Research Article **AJAR (2019), 4:37**

American Journal of Agricultural Research (ISSN:2475-2002)

Prevalence and economic significance of bovine fasciolosis in Bale Rural Abattoir of Essera Woreda, Dawuro Zone in SNNPRS, Ethiopia

Ataro Abera

Dawuro Zone, Livestock and Fishery Resource Development Department.

ABSTRACT

A cross sectional study on bovine fascioliasis was carried out at Bale Municipal abattoir, Southern Nation Nationality and Peoples Regional State (SNNPRS), from November 2016 to July 2017 with the aim of determining the prevalence, financial significance of fascioliasis and to determine the most prevalent species of liver fluke in cattle slaughtered at the study abattoir. Out of the total 385 cattle examined during the study period, 115 (29.9%) were positive for Fasciola infection on postmortem examination. The prevalence based on body condition of the animal was 60% in poor body condition, 22.2% in medium body condition and 21.1% in good body condition on abattoir survey. Fasciola hepatica was found to be the predominant Fasciola species affecting cattle slaughtered in the study area, 60% of the total livers positive for bovine fasciolosis where infected by Fasciola hepatica while 11.30% livers had Fasciola gigantica, 16.52% were infected by both species and 12.17% were infected by the immature fluke. Out of the total positive livers, 37.71% were affected lightly, 43.86% were affected moderately and 18.42% were affected severely. The financial loss due to liver condemnation was summarized 91942.5 Ethiopian Birr per annum.

Key words: Bovine Fascioloss; Prevalence; Economic sifnificance

***Correspondence to Author:**
Ataro Abera
Dawuro Zone, Livestock and Fishery Resource Development Department.

How to cite this article:
Ataro Abera. Prevalence and economic significance of bovine fasciolosis in Bale Rural Abattoir of Essera Woreda, Dawuro Zone in SNNPRS, Ethiopia. American Journal of Agricultural Research, 2019,4:37.

eSciPub LLC, Houston, TX USA.
Website: https://escipub.com/

1. INTRODUCTION

Ethiopia is endowed with the largest number of livestock population estimated more than 42million cattle, 47million, small ruminants (sheep and goat), 7 million equines, 53 million chicken and 15 million camels [9] which is first in Africa and tenth in the world.

Among many prevalent parasitic problems of domestic animals fasciolosis is one of the major disease entities incurring huge direct and indirect losses in the livestock productivity in Ethiopia. Economic losses of several million dollars per year due to fasciolosis expressed in terms of mortality, liver condemnation at slaughter, poor weight gain, infertility, reduction in traction power of oxen and low calf weight at birth have been reported. Bovine fasciolosis is an economically important parasitic disease of domestic ruminants caused by fasciolidae trematodes of the genus Fasciola. The two most important species of this genus, *F. hepatica* and *F. gigantica*, are commonly known as liver flukes. Generally, the distribution of fasciolosis is worldwide, however, the distribution of *F. hepatica*, is limited to temperate areas and high lads of the tropical and sub-tropical regions, and F. gigantica predominate in tropical area [27].

The two most important species of Fasciola (*F. hepatica* and *F. gigantic*) are found in many parts of Ethiopia where there is suitable ecological condition for growth and multiplication of intermediate host snails [18]. The intermediate host of *F. hepatica* is *L. truncatula*, an amphibious snail living in shallow water and wet lands with a wide distribution throughout the world. *Fasciola hepatica* and *Fasciola gigantica* have similar life cycles. The adult fluke inhabits the bile ducts of the final host. The hermaohroditic parasite produces eggs, which are expelled with the bile in to the intestine and shed in the feces. The eggs embryonate and hatch in the water and wet pastures releasing, a free swimming miracidium. The ciliated miracidia actively seek and penetrate suitable intermediate hosts and undergo several stages of development by asexual multiplication [14]. Eggs pass in the feces of mammalian hosts develop and hatch releasing motile ciliate miracidia. This takes 9 days at optimal temperature of 22-26^{o}c and little development occurs below 10^{o}c. eggs laid by the adult parasite in the bile ducts of their pass in to the duodenum with the bile. The eggs then leave the host through the feces and it continuous to develop and a ciliated miracidium emerges that is free living. The liberated miracidium have a short life span and must locate a suitable snail within three hours if successful penetration of the liver is to occur.

