The Prevalence and Associated Risk Factors of Ovine Fasciollosis, Northwest Ethiopia.

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Abstract: A cross sectional study was conducted to assess the prevalence and associated risk factors of fasciollosis in Ovine in three randomly selected areas (Adissalem, Dagi and Merawi) of Mecha district, north west Ethiopia. A total 384 sheep were examined for the presence of *Fasciola* eggs by coproscopical examination. Fifty two questionnaires were also administered. The eggs were examined using standard fecal sedimentation technique. The overall prevalence was 28.9%. The Prevalence rates were 7.3% in young and 21.6% in adult sheep. The site related Prevalence rates were; 19.8%, 7.3% and 1.8% in Adissalem, Dagi and Merawi, respectively. Furthermore, prevalence rate was seasonally varied; it was 15.1%, 2.9%, 5.2% and 5.7% in November, December, January and February, respectively during the study period. The study indicated as there is very significant statistical deference among; Age group, feeding point, districts and season (P = 0.00, 0.002, 0.00 and 0.000) respectively in the occurrences of *Fasciola*. The questionnaire survey revealed that snail is dominant in the study area. Thirty (57.7%) of the farmers indicated that fasciolosis was prevalent during the wet seasons of the year. The epidemiology of fasciolosis is affected with different animal and environmental factors Therefore, further studies on the epidemiology, seasonal dynamic of the disease, the snail and impacts of the disease in animal production need to be conducted.

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1. Introduction

Agriculture is the ministry of the Ethiopian economy. It employs over 80% of the adult population and accounts for 45% of the GDP and 85% the export earnings (Asfaw, 1997). Livestock production is one of agricultural branch which constitutes the principal means of achieving improved living standards in many regions of the developing world. In Sub-Saharan African countries, livestock plays a crucial role both in national economies and the livelihood of rural communities. In Ethiopia, livestock shares agricultural output of about 40% from which small ruminants constitute about 30% of the total livestock population and they are important contributors to food production providing 35% of meat consumption and 14% milk consumption (Asfaw, 1997). In central high lands of Ethiopia where mixed crop livestock production system is practiced, small ruminants account for 40% of cash income and 19% of the household meat consumption (Fletcher and Zelalem, 1991).

Ethiopia has a large livestock population in Africa, which is estimated to be around 34-40 million TLU (Tropical livestock unit) out of which 17% and 12% are cattle and small ruminants, respectively, (FAO, 1993). Sheep are the dominant livestock, providing up to 63% of cash income and 23% of the food subsistence value obtained from livestock production (Zelalem and Fletcher, 1993). The sheep population of the country is estimated to be 25.5 million (CSA, 2004) and 18,075,580 sheep (CSA, 2009). In Amhara region the small ruminant population is estimated to be 5,320,330 million sheep and 3,815,859 million goats (CACC, 2003) which represent 24.6% and 22.1% of the national sheep and goat population, respectively.

Production of sheep for meat, milk, wool, hair, skin, and manure is an attractive agricultural enterprise for Ethiopian farmers because of the relatively low cost of breeding stock, the high productive rate of sheep and the source of cash income, small initial capital, fewer resources and maintenance cost. Furthermore, their production cycle need only short periods to reconstitute flocks after disaster and respond quickly to the demand. Sheep require minimal inputs and maintenance costs to live in various conditions, from desert to humid rainforest (Gatenby, 1991). Despite the large size of the sheep population, the productivity per animal and the contribution of this sub-sector to the national economy is relatively low due to endo-parasitic infections, malnutrition, and management problems. The various species of gastrointestinal and pulmonary

nematodes, trematodes, and cestodes are known to be prevalent in Ethiopia (Radostitis, *et al.,* 1994).

It is evident that water resources can play a significant role in improving food security and household income (Encarta enclyopedia, 2001). Agricultural production that depends on rain is mostly aimed at self-provision and this kind of production system is severely affected by climatic irregularities. An effective method to reduce vulnerability of climatic irregularities is to use irrigation for the agricultural production (Rahmato, 1999). Wrongly planned irrigation, however, impedes production and results in wasted effort by favoring the incidence and spread of common waterborne animal and human diseases such as fasciolosis, schistosomosis, paraphistomosis and malaria (Traore, 1989; Encarta enclyopedia, 2001) because irrigation projects are expected to bring about changes in land use patterns, and intensification of labor (Rahmato, 1999). The increasing number of dams and irrigation canals built to boost energy and food production will also increases the number of potential snail habitats and with them the risk and incidence of fasciolosis (Traore, 1989). On the other hand, a reliable water supply suitable for irrigation, coupled with the necessary input, can boost agricultural production and ensure self-sufficiency.

