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Epidemiology of Small Ruminant Fasciolosis in Arid Areas of Lower Awash River Basin, Afar Region, Ethiopia

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Abstract: Across sectional study was conducted from December 2014 to February 2015 to determine the prevalence of Fasciolosis and associated risk factors of small ruminant in selected districts of Lower Awash River Basin. A total of 295 faecal samples were collected from (166 goat and 129 sheep), kept under pastoral and agro-pastoral area. Out of the total 295 faecal samples examined 32.5% (259) were found positive to Fasciola infection. The result revealed that significantly higher prevalence of Fasciola infection was observed in goats 37.9% (63) than sheep 25.6% (33). The risk of Fasciolosis in goats were 0.477 times higher than sheep (OR=0.477, p<.048). Animals with poor body condition had higher (44.5%) prevalence than animals with good body condition (13.3%). Significantly (OR=3.513, p<0.001) higher prevalence of disease was observed in animals managed under agro-pastoral production system than those kept in pastoral production. Like wise significant variation in prevalence was observed between the flocks contain both species of animal and contain only sheep or goat (OR=0.354, p<0.036). However, the prevalence of Fasciola infection was not significantly different between male and female animals. In the study area animal nutrition and social awareness on the importance of Fasciola infection is generally poor; low productivity in small ruminants is likely to be aggravated by a high prevalence of Fasciola. Hence, urgent and organized control strategies should be designed and implemented as milk of small ruminant is main source of food for pastoralists.

Keywords: Fasciola, Small Ruminants, Prevalence, Lower Awash, Afar

1. Introduction

Livestock production performs several functions primarily as source of household incomes, food and animal drought power for livestock producers (UNECA, 2012). It has been estimated that small ruminants provide up to 30% of the meat and 15% of the milk supplies in sub-Saharan Africa where thrive in the wide range of ecological regions which are too harsh for the beneficial rearing of cattle (Piedrafita et al., 2010). Small ruminants have also been reported to survive better under drought conditions than cattle due to their low body mass and low metabolic requirements which in turn minimize their water requirements and maintenance needed in arid and semi-arid areas. In spite of the large population and potential use of small ruminants in pastoral area, the production system is affected by feed shortage, poor genetic make up of the animals, and wide spread occurrence of livestock diseases such as endoparasites which have great economic significance to the communities and the country as a whole (UNECA 2012).

Ethiopian livestock production systems are broadly characterized as low input, mixed crop-livestock, agro-pastoral and pastoral systems; as well as medium input, peri-urban and urban enterprises (Sissay, 2007). Small ruminants represent the most important part of the Ethiopian livestock system, about 24.2 million sheep and 22.6 million of goats reported in the country (CSA, 2012). In pastoralist area, small ruminants are mainly utilized for milk and meat

production and generate income to the owner.

Fasciolosis is an economically important disease of domestic livestock in particular ruminants. It is a trematode infection caused by the two major species of Fasciola: Fasciola hepatica and Fasciola gigantica. Recently worldwide losses in animal productivity due to Fasciolosis were conservatively estimated at over US 3.2 billion per annum (Mas-Coma *et al.,* 2005). The prevalence of Fasciolosis in many parts of Africa has been determined mainly at slaughter. However, estimation of economic loss due to Fasciolosis at national or regional level is limited by lack of accurate estimation of the prevalence of disease. In addition Fasciolosis is now recognized as an emerging human disease. Fasciola species are one of the most important zoonotic diseases with a global economic impact in livestock production systems and a poorly defined but direct effect on human health (Piedrafita et al., 2010). The WHO has estimated that 2.4 million people are infected with Fasciola and 180 million are at risk of infection.

Small ruminant Fasciolosis in highland part of Ethiopia were studied by different researchers with the prevalence ranging from 11%-100%. In this area of the country Fasciolosis is very frequent and causes a significant economic loss either in production or productivity (Chanie and Begashaw 2012; Rahmeto *et al*., 2010; Abunna *et al*., 2010; Jibat et al., 2008; Daniel, 1995). However, this important disease was usually overlooked not addressed and not assessed all over pastoral area of Lower Awash Rift Valley Afar. According to Yilma and Malone (1998) Irrigation would have major effects on transmission of Fasciolosis and in the study areas pastoralist also engaged on cultivation of plant by irrigation. Therefore, the objectives of this study were; (i) to investigate the current status of small ruminant Fasciolosis and determine associated risk factors in selected areas. (ii) to assess awareness of the pastoralist on the importance of small ruminant Fasciolosis in the study area.

