

Parasitological and Hematological Study on *Fasciola* spp. Infections in Local Breeds of Sheep in Middle Awash River Basin, Afar Region, Ethiopia

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ABSTRACT

The study was carried out at Gewane Agricultural Technical and Vocational Education Training Collage, Gewane district, Ethiopia. Two local breeds of sheep, Afar and Blackhead, were experimental animals. Twelve each of Afar and Blackhead sheep aged between 5-6 months were assigned and each breed was divided by sex into two groups of 6 animals. All sheep was naturally exposed to infection with *Fasciola* spp. for 5 months from contaminated pasture near the Awash River path. The animals were regularly monitored for any evidence of disease. It was found that the overall prevalence of *Fasciola* spp. infection was 54%. Prevalence of infection by breeds was 37.5% for Blackhead and 33.3% for Afar breed. Prevalence of the infection by sex group was 61.5% for female and 38.5% for male group. There was no significant difference of the prevalence for different breeds and sex groups. The health status of these sheep was reduced in body weight, red cell count (RBC), packed cell volume (PCV), total protein (TP) and hemoglobin (Hb) and this condition was obviously seen in severe infected sheep. Severe infection of *Fasciola* spp. started from fourteen weeks after the exposure to the end of the experiment. Breeds resistant potency occurred at sixteen weeks for infected breeds and the shedding rates were higher in the Blackhead sheep. On the basis of egg per gram and clinicalpathology parameters, the Blackhead breed was considered more susceptible to *Fasciola* spp. infection than the other. The Afar breed may be better adapted in the study area as shown in PCV and another blood parameters. However, there was no significant difference between the two breeds and sex groups.

Key words: sheep breeds, fascioliasis, Middle Awash River Basin, Ethiopia, infection

INTRODUCTION

Fascioliasis, caused by *Fasciola hepatica* and *Fasciola gigantica*, is a parasitic disease of cattle and sheep with a cosmopolitan distribution,

and is responsible for important economic losses from condemned livers, poor weight gains, progressive loss of condition and mortality. Prevalence of liver fluke infection is higher near irrigation areas through lymnaeid snail

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intermediate hosts. In Middle Awash River Basin especially near the path provides, worms and wet conditions throughout the year are highly favorable for proliferation of snails, hatching of fluke eggs and the development of cercariae within snails.

Chronic fluke disease is associated with the presence of adult flukes in the bile ducts and is characterized by gradual loss of condition, progressive weakness, anemia, and hypoproteinemia with development of edematous subcutaneous swellings, especially in the intermandibular space (bottle jaw) and over the abdomen (Bowman, 1995).

Eradication of fascioliasis infections is rarely a practical option and control needs to be established for the reduction of the disease to allow economic livestock production. The specific aims of the control program may be to prevent the build-up of parasites in the environment and to avoid areas of heavily contaminated pasture (Brunsdon, 1980).

Reduction of pasture contamination may be accomplished through the use of anthelmintics, management regimes, molluscicides and biological competition, a component of an integrated control program. And also when individual sheep and sheep breeds demonstrate a variation, it should be possible to create relatively resistant strains of animals. Indonesian thin-tailed sheep have high resistance to *F. gigantica* (Wiedosari and Copeman, 1990).

Genetic resistance of various breeds of sheep to fascioliasis, as measured by fecal egg output and the percentage of the metacercariae that are later recovered as adult flukes, has been reported previously (Boyce *et al.*, 1987; Wiedosari and Copeman, 1990). The report by Boyce *et al.* (1987) concerned *F. hepatica*, while that by Wiedosari and Copeman (1990) involved *F. gigantica*. Boyce *et al.* (1987) pointed out the possible value of selectively breeding for such a trait to control this disease. Since there are many

sheep herds and breeds in different locations in Ethiopia, there is a chance of getting a resistant breed for fascioliasis.

The selection of such resistant sheep has been suggested as productive and mostly appropriated to reduce the impact of infection in endemic areas especially where treatment costs are relatively high (Roberts and Suhardono, 1996). However, the susceptibility of sheep breeds of the Afar region to *Fasciola* spp. infections has not so far been evaluated.

The main objective of the present study was to establish whether the breed and sex of local sheep factors influencing on the development of fascioliasis under natural conditions.