Globally, many countries are dependent on irrigated agriculture to produce food for consumption and cash crops to enhance the food security of their people and to generate income. Also, irrigation is the most common means of ensuring sustainable agriculture and coping with periods of inadequate rainfall and drought (Rahmato, 1999).

The epidemiology of major veterinary important termatodes under the family fasciolidae, paraphistosomidae, and schistomatidae depend on water as medium for infection of both the intermediate host and final host (Urquhart *et al.,* 1996). In and around marsh areas where there is availability of water, the larval stage development of digenetic trematodes increase forming suitable environment for intermediate host, snails (Dalton, 1999). Fasciolosis, a parasitic disease of sheep and cattle is caused by the ingestion of metacercariae of *Fasciola hepatica* or *Fasciola gigantica* which are common in water logged areas (DACA, 2006) and one the major parasitic diseases that inflict an enormous loss to sheep production. The resulting losses in productivity are substantial and highly relevant for the individual farmers and the economy of the country as a whole in addition to direct economic losses. Several helminthes also transmitted to humans and pose major health threats. The disease has greater impact on animal health in terms of the number of animal infected, morbidity and mortality (Urquhart *et al.,* 1996).

Generally, the distribution of fasciolosis is worldwide. However, the distribution of *F. hepatica* is limited to temperate areas and high land of tropical and sub-tropical regions. The definitive hosts for *F. hepatica* are most mammals among which sheep are the most important once. The geographical distribution of this trematode species is dependent on the distribution of suitable species of snails: The genus *Lymmnaea* in general and *Lymmnaea truncatula* in particular is the most common intermediate hosts (IH) for *F. hepatica.* The species of snail was reported to have a worldwide distribution (Urquhart *et al.,* 1996).

The presence of fasciolosis due to *F. hepatica* and *F. gigantica* in Ethiopia has long been known and its prevalence and economic significance has been reported by several studies and reported variable prevalence of ovine Fasciolosis. Bitew *et al* (2010), Ahmed *et al* (2007) and Michael *et al* (2005) have reported prevalence rates of 49%, 13.2% and 57.3% in sheep, respectively in different places of Ethiopia and Amhara Region.

In Ethiopia, the annual losses due to ovine fasciolosis were estimated at 48.4 million Ethiopian Birr per year, of which 46.5, 48.8, and 4.7% were due to mortality, productivity (weight loss and reproductive wastage), and liver condemnation at slaughter, respectively (Bitew *et al* 2010). But studies on the prevalence of Fasciolosis in sheep were not so far conducted in Mecha District of Amhara Regional State and it was the rationale that initiated this study. Therefore, the objectives of this study were: To determine the prevalence of ovine fasciolosis in the study area, and to assess major risk factors associated with the disease.

2. Material and Methods

Description of study area

The study was conducted from November, 2011 to April, 2012 on different kebeles of Mecha district including Adissalem, Dagi and Merawi with different management system Mecha wereda in Western Amahra. Mecha district is one of the 106 woredas of Amhara Regional State and found in West Gojjam zone. It is situated at 11'99" N latitude 37'29" E longitude. Merawi, the capital city of Mecha woreda, is found 536 km from Addis Ababa and 34 km from the regional capital, Bahir Dar. Mecha woreda is divided in ten rural kebeles. Farmers in this district practice mixed farming system (MWARD, 2010). According to Merawi agricultural branch veterinary clinic statics the area has a sheep population of 103,653 (MWARD, 2010).

Mecha wereda is classified as one of the 15 weredas of West Gojjam Zone and the surplus productive woredas in the region. The altitude ranges

from 1500-2500 meter above sea level. The mean annual rainfall varied from minimum of 1000 mm, medium of 1500 mm and a maximum of 2000 mm. The temperature also varies according to altitude and ranges from 24^0C to 27^0C (MWARD, 2010).

Study Animal

The study was conducted on indigenous sheep managed mainly under extensive system in the study area. The study population comprises of sheep at different age and sex category found under the extensive and semi intensive grazing system. According to the current document of Mecha wereda Agricultural and Rural Development Offices the population of the area comprises 103,653 (MWARD, 2010).

