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The Prevalence of Bovine and Ovine Fasciolosis and the Associated Economic Loss Due to Liver Condemnation in and around Debire Birhan, Ethiopia

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List Of Abbreviation

CAO	Baso Agricultural Office
CSA	Central Stastical Agency
DACA	Drug Administration and Control Agency
ETB	Ethiopian Birr
FAO	Food and Agricultural Organization
OR	Odd`s Ratio
USD	United State Dollar
MASL	Meters above sea level
PAs	Peasant Associations

Abstract

A cross-sectional survey was conducted from October 2013 up to March 2014 to assess the prevalence, risk factors and direct economic loss of bovine and ovine fasciolosis in and around Debire Birhan, a town of North shoa Amhara Regional state. In the present study coprology, postmortem examination, questionnaire survey and an abattoir retrospective data were retrieved and analyzed. Seven Kebeles were purposively selected for coprological examination by considering the number of cattle and sheep population of the area and proximity to parasitological laboratories. Coprological examination of fecal samples randomly collected from 300 cattle and 280 sheep revealed an overall prevalence of 62.3% in cattle and 60.7% in sheep whereas 450 (300 cattle and 150 sheep) animals were randomly selected from Debire Birhan Municipal Abattoir for post mortem examination and revealed a total prevalence of 58.6% and 56.0% in cattle and sheep, respectively. This study shows that risk factors such as locality, species and age didn't show significant effect on the prevalence of infections in both cattle and sheep ($P>0.05$). However, season, sex, and body condition revealed significant difference ($P<0.05$) as higher degree of infections were detected in Autumn, female and in poor body conditioned, respectively. Species identification revealed that F. hepatica was highly abundant (43.8%) as compared to Fasciola gigantica (10.2%) in cattle. Likewise sheep livers also harbored F. hepatica (44.0%) and F.gigantica (15.5%). Certain proportion of mixed and unidentified immature fluke infection also common in both species. The economic loss incurred due to condemned liver as a result of bovine and ovine fasciolosis was estimated to be 59,387ETB (2969USD) per annum. In conclusion, fasciolosis was proved to be widely distributed disease with higher prevalence and great impact on the economy. Therefore integrated vector and parasite control approaches should be involved so as to reduce the snail burn and infection rate.

Key words: Abattoir, Bovine, Ovine, Coprology, Economic significance, Fasciolosis, Prevalence. Debire Birhan.

Introduction

Ethiopia has the largest livestock inventories in arid and semi-arid extensive grazing areas of Northern, Eastern, and Western as well as southern low lands with a total contribution of 15% gross domestic product and 33% agricultural output [6]. Current estimation shows that there are 53.99 million heads of cattle, 25.5 million sheep, 24.06 million goats, and 1.1 million heads of dromedary camel, 9.01 million equines, and 50.38 million chickens [5]. Among the animal constraints that hinder their health, productivity and reproduction performance, parasitic diseases are great interest to many tropical countries including Ethiopia. From many of parasitic diseases of domestic animals, Fasciolosis is the most economically important and more prevalent disease that causes huge direct and indirect economic loss of animal productivity. Evidence suggests that sheep and cattle may be considered as the main reservoir host species, pigs and donkeys being secondary. Fasciolosis which is termed as liver fluke disease is caused by the two greatest veterinary important species of the genus Fasciola namely *F. hepatica* and *F. gigantica* [22].

Species identification of Fasciola is possible both grossly and microscopically at the adult level. *F. hepatica* is a leaf shaped fluke with broader anterior and cone shaped posterior projection. It is grayish brown in color changing to gray when preserved. The cuticle is armed with sharp spines. The mature adult flukes measure about 2.5-3.5cm in length and 1cm in width. *F. gigantica* is larger than *F. hepatica* and can reach up to 7.5cm length. The shape is more of leaf like, the conical anterior end is very short and the shoulder characteristic of *F. hepatica* is barely perceptible [37].

The distribution of Fasciolosis is dependent on the ecology of aquatic snail intermediate hosts. *F. hepatica* whose intermediate host is *Galba truncatula* has cosmopolitan distribution, mainly in temperate zones [21]. While *F. gigantica* whose intermediate host is the lymnaeid snail; *Radix natalensis natalensis* is an important Fasciola species in tropics and occurs throughout the western, sub-Saharan and eastern Africa [38]. In Ethiopia, it is found at altitude below 1200 - 2560 mean above masl. Mixed infection by two species can be encountered at 1200 to 1800 masl [41]. The disease is found in vast water lodged and marshy grazing field condition anticipated to be ideal for the propagation and maintenance of high prevalence of Fasciolosis.

In Ethiopia, the highlands contain pockets of water logged marshy areas and these provide suitable habitats year round for the snail intermediate hosts [33]. Following this Fasciolosis due to *F. hepatica* and *F. gigantica* has been reported to be one of the major disease problems of livestock industry especially in the highlands and the low land areas at which irrigation is the common practices in the country [17]. As previous studies shows that *F. hepatica* was shown to be the most important fluke species in Ethiopian livestock with distribution over three quarter of the nation except in the arid North, East and East of the country. On the other hand the distribution of F. gigantica was mainly localized in the Western humid zone of the country that encompasses approximately one fourth of the nations [35]. In recent years, small scale traditional irrigation scheme are expanding in many parts of Ethiopia, which has created favorable habitat for fluke transmitting snail vector. Different coprological and abattoir survey conducted so far in Ethiopia from (1988-2007) indicated that the prevalence of bovine Fasciolosis varied from (15.77- 60.2%) and (14.4-90.7%), respectively. Meanwhile, the higher was recorded in Bahr Dar coprological finding (60.2%) and in Gondar abattoir survey (90.7%).