Different works so far conducted in Ethiopia reported variable prevalence rate of bovine fasciolosis in different localities of the country [21; 18]. In Ethiopia, the prevalence of bovine fasciolosis has shown to range from 11.5 % to 87 % (15). In our country *F. hepatica* is a wide spread in areas with an altitude of 1800-2000 meters above sea level while *F. gigantic* appears to be the most common species in areas below 1200 meter above sea level. Both species co-exist in areas with altitude ranging from 1200-1800 meter above sea level [5]. Fasciola 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 northeast and east of the country Economic losses caused by fasciolosis are due to rejection of affected organs (direct loss) and diminution of the potential productivity of livestock. Infection of domestic ruminant with *Fasciola gigantica* (tropical liver fluke) and *Fasciola hepatica* (temperate liver fluke) causes significant economic loss estimate over 2000 million US dollar per year to the agriculture sector w3orld wide with over 600 million animal infected [7].

The pathogenesis of fasciolosis varies according to the phase of parasitic development in the liver and the species of host involved. Essentially the pathogenesis is two-fold; the first (acute fasciolosis) is due to massive invasion or migration of young flukes in the liver parenchyma, rupture of blood vessels and it is associated with liver damage and hemorrhage. Diagnosis is based primarily on clinical signs,

seasonal occurrence, and previous examination, hematological tests and examination of feces for fluke eggs are useful and may be supplemented by two other laboratory tests. The control of fasciolosis is approached through a combination of two ways; reducing population of the intermediate snail host and anthelminthic treatment of infected cattle [27].

The objectives of this study were, therefore:

- To determine the prevalence of Bovine fasciolosis in Bale Rural Abattoir in Essera Woreda of Dawuro Zone in SNNPRS of Ethiopia
- To identify the Fasciola species of bovine slaughtered at Bale Rural Municipal abattoir.
- To determine the associated financial loss due to liver condemnation

2. LITERATURE REVIEW

2.1 Etiology

The two most important species of Fasciola (*F. hepatica* and *F. gigantic*) are found in many parts of Ethiopia where there is suitable ecological condition for growth and multiplication of intermediate host snails [18]. The intermediate host of *F. hepatica* is *L. truncatula*, an amphibious snail living in shallow water and wet lands with a wide distribution throughout the world. Other important *lymnaea* vectors of *F. hepatica* are: *L. tomentosa* in Australia and New Zealand, *L. columella* in North America, *L. viator* and *L. diaphena* in South America. *L. natalensis* is an important intermediate host of *F. gigantic* in Africa, *L. auricularia* in Southern Europe, Southern USA, Middle East and the pacific islands, *L. rufescens* and *L. acuminate* in India and Pakistan and *L. rubiginosa* in Malaysia. All these snails are primarily aquatic snails and are found in streams, irrigation channels and marshy swamps (34). Areas with seasonally flooded pasture, grazing areas of lake shores, slowly flowing water ways, and banks of rivers are among the conducive environments for breeding of snails vectors of the Fasciola [34].

Fasciollosis has zoonotic importance and in human causes malaise, intermittent fever, weight loss, pain under right coastal margin and often peritonitis with eosinophilia [12]. Man is an accidental host. Human fasciolosis caused by *F. hepatica* has been found mainly in Australia, Bolivia, Cuba, Ecuador, England, Egypt, France, Iran, Peru, and Portugal. The largest epidemic on record was in France, near Lyon in 1956-1957, with some 500 cases, and in the lot valley in 1957, with about 200 cases. The common source of infection was watercress contaminated with metacercariae. The frequency of the parasite in animal does not appear to be closely correlated with its occurrence in man [25].

2.2 Life cycle

Fasciola hepatica and *Facioloa gigantica* have similar life cycles. The adult fluke inhabits the bile ducts of the final host. The hermaohroditic parasite produces eggs, which are expelled with the bile in to the intestine and shed in the feces. The eggs embryonate and hatch in the water and wet pastures releasing, a free swimming miracidium. The ciliated miracidia actively seek and penetrate suitable intermediate hosts and undergo several stages of development by asexual multiplication [14]. Eggs pass in the feces of mammalian hosts develop and hatch releasing motile ciliate miracidia. This takes 9 days at optimal temperature of 22-26^{o}c and little development occurs below 10^{o}c. eggs laid by the adult parasite in the bile ducts of their pass in to the duodenum with the bile. The eggs then leave the host through the feces and it continuous to develop and a ciliated miracidium emerges that is free living. The liberated miracidium have a short life span and must locate a suitable snail within three hours if successful penetration of the liver is to occur. In infected snails, development proceeds through the sporocyts and radial stages to the final stages in the intermediate hosts, the cercariae, these are shed from the snails as motile forms which attach themselves to firm surface, such as grass blades, and encyst there to form the infective metacercariae [34]. Cattle are infected when metacercariae are accidentally ingested with grasses or vegetation then the metacercariae excyst in the small intestine, move through the intestinal wall and peritoneal cavity to the liver.