MATERIALS AND METHODS

Description of the study area

This work was carried out from March to July 2005 in Gewane Agricultural Technical and Vocational Education Training College, Gewane district, Ethiopia. Gewane district is an endemic area for ovine fascioliasis with a hot and semi-arid climate. The location of the study area is 10°9'59N latitude and 40°8'43E longitude. The college is 344 km away from Addis Ababa. The altitude of the area is 560 meters above the sea level.

The majority of the populations in the area lead a pastoral way of life searching for better grazing and watering sites for their livestock. Sheep are a source of income generation and mutton needed for religious ceremonies - burial, visitors, famine and women giving birth. During the rainy season the animals are grazing freely on the open range and when the dry season starts, the animals are moved to swampy and low-lying areas near the Awash River path. On the flood paths and near the Awash River, the area is covered with acacia trees, *Prosopis juliflora*, while the rest of the area is covered with shrubs, bushes or grass.

Meteorological data

The meteorological data of Gewane district were obtained from the Ethiopian Metrological Services Agency. The climate of the area is normally hot and dry. The rainfall is between July and September and a short rain is during March and April. The mean maximum annual temperature reaches 40 °C and the mean minimum temperature is 19.4 °C and the total annual rainfall is 663.7 mm. Mean average relative humidity is 52%

Animal management

The study was conducted on two local breeds of sheep (Afar and Blackhead) under naturally infected conditions with *Fasciola* spp. Twelve each of Afar and Blackhead sheep, aged between 5-6 months were selected, and each breed of 6 animals was divided into two groups by sex (Table 1).

Prior to the treatment, sheep were housed for 15 days. The acclimation period of time was given for the adaptation to weather conditions. During this period body weights were measured, fecal samples and blood samples were also examined to confirm that they were free from ovine fascioliasis. All animals were ear tagged, and housed separately in pens at night. The sheep grazed in infected pasture with highly risk of *Fasciola* spp. for five months between March to July 2005. All sheep was allowed to graze for 8 hours (8:00 AM up to 4: 00 PM) per day. Water was freely provided from natural sources.

The sheep were vaccinated against the common infectious diseases of the area such as Anthrax and Pasteurellosis with the vaccine obtained from the National Veterinary Institute,

Debre Zeit, Ethiopia. Acaricides spraying against ectoparasites was performed throughout the study period regularly every month with Diazinol 60% E.C. (Kafr El Zayat Pesticides and Chemical Co., Egypt). The susceptibility to infections with *Fasciola* spp. was evaluated by fecal and blood examination based on pre and post treatments design.

Detection of fasciola egg in feces

Fecal samples were taken directly from the rectum and also during defecation every two weeks. Egg counts were performed using standard sedimentation methods (Garcia, 1997; Tiber, 1999). The estimation of Egg count per gram of feces (EPG), was determined according to the following equations:

$$\text{EPG} = \frac{\text{Amount of egg counted} \times \text{Consistency correlation factor}}{100}$$

Where consistency value was given for a form of stool, (1= normal stool and hard; 2=soft, 3= moisture, 4= diarrhea and 5= watery)

Blood sampling and hematological analyses

Blood samples collected from each animal were taken into 10 ml test tubes containing ethylene diamine tetraacetic acid (EDTA) by jugular vein puncture at two week intervals. The packed cell volume (PCV) was determined by microhematocrit method and blood was further centrifuged at 12,000 rpm for 10 minutes to remove the erythrocytes and plasma was collected. The following parameters namely, RBC count was measured using a cell counter, and also the

Table 1 Experimental design 2 treatment combinations (on field trials).

Type of breeds	Type of management	Sex groups		Number of animals
		Male	Female	
Afar	Expose animals to contaminated pasture	6	6	12
Blackhead	Expose animals to contaminated pasture	6	6	12

hemoglobin (Hb) concentration was determined in the form of cyanmethaemoglobin. Total protein (TP) concentration in plasma was determined by using commercial kits supplied from Life Science Dynamic Division, Arnaparn Co.Ltd. Nonthaburi, Thailand.

Weight gain

Animals' weight gain performance in the study was aimed to assess the effect of treatments on monthly live weight. Each animal was weighed in the morning every week, before they were released to graze. Animals were individually weighed using a spring scale. Furthermore, all animals were also subjected to a daily clinical examination for other infections.

