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Original article

Prevalence of ovine fasciolosis and its economic significance in basona worana district, central Ethiopia

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ABSTRACT

A cross-sectional and retrospective study was conducted from February-May, 2012 to determine the prevalence of ovine fasciolosis. A total of 1528 sheep were selected and sampled by using systematic simple random sampling, Sedimentation technique, haematocrite centrifugation and postmortem examination were employed during the study period. Overall prevalence of ovine fasciolosis based on farm, abattoir and retrospective clinical study was 62.7%, 52.6% and 59.1%, respectively. There was no statistically significant variations ($p>0.05$) by sex and age of sheep in both farm and abattoir study. The association of ovine faciolosis with different breeds of sheep was statistically significant variation ($p<0.05$) was observed in farm, abattoir and retrospective veterinary clinical data analysis. The prevalence of fasciolosis was different among FAMACHA eye-colour scores, body condition, mean PCV value, liver pathology, types of Fasciola species and worm burden ($p<0.05$). The prevalence of ovine fasciolosis based on FAMACHA eye-colour scores was highest (100%) in pink white and lowest in red (51.9%). The mean PCV value of Fasciola species in infected and uninfected sheep were 24.04 ± .381 and 25.87 ± .516, respectively. The mean worm burden of lightly, moderately and severely affected livers was 21.00 ± 1.889, 34.30 ± 2.662 and 105.09 ± 9.741, respectively. The average mean worm burden per affected liver was 56.79 ± 4.635. The predominant species identified in the study area was Fasciola hepatica (68.8%). The mean fluke burden of each Fasciola species

counted was 47.17 ± 4.737, 25.50 ± 4.912 and 93.02 ± 12.139 for Fasciola hepatica, Fasciola gigantica and mixed Fasciola species infection, respectively. The prevalence of ovine fasciolosis in the study area should be reduced by sustainable and integrated control programmes which include strategic application of anthelmintics, efficient farm and grazing management by Veterinarians and sheep owners in the study area.

1. Introduction

Fasciolosis is an economically important zoonotic disease of domestic livestock, especially cattle, sheep, and goat, as well as occasionally man. The disease is caused by digenean trematodes of the genus Fasciola, commonly referred to as liver flukes. The two species most commonly implicated as the etiological agents of fasciolosis are Fasciola hepatica and Fasciola gigantica (family Fasciolidae). Fasciola hepatica has a worldwide distribution but predominates in temperate zones while Fasciola gigantica is found on most continents, primarily in tropical regions (Andrews, 1999). Both F. hepatica and F. gigantica are transmitted by the snails of the family Lymnaesidae. Infestation with fasilolosis is usually associated with grazing wet land and drinking from the snail infesting watering places (Payne, 1990. Liver fluke infection in lambs and kids is characterized by anemia, edema, weight loss and death (Kassaye, 2011; Yilma and Malone, 1998). The farming system in Basona Worana district is mixed crop-livestock in which sheep are kept in small flocks as a source of cash income, meat, manure, skins and in some areas for coarse wool. The sheep flocks are kept along with other livestock species such as cattle, goats and equines in rather reduced communal grazing areas, unsuitable for cropping, or fallows, waterlogged land and steep slopes. Sheep rearing is conducted in some study peasant associations with no additional feed supplement (Mukasa-Mugerwa et al., 1986; Mengistu, 2000). The temperature, rainfall and altitude of the study area are also favorable for the development of the intermediate host and Fasciola species. Therefore; the purpose of this study is to determine the current prevalence of ovine fasciolosis and its economic significance in BasonaWorana district. Specifically, the study is initiated to provide information about the prevalence of ovine fasciolosis in sheep owned by smallholder farmers which live in selected peasant association of BasonaWorana district and estimated the magnitude of direct economic loss due to Fasciola species infection because of condemnation.

2. Materials and methods

2.1. Description of the study area

The study was conducted in selected sites of Basonaworana district, located at the central highlands of Ethiopia in the Amhara National Regional State (Figure. 1) and situated at a distance of 130 km away from Addis Ababa in the North East direction. The geographical location of the study area is 090 01’232’’ N, 0380 48’177’’ E at an altitude of 2780 m.a.s.l. The rainfall pattern of the study area is bimodal in distribution; the average annual rainfall was 79.8 mm, while the maximum total monthly rainfall falls in the range of 357.4 – 435.1 mm in July and 273.2 – 397.7 mm in August. The average monthly minimum air temperature ranges from 3.1°C in November to 9.3°C in August. While the average monthly maximum air temperature ranges from 18.1°C in August to 23.7°C in January. The climate is characterized by a long rainy season extending from June to September, a short rainy season that extends from February to March. There is an extended dry season from December to February (Markos, 2006). The area is mountainous naturally and dissected by rivers and streams. The grazing lands in the study area are drained by streams and pocketed by water logged (marshy) areas. The total target population in the district was estimated to be 133,736 flocks of sheep. The farming system of the area is a mixed type characterized predominantly by crop and livestock production, BAO (2011)

