RESEARCH ARTICLE

Studies on Etiologies and Hemato-Biochemical Alterations Associated with Anemia in Goats

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Abstract

The present investigation was carried out to study the incidence and etiological factors, including Hemato-biochemical changes associated with Anemia in goats presented at Veterinary Clinical Complex of the College of Veterinary Science and Animal Husbandry Anand for 2 years. Total 559 goats were suspected of Anemia, and 80 (14.31 %) goats were found anaemic. Sex-wise incidence was higher in females (72.50%, 58/80) than males (27.50%, 22/80). Age-wise incidence was higher in ≥1-year age group (66.25%, 53/80) as compared to <1-year age group (33.75%, 27/80). The season-wise highest incidence was recorded in monsoon (50.00%, 40/80), followed by winter (27.50%, 22/80), and in summer (22.50%, 18/80). Hematological parameters indicated significantly ($p < 0.05$) decreased TEC, Hb, PCV, MCV, MCH, and MCHC, and significantly increased TLC and neutrophils in anaemic goats compared to healthy goats. Serum biochemical estimations indicated a significant reduction in SGPT and total protein levels in anaemic goats compared to healthy goats. The etiological study revealed the highest incidence for mixed endoparasitic infestation (48.75%) followed by poor nutrition (25%) and other causes, like coccidia and scabies (8.75% each) and Trypanosoma and lice-tick mixed infestation (3.75% each).

Keywords: Anemia, Etiology, Goats, Hemato-biochemical profile, Incidence.

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Introduction

Domestic goats (*Capra hircus*) play an important role in meeting many rural households' nutritional, economic, and social needs (Byaruhanga *et al.,* 2015). They play an important role in improving the national economy through meat, milk, skin, and hair production. Anemia is one of the common conditions of goats affecting production performance. Clinically, Anemia is characterized by an absolute decrease in the packed cell volume (PCV), haemoglobin concentration (Hb), and total erythrocyte count (TLC) per unit volume of blood with values below the normal generally observed in hydrated animals. PCV, Hb, and mean corpuscular haemoglobin (MCH) are major indices used to diagnose Anemia. Typically, PCV values in goats range between 22 and 38%, whereas the Hb and MCH range from 8-12 g/dL and 5.2-8.0 pg, respectively (Kahn and Line, 2010). This study aimed to assess the incidence, etiologies, and Hemato-biochemical alterations associated with Anemia-affected goats.

Materials and Methods

The present study was carried out at the Veterinary Clinical Complex of the College of Veterinary Science and Animal Husbandry for 2 years, *i.e.,* from January 2018 to December 2019. Total 559 goats were screened for Anemia based on clinical signs like pale mucous membranes, lethargy, tachycardia, and rough hair coat. All goats belonged to small landless goat keepers without much scientific method of rearing and no history of deworming or vaccination. The goats with low haemoglobin (less than 8.0 gm/dL) were considered anaemic (n = 80).

For haemotological analysis, about 2 ml of whole blood was collected in K_3EDTA tubes by jugular venipuncture. Blood samples were analyzed on an automated haemotology analyzer (Abacus Junior Vet-5). About 4 ml of blood was also collected in clot activators for serum biochemical analysis on CKK 300 auto-analyzer. Complete blood count (CBC) was carried out which included total leucocyte count (TLC), lymphocytes, neutrophils, monocytes, eosinophils, total erythrocyte count (TEC), haemoglobin (Hb), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC). Serum samples were analyzed for biochemical parameters like serum glutamate

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pyruvic transaminase (SGPT), serum glutamate oxaloacetate transaminase (SGOT), and total protein.

Systematic clinical examination of each anaemic goat was done to detect ectoparasites on the body. Deep skin scrapings were collected from animals with skin lesions and subjected for microscopical examination with 10 % potassium hydroxide for detection of mites. The fecal samples were collected and subjected to microscopical examination for detection of parasitic ova and oocysts (Soulsby, 1982). Peripheral blood smears from the animals were prepared, stained with Giemsa stain, and examined for haemoiparasites. The data were analyzed using descriptive statistics and an unpaired 't-test.

