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The Abattoir Prevalence and Monetary Loss of Fasciolosis and Hydatidosis among Apparently Healthy Slaughtered Cattle at Asella Town, Ethiopia

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Abstract: Each year a large loss from slaughtered animals occurs due to condemnation of edible organs such as liver and lung. Fasciolosis and hydatidosis are among the major causes of organ condemnation and monetary losses in slaughtered animals. Therefore this study was conducted to assess the prevalence and monetary importance of organ condemnation and carcass weight loss due to fasciolosis and hydatidosis in cattle that are slaughtered at Asella municipal abattoir, South Eastern Ethiopia, between the periods of November 2014 and April 2015. Out of 399 cattle slaughtered and examined, 69(17.3%) animals had their liver infected due to fasciolosis. The percentage of organs affected during the study period was (38.59%) lung, (22.3%) liver,(1%) heart, (2%) spleen and (2.25%) kidney. Of the total, cattle examined in this study, 230(57.6%) were cattle found to be positive for hydatidosis. The total monetary loss as result of fasciolosis was estimated to be about 2,102,572.8 Ethiopian birr (105128.64 USD). While the annual monetary loss due to organ condemnation and carcass weight loss due to hydatidosis was estimated at about 3,479,679.13Ethiopian birr (173983.96 USD). Total annual monetary loss due to both fasciolosis and hydatidosis was calculated to be 5582251.93Ethiopian birr (279112.6 USD). Thus, fasciolosis and hydatidosis were considerably prevalent disease with serious public health concern reflection and caused visible and invisible losses in cattle in the study area.

Key words: Abattoir · Cattle · Prevalence · Monetary Loss · Fasciolosis · Hydatidosis

INTRODUCTION

Ethiopia has large livestock population in Africa with an estimated of 44,318,877 cattle, 23,619,720 sheep and 23,325,113 of goats [1]. However, there are constraints that hindered the potential of livestock production include; traditional management system, limited genetic potential, lack of appropriate disease control policy and veterinary services. Due to these and related factors, each year significant monetary losses result from condemnation of edible organs and carcass were estimated from different abattoirs of the country. The significant monetary losses incurred each year in the different abattoirs in Ethiopia are due to mortality, inferior weight gain and condemnation of edible organs at slaughter [2].

Parasitic diseases are considered as a major health problem and cause a significant monetary loss in countries where livestock production is an important segment of the agricultural practice. Developing countries have about two third of the world's livestock population but their meat and milk production are less than a third of the world. Among many parasitic problems of farm animals, fasciolosis and hydatidosis are major diseases, which impose direct and indirect monetary impact on livestock production, particularly of sheep and cattle [3]. Fasciolosis caused by the trematode *F. hepatica* is a worldwide parasitic disease and common in ruminants, especially in cattle, buffaloes, sheep, goats and swine. It occasionally affects humans. The disease is responsible for considerable monetary losses in the cattle industry, mainly through mortality, liver condemnation, reduced production of meat, milk and wool and expenditures for anthelementics [4].

Hydatidosis is a term used to describe infection of different animals species and humans with larval or metacestodes stage of *Echinococcus* species. Ungulates, including sheep, cattle, goats, pigs and horses are

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intermediate hosts in which Hydatid cysts occur. Adult of the genus *Echinococcus* are found in the small intestines of dogs and other carnivores. Four species are currently recognized within the genus *Echinococcus*; *E. granulosus, E. multilocularis, E. oligarthus and E. vogeli*. The parasites are perpetuated in life-cycles with carnivores as definitve hosts, which harbour the adult egg-producing stage in the intestine and intermediate host animals, in which the infective metacestode stage develops after infection with eggs. Hydatid cyst in livestock leads to considerable monetary losses due to condemnation of edible offal's primarily liver and lung.

The loss due to condemnation of organs by Hydatid cyst, particularly liver and lung in some countries is very considerable. These losses are of especial significance in countries of low monetary output, where sheep and goat production is of particular importance. Though Hydatidosis, constitutes a public health problem worldwide, yet causes a particularly heavy burden in developing countries. The distribution *E. granulosus* is higher in rural communities of developing countries where there is close contact between definitive host, the dog and various domestic animals, acting as intermediate hosts [6]. Various studies have been carried out in the country in this regard to know the causes of organ condemnation. However, these studies did not consider losses due to partially condemned of liver and lung. Therefore, the objectives of this study were to:

- Determine the prevalence of fasciolosis and hydatidosis and
- Estimate the direct and indirect monetary losses due to fasciolosis and hydatidosis among cattle slaughtered at Asella municipal abattoir.