The pathogenesis occurs during migration in the liver parenchyma and is associated with the liver damage and hemorrhage. The other occur hematological activity of the biliary mucosa by their cuticular spines [39].

2.3 Epidemiology of Fasciolosis

Different works so far conducted in Ethiopia reported variable prevalence rate of bovine fasciolosis in different localities of the country [21; 18]. In Ethiopia, the prevalence of bovine fasciolosis has shown to range from 11.5 % to 87 % [15]. In our country *F. hepatica* is a wide spread in areas with an altitude of 1800-2000 meters above sea level while *F. gigantic* appears to be the most common species in areas below 1200 meter above sea level. Both species co-exist in areas with altitude ranging from 1200-1800 meter above sea level [5]. Fasciola 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 northeast and east of the country. The distribution of *Fasciola gigantica* was mainly localized in the Western humid zone of the country that encompasses approximately one fourth of the nation [37].

2.4 Economic losses

Economic losses caused by fasciolosis are due to rejection of affected organs (direct loss) and diminution of the potential productivity of livestock. Infection of domestic ruminant with *Fasciola gigantica* (tropical liver fluke) and *Fasciola hepatica* (temperate liver fluke) causes significant economic loss estimate over 2000 million US dollar per year to the agriculture sector w3orld wide with over 600 million animal infected [7]. The annual loss due to endoparasites, including fasciolosis in Ethiopia is estimated at 700 million birr [20].

2.5 Pathogenesis

The pathogenesis of fasciolosis varies according to the phase of parasitic development in the liver and the species of host involved. Essentially the pathogenesis is two-fold; the first (acute fasciolosis) is due to massive invasion or migration of young flukes in the liver parenchyma, rupture of blood vessels and it is associated with liver damage and hemorrhage. This occurs 2-6 weeks after ingestion of large number of metacercariae (usually over 2000). The second (chronic fasciolosis) is the most common form of the disease. It results when the parasite is in the bile ducts, and results from the hemorrhagic activities of the adult flukes and from damage to the biliary mucosa by their cuticular spines. It occurs 4-5 months after the ingestion of moderate number of metacercariae (200-500) [30]. Fasciolosis is responsible for the wide spread morbidity and mortality especially in cattle and sheep characterized by weight loss, anemia, submandibular edema and hypoproteinemia.

2.6 Diagnosis

Diagnosis is based primarily on clinical signs, seasonal occurrence, and previous examination, hematological tests and examination of feces for fluke eggs are useful and may be supplemented by two other laboratory tests. The first is the estimate of plasma level of enzymes released by damaged liver cells and the second is the detection of antibodies against components of flukes [34].

2.7 Control and Prevention

The control of fasciolosis is approached through a combination of two ways; reducing population of the intermediate snail host and anthelminthic treatment of infected cattle [27]. In general, treatment should be given at the end of the winter to remove eggs laying flukes and reduce contamination. In those areas where over wintering cercariae are important another treatment in the spring, given when the flukes are large enough to be susceptible therefore all eggs lying may be desirable [26].

3. MATERIALS AND METHODS

3.1 Description of the study area

The study was conducted at Essera Bale town, Southern Nation Nationality and Peoples Regional State, Dawuro Zone from November, 2016 to July, 2017. Bale town is serving as the capital of Essera Woreda. It is located between 6.7-7.02^0 latitude and 36.7-37.1^0 longitude.

Essera Woreda found at a distance of 575 km South of Addis Ababa and the altitude ranges from 501-2500m above sea level [11].