Fasciolosis causes high morbidity and mortality in most mammal species, but are of particular importance in sheep and cattle to livestock producers. Other than the herd-level losses, Fasciolosis also results in losses associated with liver condemnation in slaughtered animals, reduced weight gains, poor feed utilization and poor quality of meat and milk. Recently, worldwide productivity losses due to Fasciolosis were, F. hepatica infect more than 300 million cattle and 250 million sheep worldwide and, together with F. gigantica, causes significant economic losses to global agriculture estimated at more than US$3 billion annually through production loss, such as a reduction of milk and meat yields [24]. According to previous works done on coprology and abattoir survey by externship (DVM) and MSc students in Addis Ababa University College of Veterinary

Medicine Ethiopia has lost from hundreds to half million ETB per year from a single municipal abattoir due to liver condemnation and carcass weight loss as a result of ruminant Fasciolosis [39].

Apart from its great veterinary importance throughout the world, *F. hepatica* has recently been shown to be emerging and wide spread zoonosis affecting numerous human populations in which they can being infected from accidental ingestion of parasite eggs/larvae passed into the environment with faeces from definitive hosts [31].

Confirmatory diagnosis for Fasciolosis is based on demonstration of characteristics *Fasciola eggs* through standard examination of faeces in the laboratory and demonstration of immature and mature flukes in the liver through postmortem examination [16].

Several control methods against ruminant Fasciolosis are available and can either be used independently and or as a combination of two or more of them. These methods involve elimination of the intermediate host, control of the parasite itself, adoption of good grazing practices (avoiding marshy pastures), regular and rational use of anthelmintics or a combination of all

these strategies. However, anthelmintics are the most preferred due to the private nature of such treatments [15].

Fasciolosis is the priority disease in the highland as well as in lowland areas of Amhara region [33]. Particularly in Debire Birhan, Fasciolosis is considered to be endemic disease requiring immediate intervention. Even if there were a number of studies presented about the prevalence of bovine and ovine Fasciolosis in the same study site, the present study was designed to fill the gap occurred as a result of work done by Dagne [7] to assess the economic losses due to liver condemnation and body weight loss in cattle some 20 years ago. However, the absence of studies on the economic loss due to liver condemnation in sheep slaughtered at Debire Birhan Municipal Abattoir is the point of initiation to undertake the current study. Furthermore, the study is meant to assess the current status of bovine and ovine Fasciolosis. Therefore the specific objectives of the preset study are:

- to determine the prevalence of bovine and ovine Fasciolosis in and around Debire Birhan using coprology and abattoir survey;
- to assess the risk factors associated with the prevalence of ovine and bovine Fasciolosis; and
- To assess the potential economic loss of Fasciolosis from the annual liver condemnation.

Material and Methods

The study area

The study was conducted at Debre Birhan town and its surrounding peasant associations from October 2013 to April 2014. Debre Birhan is a town of North Shoa Administrative Zone of Amhara National Regional State situated at 130 km North East of Addis Ababa. The geographic location of the study area is at a latitude of 090 31′ N and longitude of 390 28′ E with an altitude of 2780 masl The climate condition is characterized by bimodal rainfall pattern consisting of long rainy season (June to September) and short rainy season (February to May) and an extended dry season from late November to February [19]. The annual rainfall and humidity recorded was 960mm and 62.7%, respectively. The maximum and minimum temperature was 16.80C (May) and 1.20C (November), respectively. This area is mountainous with large plane grazing lands and dissected by two rivers, namely Dalicha and Beresa and characterized by marsh area nearby those rivers persist throughout the year. In the study area indigenous, non- discriminatory type and few exotic cattle and sheep are the major livestock with mixed crop-livestock and some small holder farming system. According to Basona Worana Agricultural Office (2013) the livestock population in the study area comprises of cattle (116,751), goat (49,990), sheep (103,344), horse (9,184) and donkey (29,657).

Study animals

The study animals for coprological examination included were indigenous /local and non-discriminatory type of 300 cattle and 280 sheep of different age category of any sex that are managed under extensive farming or some small holder dairy farms. Post mortem liver inspection was conducted in 300 cattle and 150 sheep that were slaughtered at Debire Birhan municipal abattoir.

Sampling method and sample size determination

For coprological examination three Kebeles from Debire Birhan town and four peasant associations from Basona Worana District were purposively selected by considering distance from the parasitological laboratories and the population size. Individual animals for sampling were selected randomly from each peasant associations and animals presented to Debire Birhan Municipal Abattoir for slaughtered by employing lottery system. Names of peasant associations, season species, age, and sex of cattle and sheep data were recorded for coprological study. Moreover, species and body condition score of the animal were also recorded to the abattoir survey. Since tracing back the origin of animals for slaughter was difficult datum in relation to this was excluded in the current study. The desired sample size for the study was determined by using the formula described by Thrusfield [36].

$$N = \frac{1.962 P_{exp}(1 - P_{exp})}{d^2}$$

Where

N= required sample size

d = desired absolute precision

1.962 = z- value for 95% confidence

P exp = expected prevalence

To determine the sample size previous studies in the same site revealed that the prevalence of bovine and ovine Fasciolosis was 64.23% [46] and ovine Fasciolosis 62.7% [45]. So the required sample size to the present study was 320 cattle and 325 sheep. However, to increase the precision 430 sheep and 600 cattle were sampled [36].

Study design and sampling methodology

A cross-sectional investigation was conducted to determine the prevalence of bovine and ovine Fasciolosis by using post-mortem examination of liver in randomly selected animals that presented for slaughtered to Debire Birhan Municipality Abattoir. Faecal examination was conducted by using standard sedimentation technique on faeces collected directly from the rectum of live animals (cattle and sheep). In addition to this, annual slaughtered rate was estimated from retrospective

abattoir records of the four and two years back for cattle and sheep, respectively. While retail market price of an average sized cattle and sheep livers was determined from the restaurant owners in Debire Birhan town through interview.

