Hemoglobin Concentration and Hematocrit Value of Black Bengal Goats Infected with *Fasciola gigantica*

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ABSTRACT : A total of 72 Black Bengal goats of 2.5 to 3.5 and 4.0 to 6.0 years old were used in this study. Equal number of animals were included in *Fasciola gigantica* infected and non-infected control groups. For each age and treatment groups 18 blood samples were collected in glass vials contained EDTA anticoagulant in summer and winter seasons before the animals were slaughtered at abottoir. Packed cell volume (PCV) was determined using microhematocrit and hemoglobin (Hb) concentration by cyanmethemoglobin methods. The PCV of *F. gigantica* infected animals were significantly lower than the non-infected animals. The average PCV values obtained were 26.60 and 32.20% for *F. gigantica* infected and non-infected animals, respectively. The Hb values of infected animals were significantly lower than the non-infected animals. The average Hb values obtained were 9.17 and 10.51 gm% for *F. gigantica* infected and non-infected goats, respectively. There was no significant effect of age and season on the values of PCV and Hb of infected and non-infected animals.

(**Key Words** : Black Bengal Goat, Hemoglobin Concentration, Hematocrit Value, *Fasciola gigantica*)

INTRODUCTION

Fascioliasis of goats caused by *F. gigantica* is wide spread in Bangladesh (Rahman, 1956; Nooruddin, 1977; Qader, 1981; Bhuyan, 1970). A high rate of mortality occurs due to *F. gigantica* infection in sheep and goats in this country (Kendall, 1954). The economic loss caused by this parasite is enormous (Boray, 1969). This loss is due to anemia and poor production performance, condemnation of liver and mortality (Kendall, 1954; Bhuyan, 1970; Cawdery, 1976; Hammond and Sewell, 1974; Fabiyi and Adeleye, 1982). The causes of anemia in fascioliasis have been the subject of study over many years (Stephenson, 1947; Jennings et al., 1956; Pearson, 1963; Sinclair, 1964; Todd and Ross, 1966; Holmes et al., 1968; Berry and Dargie, 1978). It is now considered that the flukes feed on host blood. A marked increase in plasma volume occurs during the first several weeks of infection which coincides with the rapid drop in PCV (Berry and Dargie, 1978). In chronic infections, the adult flukes suck more blood and there is leakage of protein through the bile duct epithelium in sheep (Dargie and Berry, 1979). A continuous loss of iron into the intestine is associated with an increased plasma iron turnover rate and a reduction in plasma iron concentration. As a result, an iron deficiency anemia develops (Berry and Dargie, 1978). To combat this problem efficiently, an understanding of the effect of this parasite on hematological parameters is essential. Although some reports on the blood pictures of fascioliasis in sheep are available in literature (Sinclair, 1964; Dargie and Berry, 1979; Berry and Dargie, 1978) but very little of such information is known in Black Bengal goats. Therefore, this paper describes the effects on Hb and PCV in Black Bengal goats naturally infected with *F. gigantica*.

MATERIALS AND METHODS

Seventy two Black Bengal goats of two age groups of 2.5 to 3.5 and 4.0 to 6.0 years old were used in this study. Equal number of animals were included in *F. gigantica* infected and non-infected control groups. Animals were selected after fecal sample examination on the day before they were slaughtered at Mymensingh abattoir. Animals having *F. gigantica* infection were included as infected group. While, animals found apparently healthy and free from *F. gigantica* and most other parasites were included as non-infected control group. Fecal samples were collected directly from the rectum of each animal and analyzed using Stoll's ova counting technique. Number of egg per gram of feces was

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determined by examining 5 slides for each sample which were prepared with the emulsified fecal solution. The number of *F. gigantica* parasite recovered from each animal was counted and identified following the key of Yamaguti (1958). For each age and treatment groups 18 blood samples were collected in summer (March-June) and winter (Nov.-Feb.) seasons. About 5 ml blood was collected from the jugular vein were contained in glass vials using EDTA as anticoagulant. One blood sample was collected from each animal which was analyzed in triplicates for Hb and PVC for each blood sample. The PCV was determined using microhematocrit and Hb by cyanmethemoglobin methods (Coles, 1980). After each animal was slaughtered, the liver and gall bladder were collected. These were placed on a tray and cut into slices with a sharp knife. Slight pressure was exerted to the sliced pieces with the thumb and fingers to squeeze out the parasite. The sliced pieces were placed in saline water for an hour to collect the immature fluke. Every piece of sliced liver was removed from the saline water individually and the sediment was examined for the presence of the parasite.