2. Material and Methods

2.1. Study Area and Population

Investigation of Fasciolosis infections was carried out in two districts (Assayita and Dubti) of Lower Awash River Basin in Afar National Regional Sate. The Afar National Regional State is located in the Great Rift Valley, comprising range land in Northeast Ethiopia with an estimated area of 95,958 Km^2. The Region is located between 39°34*'* and 42°28*'* E longitude and 8°49*'* and 14°30*'* N latitude. In the Afar Region, there are about 4.268,000 goats and 2.464,000 sheep, 2,420,488 heads of cattle, 903,630 camels and 193,317 equines which are managed under pastoral and agro-pastoral production system. The annual temperature and rainfall in the region is 30-50℃ and 200-600 mm, respectively. The altitude of the region ranges from 116 meter below sea level to 1600 meters above sea level (ANRS, 2010).

Asayita district is located in between 11°34*'* N and 41°26*'* E. The annual temperature and rainfall in the district is 28-41.7℃ and 144 mm annual precipitation, respectively. Asayita district located at an elevation of 340 meter above sea level (ANSR, 2010). In Asayita district there are about 97,013 goats, 17,198 sheep, 81,767 heads of cattle, 6108 camels and 3303 equines which are managed under pastoral and agro-pastoral production system. Dubti district contained about 49,234 goats, 24,363 sheep, 39,412 heads of cattle, 7241 camels and 2295 equines which are managed under pastoral and agro-pastoral production system. The production system in the area pre dominantly is pastoralism and agro-pastoralism (ANRS, 2010).

2.2. Sampling Method and Sample Size Determination

Across sectional study was employed from December 2014 to February 2015 to address the objectives of the study. The sampling method was supposed to be a multi-stage cluster sampling approach. However, due to the absence of between cluster variance and sampling frame in the study districts and pastoral community as a whole, unwillingness of pastoralists to include their animals in this study and conflict among pastoralists therefore, the flocks of small ruminants were sampled purposively. However, proportional allocation was used to distribute the individual sampled small ruminants evenly among the flock. Consequently, 5 to 10 individual animal from each small ruminants flock were sampled. Zone one was purposively selected based on the small ruminant population, ecology and accessibility to vehicle. The primary stage was sampling of districts from the selected zone. Selection of kebeles/PAs, flock and individual small ruminant within the flock were the 2^{nd}, 3^{rd} and 4^{th} stages, respectively. Accordingly, two districts and four kebeles/PAs from each district, proportional flocks from each Kebeles and 5 to 10 small ruminants from each flock was sampled. Therefore, total of 295 small ruminants (129 sheep and 166 goats) were included in this study. Each kebeles/PAs and individual animals from the flock sampled randomly. For questionnaire survey all owners (pastoralists) from which sample unit taken were included in the study.

2.3. Sample Collection and Laboratory Examination

Fresh fecal samples approximately 10g were collected directly from the rectum of 295 small ruminant, samples placed in labeled sampling bottles and then after the collected samples were transported to laboratory for analysis. Following transportation of fecal sample laboratory analysis was carried out at the same day and the remaining samples were kept under 4°C and examined up on the next days. Coproscopic examinations were performed to detect Fasciola eggs using the standard sedimentation technique (Soulsby 1982, Hansen and Perry 1994). To differentiate between eggs of Paramphistomum species and Fasciola species, a drop of methylene blue solution was added to the sediment. Eggs of Fasciola species show yellowish brown with an indistinct operculum and embryonic cells, while eggs of

Paramphistomum species is large and show transparent egg shell with distinct operculum and clear embryonic cells (Michael 2004).

2.4. Data Analysis

Data was recorded and entered to Microsoft Excel sheet and analyzed by using SPSS version 20. Chi square test and logistic regression were implemented to test the association between Fasciolosis and various risk factors (species, age, sex, body condition, production system and management).