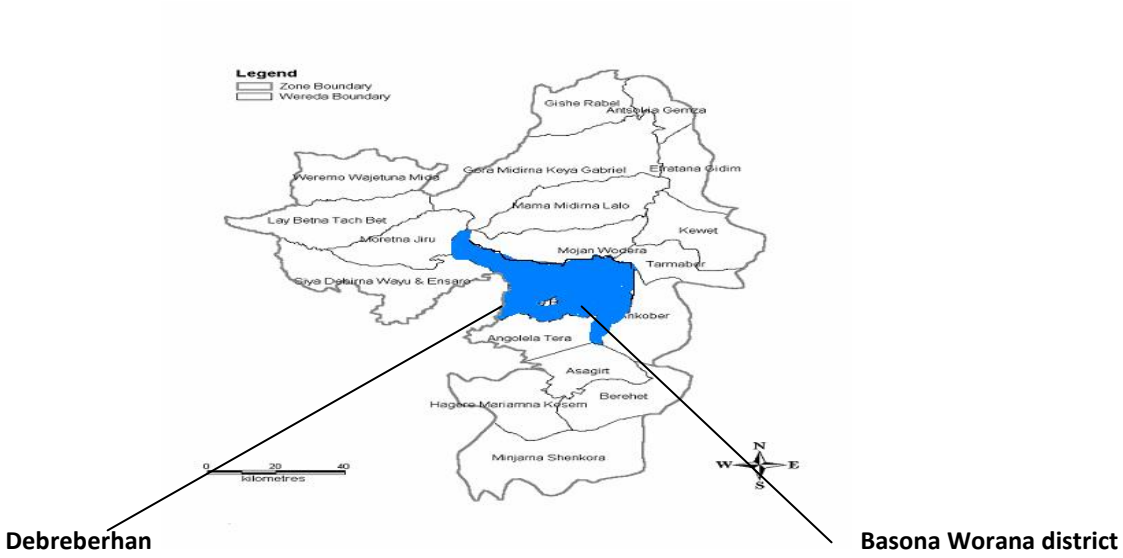

Fig.1. Location map of the study area.

2.2. Study design and sampling techniques

A cross-sectional investigation on prevalence of ovine fasciolosis was carried out from Febreuary, 2012 to May, 2012 for four months in Basona Worana district. From 30 peasant associations of Basona Worana district six peasant associations were purposively selected by considering distance from the parasitological laboratories, transport accessibility, irrigation activities, and sheep population and of availability of health center. The sheep owners and individual animals were selected randomly from each peasant associations. Systematic sampling technique was implemented in abattoir study for ante and postmortem examination of slaughtered sheep. This research did not include those sheep came from research center, those treated for any helminthes parasites for the last three months and those that came from lowlands as an excluding criteria.

2.3. Sample size determination

The sample size was determined using simple random sampling method with 95% confidence level, 5% desired absolute precision, Thrusfield (2005) and 48.21% expected prevalence of fasciolosis in sheep (Fikadu, 2008). Accordingly, 384 sheep were sampled from peasant associations of Basona Worana District (Appendix 2) and equal number of sheep was eaxamined for presence of liver fluke in those sheep slaughtered at the Debreberhan municipal abattoir.

2.4. Data collection methods

Coproscopic examination, Packed Cell Volume, FAMACHA eye-colour scores, body condition scores, and antemortem and postmortem abattoir inspection records were employed. Faecal samples from Fasciola infection suspected sheep were collected from six peasant associations of the study area. Moreover, liver with evidence of fluke infestation was collected from Debreberhan municipal abattoir. In both farm and abattoir study necessary data such as age, sex, peasant associations, breed and body condition were recorded. Data from the municipal abattoir was collected via postmortem inspection of each liver after correlating each liver under examination to the mutton of each slaughtered sheep.

2.5. Coprological examination

Faecal samples for parasitological examination were collected directly from the rectum of each sheep, using disposable plastic gloves and placed in clean screw -capped universal bottle and each sample was clearly labeled and processed, Thompson and Meyer (1994). Faecal samples were preserved with 10% formalin solution to avoid the eggs developing and hatching. The age of each animal was determined by interviewing stockowners and using dentition (Gatenby, 1991).

2.6. Haematocrit (pcv) determination

Paired blood samples were collected from the peripheral ear vein of each animal using heparinized microhaematocrit capillary tubes that filled 3/4 of the height and sealed with cristaseal. The sealed microhaematocrit capillary tubes containing 70 µl of blood were centrifuged immediately in microhaematocrit centrifuge for 5 min at 12000 rpm. After centrifugation, the pack cell volume (PCV) was read for estimation of anemia using haematocrit reader and the buffy-coat examination done as described in (Murray et al., 1983).

2.7. Ante-mortem and postmortem examination

Complete ante mortem examinations of the animals were carried out prior to slaughter. Inspection of the animals were made while at rest or in motion for any obvious sign of disease.

2.8. Postmortem examination

During post-mortem inspection, each liver was visually inspected, palpated and incised based on routine meat inspection procedure developed by FAO (2000). All condemned liver due to infestation by Fasciola species was registered and collections of flukes were conducted for the purpose of species identification.

2.9. Data management and analysis

Microsoft Excel database system, SPSS version 16.0 computer programs was applied for data analysis. The prevalence of ovine fasciolosis was calculated as the number of infected individuals divided by the number of individuals sampled x 100. Chi-square ($\chi 2$) was used to measure association between prevalence of the parasite with sex, age, breed, location, body condition and FAMACHA. Mean comparison was used to calculate the mean value of PCV readings and worm burden counts.

3. Results and discussion

As shown in Table 1 the prevalence of ovine fasciolosis in male and female sheep was 66.7% and 61.5%, respectively. The association between prevalence of ovine fasciolosis with sex was not statistically significant (χ 2 = 0.801, P= 0.371). The prevalence of ovine fasciolosis was 72(66.1%) and 169(61.5%) in young and adult sheep, respectively. The association between prevalence rate and age of sheep was not statistically significant (χ 2 =0.707, p= .400).

