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Prevalence and Associated Risk Factors for Ovine Fasciolosis in Selected Sub-Districts of Alamata District, Ethiopia

[1]Mathewos Temesgen, [2]Tadesse Dejenie and [3]Zawdneh Thomas

[1]Department of Biology, Ambo University, College of Natural and Computational Science, Ethiopia
[2]Department of Biology, Mekelle University, College of Natural and Computational Science, Ethiopia
[3]Department of Biology, Welaita Sedo University,
College of Natural and Computational Science, Ethiopia

Abstract: Fasciolosis is an economically important disease of domestic livestock caused by *Fasciola hepatica* and *Fasciola gigantica*. It causes a great economic loss in developing countries. Thus, the objective of this study was to examine the prevalence and associated risk factors of Ovine fasciolosis in selected sub-districts of Alamata district in dry season. Fresh feacal samples were collected from rectum of 500 sheep from irrigated (Waja-Tumuga) and non-irrigated (Alamata town) areas from January - March, 2011. The collected samples were processed by sedimentation technique using methyl blue solution. The association between the general information of sheep and infection prevalence was analyzed by Chi-square while associated risk factors were analyzed by logistic regression. Out of 500 sheep examined, 121 (24.2%) were infected with fasciolosis. Higher infection was observed in Waja-Tumuga 93(35.8%) than Alamata town area 28(11.7%) ($x2$=39.524; P=0.000). The relevant risk factors of fasciolosis in this study area were age, body condition, distance from the irrigation canal and deworming history while sex, breed and reproductive condition were not a significant factors. Generally, presence of irrigation canal is the main risk factor in this area. Thus, further study, intervention and control should be in place.

Key words: Alamata · Irrigation · Ovine fasciolosis · Risk factors · Sheep

INTRODUCTION

Livestock are the backbone of agricultural sector in terms of economic benefits and food supply [1]. However, these livestock resources are not properly exploited due to factors including poor management, limited genetic potential and rampant parasitic infection [2]. Fasciolosis is found to be distributed in all parts of the world [3]. It causes a major impact on productivity of livestock production in tropical countries including Africa, Asia and South America [4]. In Ethiopia, fasciolosis is widely distributed in north and western parts of the country mostly in rift valley where the usage of running water and micro dams for irrigation is common [5].

Water development project such as construction of micro dams for irrigation caused increase the occurrence of fasciolosis and other water-borne diseases [6]. Mainly irrigation was reported to contribute a major part in prevalence of fasciolosis and creating a suitable potential habitat for snail intermediate host [7]. Fasciolosis caused an enormous economic loss worldwide such as reduced growth rate, mortality, liver condemnation, morbidity and increased susceptibility to secondary infections [5]. The annual loss due to endo-parasites including fasciolosis in Ethiopia was estimated to 41.17 million US Dollars per annul Mulugeta and others [17]. Financial loss due to ovine fasciolosis alone was estimated to be 2.84 million US Dollar per annual. Of this, 46%, 48.8% and 4.7% was due to mortality, loss of productivity and liver condemnation, respectively [8, 9].

Evidences suggested that sheep and goats might be considered as the primary reservoir host for *Fasciola* parasite while pigs and donkeys were considered as secondary host [10, 12]. Sheep production

Corresponding Author: Tadesse Dejenie, College of Natural and Computational Science, Department of Biology, Mekelle University, Ethiopia.

is the pillar activity of agricultural practice in Ethiopia where 63% of them are used as a source of income while 37% of them are for human consumption [23]. In marshy and irrigation based area, ovine fasciolosis is the major limiting factor for this agricultural activity. Different workers have been reported the prevalence of ovine fasciolosis differently in different parts of Ethiopia. However, none of the previous studies indicated the prevalence of ovine fasciolosis and its associate risk factors particularly in dry season and Alamata district. For this reason, this survey was undertakento assess the prevalence of ovine fasciolosis and its associated risk factors in two sub-districts of Alamata district in dry season.

MATERIALS AND METHODS

Study Area: The study was carried out in two sub-districts of Alamata district (Waja-Tumuga and Alamata town area), Tigray Regional State, Northern Ethiopia. Alamata town is located 183km south of Mekelle, the capital city of the region and 600 km north of Addis Ababa. Alamata is situated between 1178-3148 m.a.s.l. with 12°25'13"N latitude and 39°33’52’’E longitude. On the other hand, Tumuga is located 15km south of Alamata town at 12°18'46"N latitude and 39°34'50"E longitude while Waja is small village located 18km south of Alamata town at latitude of 12°17'4"N and longitude of 39°36'15"E. The residents of the district rely on subsistence agriculture for household consumption and income generation. The mean annual rainfall of the study area is 628.8mm. The minimum and maximum temperature of the district is 18 and 27 ºC, respectively. The rainfall is scarce with the small rainy season occurring from March to May and the long rainy season from June to August, followed by long dry season.