Sampling and Sample unit

Simple random sampling was used for sampling. The sample size was calculated using an expected prevalence of 50 % to make the sample size large. The desire sample size for the study was thus calculated using the formula given by (Thrusfield, 1995) with 95% confidential interval and 5% absolute precision, and the total sample calculated was 384.

$$n = \frac{1.96^2(P)(1-P)}{d^2}$$

where

n = sample size

P = expected prevalence

d = desired level of precision

Therefore, using 50% expected prevalence and 5% absolute precision at 95% confidence level; the number of animals needed in this study was calculated to be 384.

Study Design

A cross sectional survey was conducted by selecting 3 kebeles randomly, namely Adissalem, Dagi and Merawi in Mecsha destrict of Amhara Regional State. The sampling method used was simple random sampling to select the kebeles and individual sheep in the kebeles. Study was conducted to determine prevalence of Fasciolosis in sheep.

Methodology

Coproscopical Examination

A total of 384 fecal samples were collected from the three kebeles of Mecha wereda. Using plastic gloves, five grams of fresh fecal matter were collected directly from the rectum or during defecation. The samples were stored in universal bottle which contains 5 ml of 10% formalin in order to prevent hatching of meracidium, and then well labeled and placed in icebox until examined. Coproscopic examinations were performed to detect *Fasciola* eggs using the standard sedimentation technique (Annex 1). The sedimentation was done till the sediment of the fecal sample become clear and then the sediment were observed under law power microscope. Results were recorded in data recording format (Annex 2). The age of the animals was recorded by interviewing owners and cross-checked using dental formula (MAAFRMD, 1998). The study sites were randomly selected, the distribution of samples was the proportion of one herd per one study site.

Questionnaire survey

A comprehensive questionnaire format was prepared (Annex 4) and administered to willing sheep owners at veterinary clinic (Mecha district agriculture veterinary clinic) and selected site of town. This was to get additional information from farmers about the seasonality of disease, vectors intermediate host and management system (feeding and watering).

Data Analysis

All raw data generated from this study were coded and entered to Microsoft office excel data base system. The findings were analyzed using SPSS version-15 computer program; and data were analyzed to find percentage and Chi-squire (χ^2). P-value was determined for determination of the significance. Chi-square test was also used to determine the variation in infection, prevalence between sex, management history, study sites and age groups. Estimation of age based on teeth development was done (Annex 3). The total prevalence was calculated by dividing the number of disease positive animals by the total number of animals examined. Statistical significance was set at $P < 0.05$ to determine whether there are significant differences between the parameters measured be.

3. Results

Prevalence

Of the total 384 fecal samples examined, an overall prevalence of 28.9% was found positive for fasciolosis in the study area. The prevalence of fasciolosis is varied significantly among the three areas and the highest prevalence of fasciolosis i.e. 19.8% was recorded in Adissalem, followed by Dagi (7.3%) and Merawi (1.8%) as indicated in Table 1. Statistical analysis revealed that there was significant difference ($P < 0.05$) in infection between areas. Prevalence of fasciolosis in female and male animals was 23.2% and 5.7%, respectively and a significant difference ($P < 0.05$) was observed between sexes (Table 1).

Table 1: Prevalence of ovine fasciolosis as compared with sex and sites, Mecha, Ethiopia

Variables		No of sheep sampled	No of sheep positive	χ^2 (*P*-value)
Site	Adissalem	201	76 (19.80%)	23.40 (0.00)
	Dagi	104	28 (7.30%)	
	Merawi	79	7 (1.80%)	
Sex	Male	137	22 (5.70%)	17.11 (0.00)
	Female	247	89 (23.20%)	

Prevalence of fasciolosis in sheep greater than 2 years old also showed higher rate (21.6%) than those sheep with less than 2 years old (7.3%) (Table 2).

Table 2: Prevalence of ovine fasciolosis based on age, Mecha, Ethiopia.

Variables		No of sheep	No of sheep positive	χ^2 (*P*-value)
Age group	< 2 years	104	28 (7.3%)	0.273 (0.00)
	> 2 years	280	83 (21.6%)	
	Total	384	111 (28.9%)	

Prevalence of fasciolosis with respect to feeding and watering point of the animals was also determined and a prevalence rate of 27.9% was obtained in animals feeding at marshy area. Similar prevalence (27.9%) was calculated in animals watering from river, and prevalence rates of 1.0% were obtained in both home feeding and home watering cases. The result of statistical analysis revealed significant difference ($P < 0.05$) in each group (Table 3).