The overall prevalence of ovine fasiolosis in current study was 241(62.7%), which was in agreement with 74% prevalence was reported by Suleman (2010), 70.20% prevalence was investigated by Chanie and Begashaw (2012) in Lalo Mider district, Ethiopia. Sheep graze and drink water around marshy and stagnant water areas, which were favorable environment for the growth and development of snails as well as Fasciola species (Boray, 2007), are more at risk than those that are managed at drier areas. Moreover, the owners of sheep lack the experience of deworming their sheep during the dry season. In addition, risk factors such as drinking water on the same stream or river with cattle, goat, donkey and other domestic animals, optimum temperature and altitude of the study area were favorable for the developmental life cycle of Fasciola species, especially Fasciola hepatica.

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Now adays, there is expansion of small scale irrigation schemes in the study area for the purpose of food security and natural resource management. Irrigational activities are carried out by making use of local rivers, streams and ponds. This scheme has created conducive environment for the development and survival of the intermediate host, snail. Because of shortage of animal feeds during the dry season the farmers have the tendency to graze their sheep in these marshy and damp areas. The sheep populations in Basona Worana district are kept

Table 1
Prevalence of ovine fasciolosis by sex, age, breds and location based on coprological examination of study animals in Basona Worana district during February-May.

Host factors		№. of (N=384) Examined	№.of Positives	95%CI	Odds ratio	χ 2	P- Vlue
Sex	Male	93	62(66.7%)	56.13 - 76.10			
	Female	291	179(61.5%)	55.65 - 67.13			
	Total	384	241(62.7%)	57.71 – 67.61	.799	.801	.371
Age	Young	109	72(66.1%)	56.36 - 74.85			
	Adult	275	169(61.5%)	54.42 - 67.23			
	Total	384	241(62.7%)	57.71 – 67.61	.819	.707	.400
Breeds	Local	315	190(60.3%)	56.67 - 65.75			
	Cross*	69	51(73.9%)	61.94 - 83.74			
	Total	384	241(62.7%)	57.71 – 67.61	1.864	4.476	0.034
Location	Keyt	77	53(68.8%)	57.25 - 78.90			
	Bakelo	62	47(75.8%)	63.25 - 67.08			
	Dibut	90	51(56.7%)	45.80 - 67.08			
	Saria	44	25(56.8%)	41.03 - 71.65			
	Kormargefia	50	25(50.0%)	35.52 - 64.47			
	Angolela	61	40(65.6%)	52.30 - 77.27			
	Total	384	241(62.7%)	57.71 – 67.61	1.905	11.514	0.042
Body condition scores	Thin	255	170(66.7%)	60.51-72.42			
	Average	129	71(55.0%)	46.03 – 63.80			
	Total	384	241(62.8%)	57.71-67.61	1.634	4.956	0.026

*Awassi crosses Menz.

under extensive livestock production system which increases the contact between Fasciola eggs and the snail. The optimal binomics (temperature and rainfall) in the study area provided a good environment for hatching and later ingestion of metacercariae by sheep when they drink and pasture around the contaminated field. As shown in Table 1 the prevalence of ovine fasciolosis in local and Awassi cross Menz breeds of sheep was 60.3% and 73.9%, respectively. The association in the prevalence rate of ovine fasciolosis and sheep breeds was statistically significant (χ 2 = 4.476, P = 0.034). On the otherhand the agreement of present result with Markos et al. (2004), Samuel (2006) and Zerihun (2006) might be due to the similarity of the study area and the management of sheep. In addition, resistance differences between sheep breeds due to innate immunity and individuals within breeds have variation in resistance against fasciolosis (Dalton, 1999; Windon, 1996). Therefore, the individual variations in resistance were used to create relatively resistant breeds of animals in Fasciola endemic area (Roberts and Suhardono, 1996). The current prevalence of ovine fasciolosis varies with respect to Peasant Associations (Table 1). The highest prevalence of fasciolosis was in Bakelo 47(75.8%) and the lowest in Kormargefia 25(50.0%) peasant association. The relationship between prevalence of ovine fasciolosis and peasant associations were statistically significant (χ 2=11.514, P = 0.042).

According Soulsby (1982) the intermediate host, snails commonly present in poorly drained land, irrigation tunnels, wet and muddy places of near grazing pasture and drinking water. Lymnaea truncatula were found in and around irrigation tunnels, small stagnant water bodies and streams which flow slowly. Urquhart et al. (1996) also conformed the Lymnaea truncatula prefers wet mud to free water and edges of streams and small ponds as well as

irrigation tunnels. Michael (2004) who reported that expansion of small irrigation system was one of the causes for increasing prevalence of ovine fasciolosis. Bakelo Peasant Association was one of location where farmers used streams and rivers for active irrigation practice. The irrigation practice was based on traditional methods. There were also stagnant and slowly moving water which was conducive for Fasciola intermediate host, snails. Most of the time sheep graze around the tunnels and drink water there and from stagnant water in the peasant association. However, in Kormargefia peasant association there was no stagnant water bodies and active traditional irrigation practice in which sheep graze and infected with Fasciola metacercarae.