Sampling Design: Purposive sampling methodology was used to select the study areas based on the presence of irrigation and agricultural activity of the areas. For this study, out of the 10 sub-districts and two dweller peasant associations two sub-districts belonging to different ecological settings namely Waja-Tumuga and Alamata town area were selected.

The data was collected based on their sex, age, body condition, breed, grazing place, information of female sheep groups and treatment condition (dewormed or non-dewormed) of sheep population. Systematic simple random sampling method was carried out to collect the fresh feacal samples of sheep population in the study sub-districts. A multi stage random sampling procedures were also used to select a representative sample of the sheep population in the study population. The age and body condition division was performed based on key set of techniques [13]. Similarly, the breeds of sheep were studied and classified based on Desta [14] of Ethiopian local breed species identification. Deworming information was first gained from local domestic animal’s clinic of the two sub-districts and the sampled sheep were categorized as dewormed or non-dewormed by direct interview of the owner.

Sample Size Estimation: Sample size was calculated using the following formula $n=Z^2P(1-P)/D^2$[15], Where n= minimum sample size, p= estimate of the prevalence proportion, d= margin of error and z= confidence level (95%).

Since no report was yet recorded for Ovine fasciolosis from this area, P-value was considered to be 50% thus, the minimum sample size is 384. To minimize sampling error during sample collection, 25% of the estimated values (96 sheep) were added as contingency for missing data. However, 20 sheep were added since there was enough man power and resources. Then a total of 500 sheep were taken as minimum sample size.

Collection and Examination of Feacal Samples: Fresh fecal sample was collected directly from the rectum of sheep. The collected feacal samples were placed in screw cap bottles containing 10% formalin and transported to the Parasitology Laboratory of Biology Department, Mekelle University for examination. In laboratory, the samples were processed by sedimentation technique and the egg of *Fasciola* species were identified under compound microscope after staining the sample with 1% methyl blue [16].

Data Analysis: The collected data were stored into the Microsoft Offices Excel, 2003 and coded properly and for data analysis SPSS version 16 soft ware were used. The association between general information of the sheep and prevalence of fasciolosis were tested using chi-square test while risk factors were analyzed by univariate logistic regression (COR).

RESULTS

Out of the total 500 sheep examined, an overall prevalence of 121 (24.2%) were recorded in the current finding. However, higher prevalence (35.8%) was

Table 1: Comparison of ovine fasciolosis between the Waja-Tumuga and Alamata town sub-district

Site	No. Examined	Positive (%)
Waja-Tumuga	260	93 (35.8%)
Alamata town area	240	28 (11.7%)

observed in Waja-Tumuga as compared to Alamata town area (Table 1). The variation of infection between the two sites was highly significant ($x2$=39.524; P=0.000) (Table 1).

There was no significant variation of fasciolosis in male and female sheep (P>0.05). On the other hand, the prevalence of fasciolosis was higher in 2-3 years age groups of sheep (32.20%) followed by age groups older than three years (26.20%). Moreover, lowest prevalence was observed in sheep less than two years old (17.70%) ($x2$=9.621; P=0.022). Prevalence of ovine fasciolosis did not show significant difference among pregnant, nursing and neither pregnant nor nursing sheep (P>0.05). In contrast to this, the comparison of observed percentage of infection among poor, medium and good body condition of sheep showed high significant difference ($x2$=1.10; P=0.000). Highest prevalence (53.20%) was observed in sheep with poor body condition while lowest infection prevalence (4.70%) was observed among sheep with good body condition. The prevalence of fasciolosis was lower (16.30%) in sheep dewormed with effective antihementhic drugs and higher in non-dewormed sheep groups (28.10%) and the difference was highly significant ($x2$=8.530; P=0.003) (Table 2).

Risk Factors for Ovine Fasciolosis: In the present survey, there was no significant difference in infection prevalence of fasciolosis among breeds (P>0.05). However, infection prevalence of fasciolosis was found to be associated with the types of grazing place (P<0.05). Infection prevalence was 3 times higher in sheep that graze near the irrigation canal than those graze far way from irrigation canals and both areas (AOR=3.23, p=0.01) (Table 3).

