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Effects of nematode *Haemonchus contortus* on blood parameters and growth performance of lambs

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Abstract
Eighteen Turkish breed Lambs of five months old were studied in this study, they were divided into two groups, control and infested, each group subdivided into three replication. Three animals were allocated in each replication of infested groups. Control group animal were dewormed and housed in pens. They were provided with a uniform management. Blood samples were collected from the jugular vein of each animal at monthly intervals for 5 months and were weighted for body weight gain. Hemoglobin (Hb) concentration was determined using hemoglobinometer, total white blood cells (WBC) and total red blood cells (RBC) were measured by hemocytometer method. This study shows that control group significantly (P<0.05) increased body weight gain, hemoglobin concentration and RBCs counts than infested group. *H. contortus* infection did not significantly influence the total WBCs counts between control and infested groups. Overall results demonstrated that *Haemonchus contortus* reduce the growth of Lambs.

Keywords: nematode, growth, hemoglobin, erythrocytes, leukocytes and lambs

1. Introduction
Sheep and goats are of great importance as major sources of livelihood and contribute to the sustenance of landless, smallholder and marginal farmers especially to the poor in the rural areas in Afghanistan. Sheep and goats can withstand a period of drought better than any other livestock and they can use those pastures, which cannot be used by other livestock (Upadhyay, 2003) [10]. Helminthiasis, especially parasitic gastroenteritis, pose a serious health threat and a limitation to the mortality, cost of treatment and control measures (Nwosu *et al*, 2007) [9]. Haemonchus is caused by *Haemonchus contortus* is a predominant highly pathogenic and economically important diseases of sheep (Mortensen *et al*, 2003) [8]. These parasites are common blood feeders that cause anemia and reduced productivity and can lead to death in heavily infected animals (Gighigia *et al*, 2001). It has been estimated that each worm sucks about 0.05 ml of blood per day by ingestion or seepage from lesions (Urquhart *et al*, 2000) [7]. The understanding of the effect of this parasite on hemoglobin concentration, WBCs counts, RBCs counts and body weight gain is essential to reduce the losses caused by this infection in Lambs. Reports of a number of studies have been published on the hematological parameters of pasture grazing sheep and goats predominantly infected with this parasite (Cobone and O'Sullivan, 1992; Albers *et al*, 1989) [15]. However, no attempt was made to evaluate the effects of *H. contortus* infection on hemoglobin concentration, WBCs, RBCs counts, WBCs counts and body weight gain of Lambs in Afghanistan.

Hypothesis: Haemonchosis reduces sheep growth performance and affect the blood parameters.

2. Objectives
1. To determine the effects of Haemonchosis on sheep growth performance.
2. To determine the effects of Haemonchosis on Hemoglobin concentration per 100 Ml blood (g/dl).
3. To determine the effects of *Haemonchus contortus* on counts of Erythrocytes and Leukocytes per microliter.

3. Materials and Methods
The experiments were conducted at the Laboratory of Pre-clinic department, Veterinary Science faculty, Nangarhar University.

Eighteen male Turkish Lambs of 5 months old were randomly allocated into two control and infested groups, each replication had three Lambs. Control group animals were dewormed by Albendazole orally with two dose (10 ml) at 15 days interval. The animals were housed in pens with concrete floors to ensure that adventitious infections with nematode parasites do not occur. They were fed a concentrate mixture at equivalent to 1% of their live weight, ice bran, wheat bran, vitamin-mineral, alfalfa and wheat straw.

Fecal samples were collected directly from the rectum of each animal in a sterile can after wearing disposable glove. The number of eggs of feces was determined using a modified method (Gordon and Whitlock, 1939). Four grams of feces were mixed with 60 ml saturated sodium chloride (NaCL) solution. A portion of the fecal suspension was examined using a McMaster's slide.

About 5 ml blood was collected in glass vials with EDTA anticoagulant to prevent blood clotting from the jugular vein of each animal at the end of each month. Hemoglobin concentration was determined using hemocytometer method (Coles, 1980) [14]. Total red blood cell and total white blood cell were determined by hemocytometer method (Bauer *et al*, 1974 and Coles, 1980) [14]. The body weight was measured with digital balanced scale at the end of each month.

4. Results
Hemoglobin concentration
There was significant (P<0.05) interaction of H. contortus and duration of infection on hemoglobin concentration (Fig. 1). Hemoglobin levels of the animals in infected groups were significantly (P<0.05) lower than the control. The difference in hemoglobin concentration was found between the animals in infested group throughout the experiments. The animals in control group registered unfluctuating values of hemoglobin. The postinfection fall in hemoglobin concentrations in

infested group suggests the development of anemia.