Data analysis

The differences between treatment groups for different parameters were tested using SAS procedures using a functional experiment in complete randomized design (CRD) with the following statistical model with 6 heads was used for each sub group. The model to be used was:

$$Y_{ijk} = \mu + B_j + S_i + (BxS)_{ij} + e_{ijk}$$

Where as,

Y_{ijk} = Response variable

μ = Overall mean

B_j = Effect of j^{th} breed ($j=1-2$)

S_i = Effect of i^{th} sex ($i=1-2$)

$(BxS)_{ij}$ = Effect of i^{th} sex of j^{th} breed

e_{ijk} = Error term.

RESULTS AND DISCUSSION

Fasciola spp. infections overall prevalence were detected at 54.2%. The prevalence within breeds was 37.5% and 33.3% for Blackhead breed and Afar breeds, respectively. The prevalence of sex groups were 61.5% and 38.5% for female and male sex groups, respectively. Nevertheless the prevalence of *Fasciola* spp. infection was not significantly influenced by breed and sex.

The least square means of different parameters are presented in Table 2. The lower result in egg per gram (EPG) was obtained in the Afar breed sheep and male sex group (Figure 1 and 2). the result indicates that they were significantly ($p<0.05$). The effect of both breeds upon blood parameters (PCV, RBC, TP and Hb concentration) revealed not significantly different ($p>0.05$), which also there was no significant interaction of breeds by sex.

The overall estimates of PCV, RBC, TP, Hb, and daily weight gain for Afar breed were slightly higher than Blackhead breed sheep except Fecal Egg count value indicated slightly lower after the exposure of the animals to the contaminated pasture. The results indicated that the Afar breed in the study areas had slightly higher resistance to *Fasciola* spp. infections than Blackhead breed sheep. This result might be due to the better resistance to the *Fasciola* infected area by the Afar breed sheep than the Blackhead sheep breed. The result coincides with Asegde (1990)

Table 2 Effects of *Fasciola* spp. infection parameters.

Factors	Wt.gain(g)	EPG	RBC ($\times 10^6 \mu\text{L}$)	PCV (%)	TP (%)	Hb (g/dl)
BREED						
Afar	17.98 ^a	66.67 ^a	7.53	27.50	64.36	9.52
Blackhead	15.70 ^a	158.33 ^b	7.20	24.13	58.15	8.10
SEX						
Female	14.71 ^a	133.33 ^a	7.56	26.67	61.97	9.00
Male	18.97 ^b	91.67 ^b	7.17	24.96	60.54	8.61

* Means in the same column with different superscripts are statistically different ($p<0.05$).

where he compared four breeds of indigenous Ethiopian sheep for their resistance to endoparasites (predominantly *Haemonchus contortus*) at Awassa in Southern Ethiopia. The breeds evaluated were Afar and Blackhead originating from semi-arid and lowland regions of Ethiopia, Horro and Arsi from the humid Highlands. The result indicated that the Blackhead

Somali breed were the most susceptible to endoparasites while Arsi breed were the most resistant.

There were no significant ($p>0.05$) sex differences for FEC, PCV, RBC, TP and Hb but difference in weight gain. In the female group revealed significant lower than the male group ($p<0.05$). The values of blood parameters were not