Coprological examination

A cross sectional study to determine bovine and ovine Fasciolosis has been conducted from October 2013 to April 2014 in and around Debire Birhan town and a total of 580 faecal samples (300 from cattle and 280 from sheep) were collected directly from the rectum in a standing position. The samples were clearly labeled with universal bottles and preserved in 10% formalin when examinations were delayed in the laboratory. All the faecal samples were subjected to standard sedimentation technique and examined under microscope at Basona Worana District veterinary clinic laboratory to detect the presence of Fasciola eggs [15]. Each sample was examined for three times under the microscope to avoid messing of Fasciola eggs during detection. To differentiate Fasciola eggs from that of Paramphistomum, the samples were decolorized using methyl blue indicated as Paramphistomum eggs take the color (methyl blue) where as that of Fasciola eggs remain yellowish [2]. Rerecords of age, sex, origin and body condition score of individual animals were made before sample collection.

Abattoir survey

Active abattoir survey was conducted during routine meat inspection on cattle and sheep slaughtered at Debire Birhan Municipality Abattoir. Each animal was identified based on the tagged number written on the dorsolateral part of the body before slaughter. Intensity of liver lesion was appreciated by visual examination, palpation and systemic incision of the organs based on the recommendation in FAO (2003). For identification of Fasciola species incision was carried out on each infected liver with sharp scissor or knife following the bile ducts even deep cut with a number of small subcuts. Each mature fluke was identified to species level using the morphology and size parameters described by Hansen and Perry [15]. During ante-mortem examination detail records about the species, sex, and body conditions of the animals were performed. However; almost all sheep presented for slaughter were local breed of both sexes. Moreover, cattle presented for slaughter were local, non-discriminatory type and very rarely pure exotic breeds. Care was taken not to slaughter pregnant cows and pure breeds that are on active breeding. Categorization of liver lesion was depending on the severity of pathological condition and those livers that were severely and moderately affected were condemned in this abattoir [34].

Economic loss assessment

Retrospective Abattoir studies included previous recorded information about the total number of cattle and sheep slaughtered at Debire Birhan Municipal Abattoir. The average numbers of cattle and sheep slaughtered in Debire Birhan municipal abattoir during the past four and two years were 2314 and 520, respectively. The average selling price of cattle liver was established through survey in various restaurants in Debire Birhan town. The direct economic loss due to Fasciolosis in Debire Birhan Municipal Abattoir was estimated from annual liver condemnation. All moderately and severely affected cattle livers with Fasciolosis were totally condemned, but those lightly affected livers were either approved or partially condemned. For any fluke positive livers, total condemnation was warranted in ovine species in this abattoir. The annual loss from liver condemnation was assessed by considering the overall annually slaughtered animal in the abattoir, Prevalence of totally condemned liver due to Fasciolosis and the selling price of the livers (expressed as Ethiopian Birr). Total annual liver condemnation was calculated as

(ALC) = NAL X CL X Prev (Ogunrinade 1980).

Where:

NAL = Average number of cattle slaughtered in Debire Birhan Municipal Abattoir

CL = Mean cost of one liver in Debire Birhan town

Prev = Prevalence of totally condemned liver due to Fasciolosis in Debire Birhan municipal abattoir

Data management and analysis

All raw data that were recorded during field survey were registered in a Microsoft excel spread sheet. It was screened and encoded in the Microsoft Excel database system and imported to be analyzed with SPSS Version 20 Stastical soft software. Data like origin, age, sex, body condition and species were risk factors (independent variables) and laboratory result of the sampled animals as the response variable (dependent variable). Furthermore, identified Fasciola species and intensity of liver lesion were considered for abattoir data analysis. Logistic regression statistics was used to measure the strength of association among the risk factors to precipitate the occurrence of Fasciolosis in cattle and sheep.

Results

Coprology

Out of the total 300 cattle and 280 sheep of different age and sex groups examined in the study period 187 (62.33%) and 170 (60.71%) were found to be positive for Fasciolosis respectively. On the bases of species difference Fasciola infection was relatively higher in bovine (62.33%) as compared to ovine (60.71%). However, the difference between the two species was not statically significant ($p>0.05$) (see table 1).

Table 1: Prevalence of Fasciolosis based on species

Species	No. Animal Examined	No. Positive (%)	Prevalence	P-value	OR	95% confidence interval for OR
Bovine	300	187	62.33	1		
Ovine	280	170	60.71	0.95	1.01	0.7 - 1.5
Total	580	357	61.5			

The prevalence of bovine Fasciolosis on the bases of season identified as 69.52% in autumn, 53.73% in winter and 68.85% in spring. Whereas ovine Fasciolosis (69.44%), (50.00%) and (69.56%) in autumn, winter and spring, respectively. In both species there was significant difference between autumn and winter ($P < 0.05$), the strength of association was 0.5 and 0.48 folds in cattle and sheep, respectively (see table 2).

Results of coprological examination from different localities showed variation in infection rate. The overall prevalence of Bovine and ovine Fasciolosis was found to be 56.96 (Kebele 07), 59.77% (kebele 08), 60.71% (Kebele 09), 63.51% (Birbisa), 77.81% (Kormargefia), 6.1.25% (Woshawushign) and 62.5% (Woynye). Relatively the prevalence rate in Kormargefia (76.81%) was higher followed by Birbisa (63.51%) and Woynye (62.5%) and lower in Kebele 07 of Debire Birhan town (56.96). However, the difference was not statically significant ($P >0.05$ (see table 3).