Essera Woreda has total area of 1043.1km and is divided into 29 peasant associations. The area covers average annual rain fall 1600mm and an average annual temperature ranges from17.6-27.5^{o}c. The mixed farming system is the main economic activity practiced in in the Woreda [11]. The total population of Bale town is estimated to be 82756, covering over an area of 50km^{2}. The total livestock population of Essera Woreda is estimated to constitute 68435 cattle, 32432 goats, 35681 sheep, 10231 horses, 4360 donkeys, 45678 poultry and 28567beehives. Livestock production occupies an enormous share in farm economy of the area. Equine are widely used in pull carts, carrying peoples and goods in the town and nearby villages as income generation for employment opportunity [11].

3.2. Study animals

The study animals include systematically selected cattle slaughtered at Bale Municipal abattoir. These animals are from different livestock markets from 29 peasant associations and the neighbor Woreda. Sampling live cattle involves sex, age and site independent variables of interest. The cattle of age greater than or equals to 2 years were considered as adults while those below two years are as young. Moreover, abattoir samples were entirely dependent on liver examination of slaughtered adult cattle in this site during specified period (Martin, 2005)

3.3. Study design

A cross-sectional study was carried out from November, 2016to July, 2017 by collecting data on events associated with fasciolosis on cattle slaughtered at Bale Municipality Abattoir. After autopsy the liver was inspected grossly; the fluke recovery and count was aimed to be conducted following the approach [34] and identification of the fluke species were carried out by using size parameters described by [26]. Fecal samples were taken from the rectum of randomly selected animals and were examined according to the method described by [6].

3.4. Sample size determination

Sample size was conducted using random sampling techniques which ensure the sample is evenly distributed across the study population. The sample size was calculated according to [31]. The average is 50% to be determined with 95% confidence interval (95% CI) and 5% desired absolute precision (d=0.05).

Where, **n**= Sample size

Pexp= expected prevalence= 50%

d= Absolute precision= 5 %

Accordingly, based on the above formula the required sample size was 384.

3.5. Study Methodology

3.5.1. Anti-mortem Examination

During anti-mortem Examination the health status of the animals was examined. The inspected health status includes coughing, diarrhea, emaciation and also normal health status were examined.

3.5.2. Post mortem examination

During meat inspection, the same cattle already examined for anti-mortem and their respective livers were strictly supervised and examined. Postmortem examination was taken by visual inspection, palpation and incision of liver parenchyma, bile duct and gallbladder for the presence of *Fasciola*. The fluke recovery was conducted by cutting the liver in to slice of about one centimeter for recovery of immature flukes, and the bile duct was incised to recover adult Fasciola [34].

3.5.3. Fluke Species Identification

From the positive livers adult parasites were collected by squeezing in to universal bottle containing 10% formalin preservative and then examined to identify the involved fluke species by their size and morphological character. *F. gigantica* is distinguished from *F. hepatica* by its larger size 20-75 x 3-12mm for *F. gigantica* and 20-30 x 10mm for *F. hepatica*, smaller cephalic cone, less prominent shoulders and more transparent body [25].

3.5.5. Financial Loss Assessment

All livers affected with fasciolosis were totally condemned. The annual financial loss due to condemnation of liver was assessed by considering the overall prevalence rate of the disease, the total annual slaughtered animal in the abattoir and retail price of an average animal liver. The information obtained was subjected to mathematical compilation using the formula set by [24].

ALC = CSR*LC*P

Where, ALC = Annual loss from liver condemnation

CSR = Mean annual cattle slaughtered per year at Bale Municipal abattoir

LC = Mean cost of one liver at Bale town

P = Prevalence rate of fasciolosis at Bale abattoir

3.6. Data Management and Analysis

The data which was collected from the study area were coded and then entered for preliminary analysis in to Microsoft Excel (2007) and was analyzed using STATA 11.0 software [28].

4. RESULTS

4.1 Anti- mortem examination

Anti-mortem examination of 385 animals which was brought to Bale abattoir according to their health status 28.6% were coughing, 51.4% were Diarrhea, 40% Emaciated and 24.5% were normal.

Table 1: Anti-mortem examination with Fasciola positivity

Variable		No. examined	Positive	Prevalence (%)	P-value
Health status	Coughing	14	4	28.6	0.009
	Diarrhea	35	18	51.4	
	Emaciation	5	2	40	
	Normal	331	82	24.5	
Total		**385**	**106**	**27.5**	

4.2 Postmortem examination

Abattoir survey conducted on 385 selected cattle slaughtered at Bale municipality abattoir revealed a mean prevalence rate of 29.9% with condemnation of 115 affected livers. The result of abattoir examination with different factors is presented on the following table.