Body live weight

The live body weight was significantly (P<0.05) increased in control group than infested group (Fig. 2). The live body weight gained gradually throughout the experiments in control group. In infested group the body weight gain was increased but in the second month of experiments decreased significantly. At the end of study, live body weight of infested animals were severely reduced.

Red blood cell

Fig.3 shows the RBC values of Lambs infected with *H. contortus* worm. The analysis of variance of this variable indicated significant (P<0.05) interaction effect of *H. contortus* infection on red blood cell values. The infected Lambs showed gradually lower RBC counts from preceeding monthly experiments, while RBC counts was significantly (P<0.05) lower than non-infected group at last month of experiments. On the average, results indicated significant (P<0.05) interaction effect *H. contortus* and duration of infection reduced the number of circulating erythrocytes.

White blood cell

The average monthly WBC counts of control and infected Lambs are presented in Fig. 4. *H. contortus* did not significantly (P>0.05) influence the leukocyte counts of infected Lambs. However, the influence of the duration or time of infections was found. Infection with *H. contortus* did not alter the circulating white blood cell count.

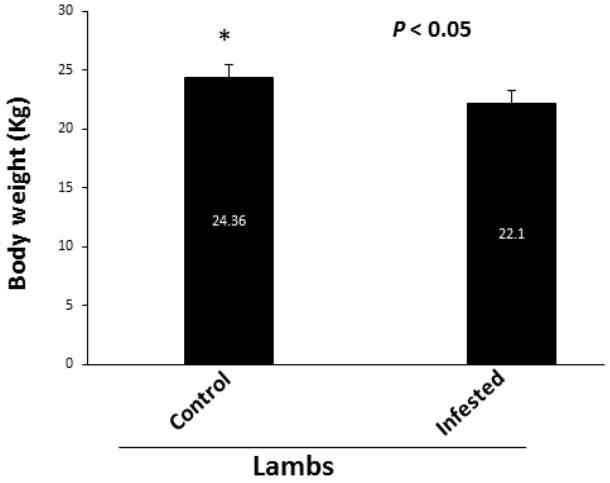

Fig 1: Effects of *H. contortus* on growth performance of Lamb. Control group Lambs were dewormed with Albendazole. All values represent mean ± SEM of 5 experiments. Control groups Lamb significantly (P<0.05) increased body growth Compare to infested group Lambs. * Symbol indicate a significant difference (P<0.05; ANOVA) followed by tukey's multiple comparison test.

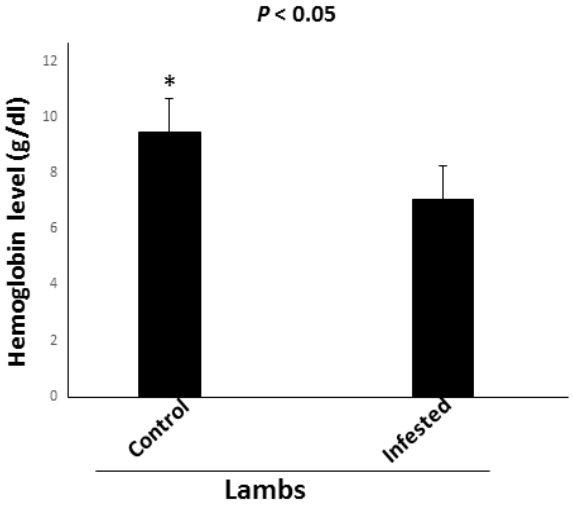

Fig 2: Effects of *H. contortus* on hemoglobin level (g/dl of blood) of Lamb. Control group Lambs were dewormed with Albendazole. All values represent mean ± SEM of 5 experiments. Hemoglobin level of Control groups Lamb significantly (P<0.05) increased Compare to infested group Lambs. * Symbol indicate a significant difference (P<0.05; ANOVA) followed by tukey's multiple comparison test.

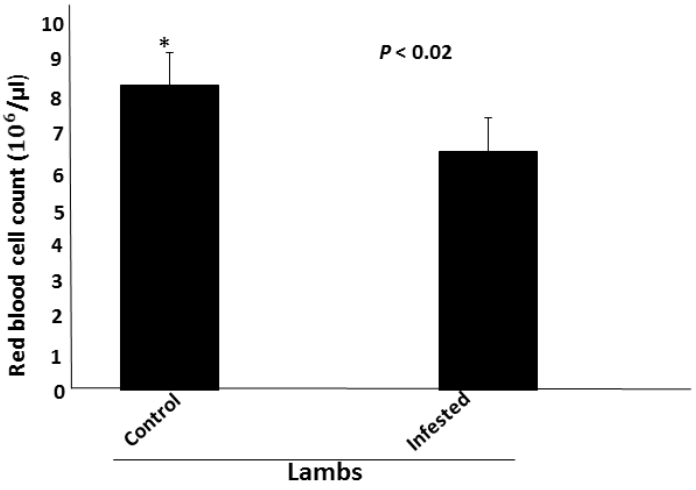

Fig 3: Effects of *H. contortus* on total red blood cell count (10^6/µl of blood) of Lamb. Control group Lambs were dewormed with Albendazole. All values represent mean ± SEM of 5 experiments. Total RBC count of Control groups Lamb significantly (P<0.05) increased Compare to infested group Lambs. * Symbol indicate a significant difference (P<0.05; ANOVA) followed by tukey's multiple comparison test.