Table 2: Prevalence of bovine and ovine Fasciolosis based on season

Species	Seasons	No. Positive	P-value	OR	95% CI for OR
Bovine	Autumn (105)	73 (69.52 %	1	.....	....
	Winter (134)	72 (53.73%)	0.045	0.5	0.24-0.98
	Spring (61)	42 (68.85%)	0.54	1.3	0.56-3.00
	Sub. Total (300)	187 (62.33%)			
Ovine	Autumn (108)	75 (69.44%	1	.....	.....
	Winter (126)	63 (50.00%)	0.014	0.48	0. 27- .87
	Spring (46)	32 (69.56%)	0.8	1	0.48- 2.4
	Sub total	170(60.71)			
	Ground total	580(61.55%)			

Table 3: Over all prevalence of bovine and ovine Fasciolosis based on localities

Kebeles	Total No. positive	P-value	OR	95% confidence interval
Kebele 07 (86)	49 (56.96%)	1	.....	....
Kebele 08 (87)	56 (59.77%)	0.38	1.4	0.7-2.7
Kebele 09 (112)	68 (60.71%	0.46	1.2	0.6-2.23
Birbisa (74)	47 (63.51%)	0.92	1.4	0.51-2.12
Kormargefia (69)	53 (76.81%)	0.16	1.7	0.8-3.5
Woshawushign (80)	49 (61.25%)	0.4	1.4	0.8-2.75
Woynye (72	45 (62.5%)	0.168	1.6	0.8-3.4
Total (580)	357(61.55%)			

The finding from coprological examinations reveals that the prevalence of bovine Fasciolosis was found to be 50.95% in male and 74.82% in female. It was also found 56.06% and 64.86% in male and female sheep, respectively. This was significantly higher in female animals of both cattle and sheep as compared to male. Statically Significant difference was observed in the prevalence of bovine and ovine Fasciolosis among sex groups (P<0.05). Therefore female cattle and sheep had a chance of getting infection 2.74 and 1.5 times higher than their respective male animals with equal exposure, respectively (see table 4).

The prevalence of bovine Fasciolosis based on age group was 70.76%, 55.62% and 68.08 for young, adult and old cattle, respectively. On the other hand the prevalence in ovine was 66.66%, 52.55% and 72.34% for young, adult and old aged sheep, respectively. In young cattle the prevalence of bovine Fasciolosis was relatively higher than old and adult. In contrast to this ovine Fasciolosis was more prevalent in old aged group as compared to young and adult sheep. The analysis of data demonstrated that, there was no significant difference between prevalence of Fasciolosis among different age group in both animal species (P >0.05) (see table 5).

Table 4: Prevalence of bovine and ovine Fasciolosis based on sex

Species	Sex	No. Examined	No. positive	P-value	OR	95% confidence Interval for OR
Bovine	Male	157	80(50.95%)	1	…	…
	Female	143	107 (74.82%)	0.001	2.74	1.5-5
	Subtotal	300	187 (62.33%)			
Ovine	Male	132	74 (56.06%)	1	...	...
	Female	148	96 (64.86%)	0.014	1.5	0.8-2.5
	Subtotal	280	170 (60.71%)			
	Total	**580**	**357 (61.55%)**			

Table 5: The prevalence of bovine and ovine Fasciolosis based on age groups

Species	Age	No. Examined	No. positive	P-value	OR	95% confidence Interval for OR
Bovine	Young	93	66 (70.76%)	1		
	Adult	160	89 (55.62%)	0.73	0.14	0.5-1.2
	Old	47	32 (68.08%)			
Ovine	Young	96	64 (66.6)	1	...	...
	Adult	137	72 (52.55)	0.85	0.14	0.9-2.5
	Old	47	34 (72.34%)			
	Total	**580**	**357(61.55%)**			

Abattoir study

In the present study, out of 300 cattle and 150 sheep selected for post mortem examination, 176(58.6%) and 84(56.0%) were positive to Fasciolosis, respectively. Among these, cattle were infested with *F. hepatica* 77 (43.8%), *F.gigantica* 18 (10.2%), mixed infestation 51 (29.0%) and immature flukes 30 (17.0%) (See table 7). Similarly the infection rate of those Fasciola species in sheep was F. hepatica 37 (44.0%), *F. gigantica* 13 (15.5%), and some proportion of mixed and immature fluke infestation (see table 6).

The prevalence of Fasciolosis based on poor body condition in cattle and sheep was 81.0% and 94.7% respectively. However, animals with good body condition showed the prevalence of 47.3% and 24.0% in sheep and cattle respectively. The prevalence was significantly higher in poor body conditioned cattle (81.0%) and sheep (94.7%). The difference was statistically significant (P < 0.05). As the OR indicated the risk estimated in poor vs. good body conditioned animals was more than 4.6 and 89 times (OR =4.6 and 89) higher in cattle and sheep, respectively (see table 7).

The major Fasciola species identified from cattle slaughtered in Debire Birhan Municipal Abattoir were F. hepatica (43.8%), F. gigantica (10.2%), mixed infection (29.0%) and immature flukes (17.0%). The relative proportion of those Fasciola species in sheep was F. hepatica (44.0%), F. gigantica (15.5%), mixed (26.6%) and immature (14.3%). F.hepatica was the most

Table 6: Over all abattoir prevalence of bovine and ovine Fasciolosis in the study site

Species	No. Positive	P-value	OR	95% Confidence interval for OR
Bovine (300)	176 (58.6%)	1	...	...
Ovine (150)	84 (56.0%)	0.42	0.84	0.535-1.23
Total (450)	260 (57.77%)			

Table 7: Prevalence of bovine and ovine Fasciolosis based on body condition

Species	Body Condition	No. positive	P-value	OR	95% Confidence Interval for OR
Bovine	Good (110)	52 (47.3%)	1	...	...
	Medium (169)	109 (64.5%)	0.031	1.76	1.05-3.0
	Poor (21)	17 (81.0%)	0.012	4.6	1.4-15.5
	Subtotal (300)	**176 (58.6%)**			
Ovine	Good (46)	11 (24.0 %)	1	...	...
	Medium (85)	55 (64.7)	0	7.8	3.0-19.8
	Poor (19)	18 (94.7)	0	89	96-829.5
	Subtotal (150)	**84 (56.6 %)**			
	Grand total (450)	**260 (57.77%)**			

abundant species in both cattle (43.8%) and sheep (44.0%) as compared to F. gigantica (see table 8).