MATERIALS AND METHODS

Study Area: The study was carried out in Asella town municipal abattoir. Asella town is situated at 6°59'-8°49' N latitude and 38°41'-40°44'E longitude in central Ethiopia, 175 km south east of Addis Ababa. The altitude of the area ranges from 1780-3100 m.a.s.l and characterized by mid subtropical temperature ranging from 5°c-28°c, with an annual mean temperature of 12.1°c. The annual average rainfall is 1,200 mm. The area covers 23,674.72 km square and topographically has highland escapement and lowland areas. The high land areas are found centrally and the low lands dominate the periphery of the area [1].

Study Population: The study was conducted on cattle slaughtered at Asella municipal abattoir. In active abattoir survey, only male animals of local breed were included in the study. The origins of animals were from different places surrounding Asella town; including Sagure, Bokoji, Sire, Dera, Kersa, Assesa and Eteya. Slaughtered animals reached at Asella abattoir either by transporting using vehicles or on foot.

Sample Size Determination: Simple random sampling method was employed for determining the prevalence of fasciolosis and hydatidosis among cattle and the magnitude of direct monetary loss due to liver condemnation and indirect carcass loss at Asella municipal abattoir, Ethiopia. To calculate the total sample size, the following parameters were used: 95% level of confidence (CL), 5% desired level of precision and 50% prevalence of cattle fasciolosis and haydatidosis in Asella municipal abattoir, the sample size was determined using the formula given in [7]. Therefore, the sample size in this study was calculated using the following formula.

$$n = \frac{(1.96)^2 - p\,(1-p)}{d^2}$$

Where;
n = Sample size
p = Expected prevalence (50%)
1.96 = the value of Z at 95% confidence level
d = Desired absolute precision = 5%

Hence, the sample size required as per the above formula was 384 heads of cattle. But to increase the precision of the study the sample size were increased and a total 399 of cattle were included in the current study.

Sampling Method: Simple random sampling technique was used to select animals and to determine the prevalence and monetary loss of fasciolosis and hydatidosis among cattle slaughtered in Asella municipal abattoir during the study period

Study Methodology: The study was carried out from November 2014 to April 2015 in Asella town in Asella abattoir. The study was across sectional type with active abattoir survey with routine meat inspection of the carcass slaughtered in the abattoir. From all animals those

came to the Asella municipal abattoir, study animals were randomly selected and their carcasses were routinely inspected for prevalence of fasciolosis and hydatidosis.

Ante-Mortem Inspection: Pre-slaughter examination of cattle was conducted in the lairage by grouping the animals based on species, age and place of origin. Age grouping was done based on dentition and those which erupted only one pair of incisor teeth was classified as young, while those with erupted more than one pair of incisor teeth was classified as old [8]. Ante-mortem inspections was conducted on individual animals, while the animals entering into the lairage and after they entered into the lairage in mass. Both sides of the animals were inspected at rest and in motion. Moreover, the general behavior of the animals, body condition, cleanness and sign of diseases and abnormality of any type was registered according to the standard ante-mortem inspection procedures [9].

Postmortem Inspection: According to Meat Inspection Regulation Notice Number 428, 1972 by Government of Ethiopia, the routine inspection of carcass was done.

All animals that undergo post-mortem examination were those which passed ante-mortem inspection. During postmortem inspection liver, lungs, heart, kidney, brain and carcasses were thoroughly inspected by visualization, palpation and making systemic incisions where necessary for the presence of cysts, parasites and other abnormalities. Pathological lesions were differentiated and judged according to guidelines on meat inspection for developing countries and the results were recorded on the predesigned data collection format. The decisions at postmortem inspection were classified in to the following categories of judgments: approved as fit for human consumption, conditionally approved as fit for human consumption, totally condemned as unfit for human consumption and partially condemned as fit for human consumption [10].