Table 2: Fasciola prevalence by different risk factors

Variables		No. examined	Positive	Prevalence (%)	P-value
Origin	Bale	151	46	30.5	0.26
	Duzi	44	15	34.1	
	Dali	13	4	30.8	
	Offa	104	33	31.7	
	Sengeti	20	3	15	
	Shada	28	11	39.3	
	Z/shemayti	25	3	12	
Sex	Female	104	33	31.7	0.62
	Male	281	82	29.2	
Age	Young	162	43	26.5	0.22
	Adult	223	72	32.3	
Breed	Cross	31	8	25.8	0.60
	Local	354	107	30.2	
BCS	Good	57	12	21.1	0.00

	Medium	248	55	22.2
	Poor	80	48	60
Total		**385**	**115**	**29.9**

4.3 Fluke species identification

Both species of Fasciola was identified with relative abundance of *F. hepatica* 69 (60%), *F. gigantic* 13 (11.30%), mixed species 19 (16.52%) and immature flukes 14 (12.17%), as indicated in table below.

Table 3: Relative abundance of Fasciola species at Bale abattoir

Fasciola species	No. of liver infected	Percentage (%)
F. hepatica	69	60.0
F. gigantica	13	11.30
Mixed	19	16.52
Immature	14	12.17
Total	**115**	**100**

4.4 Degree of liver damage

Based the degree of pathological lesions observed the infected livers were categorized as lightly infected 44(37.71%), moderately infected 50(43.86%) and severely infected 21 (18.42%), as described (Table 4).

Table 4: Categorization of affected livers according to degree of infection

Intensity of infection	No. of liver (%)	Percentage
Lightly infected	44	37.71
Moderately infected	50	43.86
Severely infected	21	18.42
Total	**115**	**100**

4.5. Financial loss assessment

Estimation of financial loss resulted from liver condemnation due to fasciolosis. The average annual cattle slaughtered rate was estimated to be 10,250, average price of bovine liver was 30 ETB and prevalence of bovine fasciolosis in this study was found to be 29.9%. Therefore, it is calculated as:

ALC= CSR x LC x P

ALC= 10,250 x 30 x 29.9%

ALC= 91942.5 ETB

5. DISCUSSION

Both *Fasciola hepatica* and *Fasciola gingantica* have been reported to exist in many parts of Ethiopia. The overall prevalence of bovine fasciolosis in cattle slaughtered at Bale Municipal Abattoir during the study period was 29.9% and this result was almost similar to the earlier prevalence reported in around Dangila District and Kombolcha, 30.02% by [5] and 28.63% by [19] respectively. As the result of this study showed that the prevalence is closely similar with that of (13) at Soddo abattoir, (35) at Bedelle and [3] at Hawassa reported the prevalence of 28%, 31.5% and 27.22% respectively.

The result was lower when compared with higher prevalence reported by (29) at Jimma Municipal abattoir,[38] at Gondor abattoir, and Tolosa and Tigre (2007) at Jimma abattoir, who

found a prevalence of 46.58%, 90.7% and 46.2% respectively. The result of this study was higher compared to the prevalence reported by [2] at Wolaita Soddo abattoir, Kahn et al (2010) and [4] at Dangila Abattoir, who found a prevalence of 14%, 25.46% and 22.14% respectively. This difference may be due to the variation in the ecological and climatic conditions such as altitude, rainfall and temperature for the presence of their intermediate snail hosts over mass of areas on the origins of animals slaughtered at study abattoir or due to expansion of veterinary services, awareness created among the people about the advantage of periodically deworming of animals or due to local husbandry condition.

The relative abundance of Fasciola species in the study area was studied. From the total of 115 Fasciola infected livers examined during post mortem examination, 60% of them were infected by *Fasciola hepatica*, 11.30% were infected by *Fasciola gigantica,* and 12.17% were infected by immature flukes. The predominant species involved causing bovine fasciolosis in the study abattoir was *Fasciola hepatica*. Similar study conducted at Bedele and Jimma municipal abattoirreported 64.5%, 60.3%; of liver harbored F.hepatica, 24.8%,23.85%; of liver harbored *F. gigantica*; and 10.7%, 11.93% harbour immature or unidentified form of fasciola species were recorded by [35] and [29], respectively.This result was not in agreement with the finding of[13] with the highest prevalence of F.gigantica in Soddo municipal abattoir.