3. Results

3.1. Questionnaire Study Outputs

A questionnaire was prepared in an attempt to obtain the general information on livestock ownership patterns, importance of small ruminant rearing, awareness about impact of Fasciolosis on production and productivity and the control practices implemented in the area. Response on livestock ownership pattern indicates that in both areas small ruminants mainly goat is the major species of animal kept by pastoralists for various reasons. The major reasons for keeping small ruminants were 57/57 (100%) for milk consumption at home as priority number one, priority number two were income generation and insurance 53/57 (92.9%); 42/57 (73.7%) were kept small ruminants for meat consumption at home priority number three; 27/57 (47.4%) of pastoralists kept small ruminants for skin as priority number four. According to the respondents (100%) manage small ruminants separately from other species of animal around their vicinity.

From the total 57 pastoralists interviewed only 8/57 (14%) respondents knew Fasciolosis. However, only 3/57 (5.3%) of respondents recognize the impact of Fasciolosis on animal production and productivities; among the major impacts mentioned by the pastoralist weight loss, death and reduction of milk yield were the principal one. All of the respondents those knew Fasciolosis replied there were no age difference on the occurrence of Fasciolosis it affects both adult and young. In general 57/57 (100%) of respondents were have no idea about the transmission of disease and ecological impact on disease occurrence.

None of the pastoralists used modern treatment to control Fasciolosis as availability of modern veterinary service delivery is limited and their knowledge on modern veterinary importance is less (Figure 1).

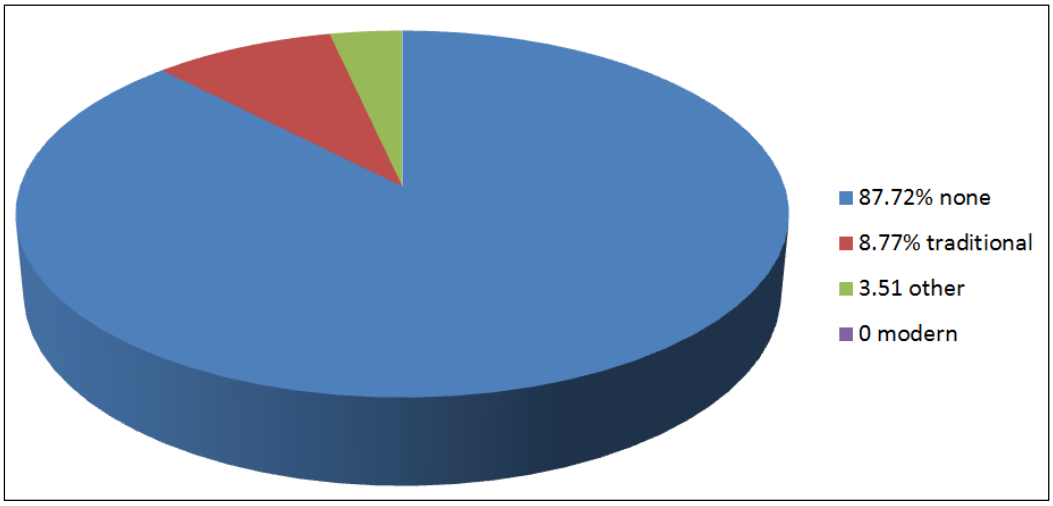

Figure 1. *Proportions of respondent treatment method prefer to treat Fasciolosis in the study area.*

3.2. Results of Laboratory Findings

Coprological examinations revealed out of 295 small ruminant examined 96 (32.5%) were found to be positive for Fasciolosis. The specific prevalence of Fasciolosis in the study area was 37.9% in goat and 25.6% in sheep (Table 1).

3.3. Production System and Management Based Prevalence

The prevalence of Fasciolosis was 38.5% and 30.4% in small ruminants reared under agro-pastoral and pastoral production system respectively. Significance difference in prevalence of Fasciola infection (OR=3.513, P<0.001) was observed between animals reared in agro-pastoral and pastoral area of the study (Table 1). The prevalence is significantly higher in the small ruminants kept under agro-pastoral production system. Like wise the prevalence of Fasciolosis was 38.1%, 25.9% and 24.7% in flock contain both sheep and goat, flock contains sheep only and flock contain goat only respectively. Statistically significance difference in prevalence of Fasciolosis was recorded among the flock contain both species and flock contain only each species separately (OR=0.354, P<0.036) higher prevalence was recorded in flock contain both sheep and goat.