Monetary Loss Assessment: The monetary significance of bovine fasciolosis and hydatidosis was estimated from the amount of organs condemned and also from loss of carcass weight caused by the two diseases. The following points have been considered in calculating the monetary loss:- market price of liver, lung, heart, kidney, spleen and a kg of beef at Asella is price 50, 20, 30, 30, 10 Ethiopian birr (ETB) and 130 ETB respectively. Average annual slaughter rate of cattle in the abattoir is 7200 (record of the slaughter house). Carcass weight loss was estimated to be 10% due to fasciolosis and 5% due to hydatidosis and the average carcass weight (126 kg) of Ethiopian zebu cattle breeds was taken from estimation by ILRI [12].

In order to evaluate the monetary loss from offal condemnation, the following parameters were taken into consideration.

- The mean retail market price of liver, heart, kidney, lung and spleen at Asella was collected from butchers.
- Average annual slaughter rate of cattle in Asella municipality abattoir was estimated based on retrospective analysis of data recorded from three years. Accordingly, the loss from liver, heart, kidney, lung, spleen condemnation was calculated as follows [13].

Direct Monetary Loss:

- Annual monetary loss of fasciolosis dueto liver condemnation
- Annual cost of condemned liver = total number of animals slaughtered annually and positive for fasciolosis (NS) multiplied by Mean cost of liver at Asella town (CL)
- Annual cost of carcass weight loss due to fasciolosis = NS.CI.PA where
- NS=total number of animals slaughtered and positive for Fasciolosis (multiplication of average annual kill of the abattoir and prevalence rate)
- CI= carcass weight loss in individual animal due to fasciolosis
- PA= average market price of a kg of beef in Asella
- Annual monetary loss of organ condemned due to hydatidosis
- LOC= (NAS x ph x plu x cplu) + (NAS x ph x phr x cphr) + (NAS x ph x pli x cpli) + (NAS x ph x psp x cpsp) + (NAS x ph x pkid x cpkid);

Where NAS–Average number of cattle slaughtered annually

- Ph-prevalence rate of hydatidosis
- Plu-percent involvement of lung
- Cplu-current mean retail price of lung
- Ph-percent involvement of heart
- Cph-current mean retail price of heart
- Pli-percent involvement of liver
- Cpl -current mean retail price of liver

- Psp-percent involvement of spleen
- Cpsp-current mean retail price of spleen
- Pkid-percent involvement of kidney
- Cpkid-current mean retail price of kidney
- N: B-All prices are determined from the price at Asella town.

Indirect Monetary Loss: Thus the loss from carcass weight loss was computed as follows;

LCWL=NAS x pf x CPB x 10% x 126kg, NAS x ph x CPB x 5% x 126kg for fasciolosis and hydatidosis respectively

Where LCWL-loss from carcass weight loss

- 10%-estimated Carcass weight loss due to fasciolosis.
- 5%-estimated carcass weight loss due to hydatidosis.
- NAS-Average number of cattle slaughtered annually
- Pf-prevalence rate of Fasciolosis
- Ph-prevalence of hydatidosis
- CPB –current average price of 1 kg of beef at Asella town
- 126 kg- Average carcass weight (dressing percentage) of adult zebu cattle, ILRI (Bersissa, 1994)

Total Monetary Loss Estimation: Total monetary loss was evaluated by considering both loss from organ condemnation and loss from carcass weight loss.

Total loss= direct loss (loss from organ condemnation) + indirect loss (loss from carcass weight loss)

Statistical Analysis: Microsoft Excel was used for data management and computation of descriptive statistics. Computation of descriptive statistics was conducted using SPSS version 20.0. Descriptive statistics such as percentages, proportions and frequency distributions were applied to compute some of the data. The prevalence of fasciolosis and hydatidosis were calculated by dividing the number of cattle harboring the parasites by the number of cattle examined. Pearson's chi-square (χ^2) to measure association between prevalence of the parasite with the potential risk factors was used as a statistical tool. The difference among risk factors was statistically significant if the p- value was less than 0.05 ($P<0.05$).

RESULTS

Antemortem Examination: Out of 399 cattle examined during ante mortem inspection at Asella municipal abattoir, various types of abnormalities were encountered in 61(16.79%) of the male cattle. The major abnormalities encountered were lameness (4.01%), branding (2.76%), blindness (1%), emaciation (3.76%) and local swelling (5.26%) (Table1). These animals were, nevertheless, passed for slaughter with caution through postmortem examination.

Postmortem Examination: All animals examined during antemortem inspection were also examined during postmortem examination. From a total of 399 heads of indigenous zebu cattle slaughtered at Asella municipal abattoir 11.8, 52.1 and 5.5% were found infected with fasciolosis, hydatid cyst and mixed infection, respectively.

Fasciolosis

Prevalence of Fasciolosis: In this study the overall prevalence of fasciolosis among cattle at Asella municipal abattoir was found to be 17.3 % (69/399). The prevalence of fasciolosis was found to be higher among young cattle (18.9%) than old (18.3%) and adult (16.4%) animals. Statistical analysis of the data showed that there was no statistical significant difference ($P>0.05$) in the prevalence of fasciolosis among age groups of cattle (Table 2).

Table 1: Abnomalities conditions encountered during ant mortem inspection

Abnormal conditions	No. affected animals	Abnormality percentage
Local swelling	21	5.26%
Lameness	16	4.01%
Blindness	4	1%
Emaciation	15	3.76%
Branding	11	2.76%
Total	67	16.79%

Table 2: prevalence of fasciolosis among ages

Age	Examined	Positive (%)	χ^2	P-value
Old	126	23(18.3%)	0.306	0.858
Adult	220	36(16.4%)		
Young	53	10(18.9%)		
Total	399	69(17.3%)		

Table 3: Prevalence of fasciolosis among body condition

Body condition	Examined	Positive	χ^2	p-value
Good	146	20(13.7%)		
Medium	238	39(16.4%)	27.022	0.000
Poor	15	10(66.7%)		
Total	399	69(17.3%)		

Table 4: Prevalence of fasciolosis among origin

Origin	Examined	Positive	χ^2	P-value
Sagure	149	20(13.4%)		
Bokoji	115	36(31.3%)		
Assesa	45	4(8.9%)		
Kersa	24	2(8.3%)	26.067	0.000
Sire	23	5(21.7%)		
Dera	26	1(3.8%)		
Eteya	17	1(5.9%)		
Total	399	69(17.3%)		

Table 5: Prevalence ofhydatidosis among age

Age	Examined	No.positive	χ^2	p-value
Old	126	76(60.3%)		
Adult	220	126(57.3%)	0.884	0.632
Young	53	28(52.8%)		
Total	399	230(57.6%)		

The prevalence of fasciolosis was found to be higher among poor (66.7%) than medium (16.7%) and good (13.7%) condition animals. There was statistically significant difference (P<0.05) in prevalence of fasciolosis among different body condition categories of cattle (Table 3).

Origin dependent study revealed that higher prevalence of fasciolosis was observed in animal originated from Bokoji (31.3%) followed by Sire (21.7%) and Sagure (13.4%). The difference was statistically significant (p<0.05) (Table 4).

Monetary Losses Analysis Due to Fasciolosis: The annual monetary loss due to fasciolosis was estimated considering prevalence rate of fasciolosis (17.3%), mean annual cattle slaughter rate at Asella municipal abattoir (7200); mean retail market price of liver in Asella town (50 birr); 126kg average carcass weight slaughtered at Asella; 130 birr mean price of of 1kg beef carcass in Asella town; and carcass weight loss due to fasciolosis 10%.

Calculate the monetary loss as described in material and methodology = (NS.CI) + (NS. CI. PA).

So, Total monetary loss from liver condemnation and reduced carcass weight loss in cattle at Asella municipal abattoir is estimated as 2102572.8 Ethiopian Birr (105128.64 USD).

Hydatidosis

Prevalence of Hydatidosis: The overall prevalence of hydatidosis among cattle at Asella municipal abattoir was found to be 57.6% (230/399). The number and percentage

Table 6: prevalence of hydatidosis among body condition

Body condition	Examined	Positive	χ^2	p-value
Good	146	64(43.8%)		
Medium	238	152(63.9%)	23.000	0.000
Poor	15	14(93.3%)		
Total	399	230(57.6%)		

Table 7: Prevalence of hydatidosis among origin

Origin	Examined	Positive	χ^2	p-value
Sagure	149	95(63.8%)		
Bokoji	115	55(47.8%)		
Assesa	45	34(75.6%)		
Kersa	24	15(62.5%)	17.611	0.007
Sire	23	9(39.1%)		
Dera	26	12(46.2%)		
Eteya	17	10(58.8%)		
Total	399	230(57.6%)		

of affected organs during study period was 154 (38.59%) lung, 89 (22.3%) liver, 10 (2.25%) kidney, 4 (1%) heart and 8 (2%) spleen. The prevalence of hydatidosis was found to be higher among old (60.3%) animals followed by adult (57.3%) and young (52.8%) animals. The difference was not statistically significant (P>0.05) (Table 5).