DISCUSSION

In this study, the overall prevalence of ovine fasciolosis in Alamata town area and Waja-Tumuga sub-districts in the dry season was 24.2% which was greater than that reported by Ahmed *et al*. [8] from the Middle Awash River Basin (13.2%) but, it was less than that reported by Michael *et al*. [7] in upper Awash River basin (56.3%), Molalegne *et al*. [17] around Dawa cheffa kemissie (49%) and Edris *et al*. [18] in Middle Awash River Basin (54.2%). The variation of this infection in these areas might be due to the variation in agro-ecological condition, geographical variation, number of study samples and climatic conditions of the areas [11]. In contrast to most studies, which were carried out in year round, the current study was carried out in dry season which might be the reason for the low prevalence of fasciolosis. Lugarno and Dominic [4] also reported the

Table 2: Prevalence of ovine fasciolosis based on sex, age, body condition, deworming and reproductive condition of the sheep groups in Waja-Tumuga and Alamata town sub-district in 2011.

Factors		No. examined	Positive (%)	$x2$	P-value
Sex	Male	212	50 (23.6%)	0.07	0.783
	Female	288	71 (24.7%)		
Age	<1	104	21 (20.20%)		
	1-2	147	26 (17.70%)	9.621	0.022
	2-3	146	7 (32.20%)		
	>3	103	27 (26.20%)		
Reproduction	Nursing	108	29 (26.90%)		
	Pregnant	110	30 (27.30%)	1.734	0.242
	Neither	282	62 (22%)		
Body condition	Poor	154	82 (53.20%)		
	Medium	174	31 (17.80%)	1.10	0.000
	Good	172	8 (4.70%)		
Treatment	Dewormed	166	27 (16.30%)	8.53	0.003
	Non-dewormed	334	94 (28.10%)		

Table 3: Logistic regression analysis (COR) for risk factors of ovine fasciolosis in Waja-Tumuga and Alamata town sub-district, in 2011

Factors		No. observed.	Positive (%)	COR (95%CI)	P-value
Breed	Sekota	319	74 (23.2%)	0.90 (-0.155-0.822)	0.685
	Afar	77	20(26.0%)	0.93(-0.592-0.389)	0.772
	Wollo	94	24(25.5%)	0.93(-0.574-0.418)	0.758
	Semien	4	1(25%)	0.92(-0.729-0.563)	0.8
	Tikur	3	1(33.33%)	0.85(-0.691-0.691)	1
	Woshera	3	1(33.33%)	1	1
Grazing place	Near water	216	79(36.6%)	1.13 (0.027-0.218)	0.003
	Far	177	16(9.04%)	1.11 (-0.252-0.053)	0.012
	Both	107	26(24.3%)	1	1

association of infection prevalence of fasciolosis and climate conditions particularly with rainfall differences. For this reason, prevalence of fasciolosis in wet season is greater than the dry season due to the creation of favorable condition for the development of the snail intermediate host [8]. However, Erich [19] suggested that adult fluke infections in Ethiopian sheep commonly found during the wet season, but they found in pastures during the dry season. Yilma and Malone [5] also reported that the losses of fasciolosis during dry season in the tropics were relatively severe as the pathologic consequences were further aggravated due to sub-optimal nutrition. Additionally, animals tend to graze along the river banks and sides of irrigation canals could easily dispose to fasciolosis in dry season [7].

The finding of this study revealed higher infection prevalence of fasciolosis in Waja-Tumuga than Alamata town area. This finding was in agreement with the previous report of [7]. The main reason for this variation was explained by the presence of irrigation canal in this sub-district. In arid and semi-arid climatic condition, irrigation canal provide a suitable condition for snail intermediate host, life cycle progression and increase the *Fasciola* parasite infection risk in dry season [7, 20]. Njau & Scholtens [21] also reported that sheep frequently grazed around the irrigation canal or water logs were at high risk of ovine fasciolosis infection in dry seasons, because it facilitated the suitable condition for the snail intermediate host's development.

Even in the irrigated areas, the prevalence of ovine fasciolosis was high in sheep grazed frequently near the water canal than which grazed far from water canals which agreed with reports of Michael *et al*. [7] in upper Awash River basin. This might be due to frequent exposure of these sheep to metacercariae of *Fasciola* species. *L. truncatula,* the appropriate host for *F. hepatica* prefers a wet and mud area contains permanent free water for its survival and to release metacercaria in such area. Thus, the exposure of sheep to encysted metacercariae that resided in the wet environment was the major associate factor for fasciolosis [22].

In the current study, the prevalence of fasciolosis was not sex dependent. Both sexes were equally at risk of infection and sex had no effect on the prevalence of fasciolosis which was in agreement with the study carried out previously in different parts of Ethiopia [7, 8, 23]. This might be again due to the equal chances to be exposed to the metacercaria in this season. Lughano and Dominic [4] explained that male and female animals run together throughout the year for mating/ breeding and feeding and there was equal chance of parasitic infection among sex differences.

