane (n=17/140, 12.5%) and nasal discharges (n=21/140, 15.0%) were the main abnormalities noticed that were associated with fascioliasis, while the least being for edema cases (n=0/140, 0.0%). Out of the total examined 140 cattle, 41 were found positive for *Fasciola* parasites yielding an overall prevalence of 29.3% (41/140). The highest prevalence of fascioliasis was recorded from Korem as 59.4% and the least being for Enda mehoni (11.1%). However, no statistically significance difference (P>0.05) was observed in the prevalence of fascioliasis among the different areas of animal origin. Furthermore, the highest prevalence of fascioliasis was significantly (P<0.05) seen in cattle in the age group of < 5 years with a relative prevalence of 55.0%. Similarly, fascioliasis was highly and significantly (P<0.05) prevalent in cattle with poor body condition yielding a relative prevalence of 72.2%. The annual direct economic loss due to liver condemnation from fascioliasis was estimated to be 4,349,218.75 Birr. In conclusion, bovinefascioliasis in slaughtered cattle at Maichew municipal abattoir was observed to be an economically important disease in the study area. Hence, further studies on host varieties and species levels and on the local epidemiology of the disease are highly important for a proper control of the disease in the area.

Key words: Fasciolosis · Cattle · Abattoir · Maichew · Prevalence · Economic Importance

INTRODUCTION

In developing countries, cattle are the most important animals in the farming, as a food source and for skin production. In the last 30 years, the world average annual meat production has been raised by 4.0% with beef production rising by 3.4%. The growth rate of meat production in developing countries was much lower and this is due to an increase in the number of animals. Bovine liver is one of the largest visceral organs in the animal body which performs numerous functions and very reach sources of vitamins and minerals Radostitis *et al*. [1]. Particularly, in the sub Saharan Africa, livestock plays a crucial role both for the national economics and livelihoods of rural communities. It provides power, milk and meat, input for crop production, soil fertility and raw materials for the industry [2]. In east Africa the livestock slaughtered in abattoirs for local consumption and export are brought from rural areas whereby disease control regimens are very limited [3].

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In the Ethiopian condition, livestock contributes to more than 40% of the country's agricultural Gross Domestic Product (GDP) and more than 85% of farm cash income Abebe *et al*. [4]. They provide high quality food from consumption of fibrous and unusable resource. They serve as source of cash income and means of savings, import and export commodity and provide raw materials for industries like leather industry. Generaly in Africa and particularly in Ethiopia, the level of ruminant livestock production doesn't commensurate with its size [5]. Moreover, Ethiopia has one of the largest livestock populations in Africa with the estimated domestic animal number of 57.83 million cattle, 28.89 million sheep, 22.6 million goats, 1.23 million camels, 60.51 million poultry, 2.08 million horses 0.41 million mules and 7.88 million donkeys [6].

Livestock play an important role in providing export commodities in a form of live animals, hides and skins. However, there are constraints that hindered the potential of livestock production include traditional management system, limited genetic potential, presence of high prevalent livestock diseases, lack of appropriate disease control policy and veterinary services [7]. An abattoir house, a building for butchering of animals, can be a source of valuable information of the incidence of animal disease and condition some of which may be zoonotic. It is food factory whose primer animals to produce health, wholesome and clean products which are safe for human consumption. In adequate care of those food animals reduce their productivities and expose them to different forms of disease agent which may became hazardous to man and the environment [8].

A through meat inspection procedure requires two steps namely anti-mortem and postmortem inspection. The importance of ante mortem inspection in the abattoir has long been recognized in an attempt to avoid the introduction of clinically diseased animals into the slaughterhouse. Ante mortem inspection should be done within 24 hours of slaughter and repeated when slaughter has been delayed over a day [9]. Postmortem inspection is screening process to separate the normal from abnormal. It is the center around which meat hygiene revolves since it provides information indispensable from the scientific evolution of clinical signs and pathological process that affect wholesomeness of meat. Hence, routine post mortem inspection of carcass and organs should be carried out as soon as possible after completion of dressing [10]. The main purpose of post mortem examination is to detect and eliminate abnormalities including contamination to ensure wholesomeness of meat for human consumption [11].