3.4. Species Wise Prevalence

The prevalence of Fasciolosis in goat and sheep of the study area was 37.9% and 25.6% respectively. Statistically significant variation in the prevalence of Fasciola infection was recorded between goat and sheep of the study area

(OR=0.477, p<0.048) higher in goat than sheep of the study area (Table 1).

3.5. Sex Wise Prevalence

Fasciolosis prevalence in female and male small ruminants of the study area was 32.8% and 32.1% respectively. Statistically significant variation in the prevalence of parasites was never recoded between male and female small ruminants of the study area (p>0.05) (Table 1).

3.6. Age Wise Prevalence

The prevalence of Fasciolosis in young and adult animals of the study area was 24.3% and 37.5% respectively. Significantly higher prevalence of Fasciolosis was recorded in adult animals than young animals (OR=0.490; p<0.031) (Table 1).

3.7. Body Condition Based Prevalence

The prevalence of Fasciola infection in good and poor body condition animals was 13.3% and 44.5% respectively. Statistically significant difference in the prevalence of small ruminant Fasciolosis was recorded (OR=8.483; p<0.000), higher in poor body condition animal than good body condition animals (Table 1).

Table 1. *Summary of statistical results of small ruminant Fasciolosis in the study area.*

Category	Variables	Examined animals	No of positive	%	P-value	OR	95% of CI for OR	
							Lower	Upper
Age	Adult	184	69	37.5	0.031	0.490	0.256	0.938
	Young	111	27	24.3				
Sex	Female	186	61	32.8	0.059	1.940	1.002	3.758
	Male	109	35	32.1				
Species	Goat	166	63	37.9	0.048	0.477	0.229	0.954
	Sheep	129	33	25.6				
Production system	Pastoral	217	66	30.4	0.001	3.513	1.713	7.206
	Agro-pastoral	78	30	38.5				
Management	Goat only	73	18	24.7	0.036	0.354	0.160	0.781
	Sheep only	54	14	25.9				
	Both	168	64	38.1				
Body condition	Good	113	15	13.3	0.000	8.483	.3.934	18.294
	Poor	182	81	44.5				
Total		295	96	32.5				

4. Discussion

Results presented in this study revealed overall prevalence of Fasciolosis is 32.5%. The prevalence of Fasciolosis of the current study is inline with other reports from different parts of Ethiopia (Sirajudin et al., 2012; Manyazewal et al., 2013; Rubina et al., 2014). However, the current study result was much higher than the studies reported from different area (Adem, 1994; Daniel, 1995; Wassie, 1995; Michael 2004; Ahmed et al., 2007; Henok and Mekonnen, 2011; Abel et al., 2015) but it was lower than the finding in Ghana (Futagbi et al., 2015). The variation in prevalence might be due to the differences in temperature, moisture, humidity and also soil that might favor multiplication of intermediate snails host (Urquhart et al, 1994). Also the difference in prevalence and severity of the disease syndrome are evidence in various geographic regions depending on the local climatic condition, availability of permanent water (marshy area) and managemental practice of the area and agricultural irrigation practices. Irrigation based agricultural practice and the swampy areas are important ecologies for the continuity of the life cycle of Fasciolosis (Graber, 1975; Michael et al, 2005; Solomon, 2005).

The overall prevalence of Fasciolosis was significantly higher in caprine than ovine of the study area (P=0.048). Goats of the study area were 0.477 times at risk for the diseases than sheep. The current finding is in agreement with works of different researchers (Ahmed et al., 2005; Rubina et al., 2014). However, this finding is in contrary with other findings revealed Fasciolosis is higher in ovine than caprine (Michael, 2004; Dagnachew et al., 2011; Henok and Mekonnen, 2011; Yehualashet et al., 2013; Abel et al., 2015). Even though sheep and goats differ in their feeding habits, small ruminants are kept together on confined grazing land which may expose goats to acquire more susceptibility for Fasciolosis (Radostits et al., 2006). In consequence, the condition could be due to less or slow development of immunity in goats to the disease compared with the situation in sheep. Goats do not build up an effective immune response against helminth infections and so remain susceptible to disease throughout their lives. Sheep faced prolonged challenge over generations and had developed good resistance (Urquhart et al., 1996). The risk is enhanced if goats are forced to graze rather than browse (Urquhart et al., 1996; Radostits et al., 2006). Hence, in the study area recurrent drought occurred repeatedly and goats of the study area forced to graze as the bush become dry during this time and pastoralist provide their animals with grass collected from the irrigation channel as soon as they collect at dry