The present findings in body condition scores were supported by reported of Molalegne et al. (2010) who reported 73.7% in thin and 38.5% in average body condition of sheep, 19.5% in thin and 2.8% in average body condition scores reported by Ahmed et al. (2007), Henok and Mekonnen (2011) 16.45% in thin and 2.3% in average scores, and Yemisrach and Mekonnen (2012) reported 20.5% in thin, 14.3% in average and 14.3% in fat body condition categories and Eyerusalem et al. (2012) was reported the infection rate of Fasciola species in thin and good body condition scores of 45.7% and 32.9%, respectively. The prevalence of Fasciola species infection was higher in thin body condition scores which indicated that the parasite causes progressive weight loss, lack of appetite and the sheep became weak. Because when the body condition was thin they have less resistant and are consequently susceptible to infectious diseases. The difference might be the level of sheep exposed to Fasciola species infection which was increased during the dry period due their choice of grazing around the water bodies. The mean PCV value of infected and uninfected sheep with Fasciola species was 24.04 ± 0.381 and 25.87 ± 0.516, respectively (Table 2). The mean PCV value in infected and free sheep was was significantly different (t =79.305, P = 0.004).

Table 2
Assocaition of Fasciola species infection and mean PCV value of sheep in Basona Worana district from February- May, 2012.

Sex	Ovine fasciolosis	Age			t	P-value
		Young (mean ± SEM)	Adult (mean ± SEM)	Both Age (mean ± SEM)		
Male	Positive	23.28 ± 1.090	23.46 ± 1.193	23.35 ± .800		
	Negative	26.35 ± 1.510	25.57 ± 1.589	26.00 ± 1.080		
	Total	24.26 ± .899	24.20 ± .956	24.24 ± .653		
Female	Positive	25.33 ± .877	24.01 ± .492	24.27 ± .431		
	Negative	27.70 ± 1.216	25.42 ± .663	25.82 ± .590		
	Total	26.18 ± .722	24.56 ± .396	24.87 ± .351		
Sexes*	Positive	24.31 ± .705	23.92 ± .453	24.04 ± .381		
	Negative	27.08 ± .949	25.44 ± .610	25.87 ± .516		
	Total	25.25 ± .578	24.51 ± .367	24.72 ± .310	79.305	0.004

*Both sexes (male and female)

The mean PCV value drops in early infection of Fasciola species due to hemorrhage and blood sucking activities of the parasite (Soulsby, 1982).Taylor et al. (2007) explained that chronic fasciolosis causes anaemia. Radostitis et al. (2007) also confirmed the 'colonization' of bile ducts with adult flukes cause severs anaemia in sheep, so the reading of PCV became low percentage. The mean PCV value of Fasciola species infected sheep in the present study was 24.04 ± .381(Table 2).The current study result was similar with the report of Taimur et al. (1993) in which Fasciola gigantica infected animal had a mean PCV of 24.68 ± 1.20 and the control (uninfected) group had 32.01 ± 1.30. The reports of Howlader et al. (1997) indicated that the mean PCV of Fasciola gigantica infected Black Bengal goat lies between 26.60% and 32.20% and Howlader et al. (2004) also confirmed PCV values of 24.43% and 32.23% from Fasciola gigantica infected animal and control, respectively. Adama et al. (2011) reported that the Yankasa sheep infected with Fasciola gigantica was recoded lower mean PCV value than uninfected Yankasa sheep.The mean PCV value of Fasciola gigantica infected and control Yakasa sheep were 8.33 ± 5.29 and 37.17 ± 5.94, respectively. Teleb et al. (2007) conducted a research by infected 100, 200 and 400 of viable metacercariae of Fasciola gigantica and uninfected control Farafra sheep showed that the mean PCV were significantly lower in all infected sheep groups of 23.1 ± 1.03, 21.1 ± 0.33 and 20.9 ± 0.56 than the control group 34.8 ± 0.68 and continued to decrease until effective treatment. Al-Saffar (2008) also reported in chronically

Fasciola speices infected sheep was mean PCV value 29 ± 1.15 while control group was 35 ± 0.81. Akhtar et al. (2012) also reported the mean Packed Cell Volume of infected sheep was markedly reduced than the normal sheep mean PCV. In support of this result, Akinbamijo et al. (1994) reported that the Fasciola infected sheep indicated a significantly lower PCV compared with non Fasciola infected sheep. The close relation of the present result with other researchers might be due to similar management, hemorrhage and the blood sucking effect of Fasciola species. The similarity of climatic condition (rain fall and temperature) and the endemicity of grazing area for Fasciola species intermediate host which causes availability of infective metacercariae.

The present result of mean PCV value of infected male and female sheep was 23.35 ± .800 and 24.27 ± .431, respectively (Table 2). This result was parallel to the mean PCV value reported by: Michael (2004) and Ahmed et al. (2007) who studied separately and reported the same result of 26.67% and 24.96% mean PCV value in female and male sheep, respectively. Markos et al. (2004) reported the variation in mean PCV value between male and female small ruminants and the mean PCV of male small ruminants was 25.65 ± 0.26 and mean PCV of female was 24.81 ± 0.34.

The difference might be due to the difference in degree of infection, the nutrition of sheep, the altitude, climatic environmental factors and the number of adult Fasciola species present in the bile duct. This lower mean PCV value in infected sheep was due to hemodilution demonstrated by the increase in plasma and blood sucking activity of the adult flukes for a considerable period of time (Soulsby, 1982). The duration of infection also have a great role for the decreasing of mean PCV values. Because Fasciola species feed on blood and disturbed the proper function of liver which causes anaemia and the decrease in plasma albumin. This in turn causes loss of blood into gastrointestinal tract through blood sucking activities of adult flukes and through leakage of protein via bile duct epithelium (Pal and Qayyum, 1992).

