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A Study on Prevalence of Anemia, Etiological Factors and Hemato-biochemical Alterations in Anaemic Goats in Goat Research Station, Burnihat, Assam

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ABSTRACT

The present study was carried out from March, 2025 to February, 2026 at Goat Research Station, Burnihat, Assam, India to assess the incidence and etiological factors including haemato-biochemical changes associated with anemia in goats. Among the total of 220 goats examined for anemia, 150 (68.18%) goats were found to be anaemic. The incidence of anemia was higher in females (61.33%) compared to males (38.66%). The incidence of anemia was higher in goats of less than 1 year of age (65.33%) compared to those of more than 1 year of age (34.66%). The seasonal incidence was higher in the monsoon season (53.33%) followed by summer (26.66%) and winter (20%). The results of the etiological study showed that the highest incidence was recorded for mixed endoparasitic infestation (54.00%), followed by hemo-protozoan infection (18.66%), tick infestation (16.66%), coccidiosis (6.66%), and other etiological factors such as aging, nutritional factors, etc. (4%). The results of the haemato-biochemical study showed that the values of TEC, Hb, PCV, MCV, MCH and MCHC were significantly (p<0.05) decreased in anaemic goats compared with the healthy ones. The values of TLC and neutrophils were significantly (p<0.05) increased in anaemic goats compared with the healthy ones. The values of total protein and albumin were significantly (p<0.05) decreased in anaemic goats compared with the healthy ones. These findings emphasized the need for timely diagnosis, improved management practices, strategic deworming, and nutritional supplementation to reduce anemia prevalence and enhanced overall health and productivity in goats significantly.

KEYWORDS: Anaemia, goat, hemonchosis, theileriosis

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1. INTRODUCTION

Goats can be classified as a multipurpose animal due to their use in producing meat, milk, and fibre. Goats are very important to many people due to their ease of adaptation, growth rate, and low in management. They are a preferred animal species in a resource-constrained environment. Goats play a very significant role in meeting the nutritional, economic, and social needs of rural dwellers (Kumar et al., 2010; Dubeuf et al., 2023; Patowary et al., 2024). In addition to producing high-quality protein from meat and milk, goats are very significant to rural households in terms of generating revenue from fibre, skin, and live animal sales. Their ability to utilize poor-quality forage into valuable products further enhances their significance in rural economies. However, despite the advantages the productivity of goats is often constrained by various health challenges, among which anaemia represents a major but often under diagnosed problem. The main hidden health problem in goats is anaemia resulting from endo- and ectoparasites and hemo-parasitic infection that limits their productivity in different aspects of goat production (Anumol et al., 2012; Batool et al., 2023; Rizwan et al., 2023; Patowary et al., 2025). The main problem is anaemia that limits growth rate, reproduction efficiency, milk yield, and even mortality, which ultimately results in economic losses. The main problem is that it is commonly under-diagnosed. The most prevalent gastrointestinal nematodes of small ruminants are *Haemonchus contortus*, *Strongyloides papillosus*, *Oesophagostomum columbianum*, *Trichostrongylus colubriformis*, and *Bunostomum trigonocephalum* (Nath et al., 2021; Barua et al., 2022; Gonzalez-Garduno et al., 2025). These parasites cause chronic blood and protein loss, resulting in hypoproteinaemia, weight loss, and poor body condition. *Haemonchus contortus*, in particular, is notorious for its blood-sucking capacity, which often leads to acute anaemia and sometimes sudden death in heavily infested animals. Gastrointestinal parasitism thus represents a major health constraint, particularly in young and immunocompromised goats, affecting their productive potential. Gastrointestinal parasitism results in blood loss, anaemia, hypoproteinaemia, reduced growth rate, productive performance, and mortality (Negasi et al., 2012; Patowary et al., 2025; Strydom et al., 2025; Ullah et al., 2025). Besides gastrointestinal nematodes, small ruminants are often challenged with tick-borne haemoprotozoan infections like anaplasmosis, babesiosis, and theileriosis, which often appear to be subclinical infections. Haemoprotozoan infections result in haemolytic anaemia, jaundice, weakness, and considerable losses in productivity (Salih et al., 2015; Maharana et al., 2016; Arif et al., 2025; Patowary et al., 2024). The presence of mixed infections, for example, infections with both gastrointestinal nematodes and haemoprotozoan parasites, may increase the severity of anaemia, which may further complicate the clinical management of the disease. Besides ticks and mites, other ectoparasites like lice may also contribute to anaemia due to the direct loss of blood and irritation. Knowledge of the aetiology of anaemia is essential for the effective control of the disease. Nutritional deficiencies, parasitic infections, infections, and environmental stresses are all interrelated and can affect the aetiology of anaemia in goats. A clear knowledge of the aetiology of anaemia will help to formulate effective control strategies for the disease. For example, anaemia may be a subclinical disease, and it may be difficult to recognize the disease until the onset of severe clinical signs. Early detection and timely intervention are particularly important, as subclinical anaemia may remain undiagnosed until severe clinical symptoms appear, leading to avoidable economic losses. This study offers valuable insights into strategic interventions for addressing anaemia in goats, as it specifically explores the reasons for, as well as the impact of, this health condition in goats, which is critical for ensuring the productivity and sustainability of rural livelihoods based on goat rearing (Kumar et al., 2010; Patowary et al., 2024; Rizwan et al., 2023). Thus, this study was undertaken with the objective of assessing the incidence, etiology, and associated haemato-biochemical changes in anaemia in infected goats.