season. Therefore, metacercariae encysted on the grass may get the access to be ingested by the goats. In addition pastoralists of the study area own different species of animals, and these animals share common watering points and grazing sites. The watering points of small ruminants are commonly shared with cattle and camel creating a close interspecies interaction among these domestic animals, and this might increases the risk of transmission of parasites which infect multiple species.

Age wise prevalence revealed a higher prevalence of Fasciolosis in adult animal than young one. This finding disagrees with most literatures that young animals are more susceptible to Fasciola infection than adult animals. However, agrees with reports from different parts (Ahmed et al., 2007; Henok and Mekonnen, 2011; Abel et al., 2015). This could be due to the fact that young animals are not allowed to go far with the adult animals for grazing. Therefore, the risk of exposure for infective metacercariae is reduced in young animals when compared to adults. In addition, in this study we ascribed the higher prevalence in adult might be due to the small number of young animals included in the study as the pastoralist interested to sale young animals since the society use small ruminant milk as a source of food for the household and if keep young they may not fulfill their necessity of using milk.

In this study a higher prevalence of Fasciola infection was recorded in poor body condition animals than good body condition animals. In the present study, the prevalence of Fasciolosis was 8.483 times higher in animals with poor body condition compared to those with good body condition score. This finding agrees with (Henok and Mekonnen, 2011; Sirajudin et al., 2012; Abel et al., 2015) indicated that animals with poor condition are highly susceptible to infection and may be clinically affected by worm burdens too small to harm an otherwise well-fed healthy animal. Moreover, this might be due to the fact that Fasciolosis cause weight loss and emaciation and/or shoats with poor body conditions are more susceptible to the parasite (Ahmed et al., 2005).

Higher prevalence of Fasciolosis was recorded in animals managed in agro-pastoral area than those managed in pastoral parts of the study area is attributable to the availability of irrigation channel and also the pastoralist provided grass collected from the channel as soon as collected therefore, the probability of infected by metacercariae is high. According to Yilma and Malone (1998) irrigation would have major effects on transmission of Fasciolosis. Consequently, irrigation based agricultural practice and the swampy areas are important ecologies for the continuity of the life cycle of Fasciolosis (Graber, 1975; Michael et al, 2005; Solomon, 2005). Likewise Fasciolosis was higher in areas were goats and sheep kept together than separately. Completion of life cycle eventually depends on how successfully the parasite can overcome complex interactions continually present in the environment and host. Fasciolosis is most common and widespread disease affecting all species of ruminant livestock (Radiostits et al., 2006). Therefore, keeping ovine and caprine together may favour for circulation of the disease in the flock as the parasite infect all ruminants.

5. Conclusion

The current study revealed that Fasciolosis was wide spread in small ruminants of pastoral and agro-pastoral parts of the study areas. The prevalence was significantly influenced by age, species, production system, and management system and body condition score of the small ruminants. In the study area pastoralists own different species of domestic animals, and these animals share common watering points and grazing pasture which creating a close interspecies interaction among these domestic animals, and this might increases the risk of transmission of Fasciola infection. In addition shortage of feed source in the study area special during prolonged drought magnified the occurrence and prevalence of Fasciola infection. Pastoralists of the study area are at risk of economic losses from decreased productivity of their animals as a majority of them have no idea about the impact of Fasciola infection. Thus, Fasciola infection should considered among diseases responsible for health and productivity problems in small ruminant. Detailed study on the economic and public health implications of Fasciola infection, molecular typing of Fasciola species circulating in the area and initiation of suitable control programs are recommended. Similarly strengthen awareness of the pastoralists on the importance, transmission way of disease, influence of ecology on disease occurrence and usage of modern treatment for Fasciola infection.

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