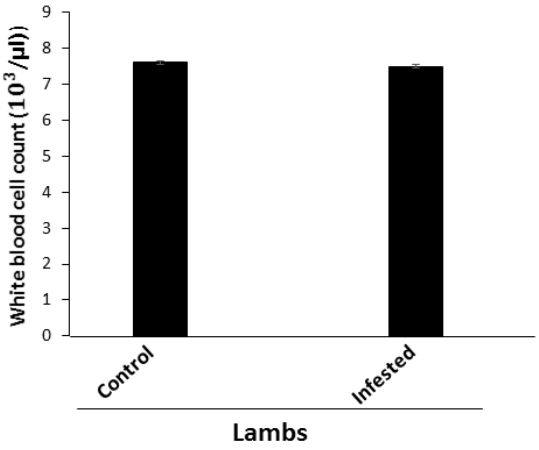

Fig 4: Effects of *H. contortus* on total white blood cell count (10^3/µl of blood) of Lamb. Control group Lambs were dewormed with Albendazole. All values represent mean ± SEM of 5 experiments. Total WBC count of Control groups Lamb significantly (P<0.05) increased Compare to infested group Lambs. * Symbol indicate a significant difference (P<0.05; ANOVA) followed by tukey's multiple comparison test.

5. Discussion

Nematode parasites of small ruminants results in low productivity due to stunted growth, poor weight gain and poor feed utilization (Pedreira *et al*, 2006) [4, 6]. Various study reported, that *Haemonchus contortus*, found in abomasum of sheep causes blood loss resulting in body weight gain (Hayat *et al*, 1996) [2]. The previous study shown, that *Haemonchus contortus* decrease weight gain loss up to 50% (Hussain, 1985). In the present study, the infected Lamb had poor body weight and feed intake compare to the non-infected Lambs (control). These studies shows that the *H. contortus* decrease the profitability and body weight gain in lambs.

In the present study, Hemoglobin level decreased in infected compare to control group Lamb and significantly ($P<0.05$) increased in control lamb as shown in Fig. 2. These results agree with those of previous studies, *Haemonchus contortus* in sheep causes blood loss resulting in decrease hemoglobin (Hayat *et al*, 1996) [2]. Another study has shown, that hemoglobin levels of the animals in infected groups were significantly ($p<0.05$) lower than the control (Howlader *et al*, 1996) [3]. Evans *et al*, (1963) reported that the anemia caused by the blood sucking of *H. contortus* was sever in sheep. Evans *et al*, 1963 has reported that hemoglobin concentration went down to about 7 g/100 ml blood by 18 weeks postinfection. In the present study the hemoglobin level decreased in the 18-20 weeks in infected lamb which support the above study.

In previous study, *Haemonchus contortus* decreased erythrocytes in sheep (Hayat *et al*, 1996) [2]. Another study shown, RBC significantly ($P <0.05$) lower values from the preceding fortnights and on fortnight 11, when RBC was significantly ($P <0.05$) lower than the second fortnight (Howlader *et al*, 1997) [3]. Another study reported, the causes of lower erythrocytes counts in *H. contortus* infection in sheep. He concluded that the anemia was purely the results of a failure in the production of erythrocytes by the erythroblast tissues (Gibson, 1954) [12]. In the present study, total red blood cell count significantly ($P < 0.05$) lower in infected Lambs and significantly increased in control group Lamb shown in Fig. 3. These results conclude *H. contortus* decrease the erythrocyte counts infected Lamb.

The average finding monthly values of Lamb infected is presented in Fig. 4. *H. contortus* did not significantly influence the WBC count. Worm infection and duration of infection interaction also was not exist. However, the infected Lamb had a slight high total WBC count than control Lamb. These results support the previous studies. Study reported, that *H. contortus* did not significantly increased WBC count in growing goats (Hawlader *et al*, 1997). Some studies reported, the total leukocyte counts remained within normal limits in sheep infected with stomach worm. However, they found extreme increased in total WBC counts during the high pathogenic stage (Leland *et al*, 1960) [11]. Infection with *H. contortus* did not alter the circulating white blood cell count.

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