Bovine liver is one of the largest vital visceral organs in the animal body which performs numerous functions and very reach sources of vitamins and minerals Radostitis *et al*. [1]. The tissue is much sought by consumers due to its palatability and easy for consumption. However, it is one of the most commonly condemned visceral organs during routine meat inspection [12]. Though, several biotic (livestock diseases) as well as abiotic internal factors are reported to cause condemnation of the different vital organs including the liver. Of the livestock diseases, parasitic diseases are considered as a major health problem and cause significant economic losses by causing tissue damages and organ condemnation in countries where livestock production is a significant section of the agricultural practice [9, 13]. Major parasitic diseases such as fasciolosis caused by trematodes of the genus Fasciola, Hydatid cysts the meta-cestode stage of Echinococcus *granulosu* and Cycticercusbovis are often reported to cause major economic losses by lowering the productivity of cattle in their life times and causing condemnation of edible organs such as the liver after their slaughter [5, 9, 14, 16]. Itis considered an important factor for bovine and ovine production. In general infection of domestic ruminants with *Fasciola* species causes significant economic loss estimated at over USD 200 million per annum to the agriculture sector worldwide, with over 600 million animals infected Raji *et al*. [17]. In developed countries, the incidence of *Fasciola hepatica* ranges up to 77% Sisay *et al*.[18]. Evidence suggests that cattle and sheep may be considered the main reservoir host species, pigs and donkeys being secondary host Rahmeto *et al*. [19]. In tropical regions, fasciolosis is considered the single most important helminthes infection of cattle with prevalence rates of 30-90% in Africa, 25-100% in India and 25-90% in Indonesia Raji *et al*. [17].

Fasciola hepatica is a temperate species and it is found in southern America, Northern America, Europe and Australia and Africa, but found in the high lands of Ethiopia and Kenya Dechasa *et al*. [20]. It is the major cause of liver Fluke disease in Ethiopia. Its tropical counterpart, *F.gigantica*, on the other hand is widely distributed in tropical countries, in Africa and Asia, parasitizing domestic ruminants and other herbivores in

almost every continent. In Ethiopia, *F.gigantica* is found at altitudes below 1800 m.a.s.l. While *Fasciola hepatica* is found at altitude between 1200-2560 m.a.s.l. Abebe *et al*. [4]. Mixed infections by the two species can be encountered at 1200-1800 m.a.s.l. Financial loss due to ovine fasciolosis is estimated at 48.8 million Ethiopian birr /annum of which 46.05%, 48.8% and 4.7% were due to mortality, weight loss and liver condemnation, respectively [21].

The epidemiology of fasciolosis depends on the grazing habitat preference of the animal. Raji and his coworkers, [17] reported that metacercaria can survive up to 3 months after harvesting in hay from endemic high land areas that are consumed by the ruminants in arid and low land areas. The adult parasite *F. hepatica* has a flat leaf-like body; typical of flukes and measures 20-30mm long by 8 to15mm wide. *F. gigatica* is a parasite very similar to *F. hepatica*, its length may vary 25 to 75mm long by 15mm wide [15].

To date, several research works have been carried at different abattoirs focusing on the causes for organ condemnations, particularly fasciolosis, hydatidosis and cysticercosis [9, 13-16, 18, 22-24]. However, despite of the several retrospective abattoir data records on fasciolosis from Maichew municipal Abattoir, there are no published research works done so far on the prevalence of fasciolosis in cattle brought for slaughter at the abattoir and on the overall financial losses resulted from the lost organs due to fasciola infestations. The present study was, therefore, conducted to determine the prevalence of fasciolosis in cattle slaughtered at Maichew municipal Abattoir and to estimate the magnitude of direct financial losses that are attributed to the condemned livers due to fasciolosis.

MATERIALS AND METHODS

Description of the Study Area: The study was conducted from January 15, 2019 to April 20, 2019 in Maichew municipal abattoir, Maichew, Tigray regional state. Maichew is a district town located in the Southern Zone of Tigray Region. It is located at 665 km north of Addis Ababa, the capital of the country. The area is located at 12°46'N latitude and an elevation of 1200- 2478 m.a.s.l. The monthly precipitation distribution in Maichew is not uniform but, rainy periods frequently occur both in summer and winter, comparatively the rainfall being heavy in the summer months. The average temperature of the area ranges from 7-26°C. [25]. Based on the national census conducted by the Central Statistical Agency of Ethiopia, this town has a total population of 23,419, of whom 11,024 are men and 12,395 women [26]

Study Animals: In the active abattoir survey, animals in the study were cattle. These animals are bringing from different locations in the region including in and around Mekelle, Raya Azebo, Alamata, Enda mehoni and Ofla districts as well. The cattle brought to the abattoir for slaughter include majority of them were local and few cross breeds including all age groups of entirely containing of male animals.

Study Design: A cross-sectional study was conducted from January, 2019 to April, 2019 to determine the prevalence of fasciolosis in slaughtered cattle and to estimate the magnitude of direct financial loss attributed to liver condemnation in the study area.