Table 3: Prevalence of ovine fasciolosis based on management history

Variables		No of sheep	No of sheep positive	χ^2 (*P*-value)
Feeding point	Home	46	4.00(1.0%)	10.39 (0.001)
	Marsh areas	338	107 (27.9%)	
	Total	384	111 (28.9%)	
Watering point	Home	46	4.00 (1.0%)	10.39 (0.002)
	River	338	107 (27.9%)	
	Total	384	111 (928.9)	

Higher seasonal prevalence (15.1%) of ovine fasciolosis in the study areas was found during the end of rainy season i.e. November followed by the hot and dry months February (5.7%), January (5.2 %) and December (2.9%) (Table 4). Therefore, the prevalence of the disease greatly varied between November and the other three months with $p<0.05$ showing significant statistical difference.

Table 4: Prevalence of ovine fasciolosis

Month	Sample	positive	χ^2 (*P*-value).
November	152	58 (15.1%)	27.8 (0.00)
December	28	11 (2.9%)	
January	57	20 (5.2%)	
February	147	22 (5.7%)	
Total	384	111 (28.9)	

Results of questionnaire survey

During the study period a semi structured questionnaire format was prepared to generate information from 85 owners regarding sheep production particularly on management practices and associated risk factors in different areas of Mecha district. However, only 52 farmers were willing to respond. Therefore, results of questioner survey were based on 52 respondents as described below.

The Most important disease mentioned by farmers affecting sheep were fasciolosis and haemonchosis which are locally called 'yegubet til' or kolkolo' and 'yanget eti', respectively. Haemochosis was the second most important disease mentioned in both young and mature sheep in the study areas. The highest prevalence in the area Yanget eti was with the highest prevalence in the area ($p<0.05$) (Table 5 and Annex 5).

Table 5: Major internal parasitic diseases

Local Name	No. of farmers	χ^2 (*P*-value)
Yegubet til	11 (21.2%)	
Yanget eti	19 (36.5%)	
Kolkolo	17 (32.7%)	52.0 (0.000)
No name	5 (9.6%)	
Total	52 (100%)	

About 21 (40.4%) farmers used traditional medicaments while 18 (34.6%) used modern medicine to treat sick animals. Slaughter was mentioned as a means to cull diseased animals by 10 (19.2%) farmers. The rest 3 (5.8%) farmers indicated that do not take any measurement to overcome the disease (Table 6). Of the total 52 farmers interviewed, 25 (48.1%), 15 (28.8%), 9 (17.3%) and 3 (5.8%) mentioned snail, tick, leach and flies respectively as important vectors in the study areas (Table 6). Disease also appear in wet season more than dry season $p<0.05$.

Table 6: Major measurements of disease control as indicated by farmers

Factors		Frequency	χ^2 (*P*-value)
Disease control Measurements	Traditional treatment	21 (40.4%)	69.30 (0.00)
	Modern treatment	18 (34.6%)	
	slaughter	10 (19.2%)	
	No response	3 (5.8)	
Vectors	Snail	25 (48.1%)	
	Leach	9 (17.3%)	
	Flies	3 (5.8%)	52.30 (0.00)
	Ticks	15 (28.8%)	
Season	Wet	30 (57.7%)	52.00 (0.00)
	Dry	22 (42.3%)	

Discussion

The present study was designed to determine prevalence and assess risk factors associated with ovine fasciolosis. Based on coproscopical investigation, an overall prevalence of 28.9% ovine fasciolosis was revealed. The current high overall prevalence of liver fluke in sheep is in agreement with reports of Mergard (1975) in Sudana (37%), Camerun (45%) and Kenya (33%); however, it is higher than the prevalence reported in Uganda (10%) by same author. This may be due to implementations of control strategies over the periods in the study areas and difference in ecology of animal's habitat. The variation in prevalence between the different locations was also likely due to the differences in landscape, agricultural irrigation practices and flooding (Urquhart *et al.,* 1994 and Michael *et al* (2005).

The result of the present study also revealed a higher prevalence (28.9%) of ovine fasciolosis than 13.2% reported by Ahmed *et al* (2007) in the Middle Awash River Basin. This difference may be attributed to various factors such as the distribution of the study period and other factors such as availability of suitable snail habitat (Urquhart *et al.,* 1996).

The current 28.9% prevalence of ovine fasciolosis in Mecha district is lower than 49% reported by Bitew *et al (*2010) at Dawa Chefa in the same region. This difference might be due to the difference in geographical location and the temperature.