3.1. Association of fasciola species infection with famacha eye-colour scores

As shown in Table 3, the prevalence of ovine fasciolosis in red (non-anaemic), red-pink (non anemic), pink (mildly anaemic) and pink white (anaemic) was 51.9%, 61.3%, 61.9%, and 100%, respectively. The prevalence of ovine fasciolosis was highest in pink white (anaemic) (100.0%) and was lowest in red (non anaemic) (51.9%). The association between prevalence of ovine fasciolosis and FAMACHA eye - colour scores were were statistically significant (χ 2= 3.713, P = 0.05).

Table 3
Association of Fasciola species infection with FAMACHA eye-colour scores of study sheep.

Famacha eye-colour	Freq.	№.Positive (%)	№. Negatives (%)	95%CI	χ 2	P-value
Red 1	27	14(51.9%)	13(48.1%)	31.94-71.33		
Red pink2	142	87(61.3%)	55(38.7%)	52.73-69.31		
Pink3	197	122(61.9%)	75(38.1%)	54.75-68.73		
Pink white 4	18	18(100.0%)	0(00.0%)	81.46-100.00		
Total	384	241(62.8%)	143(37.2%)	57.71-67.61	3.713*	0.05

Freq. = Frequencey, 1. Non –anaemic, 2. Non –anaemic, 3. Mildly-anamic, 4. Anaemic
*Kruskal Wallis H test

Fasciola species which infect the sheep suck the blood and causes anaemia (Soulsby, 1982; Unquhart et al .1996; Aitken, 2007: and Taylor et al. 2007). FAMACHA eye-colour scores was one of the methods used by veterinarian for clinical diagnosis of anaemia (Bath et al., 2001; Kaplan et al., 2004; Kahn et al., 2005; Burke et al., 2007; Sissay, 2007 and Susan, 2012). Bath and Van Wyk (2001) confirmed that FAMACHA eye-colour scores were equally effective to identify adult Fasciola species infection. Howlader et al. (2004), Adama et al. (2011), Markos et al. (2000) and Kaplan et al. (2004) who reported that FAMACHA eye-colour scores were used to indicate the level of anaemia in Fasciola infected sheep. In present study, FAMACHA eye-colour scores 3 and 4 indicated the degree of anaemia from lightly to severely anaemic was supported by Bath and Van Wyk (2001), Sissay (2007), Sissay et al. (2007). And Susan (2012) who reported FAMACHA eye-colour scores 3, 4 and 5 were indicated the degree of anaemia from lightly to severely in Fasciola species infected sheep. Kaplan et al. (2004) reported association between the parasite and FAMACHA eye-colour scores. Vatta et al. (2001) also confirmed the association of FAMACHA eye-coloure scores with PCV and then to anaemia due to internal parasites. Similarly, the present result

shows the association between FAMACHA eye-colour scores and PCV reading. Almost all pink and white pink FMACHA eye-colour categories were positive with Fascciola species.The similarity might dependes on the blood sucking effect of Fasciola species and the worm burden with in infected definitive host sheep.

3.2. Prevalence of fasciolosis in sheep slaughtered in debreberhan municipal abattoir

The abattoir study of ovine fasciolosis was conducted from February to May, 2012. Antemortem and postmortem examinations of sheep slaughtred at Debreberhan municipal abattoir were carried out. During abattoir survey variables such as age, sex, breeds, body condition, severity of liver lesions, Fasciola species identification and fluke burden count were considered. The prevalence of ovine fasciolosis in male and female sheep was 41(51.9%) and 161(52.8%), respectively. The association of fasciolosis with sex was not statistically significant ($\chi 2 = .020$, $P = .888$). The overall abattoir prevalence of ovine fasciolosis in Debrberhan municipal abattoir from February to May, 2012 was 202(52.6%). The prevalence of ovine fasciolosis based on age was 111(55.0%) in young and 91(50.0%) in adult sheep. The association of fasciolosis with age was not statistically significant ($\chi 2 = .941$, $P = .332$). The prevalence of ovine fasciolosis was 193(54.2%) in local breeds and 9(32.1%) in Awassi cross Menz breeds. The association between prevalence of fasciolosis with sheep breeds were statistically significant ($\chi 2 = 5.072$, $P = .024$).

The current study revealed that the overall prevalence of ovine fasciolosis at Debreberhan municipal abattoir was 202(52.6%) (Table5). Different researchers carried out abattoir studies on the prevalence of ovine fasciolosis in various parts of Ethiopia and they reported varied prevalence rate of fasciolosis.The present result was inagreement with a study conducted by Mihreteab et al. (2010) who reported 23.35% prevalence in Adwa municipal abattoir. Adem (1994) reported 38.9% and Dinka (1996) reported 31.8% prevalence of Fasciola species in Zeway and Assela abattoir, respectively. 40.6% was reported by Mezgebu (2003) in Gonder Abattoir. 29.76% reported by Melkam (2008) at HELMAX Abattoir Debrezeit and Ozung et al. (2011) were observed 94.5% prevalence of ovine fasciolosis in Ikom Abattoir of Cross River State, Nigeria, 84.5% reported by Yadeta (1994) West Shoa and Zuko (2010) who reported 54.2% prevalence of ovine fasciolosis in Sarajevo.

The variation might be due to the use of antihelimenthic drugs properly at the right time, the awareness of smallholder farmers about fasciolosis and its control system and the ecological zone from where they came to slaughter they came to the abattoir. Most part of Basona Worana district was mountainous in which rivers cross it and has several streams, stagnant water bodies and small scale irrigation systems (Michael, 2004) which were conducive for the development of intermediate host, snail.