Active Abattoir Survey

Ante-mortem Inspection: In the cross-sectional study of active abattoir survey, both ante mortem and post mortem inspections were carried out in accordance with the procedures of Ethiopian Ministry of Agriculture Meat Inspection Regulation Sisay *et al*.[18], in this study, anti-mortem examinations of cattle were carried out at lairage during the days of visit to the abattoir and each animal was recorded based on an identification number by marking their body, to define the animal breed, age group, body condition score and origin of animals. The age of animals was estimated into ≤ 5 years, 5-10 years and > 10 years by using dental examination according to Vatta *et al*. [27]. Based on the body condition scores were classified into four main classes as poor (0 and 1), medium (2 and 3), good (3.5 and 4) and very good (5) as described by Nicolson*et al*. [28]. Followingthe judgment guideline stated by the Food and Agricultural Organization, only animals fit for human consumption were allowed for slaughter [7].

Postmortem Inspection: During the post-mortem examinations, the liver was thoroughly inspected by visualization, palpation and making systematic incision where necessary for the presence of adult and/or immature stage of fasciola and other abnormalities Getaw *et al.* [29]. Pathological lesions that are descriptive to the parasite were differentiated and judged according to guidelines on meat inspection for developing countries Herenda *et al*. [30].

Estimation of Financial Losses: The financial loss due to liver condemnation of cattle was considered based on direct losses. In calculating the cost of condemned livers, the average market values for the price of liver in the areas of the abattoir were asked to create the price per unit of liver and the collective price of liver was determined. The average price was drawn out from the collected data and the price index was later used to calculate the liver losses in terms of Ethiopian Birr (ETB). Average annual slaughter rate of cattle in Maichew municipal abattoir was used to calculate annual economic loss attended to liver condemnation. The direct annual financial loss due to liver condemnation was calculated using the formula set below as described by Ogurinade, [31].

$$ALC=CSR*LC*P$$

where: ALC = Annual loss from liver condemnation CSR= Mean annual cattle slaughtered at Maichew municipal abattoir P= Mean cost of one liver at Maichew municipal abattoir LC= Liver condemnation rate.

Sample Size and Sampling Technique: The study animals were selected using simple random sampling method by taking the age, body condition and origin of the animals into consideration. The desired sample size for this study was calculated by using the formula given by Thrusfield [32] with 95% confidence interval, 5% absolute precision and 10.0% expected prevalence as it has been reported in a similar agro-ecological area of the region in Mekelle municipal abattoir Yidnekew *et al*. [24]. Accordingly, a total of 140 cattle were examined in this study during the study period.

$$N= 1.962 (p) (1-p) = [(3.84) *(0.1) *(0.9)]/0.0025=138$$

$D^2 = (0.05)^2$. There were a total of six working days in the abattoir, out of these three to six days which were a part of the working days that were visited to the abattoir, the daily slaughter rate of cattle in the abattoir varies with a range of 0-10 head of cattle (with an average of 4 heads of a cattle per day) depending on holidays and fasting days as well.

Data Management and Analysis: Data collected during the study were entered into Microsoft Excel and were analyzed by statistical methods using Statistical Package for Social Sciences version-17(SPSS - 17). Descriptive statistics such as percentage were used to determine the level of liver condemnation rate. The association between condemnation rate of liver/prevalence of Fasciolosis and the age, body condition and origin of the animal were assessed by Pearson chi-square (x^2) and the P-value <0.05 were considered as significant.

RESULTS

Results of Ante-mortem Examination: The overall results of the current study have shown that a total of 140 cattle were examined at ante-mortem for the presence of any abnormalities associated to fasciolosis. Accordingly, 16.4% (23/140) of the cattle examined were found to have different types of abnormalities associated with fasciolosis. Paleness of the mucus membrane (n=17/140, 12.5%) and nasal discharges (n=21/140, 15.0%) were the main abnormalities noticed that were associated with fasciolosis, while the least being for edema cases (n=0/140, 0.0%) (Table 1).

Results of Post-mortem Examination: Results of postmortem examination of slaughtered cattle have indicated that out of the 140 examined cattle judged for slaughter at the abattoir, 29.3% of the total livers inspected (41/140) were totally condemned due to Fasciolosis. Hence, a prevalence of 29.3% of Fasciola spp. were recorded across the study three months' period (Table 2).