Out of 300 inspected cattle livers, 124(41.3%) normal, 33(11%) lightly, 80(26.7) moderately and 63(21%) severely affected with Fasciolosis. Similarly post mortem finding shows that from 150 examined sheep livers 66(44%), 32(21.4%), 42(28.0%) and 10(6.6%) were found to be normal, lightly, moderately and severely affected, respectively (see table 9).

Table 8: Species composition of Fasciola detected in Debire Birhan Municipal Abattoir

Fasciola Species	Bovine (n=176)		Ovine (n=84)	
	Frequency	Percent (%)	Frequency	Percent (%)
F. hepatica	77	43.8	37	44
F. gigantic	**18**	10.2	13	15.5
Mixed	51	29	22	26.2
Immature	30	17	12	14.3
Total	176	100	84	100

Table 9: Intensity of bovine and ovine liver lesion due to Fasciolosis

Lesion type	Bovine (N= 300)		Ovine (N=150)	
	Frequency	Percent (%)	Frequency	Percent (%)
Normal	124	41.3	66	44
Light	33	11	32	21.4
Moderate	80	26.7	42	28
Severe	63	21	10	6.6
Total	300	100	150	100

Economic Loss Assessment

Retrospective studies in this abattoir showed that the total number of cattle slaughtered was 1926, 2174, 2524 and 2632 with an average 2314 in the years of 2010, 2011, 2012 and 2013, respectively. Similarly abattoir records confirmed that the total number of sheep slaughtered in this abattoir was 494 and 546 with an average 520 in the years of 2012 and 2013, respectively. However, there were no records of liver condemnation rate due to Fasciolosis. Questionnaire survey indicated the mean retail price of bovine and ovine liver in Debire Birhan town to be 48ETB and 22ETB, respectively. In the study period from 300 examined cattle livers, all moderately and severely affected livers 143 (47.7%) were totally condemned due to Fasciolosis. On the other hand from 150 examined sheep livers in this abattoir, 84(56.0%) were positive for the disease and any liver which was positive to Fasciola were totally condemned (see table 9). Therefore, in the present study area the direct financial loss incurred due to liver condemnation as a result of Fasciolosis in cattle and sheep was 52,981 ETB (2649 USD) and 6,406ETB (320 USD) per animus, respectively

Discussion

Coprology

The present study plainly indicated that the bovine and ovine Fasciolosis was prevalent in the study area. Accordingly the overall prevalence of Fasciolosis in bovine and ovine species was 62.33% and 60.7%, respectively. This finding was comparable to [20] who reported 64.23% in the same study area. However, it was higher as compared to the report of [3, 39, and 11] from abattoir study in Mekelle, Gonder and Bahir Dar who reported 24.3%. 36.7% and 39.95% prevalence rates, respectively. Furthermore, this study revealed that the overall prevalence of ovine Fasciolosis in the present study (60.71%) was higher than the previous studies done by [1,14,28] who reported the prevalence rates of 13.2% in Awash and Hirna, 49.0% in Kemise, 40.9% in Menze, respectively. But this was lower than the finding of Chanie and Begashaw [4] who reported 70.20% in Menze Lalo Midir District. The variation is probably due to the agro ecological and climatic differences such as altitude, temperature, moisture, humidity and soil that might favor the multiplication of intermediate host, snail and the parasite itself. The difference in prevalence and severity of the disease syndrome are evident in various geographical regions depending on the local climatic conditions, availability of permanent water and system of management [37]. Moreover, most of plain land of the area in and around Debire Birhan town contains pockets of water logged marshy areas and the construction of manmade micro dams for irrigation purpose following Beresa and Dalicha rivers that make the area suitable condition for breeding and survival of the intermediate host snails year round [46].

The prevalence of the disease with respect to localities was very closely similar of having 56.96% (Kebele 07), 59.77% (Kebele 08), 60.71% (Kebele 09), 63.51% (Birbisa), 76.81% (Kormargefia), 61.25% (Woshawushign) and 62.5% (Woynye) with no statistical significant difference (P>0.05). This might be attributed to nearly ecological similarities such as altitude (2780 masl) and an extensive type of farming system adapted by most farmers in the vicinity of Debre Birhan town. This inference is in agreement with that of [43] who suggested that distribution of Fasciolosis depends on altitude. The present study was consistent to the coprological finding of [28] on ovine species which stated that prevalence of Fasciolosis in different PAs of study areas was very closely similar.

The variation in sex prevalence of bovine Fasciolosis was found to be 50.95% (male) and 74.82% (female) whereas in sheep 56.06% and 64.96% prevalence rates were recorded in male and female animals, respectively. Sex as a variable do not shows significant difference (P < 0.05) in both animal species. As the study indicates that female cattle and sheep had a chance of 2.7 and 1.5 times higher to be infected by the disease than their sexual counterparts, respectively. This may be due to the fact that female animals at different reproductive pysological state such as pregnancy and lactation are immunologically suppressed from increased blood corisol level which favors the chance of exposure of female them to Fasciola infection. However, this conclusion is not in agreement with that of [32] who concluded that sex has no impact on the infection rate and hence both male and female animals are equally susceptible and exposed to Fasciolosis.

In an effort made to know the effect of season in the prevalence of Fasciolosis significantly higher (P > 0.05) prevalence was noted in Autumn in both cattle (69.52%) and sheep (69.44%). This might be due to the difference in weather conditions (optimum moisture and temperature that occurred in Autumn) that might affect the multiplication of intermediate host snails, the development of fluke eggs, and the dispersal of cercaria shed from the snails. Fasciola cercaria and Lymnae snails have been found to survive better at 25-300c which explains in parts at least; the much higher prevalence in Autumn compared to other seasons [2002]. This finding is supported by the work of Mastewal and Malede [25] from North Gonder.

The age group of the animals was geared to know the prevalence rate of Fasciolosis. In the finding it was relatively higher in

young cattle (70.7%) and old sheep (72.34%). The reason for the higher prevalence in old sheep as compared to cattle could be attributed to the difference in acquiring resistance as the age increases. In general, sheep do not acquire resistance to parasitic disease [22].

