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Short Communication

Studies on Babesiosis and Ehrlichiosis Induced Anaemia in Dogs from Palampur Valley of Himachal Pradesh

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Abstract

Anaemia is a reduction in red blood cells (RBCs), packed cell volume (PCV), and haemoglobin levels in the blood, resulting from haemolysis, blood loss, or decreased red blood cell production. This research was aimed at assessing the incidence of anaemia induced by babesiosis and/or ehrlichiosis in dogs in Palampur valley *w.e.f.* June to October 2025. In this study, thirty dogs positive for babesiosis and/or ehrlichiosis were screened for anaemia. Thin blood smears and immunochromatographic kits were used to identify the respective haemoprotozoan infection. Haemoglobin, packed cell volume, and red blood cell counts revealed anaemia in 26 cases (86.70%). Of these, 7 cases (26.90%) were severely anaemic (Hb; <5g%), 9 cases (34.60%) were moderately anaemic (Hb; 5-8 g%), and 10 cases (38.50%) were mild anaemic (Hb; 8-11g%). Non-descript dogs (n = 10; 33%) were most commonly affected, followed by breeds of German Shepherd and Labrador (n = 5 each; 17%), and other breeds (n = 10; 33%). Microcytic normochromic anaemia was the predominant type observed (50 %).

Keywords: Blood, Canine, Haemoprotozoan, Occurrence

Canine babesiosis is caused by protozoan parasites of the genus *Babesia*, which invade and destroy the erythrocytes and are transmitted by ticks. The major *Babesia* species found in dogs in India are *Babesia gibsoni* (small form) and *Babesia vogeli* (large form), Mandal *et al*[1]. Affected dogs are commonly presented with an acute, severe form of babesiosis, showing signs such as dark red urine, weakness, fever, pale mucous membranes, depression, swollen lymph nodes, and enlarged spleen. When red blood cells are infected by these protozoan parasites, a variety of clinical signs can occur, ranging from moderate lethargy to severe, potentially fatal anaemia.

Canine ehrlichiosis is a tick-borne disease caused by *Ehrlichia canis,* an obligate intracellular rickettsia of the genus *Ehrlichia*, family *Anaplasmataceae*; order *Rickettsiales*. The brown dog tick (*Rhipicephalus sanguineus*), which is the primary vector of the diseases, can spread widely throughout both rural and urban parts of India because it flourishes in the country's warm, humid climate. Ehrlichiosis has become increasingly prevalent in recent years, due to the rising population of stray dogs, inadequate tick control measures, and shifts in tick habitats caused by climate change[2]. The disease can progress through acute, subclinical, and chronic stages, with symptoms

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ranging from lethargy and fever to more severe issues like bleeding and anaemia.

Anaemia is a condition characterised by a deficiency of red blood cells or haemoglobin in the blood, which leads to reduced oxygen transport throughout the body. In canine babesiosis, anaemia occurs because the organisms replicate intracellularly in the red blood cells, resulting in intravascular haemolytic anaemia. In both babesiosis and ehrlichiosis, immune-mediated reactions against the parasites or altered self-antigens worsen the haemolytic anaemia. The present study determined the prevalence, severity and type of anaemia in dogs affected with babesiosis and ehrlichiosis presented at Veterinary Medicine, Department of DGCN COVAS, Palampur.

The study was carried out on dogs presented at the Department of Veterinary Medicine, DGCN COVAS, Palampur (Himachal Pradesh) from June 2025 to October 2025. A total of 1738 were presented during this period, out of which 30 dogs were selected for this study. Animals were selected based on clinical history and physical examination findings, including tick infestation, high fever, decreased appetite, and enlarged lymph nodes. Thirty dogs suspected of ehrlichiosis and/or babesiosis were then subjected to diagnostic testing for disease confirmation and found positive for babesiosis and/or ehrlichiosis were screened for anaemia and the haematological parameters *viz.* total erythrocytic count (TEC), haemoglobin (Hb) and packed cell volume (PCV) were recorded in both control as well as study group (six clinically healthy dogs that were presented for regular vaccination were included in the control group).

Two ml of blood were taken from each dog's saphenous vein into vials containing Ethylene Diamine Tetra Acetic acid (EDTA) for complete blood count (CBC) and parasite detection, and 3 ml of blood were collected in clot activating vial for collecting serum. Serum was separated by centrifuging the blood at 5000 rpm for 3 minutes. A drop of uncoagulated blood was put on one end of a clean glass slide, and another glass slide was placed at an angle of about 30-40 degrees to touch the blood, allowing it to spread along the contact line of the slide, and then a thin blood smear was made. The smear was air-dried and fixed by putting methanol over the slide for 15 minutes. Staining was done using Giemsa stain. The slides were observed at 100x magnification under a light microscope to identify the parasites (*Babesia* spp.), which are pyriform in shape, found within the RBCs (Figure 1), and *Ehrlichia canis* that is round-shaped, found within the monocytes (Figure 2). In addition, the immunochromatographic test kit (QuickVET®) was used for the detection of antibodies in the serum against the parasites, *i.e., Babesia gibsoni, Babesia canis vogeli*, *Ehrlichia* spp. and *Anaplasma* spp.