Assessment of Risk Factors Associated with Fasciolosis: Results of the cattle's socio-demographic survey have shown that 48 (34.3%) of the examined cattle were from Maichew, 32 (22.9%) from Korem, 36 (25.7%) from Enda mehoni and 24 (17.1%) of them were from around Chinkemayo. Accordingly, the highest prevalence of Fasciolosis were recorded from Korem as 59.4%, followed by Maichew as 29.2% and the least being for Enda mehoni as 11.1% for each. However, no statistically significance difference (P>0.05) was observed in the prevalence of Fasciolosis among the different areas of animal origin (Table 3).

Furthermore, assessments were made on the role of the animal's age and body condition on the prevalence of Fasciolosis. Accordingly, results have shown that the highest prevalence of Fasciolosis was significantly (P<0.05) seen in cattle in the age group of < 5 years with a relative prevalence of 55.0% while the least being for older cattle of more than 10 years old as 12.5%. That is, it

Table 1: Abnormalities Associated with fasciolosis encountered during ante-mortem examination of cattle slaughtered at Maichew municipal abattoir (January-April, 2019)

Abnormality	Number Tested	Number Positive	Percentage
Paleness of mucus membrane	140	11	7.9
Nasal discharge	140	8	5.7
Mixed signs of both	140	4	2.8
Total	140	23	16.4

Table 2: Prevalence of fasciolosis encountered during post-mortem examination of cattle slaughteredat Maichew municipal abattoir (January-April, 2019).

				95% CI (for prevalence)	
Causative Agent	Number Tested	Number Positive	Prevalence	Lower Bound	Upper Bound
Fasciola spp.	140	41	29.3	25.09	33.21

Table 3: Assessment of the significance of risk factors in the prevalence of fasciolosisin cattle slaughtered at Maichew municipal abattoir (January-April, 2019).

Variables	No. of animals examined	No. of positive animals	Prevalence (%)	χ^2	P-value
Origin				2.4920	0.477
Maichew	48	14	29.20		
Korem	32	19	59.4		
Mehoni	36	4	11.1		
Chinkemayo	24	4	16.7		
Age				6.3424	0.012
< 5 years	20	11	55.0		
5-10 years	88	26	29.5		
> 10 years	32	4	12.5		
Body condition				13.9935	0.003
Very good	0	0	0.0		
Good	75	7	9.3		
Medium	47	21	44.7		
Poor	18	13	72.2		

Table 4: Average Annual Estimated Financial Losses from Liver Condemnation due to Fasciolosis from Cattle Slaughtered at Maichew Municipal Abattoir (January-April, 2019)

Factors	Given Average Values	Estimated Annual Losses from liver losses due to Fasciolosis (ALC= CSR* LC*P)
Mean annual cattle slaughtered at Maichew municipal abattoir (CSR)	(1,125+1,250)/2= 1,187.5	1,187.5heads*125ETB/head* 29.3= 4,349,218.75 ETB.
Mean cost of one liver at Maichew municipal abattoir (P)	125ETB/liver	
Liver condemnation rate (LC)	29.3%	

was significantly observed that as the age increases, the prevalence of Fasciolosis was also found to increase proportionally (Table 3).

Similarly, in the present study, it has also been significantly ($P<0.05$) observed a higher prevalence of Fasciolosis in cattle with poor body condition and lower prevalence in very good body conditioned animals as 72.2% and 0.0% respectively. Hence, it was observed that as the body condition score increases numerically or as the animal becomes poor and worst in body appearance, the prevalence of Fasciolosis was found to significantly decrease in that way (Table 3).

Estimation of Annual Financial Losses: Due to the fact that the research work was conducted for a period of three months only, it was necessary to look for records on the average number of animals slaughtered per annum. Accordingly, results of retrospective survey have shown that the annual cattle slaughter rate of the abattoir for the last two years of 2009E.C and 2010E.C were 1,125 and 1,250 heads of cattle respectively. Similarly, it has also been reported that the average price of liver sold in the area of the abattoir was 125ETB. Therefore, using the necessary information and the above stated formula, the annual direct financial loss incurred due to condemnation

of liver from Fasciolosis (only) was found to be 4,349,218.75 ETB per annum (Table 4).

DISCUSSION

Bovine fasciolosis has been reported severally as an economically important cosmopolitan parasitic disease that directly causes mortality and liver condemnation at abattoir levels. The outcome of the present study showed that Fasciolosis was a serious problem in cattle slaughtered at Maichew municipal abattoir causing high economic loss due to liver condemnation. The prevalence of Fasciolosis observed in this study, 29.3%, appear to be in line with the report of Mulat *et al*. [33] as 29.6% and higher than the prevalence of 24.3% reported by Gebretsadik *et al*. [34], 8.0% from Nigeria by Okoli *et al*. [35]. Moreover, results of the current study were also found to be lower that reports of Getachew *et al*. [36] as 41%, [37] as 46.6% from Jimma; Abebe *et al*. [4] as 53.7% from Southwestern Ethiopia; Pfukenyi and Mukaratirwa [38] as 37% from Zimbabwe; and 46% from Zambia [12]. The differences in the prevalence of Fasciolosis noticed could mainly be attributable to the differences in the climatic and ecological conditions such as altitude, rainfall and temperature as well as the livestock management system among the study areas.

With regard to the animal origin, results of the present study have been shown that the highest prevalence of Fasciolosis were recorded from Korem as 59.4%, followed by Maichew as 29.2% and the least being for Enda mehoni as 11.1% for each. However, no statistically significance difference ($P>0.05$) was observed in the prevalence of Fasciolosis among the different areas of animal origin. Similar finding has been reported by Zeleke *et al*. [39] that no significant difference was observed among animals from different origins. However, results were in contrary with the reports of Abebe *et al*. [4] and Gebretsadik *et al*. [34] who have reported a significant difference between animal origins in that cattle from wet and marshy areas were found to highly significantly infected with Fasciolosis than their counters. In view of the body condition score of the examined slaughter cattle, the prevalence was higher in the it has also been significantly ($P<0.05$) observed a higher prevalence of Fasciolosis in cattle with poor body condition and lower prevalence in very good body conditioned animals as 72.2% and 0.0% respectively. Hence, it was observed that as the body condition score increases numerically, the prevalence of Fasciolosis was found to significantly decrease in that way. Similar findings were reported from Gondar abattoir 68.4% by Mulat *et al*. [33] and from Debrezeit municipal abattoir as 63.1% by Yemisrach and Mekonnen [21]. The results of the current study have proved that the weight of animals increases as the parasitic infection decreases which could be due to acquired immunity in the host. Furthermore, it is generally true that the animal's body condition improves as Fasciola infection decreases [40].

The result analysis of on the bases of age indicated that the highest prevalence of Fasciolosis was significantly ($P<0.05$) seen in cattle in the age group of < 5 years with a relative prevalence of 55.0% while the least being for older cattle of more than 10 years old as 12.5%. That is, it was significantly observed that as the age increases, the prevalence of Fasciolosis was also found to increase proportionally. However, Zeleke *et al*. [39] have found a higher prevalence in older cattle slaughtered at Metu municipal abattoir. This may be due to most of liver diseases are chronic and the older animals are mostly affected by many diseases as well as due to frequent exposure of animals as their age increases and their body condition score may be as a result of infection with the parasite Zeleke *et al*. [39].

The direct financial loss incurred as result of condemnation of liver due to Fasciolosis in the present study was 4,349,218.75 ETB. These results were found to be so much higher than 22,040 per annum due to different causes of liver condemnation that reported by Mellau *et al*. [41]at Arusha abattoir, Tanzania. A similar study carried out in Mekelle municipal abattoir revealed an annual loss of 744,471 ETB. Reported by Gebretsadik *et al*. [34]. However, results of the current study were also found to be lower than the 6,803,488 ETB reported from Jimma abattoir Dechasa *et al*. [20].

The difference in the estimated financial losses among the different study sites could be due to the difference in the annual slaughter rate, disease prevalence and the price per kg, of beef and liver at the study localities. Monitory loss estimates, merely based on losses due to liver condemnation ranging from 108,000-224,451 ETB, were reported from different abattoirs in the country [4, 16, 19, 21, 37, 42].

CONCLUSION AND RECOMMENDATIONS

In conclusion, liver condemnations due to fasciolosis have been reported in this present study as a cause of huge liver condemnation in the abattoir and to impact negatively on the economic status of the traders and the livestock industry at large. Indeed, fasciolosis was found to significantly result in liver condemnation.

Its prevalence in slaughter cattle was found to be significantly pronounced in cattle from originated Korem. Similarly, the disease was significant in cattle with poor body condition and young ones. In general, it can be stated that the disease has constituted a substantial loss to the economy of the slaughter stock owners under study area as such an amount of money would have been harnessed into livelihood improvements.

Therefore, based on above conclusion following recommendations are forwarded:

- ✓ Awareness should be created in producers, animal attendants, farmers and customers about fasciolosis disease prevention and control measures.
- ✓ The government should propose strategic disease control programs to alleviate financial losses, to improve meat quality and quantity and to avoid risk of the human consumers.
- ✓ Further large scale intensive studies should be carried out in cattle that are slaughtered in the abattoir to the species levels at higher samples and extended periods as well.

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