As shown in Table 5 the effect of ovine fasciolsis in thin, average and fat body condition categories was 107(61.1%), 86(46.5%) and 9(37.5%), respectively. The prevalence of ovine fasciolosis in thin body condition score was higher 107(61.1%) and lower in fat body condition 9(37.5%) sheep slaughtered in Debreberhan municipal abattoir. The association between body condition scores and prevalence of Fasciola species infection were statistically significant ($\chi 2 = 10.091$, $P = 0.006$). In the study period the sheep slaughtered in Debreberhan abattoir includes only thin (poor), average (medium) and fat (good) body condition categories. But, both very thin and very fat body condition categories of sheep were not slaughtered at the abattoir during the study period.

The present finding was supported by Molalegne et al. (2010) who studied prevalence of ovine fasciolosis in and around Dawachefa and observed 73.7% and 38.5% in poor and good body condition, respectively. Similarly, Abayneh (2010) was reported poor, medium and good body condition 58.02%, 41.32 %and 20.22%, respectively from Arbaminch. Seyoum (2010) who studied at Addis Ababa enterprise abattoirs reported a prevalence rate 79.44% of ovine fasciolosis in medium and 20.55% in good body condition scores and Birhan (2008) reported poor 87.86% and good 27.06% and Shiferaw et al. (2011) also reported thin 75%, moderate 49% and good 40% categories of body condition scores in and around Assela. Abie et al. (2012) observed the association of body condition with Fasciola prevalence and reported highest prevalence in poor body condition (85.9%), higher prevalence in medium (55.1%) and lowest prevalence (34.5%) in good body condition scores. Suleman (2010) reported a prevalence rate of 47.67% in good and 54.03% in poor body condition from research conducted in and around Kombolcha and Yemisrach and Mekonnen (2012) also observed poor 28.8%, medium 20.5 and fat 14.5%. This variation might be due to the difference in management, the study period; the geographical location of sheep came to slaughter house, and the awareness of the owner of sheep about the deworming period. The prevalence of ovine fasciolosis was higher in thin or poor body condition than moderate or fat body condition categories of sheep.

Table 4
The prevalence of ovine fasciolosis by sex, age and breed of sheep slaughtered at Debreberhan municipal abattoir.

Host factors		№ Exam*	№ of Positive (%)	95%CI	Odds Ratio	χ 2	P-value
Sex (N= 384)	Male	79	41(51.9%)	40.36-63.28			
	Female	305	161(52.8%)	47.01-58.50			
	Total	384	202(52.6%)	47.47-57.69	.965	0.020	.888
Age (N=384)	Young	202	111(55.0%)	47.81-61.94			
	Adult	182	91(50.0%)	42.51-57.48			
	Total	384	202(52.6%)	47.47-57.69	1.220	.941	.332
Breeds (N = 384)	Local	356	193(54.2%)	48.88-59.47			
	Cross**	28	9(32.1%)	15.87-52.35			
	Total	384	202(52.6%)	47.47-57.69	2.500	5.072	.024
Body Condition	Thin	175	107(61.1%)	53.49-68.40			
	Average	185	86(46.5%)	39.13-53.95			
	Fat	24	9(37.5%)	18.79-59.40			
	Total	384	202(52.6%)	47.47-57.69	1.720	10.091	0.006

*№ Exam. = Number of examined sheep, ** Cross = Awassi cross Menz.

The present result showed that the mean worm burden in lightly, moderately and severely affected livers was 21.00 ± 1.889, 34.30 ± 2.662 and 105.09 ± 9.741, respectively. In support of this, Mihreteab et al. (2010) was reported the mean burden of Fasciola species in lightly 60 and in severely affected livers 38. Yilma and Mesfin (2000) reported different counts of Fasciola species in different categories of liver lesions of light 32.09, moderate 112.73 and sever 61. Dechasa et al. (2012) and his colleagues who conducted a research in Jimma Municipal abattoir reported the mean Fasciola burden of light 23, moderate 91 and severely affected livers 73. Rahmeto et al. (2010) conducted a research at Hawassa Municipal abattoir and reported the mean worm burden of 25 ± 1.75, 69 ± 1.91, and 48 ± 1.71; in lightly, moderately and severely affected livers, respectively. The difference in fluke counts might be due to climatic and ecological factors which contributes major role for survival and distribution of Fasciola species and the intermediate host, the sheep management system and the awareness of smallholder farmers about the parasite control and treatment. The smallholder farmer did not give additional feed to young and female sheep which was used to develop better resistance to the parasite as compare with malnourished sheep. Most of the sheep slaughtered in the abattoir were young and female those were not deworm for fattening but sought to solve immediate problem. Moreover, sheep liver infected with Fasciola species was no calcification and this increases the number of fluke in the severely affected liver. The average mean fluke count of the current result 56.79 was in agreement with Fekadu (1988) and Wondwossen (1990) who studied separately in different years and reported the same average mean fluke burden of 69 per affected liver. Yilma and Mesfin (2000) were reported 66.23 fluke per affected liver. Zerihun (2006) reported the mean fluke burden of 78 fluke per affected liver. Kassaye et al. (2012) reported 73.5 fluke per affected liver and Rahmeto et al. (2010) also reported the mean burden of 55 flukes per affected livers. The possible explanation of the variation in the average mean worm burden of the present study and that of the previous authors might be the minimized calcification and fibrin formation of liver bile duct in sheep fasciolosis, climatic, edaphic and topographic factors, antihelimenthic and management system of sheep. Soulsby (1982) stated that the presence of more than 50 flukes per liver indicate high pathogenesis. In the present study, the average mean worm burden of 56.79 flukes per affected liver implied the presence of high pathogenesis of flukes in the study area.