The CBC was performed using an automated haematology analyser (Mindray animal care BC-5000 Vet). Total erythrocyte count, packed cell volume, haemoglobin concentration and erythrocytic indices were analysed for assessment of type and severity of anaemia. The data generated was analysed using the statistical software Graphpad Prism. Independent t-test and chi-square test were applied to determine the differences between variables. Odds ratio with a 95% confidence interval (CI) was calculated for finding the association between certain variables and anaemia, and statistical differences at the level of $p<0.05$ were considered significant.

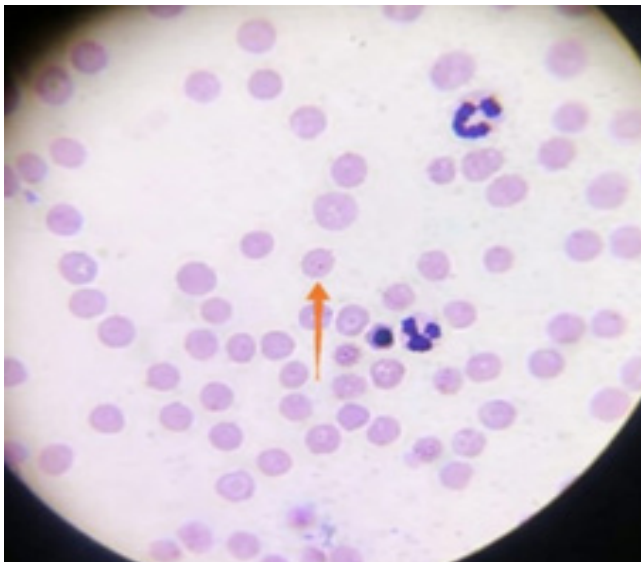


Figure 1. Blood smear showing a small annular ring-shaped Babesia gibsoni in RBCs (100x).

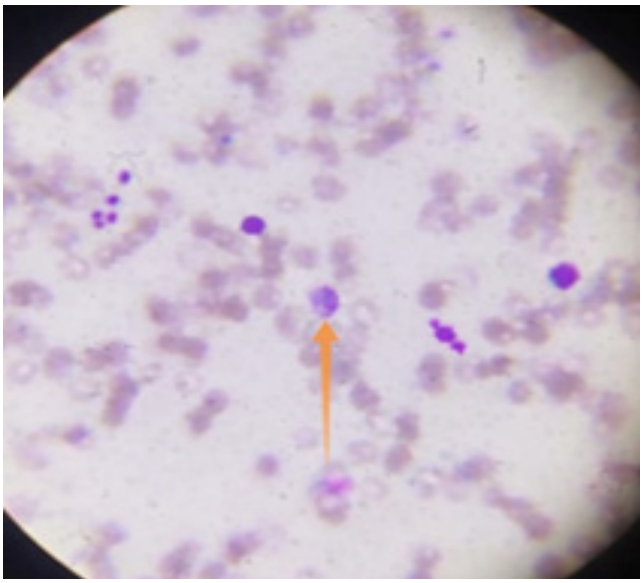


Figure 2. Blood smear showing mulberry-like morula of E. canis in monocytes (100x).



Figure 3. Immunochromatographic test kit (test result positive for *Ehrlichia*).

Out of the 30 cases studied, 13 (43%) were diagnosed with babesiosis, 12 (40%) were identified as ehrlichiosis, and 5 cases (17%) presented mixed infection involving both babesiosis and ehrlichiosis. The positivity of cases was confirmed using both direct microscopy and an immunochromatographic (IC) kit. Only those samples that were positive by both methods were included in the study, while samples negative on direct microscopy but positive on the IC kit were excluded. Among these cases, *Babesia gibsoni* infection was identified in seventeen animals, while a single case was attributed to *Babesia canis vogeli.* Additionally, *Ehrlichia canis* infection was confirmed in seventeen cases, either as a single pathogen or as part of mixed infections. Male dogs were affected more, twenty-five cases (83.30%), and five cases (16.70%) were of female dogs.

Breed-wise incidence of canine babesiosis and ehrlichiosis revealed that non-descript local breeds were affected more (10/30, 33%), followed by German Shepherd (5/30, 17%) and Labrador (5/30, 17%), then Beagle, Golden retriever and Husky (2/30, 7% each), Pomeranian (1/30, 3%), and other breeds 3 (10%). Kalia *et al.*,[3] showed a higher incidence of babesiosis and ehrlichiosis in Labradors and German Shepherds, with non-descript dogs also contributing a significant proportion. In our study, non-descript dogs were most frequently affected, followed by Labradors and German Shepherds.

Out of the 30 dogs diagnosed with babesiosis or ehrlichiosis, 26 animals (86.70%) exhibited anaemia. