



Hematobiochemical comparison of fat-tailed sheep naturally infected with nematodes in the highlands

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ABSTRACT: Gastrointestinal (GI) parasites are a major factor in reducing the productivity of small ruminants, particularly fat-tailed sheep, in tropical regions. This study aimed to evaluate the hematological and biochemical profiles of blood as indicators of GI nematode infection in sheep raised in the highlands. A total of 11 two-year-old ewes were used, consisting of three *Trichostrongylus* sp.-positive, four *Strongyloides* sp.-positive, and four negative ewes based on fecal examination. Hematological parameters were analyzed using ABX Micros 60, and biochemical parameters were analyzed using ABX Pentra C200. Data were analyzed using the Kruskal-Wallis test with Bonferroni's post hoc test. The results showed no significant differences ($P > 0.05$) in any of the hematological and biochemical parameters between the infected and uninfected groups. This variation in hematopoietic responses is thought to be influenced by infection intensity, nutritional status, individual variation, sample size limitations, and environmental conditions.

Keywords:

Strongyloides sp., *Trichostrongylus* sp., highland, fat-tailed sheep, blood profile

■ INTRODUCTION

Gastrointestinal (GI) parasites are a major factor affecting the productivity of small ruminants and cause substantial economic losses in the sheep industry (Mavrot *et al.* 2015). Worm infections can impair reproductive performance and reduce productivity (Zeryehun 2012) by damaging the intestinal epithelium, which plays a critical role in digestion and nutrient absorption. Consequently, nutrient utilization becomes inefficient, growth is stunted, and death may occur in severe infections (Charlier *et al.* 2020).

This problem is more prevalent in tropical regions, where conditions favor parasite survival. High temperatures and humidity accelerate endoparasite development and transmission, making infections more prevalent in countries such as Indonesia (Rophi 2015) and Ethiopia (Zeryehun 2012). Despite widespread GI parasitism in tropical small ruminant systems, information on blood hematopoietic parameters as early infection indicators remains limited (Moosa *et al.* 2022). Because hematobiochemical profiles reflect the physiological and metabolic status of animals, detailed examination of hematological and biochemical markers in nematodes-infected sheep is required in those reared under tropical highland environments.

■ MATERIALS AND METHODS

This study was approved by the Ethics Committee of the Faculty of Veterinary Medicine (registration no. 071-KEP-UB-2024). The study was conducted from April to May 2024 on a smallholder farm located in the Wagir District, Malang

Regency, East Java, Indonesia. The farm is located at an altitude of 610 m above sea level, with a temperature range of 15–30 °C and rainfall of 301–400 mm annually.

A total of 11 clinically suspected 2-year-old female fat-tailed sheep were enrolled using a convenience sampling approach. All animals had not received any anthelmintic treatment for at least 12 months before sampling, as confirmed by farm health records. Three sheep tested positive for *Trichostrongylus* sp. eggs, four tested positive for *Strongyloides* sp. eggs, and four tested negative based on fecal examination results (native, floating, sedimentation, and McMaster methods). These four egg-negative animals served as internal negative controls. All selected animals exhibited symptoms of hyperlacrimation, dull coat, body condition score (BCS) < 3, fecal score of 1 or 2, lethargy, and anorexia, and all 11 animals were included in the subsequent hematological and biochemical analyses.

Blood samples (3 mL) were collected by venipuncture into BD Vacutainer containing EDTA anticoagulant (Becton, Dickinson and Company, Franklin Lakes, NJ, USA) and analyzed using an ABX Micros 60 hematology analyzer for hematological analysis. Serum samples were analyzed using an ABX Pentra C200 for biochemical analysis. Quantitative data were analyzed using the Kruskal–Wallis test, followed

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Table 1 Fecal eggs count (EPG) and hematological test results of fat-tailed sheep infected with gastrointestinal nematodes

Parameter	<i>Trichostrongylus</i> sp. (n=3)	<i>Strongyloides</i> sp. (n=4)	Negative (n=4)
EPG	483.3±160.7 ^a	112.5±25 ^a	0±0 ^a
WBC (10 ³ /mm ³)	6.6±2.1 ^a	9.4±5.8 ^a	5.7±1.2 ^a
RBC (10 ⁶ /mm ³)	10.6±0.4 ^a	9.9±1.3 ^a	9.8±1.5 ^a
Hb (g/dL)	11.1±1.1 ^a	12.8±1.8 ^a	12.1±0.9 ^a
HCT (%)	32.9±2.6 ^a	38.0±5.8 ^a	35.7±3.0 ^a
PLT (10 ³ /mm ³)	594.7±49.6 ^a	583.8±97.9 ^a	501.3±162.3 ^a
MCV (fl)	32.0±3.6 ^a	34.7±1.3 ^a	33.48±0.6 ^a
MCH (pg)	11.1±0.3 ^a	11.5±0.4 ^a	11.15±0.7 ^a
MCHC (g/dL)	32.7±0.4 ^a	33.1±0.5 ^a	32.40±1.1 ^a
N (10 ³ /mm ³)	4.57±0.81 ^a	6.73±3.70 ^a	4.22±1.04 ^a
L (10 ³ /mm ³)	1.34±1.31 ^a	1.26±1.20 ^a	0.64±0.13 ^a
M (10 ³ /mm ³)	0.33±0.09 ^a	0.60±0.44 ^a	0.37±0.08 ^a
E (10 ³ /mm ³)	0.31±0.10 ^a	0.58±0.36 ^a	0.32±0.13 ^a
B (10 ³ /mm ³)	0.09±0.04 ^a	0.17±0.13 ^a	0.08±0.04 ^a

Note: The same superscript letter in a column indicates no significant difference. EPG= eggs per gram; WBC= white blood cell; RBC= red blood cell; Hb= hemoglobin; HCT= hematocrit; PLT= platelet; MCV= mean corpuscular volume; MCH= mean corpuscular hemoglobin; MCHC= mean corpuscular hemoglobin concentration; N= neutrophil; L= lymphocyte; M= monocyte; E= eosinophil; B= basophil.

Table 2 Results of biochemical examination of the blood of fat-tailed sheep infected with gastrointestinal nematodes

Parameter	<i>Trichostrongylus</i> sp. (n=3)	<i>Strongyloides</i> sp. (n=4)	Negative (n=4)
CHO (mg/dL)	51.7±19.8 ^a	65.5±21.1 ^a	66.8±10.6 ^a
AST (U/L)	89.3±34.6 ^a	76±12.8 ^a	110.8±28.9 ^a
ALT (U/L)	12.0±3.0 ^a	15.3±3.4 ^a	17.5±4.2 ^a
GLU (mg/dL)	59.7±14.3 ^a	58.0±8.3 ^a	51.5±4.5 ^a
BLB (mg/dL)	0.3±0.1 ^a	0.3±0.1 ^a	0.3±0.1 ^a
TP (g/dL)	7.4±1.2 ^a	7.5±0.6 ^a	7.2±1.0 ^a
ALB (g/dL)	2.7±0.2 ^a	2.7±0.2 ^a	2.7±0.2 ^a
GLB (g/dL)	4.7±1.3 ^a	4.8±0.8 ^a	4.5±1.0 ^a

Note: The same superscript letter in a column indicates no significant difference. CHO = cholesterol; AST = aspartate aminotransferase; ALT = alanine aminotransferase; GLU = glucose; BLB = bilirubin; TP = total protein; ALB = albumin; GLB = globulin.

by a Bonferroni-corrected post hoc test in SPSS (Statistical Package for the Social Sciences), version 28 (IBM Corp., Armonk, NY, USA).

RESULTS AND DISCUSSION

The comparative hematological and blood biochemical levels (Tables 1 and 2) showed no significant differences ($p > 0.05$) between nematode-infected and uninfected sheep. The lack of significant differences is likely due to mild infections, individual variation, and sample size, which limit the ability of statistical tests to detect relatively small hematological and biochemical changes (Dias-Silva *et al.* 2020; Fernandes *et al.* 2022; Moosa *et al.* 2022). These results contradict those of Alkateb *et al.* (2022), who reported that *Strongyloides* sp. can cause significant changes in MCV, leukocyte counts, and several biochemical parameters, such as glucose, protein, and liver enzyme levels.

This study also observed downward trends in hematocrit and hemoglobin levels, alongside increases in platelet and white blood cell counts in sheep positive for *Trichostrongylus* sp. and *Strongyloides* sp., although these differences were not statistically significant ($p > 0.05$). These results are consistent with those of Dias-Silva *et al.* (2020) and Fernandes

et al. (2022). However, several other studies have shown that hematological and biochemical changes due to nematode infection can vary significantly depending on the intensity of the interaction, nutritional status, feed type, and environment (Islam *et al.* 2019). This variation emphasizes the importance of considering various risk factors when interpreting hematopoietic data from fat-tailed sheep in the tropical highlands.

CONCLUSION

Gastrointestinal parasitic infections, particularly nematodes such as *Trichostrongylus* sp. and *Strongyloides* sp., in highland fat-tailed sheep show a trend of decreasing hematocrit and hemoglobin levels, as well as increasing platelet and white blood cell levels. Routine monitoring, including blood tests with larger sample sizes and risk factor analysis, can improve the accuracy of the measurement results and is expected to reduce the impact of infection on sheep health and productivity.

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