3.3. Major fasciola species identified in sheep slaughtered at debreberhan municipal abattoir

The major Fasciola speices indentified from sheep slaughtered at Debreberhan Municipal abattoir were Fasciola hepatica (68.8%), Fasciola gigantica (6.9%) and mixed infection (24.2%).

Table 5
The predominant Fasciola species identified from affected livers of sheep slaughtered at Debreberhan municipal abattoir.

Tyepes of infection(N=384)	№. of livers affected	Identified Fasciola Species (%)
F.hepatica	139	68.8
F.gigantica	14	6.9
Mixed	49	24.3
Total	202	52.6

The prevalence of Fasciola hepatica, Fasciola gigantica and mixed Fasciola species infection (Fasciola hepatica + Fasciola gigantica) was 68.8%, 6.9% and 24.2%, respectively (Table 7). The present result was supported by Yilma and Mesfin (2000) who reported the prevalence of Fasciola hepatica, Fasciola gigantca and mixed species was 67.14%, 14.1% and 18.77%, respectively at Gonder abattoir. Tadele and Worku, (2007) observed the prevalence of Fasciola hepatica (63.89%), Fasciola gigantica (24.07%) and mixed (12.04%) in Jimma municipal abattoir. Sissay (2007) was reported the prevalence of fasciolosis in sheep to be 26% and 20% of Fasciola hepatica and Fasciola gigantica, respectively. Ashenafi (2008) conducted a research in Mekele and reported the prevalence of predominant species Fasciola hepatca, Fasciola gigantica and mixed with a prevalence of 62.1%, 13% and 11%, respectively. Rahmeto, et al. (2010) who conducted his research in Hawassa reported Fasciola hepatica, Fasciola gigantica and mixed infection with prevalence rate of 58.86%, 10.63% and 14.71%, respectively. Mihreteab et al. (2010) reported Fasciola hepatica to be 13.9% and Fasciola gigantica 7.7% in Adwa abattoir. Gebretsadik et al. (2010) also reported the prevalence of fasciolosis with 56.42% Fasciola hepatica, 9.17% Fasciola gigantica and 5.87% mixed (Fasciola hepatica + Fasciola gigantica) from Mekelle Municipal Abattoir, Tigray Region .Abie et al. (2012) was reported Fasciola hepatica 65.4%, Fasciola gigantica 36.0% and mixed species infection was 11.5% at Jimma abattoir. Mulat et al. (2012) investigated the prevalence rate of Fasciola hepatica, Fasciola gigantica and mixed infection was 79.8%, 14.28% and 5.88%, respectively. Ahmed et al. (2005) conducted a research in Quetta of Pakistan reported the prevalence of prevalence of Fasciola hepatica (12.26%) and Fasciola gigantica (20.93%).

The current result obtained from the abattoir survey indicated that the predominant fluke in the study area was Fasciola hepatica. The predominant prevalence of Fasciola hepatica in the study area might be associated with the existence of favorable ecological and climatic condition for the development of intermediate host Lymnaea truncatula. The difference in the finding of the present study and that of the previous authors might be due to varaition in season of the study period, altitude, the management system, the nature of grazing lands and water sources of the study areas with other localities. Debreberhan has high altitude (>2800masl) which was a suitable ecology for Lymnaea truncatula, the main intermediate host of Fasciola hepatica. Lymnaea truncatula is the most amphibious snail with a wide distribution throughout the world including Ethiopia (Graber and Daynes, 1974; Urquhart et al., 1996; Brown, 2005; Zerihun, 2006). As shown in Table 8 the mean count of Fasciola hepatica, Fasciola gigantica and mixed (Fasciola hepatica and Fasciola gigantica) was 47.17 ± 4.737, 25.50 ± 4.912 and 93.02 ± 12.139, respectively. The highest and lowest mean fluke burden count was in mixed Fasciola species infection (93.02 ± 12.139) and in Fasciola gigantica (25.50 ± 4.912).

The finding of current study on the fluke counts of Fasciola species in Debreberhan municipal abattoir was supported by Kassay et al. (2012) who was reported the mean burden of Fasciola hepatica (83.8), Fasciola gigantica (55.3) and mixed (116.7) by a research conducted at Addis Ababa Abattoir.

The difference in the mean worm burden count might be due to the difference in species, altitude and animal management. In current study the prevalence of mixed infection was higher than Fasciola hepatica and Fasciola gigantica. This might be due the origin of sheep slaughtered at Debreberhan municipal abattoir. According to Kendall (1954), mixed infections of Fasciola hepatica and Fasciola gigantica colonized the cliff boundary between highland and low land ecology through overlapping of the territories of the intermidaite host for both Fasciola species. Those sheep that came from thus boundary Peasant Associations were exposed to mixed infection.The sheep management system in the study area, the awareness of sheep owners about deworming period and the age of sheep slaughtered in Debereberhan municipal abattoir. The sample size difference also the other reseason for the difference in mean fluke count.

Table 6
Mean ± SEM of liver fluke of sheep slaughtered at Debreberhan municipal abattoir.