2. MATERIALS AND METHODS

The present study was performed from March, 2025 to February, 2026 at Goat Research Station, Burnihat. A total of 220 goats were examined for the presence of anaemia based on the presence of various symptoms like pallor of the mucous membrane, lethargy, poor condition, distended abdomen, tachycardia, and rough hair coat. Animals with low hemoglobin levels (<8.0 g dl^{-1}) were considered anaemic. For the haematological investigation, approximately 2 ml of whole blood was collected in K3EDTA tubes by jugular venipuncture for the analysis of blood samples using automated haemotology analyzer. Approximately 2 ml of blood was collected in clot activators for the serum biochemical investigation using the Idexx catalyst clinical chemistry analyzer. For serum biochemical studies, 2 ml of blood was collected in clot activators. Complete blood counts were carried out and included total leucocyte count (TLC), lymphocytes, neutrophils, monocytes, eosinophils, total erythrocyte count (TEC), hemoglobin (Hb), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC). The serum levels of various biochemical parameters such as total serum proteins and albumin were estimated. Fecal samples from the animals were collected and subjected to microscopic examination to

detect the presence of parasitic ova and oocysts by employing the standard method as mentioned by Soulsby (1982). Peripheral blood smears from the animals were prepared and subjected to microscopic examination to detect the presence of hemoparasites. Systematic clinical examination of all the anaemic goats was carried out to detect the presence of ectoparasites on the body surface. Prevalence data were analyzed using the Chi-square goodness-of-fit test, while hematological and biochemical parameters were analyzed using a one-sample t-test. Statistical analysis was performed using SPSS version 25 at a significance level at $p<0.05$ and $p<0.01$.