The high prevalence of *Fasciola hepatica* may be associated with the existence of favorable ecological conditions for the intermediate host of *Fasciola hepatica (Lymnaea truncatula)* in the source origins of cattle presented to the study abattoir. Swampy areas around lakes, marshy areas in low-lying plane areas, temporary ponds and highlands provides favorable habitat for *Lymnaea truncatula* [32]. These might have contributed to the frequent occurrence of *Fasciola hepatica* in cattle. The low prevalence of Fasciola gingantica in the study abattoir may be associated with the presence of intermediate host (*Lymnaea nataliensis*), due to favorable conditions like border of lakes, flood prone areas and lowlands [26].

Mixed infection by both species of Fasciola (16.52%) may occur in the liver of the same animal was attributing to the existence of ecological conditions conducive for replication of both species of intermediate snail hosts and intermingling of cattle from different grazing areas.[5] reported coexistence of both species of Fasciola in areas with an altitude range of 1200-1800 m.a.s.l. which support the finding of this study.

Prevalence of bovine fasciolosis was statistically analyzed relatively on the bases of body condition score to determine the impact of the disease in animals with different body condition scores, 60% prevalence in poor body condition, 22.2% in medium body condition and 21.1% in good body condition of animals was found on abattoir survey. The result of the present study indicated that occurrence of fasciolosis has significant difference ($p<0.05$) in relation to body condition of the animals. This signifies the importance of fasciolosis in causing weight loss and the characteristic signs of fasciolosis are weight loss and emaciation [26]. Statistical analysis of the effect of age on prevalence of fasciolosis are indicated no significant variation ($p>0.05$) among different age groups of animal in this study.

The prevalence of fasciolosis was statistically analyzed based on the source origin of the animals. The prevalence rate found in animals from different source origins was Bale (30.5%), Offa (31.7%), Duzi (34.1%), Sengeti (15%), Zadishemayti (12%), Shada (39.3%) and Dali (30.8%). This difference is strongly associated with the difference in the presence of favorable environments for the existence, multiplication and spread of host snail and the parasite in the area and may be due to the presence of good husbandry control and strong cattle management [26].

The annual financial loss due to condemnation of liver in this study was 91942.5 ETB. The economic loss at the study abattoir was high

compared to losses reported by [22] reported 18333USD at Arusha abattoir,[13] reported 4000USD at Wolaita Soddo Abattoir,[29] reported 6300USD at jimma Municipal abattoir. The variation of financial loss may be due to the number of mean annual slaughtered cattle differs in different abattoir and variation in retail market price of liver and the difference in the prevalence of the disease.

6. CONCLUSIONS AND RECOMMENDATIONS

The result of the present study on bovine fascioliasis at Bale Municipal abattoir reveals that fascioliasis significantly prevalent parasitic disease affecting the health and productivity of the animals, and the disease remains an important health problem to the animals in the study area. The study indicates presence of significant infection on the study area which indicates the existence of conducive environmental conditions for the development and survival of the parasite in the areas of the source origin of the animals. In addition, the annual financial loss due to fascioliasis is critical to the economy of livestock industry to the study area in particular and to the nation in general. The process of choosing the best control strategy for fasciolosis would be difficult as the biological complexity is associated with the disease.

Therefore, based on the above conclusion, the following points are recommended;

- Identification and mapping of snail habitats may enable grazing plans to be devised that avoid danger areas at times of high risk where habitats are restricted in size and clearly defined, it may be possible to exclude stock by fencing.
- Strategic antihelmenthics treatment with appropriate flukicidal is most suitable measures if supported by detailed local epidemiological study on the seasonal dynamics of infection in particular area.
- Providing best long term method of reducing population of the intermediate snail host either by draining of water lodged areas or using application of mulluscides combined with antihelmenthics treatment to remove existing fluke populations and thus the contamination of habitats with eggs.
- Further studies should be conducted on the epidemiology, biology and ecology of intermediate host snail in the area, to help the planning and implementation of disease control strategies and husbandry measures.

ACKNOWLEDGEMENT

My first thanks go to a head of all things, praise be to the higher almightiest God for his save, mercy and support in my life. I would like to express my grateful thanks and sincerest appreciation to my advisor Dr. Azeb G/tensay for her intellectual guidance, helpful advice, material provision, excellent cooperation, very hard work, dedicated effort and devotion of time in all my works. I would also like to dedicate my heartfelt thanks to my husband who has supported me financially and morally until this time.