Higher infection of fasciolosis was observed in sheep with ages greater than two years old than the younger age groups (<2 years) in agreement with observation of other workers Michael *et al.*[7] and Ahmed *et al.* [8]and Molalegne *et al.* [23]. This could be due to the presence of high maternal immunity in young age groups of sheep than adult age groups. Josef *et al*. [24] and Pralomkarn *et al.* [28] reported that the level of immunity, age, nutrition, concurrent infection and genetic effects of the host were important factors for resistance of fasciolosis infection. On the other hand, Molalegne *et al*. [23] reported that young animals could not go far with adult for grazing/ feeding, so the possibility of being infected by fasciolosis was lower than adults.

In the present study, the overall fecundity based information (nursing, pregnant and neither pregnant nor nursing of sheep) did not show influence on the infection of ovine fasciolosis and all were equally at risk of infection. This might be due to grazing of all of these sheep groups only around irrigation canal throughout the dry season. Sylvie *et al*. [26] described that prevalence of fasciolosis was based on the fecundity condition of definite host but, environmental effect and individual host resistance against the parasite were

another factors. As a result, prevalence of fasciolosis did not necessarily depend on the fecundity condition of sheep but on the environmental condition.

The current study confirmed that the infection prevalence of ovine fasciolosis was dependent on body condition of sheep. This finding was in agreement with other reports [7, 23]. Sheep with poor body condition were at higher risk of infection than those with good body condition. This might be due to less resistance ability of sheep with poor body condition against *Fasciola* infection. Lughano and Dominic [4] reported that animals with poor body condition were vulnerable to parasitic diseases, because the resistance ability of sheep with poor body condition was lower than those had good body condition. Moreover, anemic sheep had less resistance to fasciolosis infection and their resistance ability was based on the body [16]. Behm and Sangster [27] also demonstrated that decreasing of live weight, loss of appetite, poor utilization of food and weekly growth rates were associated with the increase of fluke burden in the body of sheep. For this reason, *Fasciola* itself could lead to the severe damage of sheep's body condition.

In contrast to the previous reports [7, 18, 28], breed difference had no much effect on the prevalence of ovine fasciolosis in this study. This might be due to the similarity in grazing pastureland and the vulnerability of all breeds to *Fasciola* infection. Basically, these entire sheep breeds were native to semi-arid area of northern region [14]. In this region, irrigation based practice was a common activity [29] and such area was favorable for fasciolosis prevalence [7]. Ahmed *et al.* [8] reported that the infection of fasciolosis was dependent on breed difference but in Ethiopia since sheep were being reared under extensive condition; the resistances ability of all sheep breeds against fasciolosis had no more difference. This indicated that the infection prevalence of fasciolosis did not necessarily depend on the breed difference.

Evaluation of infection prevalence in dewormed and non-dewormed sheep revealed that the non-dewormed sheep were found to be more susceptible to fasciolosis than dewormed sheep. Similar finding were also reported by Molalegne *et al*. [23]. This might be due to the reduction of worm burden by effective anthelmintics drugs in dewarmed sheep. However, re-infection was observed among dewormed sheep groups due to presence of irrigation canal in this study area. That is why the small percent of dewormed sheep still remain positive to *Fasciola* infection. Treatment of sheep live around irrigation area is recommendable two times yearly, that is, during dry season and wet season which depends on the holder situation in tropical counties Yilma and Malone [5]. In addition to presence of irrigation canal, treatment of these animals by ineffective drugs at inappropriate time, inappropriate storage of drugs, frequently grazing with infected sheep and resistance ability of the parasite to drugs treatment through the veterinarian long term usage cannot completely control the parasite infection [23, 30].

From the findings of the present study, the prevalence of ovine fasciolosis was high in young age groups (>2 years old), poor body condition, non-dewormed sheep and sheep frequently graze near the irrigation canal. On the other hand, the infection prevalence was very similar in all sexes, breeds and different reproductive condition. Generally, the risk factors for the prevalence of ovine fasciolosis in this study area were the presence of irrigation canal, age difference, grazing place which further depends on this irrigation canal and prevalence of *Lymnae* species of snail intermediate host. Thus, to increase the resistance of small ruminants against fasciolosis, periodic deworming campaign by effective anthelmintics drug at appropriate time is necessary for all sheep. Particularly, this effective and periodic treatment is very essential for those are greater than 2 years old. The use of molluscicide and biological control methods to eradicate snail intermediate host in this irrigation area are also the best alternatives to control fasciolosis.

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