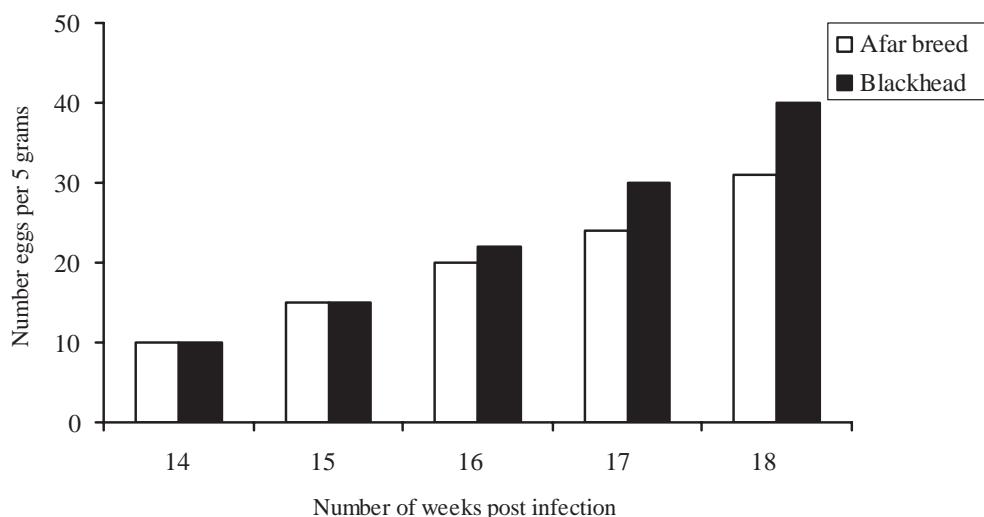
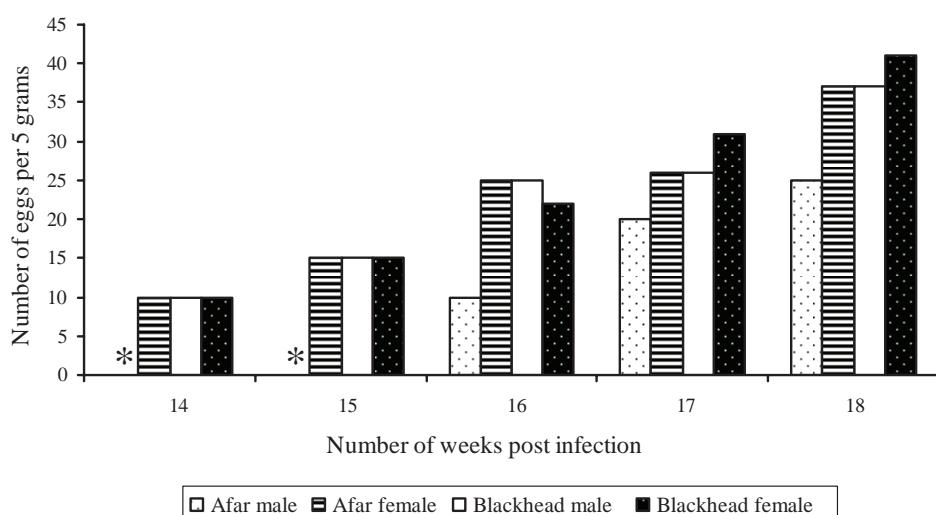


Figure 1 Mean values of EPG between Afar and Blackhead breeds.



* There was undetectable of EPG after 14-15 weeks post infection

Figure 2 Mean values of EPG between Afar, Blackhead breeds and sex group.

significantly ($P>0.05$) but higher in females than males (Table 2). These findings were consistent with Schalm *et al.* (1975), Jain (1993) and Coles (1986). The higher results of FEC were also recorded in the female group after infection compared to the male sheep. In weight gains although Afar sheep had higher gains than Blackhead but it was lower in female than in male sheep after infection ($p<0.05$).

At the end of the experiment, Afar breed maintained a not significantly higher ($p>0.05$) PCV than Blackhead sheep. It has been suggested that the higher PCV in Afar VS Blackhead sheep may be due to the fact that Afar sheep were better adapted to the *Fasciola* infected area. Similar results were reported in comparing Menz and Horo sheep breeds in Debere Brhan station (Rege *et al.*, 1996). The findings have demonstrated the preliminary results of combining the two diagnostic methods of the FEC and the blood parameter examination in establishing the influence of breed and sex naturally acquired on ovine fascioliasis.

The success of parasitic infection depends on the host and parasite interaction, and various factors may influence the relationship (Waruiru *et al.*, 2000). The most important aspects of the host that may affect it are breed, age and sex. Estimation of the prevalence of fascioliasis has classically been done by coprological analysis.

During the rainy season the volume of rainfall alone does not seem to play a decisive role in the study site. The flood of the Awash River creates favorable conditions and favors the development of the intermediate host (snail) and the transmission of the diseases. Similar findings and assertions were reported by Gruber (1975), Michael *et al.* (2005) and Solomon (2005). Irrigation based agricultural practice and swampy areas were very important ecologies for the continuity of the life cycle of fascioliasis.

CONCLUSIONS

Eventhough there was not significantly revealed such as *Fasciola* resistant between Afar and Blackhead sheeps, but the values of PCV, total proteins and also final body weight tended to be higher in Afar than in Blackhead breed.

Regarding to the results, it may be concluded that Afar sheep tended to show better adapted to the *Fasciola* infected area than Blackhead sheep and might be the most suitable sheep breed in Afar region of Ethiopia with strongly support such as an appropriate animal nutrition and health care management. Further studies on epidemiology and between breed variations in susceptibility to infections are necessary because such variations in body resistance acting as immuno-competence may be of fundamental importance in epidemiology and also the management of the various breeds of sheep.

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