Finally, I would like to thank all the Bale Rural Municipal abattoir workers for their good cooperation and material provision during the time of data collection.

REFERENCES

1. Abebe, M. (1988): Prevalence of Bovine fasciolosis and its economic significance at Nekempte, DVM Thesis, Faculity of Veterinary Medicine Addis Ababa University Debre Zeit Ethiopia.
2. Abunna F, Asfaw L, Megersa B, Regassa A (2009). Bovine Fasciolosis:Coprological, Abattoir Survey and its Economic Impact due to LiverCondemnation at Soddo Municipal Abattoir, Southern Ethiopia. Trop. Anim. Health Prod. 42:289-292.
3. Amsalu A, Desta Beyene B, Ataro A and Andualem T (2017). Prevalence of Bovine Fasciollosis, Coprological, Abattoir survey and its Associated financial losses due to liver condemnation at Hawassa Municipal Abattoir, Southern Ethiopia. Global Veterinarian, 18(2): 124-131
4. Alemu, F. and A. Mekonnen, 2013. An Abattoirsurvey on the prevalence andmonetary loss offasciolosis Among cattle, slaughetered at Dangilamunicipal abattoir, Ethopia, J. vet. Med. and ani. Health, 6(12): 309-316.

5. Samuel D. and Asmare G. (2015). Prevalence of Bovine Fasciolosis and Its Associated Risk factors in and Around Dangila, Awi Administration Zone, Northwestern Ethiopia. Department of Veterinary Clinical Studies. University of Gondor. *European Journal of Biological Science*, 7(3): 114-119.
6. Antonia, M., Conceicao, P., Rute, M., Durao, Isabel, H., Costa, Jose., Correia de Costa. (2002): Evaluation of a simple sedimentation method (modified McMaster) for diagnosis of Bovine fasciolosis. ***V**et **P**arasitol* (105): 337-343.
7. Boray, J. (1995): Parasites, pests and predators in: Go afar SM (ed) World animal serieses B2: Amsterdam. Elsevier; Pp. 179.
8. Briskey, D. (1998): Diagnosis of liver fluke infection in cattle. Veterinary Bulletin, Pp.1-4.
9. CSA, (2010): Central Statistical Authority Federal Democratic Republic of Ethiopia Agricultural sample enumeration statistical abstract.
10. ESAP, (1995): Ruminant livestock development strategy. 3 (1 and 21), Pp.1 Ethiopia, Pp.37.
11. EWLFRD, 2016. Essera Wereda livestock and Fishery Resource Development.
12. Fiseha, J. (1995): Zoonotic disease in Ethiopia. Ethiopian society of animal production publication.No.1. Pp.54.
13. Fufa A, Loma Aand Bekele M (2009).Alemayehu R Bovinefasciolosis: coprological, abattoir survey and its economicimpact due to liver condemnation at Soddo municipalabattoir, Southern Ethiopia. Trop Ani Health Prod.
14. Hansen, J. and Perry, B. (1994): The epidemiology, diagnosis and control of helminthes parasites of ruminants, ILRAD (International Laboratory for Research on Animal Disease) Nairobi, Kenya, Pp.31-41.
15. Malone, J.B., Gommes, R., Hansen, J., Yilma, J.M., Slingenberg, J., Snijder, F., Nachet, O.F. and Ataman, E. (1998): A Geographic Information System on the Potential Distribution and abundance of *Fasciola hepatica* and *f. gigantica* in East Africa based on food and agriculture organization databases. ***V**et*. ***P**arasitol,* 78:87-101.
16. Mezgebu, B. (1995): A survey on ovine fasciolosis and Lung worm infestation in Addis Ababa and the surrounding highland areas, DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University. Debre Zeit, Ethiopia.
17. Ministry of Agriculture, Animal and Fishery Resources Development (1990): Animal health extension, Addis Ababa Ethiopia-cited in book;
18. Adem, A. (1994) prevalence of bovine fasciolosis, a preliminary survey around Ziway region. DVM thesis, Addis Ababa University Faculity of Veterinary Medicine Debre Zeit. Netherlands, IUK, Pp 6-8. Parasites of ruminants ILRAO Nairobi Kenya. Pp 182-189.
19. Mulugeta, B. (2008): Fasciolosis: Prevalence, financial losses due to liver condemination and evaluation of simple sedimentation diagnostic technique in cattle slaughtered at Hawassa Municipal abattoir, Southern Ethiopia. DVM Thesis, Faculty of Veterinary Medicine, Hawassa University. Hawassa, Ethiopia.
20. Mulugeta, H., Getachew, T., Taffesse, M., Getachew, W., Kinfe, G. and Teshome, Y. (1989): The significance of helmintic parasites in livestock production. In: the 3rd livestock improvement conference, Addis Ababa, Ethiopia.
21. Mulugeta, T. (1993): Prevalence and Economic Significance of Bovine fasciolosis at the Sopral Kombolcha meat factory, DVM Thesis, Faculty of Veterinary Medicine, Addis Ababa University. Debre Zeit, Ethiopia.
22. Mwabonimana M F, Kasuku A A, Ngowi H A, Mellau L S B, Nonga H E and Karimuribo E D. (2009). Tanzania Veterinary Journal; 26: 2.
23. Nicholson, M. J. and Butter Worth, M. H. (1986): A guide to condition scoring of zebu cattle international livestock center for Africa. Addis Ababa, Ethiopia.
24. Ogunrinade and Adegoke (1982): Bovine Fasciolosis in Nigeria. Intercurrent parasitic and Bacterial infection. Tropical animal health and production. 14: 121-125
25. Pedro, N. and Boris, S. (2003): Zoonoses and communicable diseases common to man and animals. 3rdeddition.Volume III. Parasitosis. Pp.115-123
26. Radostits, O., Gay, C., Hinchcliff, K. and W. Constable, P. (2007): Veterinary Medicine. A