3. RESULTS AND DISCUSSION

3.1. Incidence

During the study period, out of a total of 220 goats, the study found that the number of anaemic goats was 150 (68.18%). Various researchers have found that the incidence of anaemia in goats was between 15.38 and 65.13% (Bhikane et al., 2006). It was also found that the incidence of anaemia was higher in females (61.33%, n=92) compared to males (38.66%, n=58). It was believed that the incidence of anaemia was higher in females compared to male goats due to various physiological and management factors. Female animals generally experienced greater physiological stress due to reproductive functions such as estrus, pregnancy, and lactation, which increased the demand for nutrients, particularly iron and other hematopoietic elements. If these nutritional requirements were not adequately met, females become more susceptible to anemia. In addition, females were often retained longer in the herd for breeding purposes, which increased their exposure to parasitic infections and other health challenges that might contribute to reduced hemoglobin levels. Similar findings were recorded by earlier researchers (Sykes and Coop (2001); Singh et al. (2017). The incidence rate was recorded as 65.33% (n=98) for the age group below 1 year and 34.66% (n=52) for the age group above 1 year. Young goats have an immature immune system and were more susceptible to parasitic infestations and infectious diseases that could lead to blood loss or impaired erythropoiesis. Moreover, rapid growth during the early stages of life increased the demand for essential nutrients required for red blood cell production. Inadequate nutrition or heavy parasitic burden during this period could therefore predispose young animals to anemia. These results were in agreement with the previous reports wherein the highest incidence of anemia was recorded for the age group of 7 to 12 months (Goklaney et al., 2012). The highest incidence was recorded for the monsoon season (53.33%, n=80), followed by the summer season (26.66%, n=40), and the lowest was recorded for the winter season (20%, n=30). The results obtained in the present study are in accordance with the results obtained by Singh et al. (2017). It was quite evident that the high percentage of infection recorded for the monsoon season in the present study could be attributed to the high percentage of parasitic infections caused due to favorable climatic conditions such as humidity, rainfall and temperature that facilitated the growth of the parasite. It was a well-known fact that gastrointestinal parasitism in grazing animals was directly correlated with the availability of larvae in the pasture.

3.2. Etiology

For the etiological study of the disease, a total of 150 anaemic goats were investigated. Among them, 54.00% of the goats were found to be positive for mixed endoparasitic infestation, whereas 18.66% of the goats were found to be anemic due to the cause of hemoprotozoal infection (Theileriosis). In addition, 16.66% each was found positive for ectoparasitic infestation and coccidiosis. Out of the total number of anaemic goats, six anaemic goats (4%) of the group were anemic might be due to nutritional deficiencies or other unknown causes (Table 1). During the present study, among different eggs of GI nematodes were found in the faecal samples screened, the prevalence of *Hemonchus contortus* was predominant. Anemia in goats infested with endoparasites was attributed to acute loss of

Table 1: Distribution of cases of anaemia in goats as per the etiology

Etiology	Total positive cases	Prevalence (%)	χ^2 value	Significance
Mixed endoparasitic infestation (*Haemonchosis, Trichostrongylus, Trichuris, Bunostomum, Oesophagostomum*)	81	54.00	120.19	$p<0.001^{**}$
Hemoprotozoan infection (*Theileriosis, Anaplasmosis*)	28	18.66		
Tick infestation (*H. bispinosa, Rhipicephalus* spp.)	25	16.66		
Coccidia	10	6.66		
Other causes (Aging, ORF, nutritional deficiency)	6	4.00		
Total	150	100		

**Highly significant

blood by their blood sucking activity and leakage through the damaged GI tract caused by the parasites. The findings were in accordance with the findings of Shinde and Rajguru (2009), who found that the major etiological agent for the cause of anaemia in goats was internal parasites, followed by external parasites. Theileriosis, another important etiological factor for the cause of anaemia in goats, was also found in anaemic goats. The hemoprotozoa infect the lymphocytes and erythrocytes, leading to the destruction of red blood cells along with impaired erythropoiesis and immune-mediated hemolysis, resulting in decreased haemoglobin concentration, TEC and packed cell volume in the host animal (Patowary et al., 2024; Arif et al., 2025). Ectoparasitism was identified as the main reason for anaemia in goats by Yakhchali and Hosseine (2006), which might be attributed to climatic changes and geographical uniqueness. Haematological findings of decreased levels of haemoglobin and haematocrit, along with granulocytic leukocytosis, in infested goats with ectoparasites were in conformity with the findings of De and Day (2010) and Jadhav et al. (2020). The chronic reduction in appetite of infected goats might be responsible for anaemia caused by infection. The decreased levels of haemotological parameters in the present observations might be due to decreased appetite, blood loss during scratching, and inflammation caused by infection. Coccidiosis was found in 6.66% anaemic goats in the present observations. Similar findings were obtained by Anumol et al. (2012). They found 8.00% coccidiosis in anaemic goats with a significant decrease in haemoglobin, TEC, and haematocrit. The temporary reduction in PCV and Hb might be due to negative effects of pathological and clinical symptoms of the infection, viz. diarrhoea, malabsorption, etc. They caused protein synthesis in liver tissue to be adversely affected, resulting in decreased RBCs in peripheral blood. Since endoparasitism was the main cause of anemia in goats, it was necessary to implement appropriate prevention and control strategies to relieve anemia.