A two-factor factorial experiment in a randomized complete block design was done. Season and age group were two factors, each with two levels. Comparisons based on the least significant difference at $p = 0.05$ were done between the means of infected and control groups in each season and age group.

RESULTS AND DISCUSSION

In all animals mature flukes were found which varied from 1 to 11. Among 72 animals 15 were found positive for both mature and immature flukes. The number of immature flukes recovered varied from 2 to 7. Fecal examination showed 100 to 900 *F. gigantica* eggs per gram of feces (epg) with a mean of 363.64 epg which indicated a low and patent chronic infection.

The average PCV values of Black Bengal goats of two age groups in two seasons infected with *F. gigantica* are presented in table 1. The PVC values of two age groups of naturally infected animals did not differ significantly ($p > 0.05$) in summer and winter seasons. The infected group registered significantly ($p < 0.01$) lower PCV values than the non-infected group irrespective of age and season. This difference could be attributed to blood sucking activity of the adult flukes for a considerably longer period of time. The findings of this study were consistent with the observation of Berry and Dargie (1978) who reported a marked drop in PCV of sheep infected with *F. hepatica*. Holmes et al. (1968) demonstrated that the red blood cell loss per fluke was approximately 0.5 ml per day in *F. hepatica* infection. In the present study, the number of flukes recovered from each animal ranged from 1 to 11 indicated a low level of chronic infection. The PCV ranged from 26.00 to 33.30%. This suggested that the infected animals were able to maintain a moderate level of PCV values despite having a patent chronic infection. The results in this study partially confirmed the findings of Sinclair (1964) who reported that a small number of *F. hepatica* in sheep did not produce clinical symptom of adverse effect on the rate of liveweight gain in the early stage of infection. The anemia that developed progressed and depressed the productivity of infected animals in the long term. In chronic infections, anemia increased over the period of infection despite the

Table 1. Average packed cell volume of black bengal goats of two age groups in two seasons infected with *Fasciola gigantica*

Group (G)	PVC (%)[1]			
	Treatment (T)		G-Mean	Difference
	F. gigantica infected	*F. gigantica* non-infected (control)		
W = Winter (Nov.-Feb.)				
2.5-3.5 years	26.00^{aA}	31.20^{bA}	28.60	−5.20**
4.0-6.0 years	27.00^{aA}	32.10^{bA}	29.50	−5.10**
S = Summer (March-June)				
2.5-3.5 years	26.60^{aA}	32.30^{bA}	29.50	−5.70**
4.0-6.0 years	26.90^{aA}	33.30^{bA}	30.10	−6.40**
T-Mean	26.60	32.20	29.40	−5.60**

[1] Average of 18 replications. Means in the same column with a common capital letter, and in a row with similar small letters are not significantly ($p > 0.01$) different.

absence of a further infection. In a previous study, Sinclair (1962) observed that the young flukes did not cause anemia in sheep since they live on liver tissues during their early development and migrate. However, on the 56th day postinfection, anemia was observed in the infected animals. Cameron (1951) reported that the parasite produced a toxin which caused damage to the red blood cells, but Urquhart et al. (1956) claimed that a sheep weighing 20 kg while infected with 200 flukes would loss 40 ml of blood per day. This would develop a progressive hemorrhagic type of anemia in the infected animals. In the present study, however, the PVC values indicated a moderate degree of anemia and this could be attributed to a loss of smaller amount of blood.