Abattoir survey

Fasciolosis is a widespread ruminant health problem and causes significant economic losses in the livestock industry. This cross-sectional study investigates the abattoir prevalence and economic significance of bovine and ovine Fasciolosis in Debire Birhan Municipal Abattoir. The overall prevalence of bovine Fasciolosis in the present study (58.6%) is much higher than 24.32% and 32.3% reported in Mekelle [13], Adwa [26], respectively. But this is lower than the finding in North West part of Ethiopia [42] which was 90.65%. The prevalence rate obtained in the present study in bovine is also lower than the finding of [7] who reported.88.85% in same species and from the same study site. On the other hand, over all prevalence of ovine Fasciolosis (56.0%) observed in the present study was comparable to [45] who reported 52.6% from Basona Worana District. However, this finding shows lower prevalence than the report of [4] from Menze Lalo Midir, Northern Ethiopia (74.6%). The lower prevalence in the present study might be due to climato-ecological differences between the study sites and the variation of whether conditions from year to years. It is also probably due to the variation of management practices of the farmers and accessibility of veterinary health care services.

The abattoir prevalence of Fasciolosis was relatively higher in cattle (58.6%) as compared to sheep (56.0%). The finding showed that there was no statistical significant variation in the infection rate ($P<0.05$) among species. This non significant difference is probably due to similarities of ecological and climatic conditions from where animals were brought to the current abattoir. In fact both cattle and sheep in Debire Birhan Municipal Abattoir originated from areas where there are similar climate-ecological conditions. Cattle have a tendency of grazing on highly marshy areas than sheep although deep gazing is common in sheep which can even gain access the hibernated metacercariae. That is why both cattle and sheep are equally likely exposed to Fasciolosis. Hence, the findings in the current coprological and abattoir survey results have confirmed the absence of variation in Fasciolosis infection in both cattle and sheep. However, the report of [40] which explained cattle have indiscriminate type of grazing behavior than sheep which increase the chance of exposure to infective stage of Fasciola which is commonly found on grasses around marshy areas contradict this finding.

In works done to know the effect of body condition score to the prevalence of Fasciolosis in the current study areas, it was encountered that the prevalence rate of Fasciolosis was higher in both poor body conditioned cattle (81.0%) and sheep (94.7%) than in good body condition. Therefore, the prevalence rates of the disease in good body conditioned cattle and sheep were (47.3%) and (24.0%), respectively. Statistical analysis of the data showed the presence of significant difference ($p<0.05$) in the prevalence of Fasciolosis in cattle and sheep on the basis of body condition score. The risk estimations between poor and good body conditioned animals were more than 4.6 and 89 times higher in cattle and sheep, respectively. This disparity might be attributed to the variation in level of resistance among age groups that poor body conditioned animals are usually less resistant and consequently susceptible to infectious diseases including Fasciolosis. This finding is in agreement with study conducted by Alula et al. (2013) and [40] who confirmed the occurrence of higher infection rate in poor body conditioned animals.

Evaluation of Fasciola speciation in the present study revealed that *F. hepatica* was frequently abundant in cattle (43.8%) and sheep (44.0%). Whereas the abundance of *F. gigantica* was 10.2% and 15.5% in cattle and sheep, respectively. Apart from these individual Fasciola species, mixed and undifferentiated immature flukes were also identified in the study area. The higher relative abundance of *F. hepatica* from the study area might be associated with the existence of favorable ecological and climatic conditions for the survival of the intermediate host *L. truncatula*, and the parasite itself. In Ethiopia *F. hepatica* and F. gigantica infestations occur in areas above 1800 masl and below 1200 masl, respectively which has been attributed to variations in the climatic and ecological conditions such as altitude, rainfall, temperature and livestock management system [41]. The current finding was supported by studies performed by [7,13,46]. However, it in another study done by [12] the most common liver fluke species affecting cattle at Wolayita Sodo (2315masl) was *F. gigantica*.

In the present study, coprological examination through standard sedimentation technique revealed that prevalence's of Fasciolosis in bovine (62.3%) and ovine (60.71%) were relatively higher than the findings from post mortem examination of cattle's' (58.6%) and sheep's' (56.0%) livers. The reason ascribed for this difference might be due to frequent deforming of both cattle and sheep with triclabendazole (fasionix) and albendazole against liver fluke soon after they are left to be fattened. It is customary, now-a-days, to fatten both cattle and sheep intensively for about three months before they are sold for slaughter. Therefore, the chance of getting liver fluke during post mortem examination is minimal. However, this finding is in disagreement with the work of [32] who reported single examination of faeces by sedimentation technique was found to be less sensitive as compared to post mortem examination.

The economic loss caused by bovine and ovine Fasciolosis was enormous in the study area. Pathological lesions caused by Fasciolosis were the causes of a considerable economic loss due to condemnation of moderately and severely affected livers. Considering the percentage of liver condemnation due to Fasciolosis during the study period and from the four years retrospective study on the average number of cattle and sheep slaughtered in Debire Birhan Municipal Abattoir, the direct economic loss was estimated to be on average 52,981ETB (2649

USD) from cattle and 6,406ETB (320USD) from sheep per annum. This finding is lower than the finding of [12,26,35] who reported 4,674.2 USD (Adwa), 6300 USD (Jimma) and 4000 USD (Wolyta soddo) abattoirs, respectively due to condemned cattle livers. However, the present finding (52,981ETB) is higher than the report confirmed by Dagne [7] from condemned cattle livers in the same study site. The possible reason for this might be the variation in the average number of animals slaughtered per year, the price of average sized liver and the total condemnation rate of liver from abattoir to abattoir