Statistical analysis of the data showed that there was statistical significant difference (P<0.05) in the prevalence of hydatidosis among body condition groups of cattle. Animals with poor body condition were more likely to be infected by hydatid cyst than animals with medium body condition. Similarly, animals with medium body condition more likely to be at risk of acquired hydatidosis than animals with good body condition (Table 6).

Origin dependent study revealed that there was statistically significant difference in prevalence of hydatidosis between origin (p<0.05) with higher prevalence of 75.6%, 63.8% and 62.5% were recorded in animal originated from Assesa, Sagure and Kersa, respectively (Table 7).

Monetary Losses Analysis Due to Hydatidosis: Annual monetary loss due to hydatidosis was estimated by considering he prevalence of bovine hydatidosis (57.6%); mean annual cattle slaughter rate at Asella municipal abattoir (7200); mean retail of lung (20 Birr), heart (30 Birr), liver (50 Birr), kidney (30 Birr), spleen (10 Birr); carcass weight loss due to hydatidosis (5%); and prevalence of each organ infected lung(38.59%), liver(22.3%), kidney(2.25%), heart (1%) and spleen (2%); 130kg mean price of 1kg beef carcass in Asella town; and as described in material and methodology; the annual monetary loss calculated as the

sum of monetaryloss due to organ condemnation and carcass weight loss(NAS x ph x plu x cplu) + (NAS x ph x phr x cphr) + (NAS x ph x pli x cpli) + (NAS x ph x psp x cpsp) + (NAS x ph x pkid x cpkid)+(NS.CI.PA). Therefore, the total estimated monetary loss in cattle at Asella municipal abattoir due to hydatidosis was calculated to be3479679.13 Ethiopian Birr (173983.96 USD).

DISCUSSION

An important function of meat inspection is to assist in monitoring the diseases by providing feedback information to the veterinary service to control or eradicate diseases, to produce wholesome products and to protect the public from zoonotic hazards [9].

The overall prevalence of bovine fasciolosis (17.3%) observed in this study was found to be in agreement with the report of 20.3% in Addis Ababa reported by Kassaye *et al.* [15] and 21.9% reported by Petros *et al.* [16] from Nekemte municipal abattior. However, the current finding was known to be lower than that of many other studies from different abattoirs in the country and elsewhere in Africa. Yilma and Mesfin [17] reported a 90.7% prevalence of fasciolosis in cattle slaughtered at Gondar abattoir, 47% in Soddo [18], 56.6 % in Ziway [19], 54.5% in Jimma by Abie *et al.* [20], 53.5% in Kombolcha by Mulugeta [21], while Tolosa and Tigre [22] recorded a prevalence of 46.2% at Jimma abattoir. The differences in the prevalence of the present study among other researchers finding within the country might be attributed mainly due to variations in the origin of the cattle slaughtered, ecological and climatic conditions such as altitude, rainfall and temperature; management systems of animals, the sample size and the ability of the inspector to detect the infection may play a part. One of the most important factors that influence the occurrence of fasciolosis in an area is the availability of a suitable habitat for the snail intermediate hosts and essential for the development of fluke eggs, miracidiae searching for snails and dispersal of cercariae [23].

This study indicated a prevalence of fasciolosis to be 18.9%, 16.4% and 18.3% among young, adult and old animals, respectively. Statistical analyses, however, showed the absence of significant variation in the occurrence of fasciolosis among the different age groups of animals. This finding was in agreement with the report of Petros *et al*. [16] in Nekemte municipal abattoir, Ethiopia. There was a decrease in infection rate (prevalence) as age increased. This might be due to the result of acquired immunity with age which is manifested by humeral and cell-mediated immune response as a result of previous challenge. The high level of tissue reaction as a result of cell-mediated immune response would lead to liver fibrosis, which impeded the passage of immature flukes. Acquired thickening, stenosis and calcification of bile ducts assumed unfavorable site for adult parasites and consequently fasten their expulsion. These are in agreement with experimental study conducted by Radostits *et al*. [24], Urquhart *et al.* [23] and Petros *et al*. [16] which confirmed the occurrence of higher infection rate in younger animals.