Results and Discussion

Incidence

During the study period, a total of 559 goats were presented with clinical signs like a pale mucous membrane, lethargy, tachycardia, and rough hair coat. Among them, 80 (14.31 %) goats were found anaemic. Many scientists reported the incidence of Anemia in goats from 15.38% to 65.13% (Bhikane *et al.,* 2006; Bhatane *et al.,* 2018).

Sex wise incidence was higher in female (72.50%, n = 58) as compared to male (27.50%, n = 22). A higher incidence of Anemia in females was in accordance with observations of many earlier scientists (Dutta *et al*., 2017; Singh *et al*., 2017; Bhatane *et al.,* 2018).

Age-wise incidence was 33.75% (n = 27) in 1 year or less than 1-year age group and 66.25% (n = 53) in more than 1-year age group. These findings were in accordance with Kulkarni (1995), whereas most of the other authors recorded the highest incidence in the 7 to 12 months age group (Saleem, 2000; Goklaney *et al*., 2012).

The season-wise incidence was highest in monsoon (50.00%, n = 40) followed by winter (27.50%, n = 22) and in summer (22.50%, n = 18). The present findings are in accordance with Dutta *et al.* (2017) and Singh *et al.* (2017). On the contrary, Bhatane *et al.* (2018) recorded the highest prevalence of Anemia in winter (56.33%), followed by summer (30.98%) and monsoon (12.67%) season. The higher incidence of Anemia was also recorded in the summer months by Bhikhane *et al.* (2006). The higher prevalence observed in the monsoon season in the present study could be due to higher parasitic infections, attributed to favorable climatic conditions, *viz*., humidity, and temperature, which support the parasitic growth and development, leading to increased availability of infective larvae in this season. It is well documented that gastrointestinal parasitism in grazing animals is directly related to the availability of larvae on pasture and seasonal pasture contamination (Gaherwal, 2016)

Haemotological Alterations

Blood samples were subjected to haemotological analysis, and the mean (±SE) values of different parameters are presented in Table 1. There was a significant decrease ($p < 0.05$) in TEC (erythrocytopenia), Hb (Anemia), PCV, MCV, MCH, and MCHC in anaemic goats and significant ($p < 0.01$) increase in the levels of TLC (leucocytosis) and neutrophils (neutrophilia) in anaemic goats as compared to healthy goats. These findings were similar to those of Bhatane *et al.* (2018) and Banka *et al.* (2021).

Serum Biochemical Analysis

Serum biochemical estimations indicated a significant reduction in the mean levels of SGPT and total protein and a non-significant reduction in SGOT in the anaemic goats as compared to healthy goats (Table 2). Similar findings of hypoproteinemia were recorded in gastrointestinal nematodiasis in goats by Bhatane *et al.* (2018) and Jas *et al.* (2008). The low level of protein in gastrointestinal parasitism is attributed to increased plasma leakage through the injured gut caused by the parasites.

Etiology

A total of 80 anaemic goats were examined for the etiology. Among them, 48.75% were found positive for mixed endoparasitic infestation, 25.00% were found to be due to poor nutrition and other causes, whereas 8.75 % each were found positive for coccidia and scabies, and 3.75% each were positive for Trypanosoma and lice /tick infestation (Table 3). These findings are in accordance with Shinde and Rajguru (2009), who reported internal parasites as a major etiological agent for Anemia in goats followed by external parasites. Yakhchali and Hosseine (2006) found ectoparasitism as the major cause for Anemia in goats in Iran which may be due to climatic differences and geographical peculiarities.