Conclusion and Recommendations

The present study confirmed that bovine and ovine Fasciolosis is one of the parasitic diseases that could potentially hinder the productivity of cattle and sheep in the study are. The high prevalence found in the study area could be due to the water lodgment following Beresa and Dalcha Rivers that made suitable conditions for the development of the snail intermediate hosts and the tendency of farmers to graze their animals in these areas. The prevalence's of both bovine and ovine Fasciolosis were not significantly associated with the difference in species and localities. However, age, season and sex were significantly affecting the prevalence rate of the disease in both animal species. The present study revealed that *F. hepatica* is the most frequently abundant fluke species followed by mixed infection in both cattle and sheep. This study also showed that Fasciolosis is an important disease entity causing significant economic loss due to condemnation of affected cattle's' and sheep's' livers. According to the present study at Debre Birhan Municipal abattoir the economic loss of Fasciolosis due to fsaciola infected liver condemnation in cattle and sheep is quantified to be 59,387ETB (2969 USD) per annum. Therefore, inlight of the above information and facts, the following recommendations are forwarded:

- there is a need to undertake further detailed studies in different seasons to generate a comprehensive data on the epidemiology of Fasciolosis and ecology of the snails;
- an integrated approach, which is a combination of parasite and vector control program, should be considered as practically acceptable and economically feasible options;
- awareness creation among livestock farmers should be done as to the economic significance of the disease, the control methods and regular deforming of animals before and just after rainy seasons;
- it is recommended that farmers who rear cattle and sheep should improve provision of feeds to their animals since the disease is significantly associated to poor body conditions of the animals;
- assessment of the overall economic loss due to bovine and ovine Fasciolosis as a result of liver condemnation and body weight loss should be conducted to implement systematic disease prevention and control methods; and
- the local administration should give due emphasis to strengthen the veterinary services as well public education pertaining the economic loss incurred due to Fasciolosis.

References

1. Ahmed, F., Markvichitr, K., Jumwasorn, S., Koonawoothtthin, S. and Achoothesa, S: Prevalence of Fasciola Species infections of sheep in the Middle Awash River Basin, Ethiopia. Asian J. trop. Med. Publ. hlth., 2007; 38:51-52.
2. Antonia, M., Conceiçao, P., Rute, M., Durao, Isabel, H., Costa, J. and Correia, C. Evaluation of a simple sedimentation method (modified Mac Master) for diagnosis of bovine fasciolosis. Vet. Parasitol., 2002;105(4):337–343.
3. Berhe, K. G., Berhane, K. and Tadesse, G. Prevalence and economic significance of fasciolosis in cattle in Mekelle Area of Ethiopia. Trop. Anim. Hlth. Prod., 2009;41(7):1503-1504.
4. Chanie, M. and Begashaw, S. Assessment of the Economic Impact and Prevalence of Ovine Fasciolosis in Menz Lalo Midir District, Northeast Ethiopia. Vet. World, 2012;5(5):261-264
5. Central Statistical Agency: Livestock resources and production Statistics in Ethiopia. Federal Democratic Republic of Ethiopia Agricultural Sample Survey: Report on Livestock and Livestock Characteristics. Statistical Bulletin. Volume II;2003
6. DACA. (2006): Standard Veterinary Treatment Guideline for Veterinary practice 1st ed.
7. Dagne, M. Survey on prevalence and economic significance of bovine fasciolosis in Debire Birhan region DVM. Thesis, College of Veterinary Medicine and Agriculture Addis Ababa University, Debire Zeit.1994.
8. Dela-Valero, M. A., Darce, A. N., Panova, M. and Mas-Coma, S. Relationships between host species and morphometric patterns in Fasciola hepatica adults and eggs from the northern Bolivian Altiplano hyper endemic region. Vet. Parasitol., 2001;102(1-2):85-100.
9. Dyce, K. M., Sack, W. O., and Wonsing, C. J. (1987): Text Book of Veterinary Anatomy. W.B. Sounders Company UK., 1: 605-607.
10. FAO. (2003): Diagnostic manual on meat inspection for developing countries. Glob. J. Med. Research Volume XI Issue III Version I September (21).
11. Fikirtemariam, A., Jenbere, B., Yeshiwas, F. and Mussie, H. Bovine Fasciolosis: A study conducted in facilities endemic area in north western Ethiopia. Ethiop. Vet. J., 2009;11: 59-68.
12. Fufa, A., Bekele, M., Alemayehu, R. and Asfaw, L. Bovine fasciolosis: coprological, abattoir survey and its economic impact due to liver condemnation at Soddo municipal abattoir, Southern Ethiopia. Trop. Anim. hlth. Prod., 2009;42(2): 289-292.
13. Gebretsadik, B., Kassahun, B. and Gebrehiwot, T. Prevalence and economic significance of fasciolosis in cattle in Mekelle Area of Ethiopia. Trop. Anim. Hlth Prod., 2009;41(7): 1503-1504.