The average Hb values of Black Bengal goats of two age groups infected with *F. gigantica* in two seasons are presented in table 2. Statistical analysis indicated that naturally infected animals registered significantly ($p < 0.01$) lower Hb values than the animals in non-infected group. There was no significant ($p > 0.05$) difference in Hb values between two seasons within the same group of infected and non-infected animals of two age groups. On the other hand, animals in infected group showed significantly ($p < 0.01$) lower Hb values than that of non-infected goats of two age groups in two seasons. This result showed that anemia had developed in the animals of infected group. In this study, the PCV and Hb values might have brought about by interference with the production of erythrocytes and or by shortening of the life span of erythrocytes which were in agreement with the observations of Sinclair (1964). A continuous production of erythrocyte depended on the presence of raw materials in the blood which circulated through the bone marrow. Adequate supplies of iron, copper, cobalt, vitamins and protein were essential for erythropoiesis and it was possible that the anemia in fascioliasis was caused by a deficiency of one or more of these components. Sinclair (1962) found that a change in the plasma protein occurred in ovine fascioliasis, particularly it was marked in the chronic stage of the disease. In this study, the lower Hb values indicated the presence of a lower plasma protein that might be inadequate for normal erythropoiesis and this might have helped to develop anemia.

Table 2. Average hemoglobin concentrations of black bengal goats of two age groups in two seasons infected with *Fasciola gigantica*

Group (G)	Hb Concentration (g/100 ml blood)[1]			
	Treatment (T)		G-Mean	Difference
	F. gigantica infected	*F. gigantica* non-infected (control)		
W = Winter (Nov.-Feb.)				
2.5-3.5 years	9.00^{aA}	10.55^{bA}	9.77	−1.55**
4.0-6.0 years	9.25^{aA}	10.50^{bA}	9.87	−1.24**
S = Summer (March-June)				
2.5-3.5 years	9.21^{aA}	10.67^{bA}	9.94	−1.46**
4.0-6.0 years	9.23^{aA}	10.34^{bA}	9.79	−1.11**
T-Mean	9.17	10.51	9.84	−1.34**

[1] Average of 18 replications. Means in the same column with a common capital letter, and in a row with similar small letters are not significantly ($p > 0.01$) different.

In the present study, all the infected animals were found to harbor populations of adult *F. gigantica*. This indicated that the infections occurred three or more months back and all the infected animals were found suffering from chronic infection. In this study, low Hb and PCV values could be attributed to an abnormal loss of red blood cells resulted from the feeding habits of the flukes or to an excessive destruction of the red blood cells caused by some hemolyzing factors produced by the parasites. In the present work, the resulted anemia might have been associated with intrabiliary hemorrhage due to blood sucking activity of the adult flukes which was in agreement with the findings of Holmes et al. (1968). In *F. hepatica* infected sheep, hemodilution and intrahepatic hemorrhage contributed to the anemia while the ultimate degree of anemia found was associated with the animal's erythropoietic capacity (Berry and Dargie, 1978). Some investigators reported that blood loss caused by the feeding activities of the fluke as the main factor causing anemia in fascioliasis (Stephenson, 1947; Jennings et al.,

1956). Others found anemia in fascioliasis as due to some other factors (Sinclair, 1964). Some studies showed that the flukes' caeca contained host's blood (Pearson, 1963; Todd and Ross, 1966). The Hb concentration of animals in infected groups showed significantly ($p < 0.05$) lower values than the animals in non-infected group. This could be attributed to a loss of whole blood due to fascioliasis. Dargie et al. (1967) reported that a loss of whole blood took place into the gastrointestinal tract of fluke infected animals. The isotopic work demonstrated that the blood loss in fascioliasis was due to the feeding activities of the fluke (Jennings et al., 1956; Pearson, 1963).

Pantelouris and Hale (1952) reported that *F. hepatica* in sheep absorbed and excreted considerable amount of iron. Iron was transported round the body in a complex form with transferin, a plasma protein that was ultimately used for Hb formation. Todd and Ross (1966) recovered 0.23 ml of blood per gram of liver fluke of which 12.5% were Hb. The sources of Hb products in the body of liver fluke therefore seemed blood or liver of the host. In the present study, the lower Hb values could be attributed to considerable amount of iron loss through the processes of absorption and excretion of iron by the flukes. From this study, it may be concluded that chronic *F. gigantica* infections significantly lower the Hb and PCV values in Black Bengal goats.

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