Table 1: Hematological parameters in healthy and anaemic goats

Parameter	*Healthy (n = 10)*	*Anaemic (n = 80)*
TLC (10^3/µL)	10.35 ± 0.11	16.75 ± 1.18**
Lymphocyte (%)	56.77 ± 0.55	24.10 ± 2.03**
Monocyte (%)	1.18 ± 0.06	1.21 ± 0.18
Neutrophils (%)	46.65 ± 0.54	70.84 ± 2.52**
TEC (10^6/µL)	11.73±0.17	10.20±0.47*
Haemoglobin (g %)	10.13±0.12	5.18±0.20*
PCV (%)	27.57±0.23	15.87±0.72**
MCV (fl)	23.88±0.41	15.86±0.43**
MCH (pg)	8.80±0.19	5.23±0.12**
MCHC (g/dl)	36.97±0.56	33.70±0.61*

*Significant at $p < 0.05$, **Significant at $p < 0.01$ between groups.

Table 2: Serum biochemical parameters in healthy and anaemic goats

Parameter	*Healthy (n = 10)*	*Anaemic (n = 80)*
SGPT(IU/L)	31.00 ± 1.65	18.92 ± 3.05*
SGOT(IU/L)	162.20 ± 8.67	114.67 ± 23.66
Total protein(gm/dL)	6.46 ± 0.06	5.25 ± 0.44*

*Significant at $p < 0.05$ between groups.

Table 3: Distribution of cases of anemia in goats as per the etiology

S. No.	*Etiology*	*Number*	*%*
1	Mixed endoparasitic infestation (Trichostrongylus, Trichuris, Strongylus, and Trichostrongyloide)	39	48.75
2	Poor nutrition and other causes	20	25.00
3	Coccidia	07	8.75
4	Scabies	07	8.75
5	Trypanosoma	03	3.75
6	Lice/Tick infestation	03	3.75
7	Fasciola and Amphistom mixed infestation	01	1.25
Total		80	100

Mange was seen in 8.75% of goats. Hematological findings of lowered haemoglobin and Hematocrit with granulocytic leukocytosis observed in mangy goats were in agreement with the findings of De and Day (2010) and Jadhav *et al.* (2020). The chronic loss of appetite in the ailing goats due to mange infestation and pruritus might be responsible for malnutrition and the development of Anemia.

Coccidiosis was recorded in 8.75% anaemic goats in the present study. Similar findings were recorded by Anumol *et al.* (2012). They recorded 8.00% coccidiosis in anaemic goats with a significant decrease in haemoglobin, TEC and Hematocrit. In contrast, Rakhshandehroo *et al*. (2013) revealed that PCV and Hb remained unchanged in experimental coccidiosis in kids. Only transient decrease in PCV and Hb was attributed to the negative influences of the pathological and clinical features of the disease (*i.e.,* diarrhea, malabsorption, etc.), which distort protein synthesis in the liver and also the production of erythrocytes in the bone marrow.

Tick and lice infestation was seen in 3.75% of cases in the present study. In contrast, Anumol *et al.* (2012) recorded 38.89 % anaemic goats with tick infestation, followed by lice (27.78 %), mites (25.93 %), and fleas (7.40 %) in Kerala. The decreased haemotological indices (Hb, PCV, and TEC) recorded in the present observations could be attributed to the reduced appetite, blood loss from scratching, and inflammatory response due to these infections. It has been found that lice infestation cause an increase in oxidative markers of blood and erythrocytes being very prone to oxidative damage can result in significant Anemia in infected animals (Ajith *et al.*, 2017)

Trypanosomiasis was observed in 3.75% of anaemic goats. The observed Anemia may be attributed to immune-mediated phenomena by autoantibodies directed against the component membrane of infected and uninfected erythrocytes, production of toxic hemolytic factors of the parasite, and mechanical damage by trophozoite intra-erythrocytic binary fission. Anemia, the most reliable finding in trypanosomosis of domestic animals, has been reported in *T. brucei* infected goats (Abdata *et al.*, 2018).

Twenty anemic goats (25.00%) of the group were not having any ecto- or endo-parasitic infections mentioned above. Most of the owners were landless goat keepers without proper access to a good plane of nutrition. Anemia in these animals may be due to nutritional deficiencies or other causes. Since parasitism is the primary cause of Anemia in goats, proper treatment and control measures are to be adopted to alleviate the Anemia.

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