3.3. Hematological alterations

The blood samples were analyzed using haemotological analysis, and the mean (±SE) of different parameters was presented in Table 2. The findings revealed that there was a significant reduction (p<0.05) in TEC, Hb, PCV, MCV, MCH, and MCHC in anaemic goats. There was a significant increase (p<0.01) in TLC (leucocytosis) and neutrophils (neutrophilia) in anaemic goats compared to the normal reference range. The reduction in these parameters was usually attributed to different pathological conditions, including parasitic infestation, haemoprotozoan infection, nutritional deficiencies, and chronic blood loss, leading to destruction of red blood cells or inability of the bone marrow to produce enough red blood cells. The increase in TLC and neutrophils in the blood of anaemic goats indicated that there was an infectious disease in the goats. Neutrophilia was usually attributed to bacterial infections, tissue damage, or parasitic infections, indicating the immune response of the body to different pathological conditions that caused anaemia in goats. The findings of this study were in line with those of Daramola et al. (2005) and Iriadam (2007).

3.4. Serum biochemical analysis

There was asignificant reduction in the levels of total protein and albumin was recorded in the anaemic goats compared to the healthy ones (Table 3). The findings of hypoproteinemia in gastrointestinal nematodiasis in goats have also been reported by Sykes and Coop (2001) and Hoste et al. (2010). The low level of protein in the blood of the goats with gastrointestinal parasitism was due to the leakage of plasma from the injured gut by the parasites.

Table 2: Haematological parameters in healthy and anaemic goats

Parameter	Infected goats (Mean±SD)	95% CI	Reference range	Significance
Hemoglobin (gd l^{-1})	6.42±0.18[a]	6.07–6.77	8–12	p<0.05
TEC (Mm m^{-3})	7.54±1.29[a]	5.01–10.07	8–18	p<0.05
PCV (%)	19.53±2.34[a]	14.94–24.12	22–39	p<0.05
TLC (mm m^{-3})	20.15±2.49[b]	15.27–25.03	4–14	p<0.01
Lymphocyte (%)	35.02±1.47	32.14–37.90	50–70	NS
Monocytes (%)	2.43±0.45	1.55–3.31	1–4	NS
Neutrophils (%)	66.14±3.14[b]	59.99–72.29	30–56	p<0.01
MCV (fl)	15.32±0.68[a]	13.99–16.65	16–25	p<0.05
MCH (pg)	6.28±1.42[a]	3.50–9.06	5.2–8	p<0.05
MCHC (gd l^{-1})	32.3±1.81[a]	28.75–35.85	28–42	p<0.05

a: Significant decrease compared to reference range (p<0.05); b: Significant increase compared to reference range (p<0.01); NS: Non-significant

Table 3: Serum biochemical parameters in healthy and anaemic goats

Parameter	Anaemic goats (Mean±SD)	95% CI	Reference range	Significance
Total protein (gd l^{-1})	5.55±0.62[a]	4.33–6.77	6.4–7.0	$p<0.05$
Albumin (gd l^{-1})	1.83±0.82[a]	0.22–3.44	2.7–3.9	$p<0.05$

[a] significantly lower than the midpoint of the reference range (one-sample t-test, $p<0.05$)

4. CONCLUSION

Anaemia was found to be more prevalent in younger goats, i.e., below one year of age, and during the monsoon season. Mixed endoparasitic infestations were found to be the main cause, with haemonchosis being the most predominant condition. This was followed by haemoprotozoan infections, tick infestation, and coccidiosis. The haemogram of anaemic goats were characterized by a significant decrease in TEC, Hb, PCV, MCV, MCH, MCHC, TP, and albumin, and an increase in TLC and neutrophils. These results indicated that parasitic infestations strongly contributed to anaemia, thereby emphasizing the need for effective parasite control and proper nutritional management.

5. FURTHER RESEARCH

Future research could focus on developing integrated parasite management strategies combined with nutritional interventions to prevent anemia in goats. Additionally, molecular studies on host-parasite interactions may help identify genetic resistance to parasitic infections.

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