14. Gebreyohannse, M. Ovine Fascioliasis. Prevalence and Associated Risk Factors in Menz Gera Midr Woreda of North Shoa Zone, Ethiopia. J. Anim. Prod. Adv., 2013; 3(6):203-207.
15. Hanson, J., Perry, B. The Epidemiology, Diagnosis and control of helminth parasite of ruminants, a hand book, printed by the international livestock center for Africa, Addis Ababa, Ethiopia. 1994.
16. Khan, E.M. The Merck veterinary manual. 9th ed. USA: Merck and conic. 2005;Pp. 269- 278.
17. Manyazewal, A. A study on bovine fasciolosis in Western Ethiopia. Parasitology Reseaserch in Africa. Babo dioulasso, Burkina Faso. 1995;Pp. 203-207.
18. Maqbool, A.C.S. and Akhtar, H.A: Epidemiology of fasciolosis in Buffaloes under different management conditions. Vet. J., 2002; 72(4): 221-228.
19. Markos, T., Aragaw, K. and Deressa, A.: Effects of anthelmintics and supplementation on Productivity of Menz and Menz-Awassi crossbred sheep with sub-clinical helminthosis. Ethiop. Vet. J., 2004;8(2):1–22.
20. Mohammed Y., Nuraddis I., Wubit T., Yosef D. (2016) Prevalence of Bovine Fasciolosis in Municipal Abattoir of Haramaya, Ethiopia : Jimma University, School of Veterinary Medicine; Vol., 48: 38-43.
21. Mas-Coma S, Bargues MD. Human liver flukes: A Review. Res. Rev. Parasitol.1997; 57: 145–218.
22. Mas-Coma, S. Barguest, M.D. and Esteban, J.G. (1999): Human Fasciolosis. In: Fasciolosis (Dalton, J.P. ed.). CABI publishing, walling ford, UK, Pp. 411-434 66
23. Mas-Coma S, Bargues MD, Valero MA. Fascioliasis and other plant-borne trematode zoonoses. Int. J. Parasitol.2005; 35(11-12):1255–1278. DOI: 10.1016/j.ijpara.2005.07.010
24. Magaji AA, Kabir Ibrahim, Salihu MD, Salawa MA, Mohamed AA, Musawa AI. Prevalence of Fascioliasis in Cattle Slaughtered in Sokoto Metropolitan Abattoir, Sokoto, Nigeria. Advances in Epidemiology. 2014; 7: 5-10.
25. Mastewal B. and Malede B. Study on ovine fasciolosis: Prevalence and associated risk factors in North Gondar Zone, Ethiop. J. Vet. Med. and Anim. Hlth.2012; 4(8):105-109.
26. Mihreteab B, Haftom T, Yehenew G. Bovine fasciolosis: Prevalence and its economic loss due to liver condemnation at Adwa Municipal Abattoir, North Ethiopia. EJAST.2010; 1(1):39-47.
27. Mike, S. Goats In: The Tropical Agriculturalist mac millan. TCTA. 1996; Pp., 78-83.
28. Molalegne, B., Nuradis, I. and Nahili, A. Study on the prevalence of Ovine fasciolosis in and around Dawa-Cheffa, Kemissie.and Jimma, Ethiopia. J. Vet. Med. Anima. 2010; 5(21): 2981-2985.
29. Ogonrinaade A. and Adegoke G. O. Bovine fasciolosis in Nigeria. Intercurrent parasiteic and bacterial infection. Trop. Anim. Hlth. Prod.1982; 14(2):121-125.
30. Petros A, Kebede A. Wolde A. Prevalence and economic significance of bovine fasciolosis in Nekemte Municipal abattoir. J. Vet. Med. Anima. Hlth. 2013; 5(8):202-205.
31. Phiri AM, Phiri IK, Sikasunge CS, Monrad J. Prevalence of fasciolosis in Zambia cattle observed at selected Abattoir with emphasis on age, sex, and origin. J. Vet. Med. 2005; 52(9):414-416. DOI: 10.1111/j.1439-0450.2005.00872.x
32. Rahmeto, A, Fufa A, Mulugeta B, Solomon M, Bekele M, at al. Fasciolosis Prevalence, financial losses due to liver condemnation and evaluation of a simple sedimentation diagnostic technique in cattle slaughtered at Hawassa Municipal abattoir, southern Ethiopia. Ethiop. Vet. J., 2009; 14(1): 39-51.
33. Solomon, W. and Abebe, W. Effect of a strategic antihelminthic treatment intervention bovine fasciolosis: Study conducted in facilities endemic area in North Western Ethiopia, Ethiop. Vet. J., 2007; 11: 59-69.
34. Soulsby, E J L. Helminths, Arthropods and Protozoa of Domesticated Animals. 7th ed. the. Balliere Tindall, London, UK.1982;40 52.
35. Tadele T, Worku T. The prevalence and economic significance of bovine fasciolosis at Jimma Abattoir, Ethiopia. The inter. J. Vet. Med. 2007;3:15.
36. Thrusfield M. Veterinary Epidemiology. 3 rd ed. Blackwell science, Ltd., London, UK. 1995;228-246.
37. Urquhart G M, Armour J, Duncan J L, Dunn A M, Jennings FW. veterinary parasitology. 2nd ed. Oxford, Long man scientific and technical press, UK. 1996;100-109.
38. Wamae L W. Hammond JA. Harrison L J S, Onyango-Abuje J A. Comparison of the production losses caused by chronic F. gigantica infection in yearling Friesian and Boran cattle. Trop. Anim. Hlth. and Prod. 1998;30:23-30.
39. Wotetu K. A study on the prevalence and economic significance of fasciolosis in cattle slaughtered at ELFORA abattoir Gondar. DVM thesis, Addis Ababa University College of Veterinary Medicine and Agriculture, Debre Zeit, Ethiopia.
40. Yemisrach A, Mekonnen A. An abattoir study on the prevalence of fasciolosis in cattle, sheep and goats in Debre Zeit town, Ethiopia. Glob. Vet. 2012;8:308-314.
41. Yilma J, Malone J: A geographic information system forecast model for strategic control of fasciolosis in Ethiopia. Vet. Parasitol. 1998;78:103-127.
42. Yilma J, Mesfin A. Dry season bovine fasciolosis in Northwestern part of Ethiopia. Rev. Med. Vet. 2000;151: 493-500.
43. Yosef Mamo, Yosef Deneke and Nuraddis Ibrahim. Prevalence of Bovine Fasciolosis in and Around Bedelle District: Jimma University College of Agriculture and Veterinary Medicine, Ethiopia; IDOSI Publications. 2014;83-86.
44. Zeleke G, Menkir S, Desta M. Prevalence of ovine fasciolosis and its economic significance in Basona Worana district, central Ethiopia. Sci. J. Zoolo. 2013;2: 81-94
45. Zerihun A. Ruminant fasciolosis studies on the clinical occurrence, coprology and abattoir survey in Debre Birhan and surrounding areas. MSc thesis, College of Veterinary Medicine and Agriculture AAU, Debre Zeit. 2006.