Fasciola species	№. of livers affected	Sum of worm burden	Mean ± SEM
F.hepatica	139(68.8%)	6556	47.17 ± 4.737
F.gigantica	14(6.9%)	357	25.50 ± 4.912
Mixed	49(24.3%)	4558	93.02 ± 12.139
Total	202(52.6%)	11471	56.79 ± 4.635

3.4. The prevalence of ovine fasciolosis by sex, age, breeds and body condition categories of veterinary clinical retrospective data analysis

Retrospective data was one of a potential source for the survey study of different parasitic diseases including fasciolosis (Mbaya et al., 2010). So, this study included clinical retrospective recorded information and the sheep diagnosed for Fasciola and treated from 2006/2007 to 2011/2012 at Tebase Veterinary clinic.

In the retrospective study, the total numbers of sheep visited the clinic and treated against fasciolosis were included. All Sheep that came for treatment were clinically examined (Urquhart et al., 1996; Radostits et al., 2007 and Taylor et al., 2007) and laboratory faecal examination was carried out mainly by sedimentation technique to observed Fasciola egg (Hansen and Perry, 1994) and the result was recorded by professional veterinarian. The recorded data was used to determine the prevalence of ovine fasciolosis. The prevalence of ovine fasciolosis was sorted by sex, age, body condition, season and year.

According to Mbaya et al, (2010), retrospective data was one of a potential source for the survey study of different parasitic diseases including fasciolosis. So, this study included clinical retrospective recorded information and the sheep diagnosed for Fasciola and treated from 2006/2007 to 2011/2012 at Tebase Veterinary clinic and it was indicated in Table 16 and Figures 7-9. The five years data showed the number of sheep treated for ovine fasciolosis and 1528 sheep were examined for fasciola species diagnosis and treated at Tebase veterinary Clinic. The result indicated 59.1% positivity for ovine fasciolosis (59.1%).

As shown in table 9 the prevalence of ovine fasciolosis at Tebase Veterinary Clinic during the study period was (60.5%) and (57.9%) in male and female, respectively. The association of fasciolosis with sex of sheep was not significant (χ 2 =1.081, P = 0.299). The prevalence of ovine fasciolosis was highest in adult (59.7%) and lowest in young (42.3%) sheep treated at Tebasie Veterinary Clinic. The prevalence rate of ovine fasciolosis was in 62.1% local and 38.1% in Awassi cross Menz breeds treated at Tebase Veterinary Clinic. The association between age categories and breed with Fasciola species infection were statistically significant (χ2 = 6.277, P = 0.012 and 39.354, P = 0.000), respectively. The highest prevalence was recorded in average body condition (80.0%) and lowest in thin body condition scores (58.5%). The association between ovine fasciolosis and body condition was statistically significant (χ 2 = 7.425, P = 0.006).

According to Taylor et al. (2007) the diagnosis of fasciolosis is primarily based on clinical signs, seasonal occurrence, prevailing weather patterns and a previous history of fasciolosis on farm or the identification of snail habitats and this confirmed by the identification of the typical operculate eggs in the faeces samples examined. Mulat et al. (2012) confirmed the use of retrospective data for the study of Fasciola prevalence rate of ovine fasciolosis.The overall prevalence rate of ovine fasciolosis (59.7%) was higher than reported by Yehenew (52.0%) in the year 1985 from clinical retrospective records. Melaku (2010) was observed 47.10% prevalence of ovine fasciolosis and FikirteMariam (2009) also reported 36.72% prevalence of ovine fasciolosis from retrospective clinical records. The difference in prevalence rates of the current result and those of the previous authors might be due to the difference in altitude and the availability of favorable snail, moisture, temperature and PH for the intermediate host of Fasciola species.

4. Conclusion

The present study confirmed that ovine fasciolosis is one of the parasitic diseases which affect sheep owned by smallholder farmers of selected Peasant Associations in Basona Worana district. This result also indicates the presence of favorable ecological, climatic and edaphic factors for the development of the intermediate host Lymnaea species in Basona Worana district. The prevalence of ovine fasciolosis was not associated with sex and age of sheep in farm and abattoir in the study area. However, the prevalence of ovine fasciolosis was not statistically significant with respect to sex but statistically significant with age in retrospective data analysis. The present result revealed that the prevalence of ovine fasciolosis was associated with breed and body condition in farm, abattoir and retrospective data analysis in the study area.

Table 7

Association of ovine fasciolosis by sex, age, breed and body condition scores of retrospective data from 2006/2007 to 2011/2012 at Tebase Veterinary clinic.

variable		№. of examined	№. of Positive (%)	95% CI	Odds Ratio	χ 2	p-value
Sex	Male	704	426(60.5%)	56.79-64.14			
	Female	824	477(57.9%)	54.43-61.28			
	Total	1528	903(59.1%)	56.58-61.57	1.115	1.081	.299
Age	Young	52	22(42.3%)	28.72-56.79			
	Adult	1476	881(59.7%)	57.13-62.20			
	Total	1528	903(59.1%)	56.58-61.57	.495	6.277	.012
Breed	Local	1339	831(62.1%)	59.40-64.66			
	Cross*	189	72(38.1%)	31.14-45.42			
	Total	1528	903(59.1%)	56.58-61.57	2.658	39.354	.000
Body Condition	Thin	1488	871(58.5%)	55.98-61.05			
	Average	40	32(80.0%)	64.35-90.94			
	Total	1528	903(59.1%)	56.58-61.57	.398	7.425	.006

*Awassi Crosses Menz

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