There was a statistically significant association ($P < 0.05$) between *Fasciola* infection and body condition of the animals. Poor body condition animals were more likely to be infected as compared to medium and good body conditions. In relation to body condition of the animals, the abattoir prevalence was higher in those animals with poor body condition (66.7%) than in those with medium and good body conditions; 16.4% and 13.7%, respectively. This is due to the fact that animals with poor body condition are usually less resistant and are consequently susceptible to infectious diseases. The reason behind is may be due to reduced performance of the animals created by lack of essential nutrients and poor management by the animal owner. In addition to this, the weight of animals increases as the parasitic infection decreases which could be due to acquired immunity in the host. Body condition improves as *Fasciola* infection decreases since *Fasciola* worms suck blood and tissue fluid and damage the parenchyma of liver due to the migrating immature worms. So this is the most appropriate reason for those animals in order to loss their body condition in the case of fasciolosis.

According to the origin of animals, the highest prevalence was observed in Bokoji (31.3%) followed by Sire (21.7%), Sagure (13.4%) and the lowest prevalence were observed in Dera (3.8%) and Eteya (5.9%) by using post mortem examination. Statistical analysis of the result revealed that there was significant difference ($p<0.05$) in prevalence of fasciolosis among the seven origins of animals. The difference was seen among different origins, this may be due to variation in ecological and climatic conditions such as altitude, rain fall and temperature which favored the perpetuation of the intermediate host. The total annual monetary loss encountered due to bovine fasciolosis in the study abattoir was found to be 2,102,572.8 ETB (105128.64 USD).

The overall prevalence of hydatidosis was 57.6% in the present study. This finding was in agreement with the prevalence of 56.6% in Greece [25] and 59.9% in Bahir Dar [26]. However, it was higher than the prevalence of, 52.6% in Hawassa [27] and 48.9% in DebreMarkos [28].

The prevalence of hydatidosis in the current study was high. This might be due to the abundance and frequent contact between the infected intermediate and final hosts. It could also be associated to slaughtering of aged cattle which have had considerable chance of exposure to the parasitic ova, backyard slaughtering of small ruminants and provision of infected offal's to pet animals around homesteads. Moreover, poor public awareness about the disease and presence of few slaughter houses could have contributed to such a higher prevalence rate. With regards to rate of infection of hydatidosis in different age groups of cattle, significant difference ($P<0.05$) was not observed. Animals with old age were highly affected than adult and young animals. The difference in infection rate could be mainly due to longer exposure time to *E. granulosus*.

Statistical analysis of the data showed that there was significant difference ($p<0.05$) in infection rate among different body condition score categories. Animals with poor body condition (93.3%) were more likely to be infected by hydatid cyst than animals with medium (63.9%) and good body condition (43.8%). Similarly, animals with medium body condition were more likely to be at risk of acquiring hydatidosis than animals with good body condition score.

Origin dependent study revealed that there was statistically significant difference in prevalence of hydatidosis between origin ($P < 0.05$)) with prevalence of 75.6%, 63.8% and 62.5% in animals originated from Assesa, Sagure and Kersa, respectively. The variation in prevalence from different areas of a country might be attributed mainly to the difference in strains of *E. granulosus* that exist in different geographical situations. Other factors like difference in culture, social activity and attitude to dog in different regions [29]. In this study, the monetary losses from offal condemnation and carcass weight loss in infected cattle due to hydatidosis was found to be 3,479,679.13 ETB (173983.96 USD).

CONCLUSSION

The study showed higher prevalence of fasciolosis and hydatidosis among cattle that are slaughtered at Asella municipal abattoir. The study also confirmed fasciolosis and hydatidosis to be important disease entities in causing considerable loss of revenue at Asella municipal abattoir due to organ condemnation and carcass weight losses. The total annual monetary losses due to organ condemnation and carcass weight loss due to fasciolosis and hydatidosis was estimated to be 2102572.8 ETB (105128.64USD) and 3,479,679.13 ETB (17983.96 USD) respectively. During the study months origin and body condition were identified as important risk factors for the occurrence of fasciolosis in cattle.

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