The higher temperature of 12^0C - 33^0C at Dawa Cheffa is favorable to maintain the disease. The prevalence of the disease in the three different kebeles of the study areas were 19.8%, 7.3% and 1.8% in Adissalem, Dagi and Mrawi, respectively showing a statistical difference in the prevalence of the disease between these kebeles ($P < 0.05$). These kebeles are ecologically similar (MWARD, 2010). However, the higher prevalence in Adissalesm may be due to its near location to the Abay River basin which is permanently wet and water logged maintaining cyclic lifecycle of the parasite. Additionally, some farmers in Adissalem use micro irrigations from river basin and this may contribute to this high prevalence.

The prevalence of the disease in female and male animals was recorded as 23% and 5.7% (Table 1), respectively. There was significant difference ($P < 0.05$) between the two sexes indicating that sex seems to have effect on the prevalence of the disease. This may be due to the fact that separate grazing of sheep in different pastureland based on sex and regular

deworming of males by drenching Albendazole for fattening purpose is being practiced.

The present study indicated the existence of highly significant difference between age groups that agrees with reports of Ahmed *et al* (2007) which reported 8.1%, 10.9% and 14.1% in animals of age < 1year, 1-2 years and > 2 years, respectively. Similarly, Bitew *et al* (2010) reported prevalence of 56.4%, 50% and 29.3% in sheep of age > 3 years, 1-3 years and < 1 year, respectively. In general, the younger the age the lower the prevalence and the older the age the higher the prevalence and this could be due the maternal immunity acquired by young animals through colostrums.

In the current study a significant difference exists in management history ($P < 0.05$). Low prevalence (1%) of *F*asciolosis was obtained in sheep that feed and water at home. However, a high prevalence rate (27.9%) is calculated in the other two animal management methods (grazing on marshy area and watering at river). The low prevalence in animals kept at home for grazing and watering may be due to less exposure to contaminated grazing pasture and no stress for food searching. Also sheep under semi-intensive maintain good feeding habit and have high resistance. Home feeding and watering enhance good body condition and less disease susceptibility.

The seasons are locally classified as 'kiremt' (July-August) which is the long rainy season; 'tibi' (September -November) which is the short rainy and cool season; 'meher' (December-February) which is the hot dry season; and 'belg" (March–May) which is the short rainy season. The higher seasonal prevalence (15.2%) of ovine fasciolosis in the study areas was found during November whereas in the other months lower prevalence was observed (Table 4). This may be November is the end of *tibi* with short rainy and cool which favored the occurrence of disease while in the rest months the life cycle of the of the disease break.

The two diseases, fasciolosis and haemonchosis, mentioned as the most important parasitic diseases in sheep is agreement with the reports of Derib (2005) and Yilma, (2003). The importance of fasciolosis in sheep was also reported by Michael *et al* (2005).

The majority of the farmers 21 (40.4%) used traditional medicaments while 18 (34.6%) used modern medicine to treat infected with parasites. Slaughtering was mentioned as a means to cull diseased animals by 10 (19.2%) of the farmers. Of the 52 farmers interviewed 25 (48.1%) mentioned snail as dominant vector, and 15 (28.8%), 9 (17.3%), and 3(5.8%) of the farmers interviewed tick, leach and flies, respectively were mentioned as other vectors important in the area. Fasciolosis was mentioned by 30 (57.7%) of farmers as a serious health problem affecting sheep mostly in wet season whereas, 22 (42.3%) farmers mentioned as important sheep disease in the dry season. This could be related to the presence of favorable conditions for the vector during the wet season (Table 6).

Conclusion and Recommendations

The result of the present study indicated that fasciolosis is a highly prevalent sheep disease in the study area. In the present study various parameters including sex, age, study sites, feeding and watering points are significantly associated. The high prevalence found in the study area enlightens the risk of water lodgment from Abay tributary rivers which increased irrigated land masses and ponds at grazing areas and the tendency of farmers to graze their animals in these areas because of feed scarcity. In general, this study indicated that fasciolosis is an important helminthes infection to livestock development in the study area. Based on the above mentioned conclusion the following recommendations are forwarded: Modernization of traditional management practices through raising the awareness of livestock owners on the close follow up of their animals should be in place. Awareness creation on the preventive strategies such as drainage of marshy areas, clearing of aquatic vegetations and seasonal strategic deworming of animals should be practiced. Supplementation of important nutrient feed in dry season is important to avoid stress conditions that affect the host resistance and susceptibility to parasitic diseases. Training need to be organized to farmers on economic significance and control methods of this disease in the study area. Detail epidemiological study should be carried out on the major diseases prevalent in the area that would help the design of appropriate disease prevention and control strategies.

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