textbook of the diseases of cattle, horses, sheep, pigs and goats. 10th edition. SAUNDERS ELSEVIER London. Pp: 1575.

27. Soulsby, E. (1982): Helminthes, Arthropods and Protozoa of Domesticated Animals, Seventh Edition. Balliere Tindal, London, UK. Pp. 40-52.
28. Stata Corp. (2009): Stastical software. Release 11.0 Lake way drive, College Station, Texas.
29. Tadelle T and Worku T.(2007). The Prevalence and economicsignificance of bovine Fasciolosis at Jimma abattoir, Ethiopia, The internet journal of veterinary medicine; 3, 15.
30. Taylor, M.A., Coop, R.L. and Wall, R.L. (2007): Vet par. 3rd. ed. Longman scientific and Technical. Pp. 201-208.
31. Thrusfield, (2005): Veterinary epidemiology. Second edition, Black well science UK. Pp. 233.
32. Troncy, P. (1989). Fasciolosis of ruminants. In manual of tropical veterinary parasitology. CTA, C.A.B. International. Pp. 63-74.
33. Tsegaye, F. (1995): Epidemiology of Bovine Fasciolosis and Haydatidosis in Debre Birhan region. Dvm thesis, Faculty of Veterinary Medicine, Addis Ababa University. Debre Zeit, Ethiopia.
34. Urquhart, G., Dunca, J., Armour, L., Dunn, J., Jenning, A. (1996): Veterinary Parasitology. Second Edition. Black well Science, UK. Pp. 103-113.
35. Wakuma M(2009). Prevalence and economic significance ofBovine Fasciolosis at Bedele municipal abattoir. DVMthesis, school of Veterinary medicine, Jimma Universitycollage of Agriculture and Veterinary Medicine, Jimma, Ethiopia.
36. Wassie, M. (1995): Prevalence of bovine and ovine fasciolosis: a prelimenary survey in Nekemte and its surrounding areas. Dvm thesis, Faculty of Veterinary Medicine, Addis Ababa University. Debre Zeit, Ethiopia.
37. Yilma, J. and Malone, J. (1998): A Geographic Information System forecast model for strategic control of fasciolosis in Ethiopia. Faculty of Veterinary Medicine, Addis Ababa University. Ethiopia. ***V****et.* Parasitol, 78:103-123.
38. Yilma J, Mesfin A (2000). Dry Season Bovine Fasciolosis inNorthwestern Part of Ethiopia. Revue de Médicine Vétérinaire.151:493-500
39. Zerihun, A. (2006). Ruminant Fasciollosis Studies on the Clinical Occurrence. Coprology, abattoir survey in Debre Birhan and surrounding area. DVM thesis, Faculty of Veterinary Medicine, Addis Ababa University. Debre Zeit, Ethiopia.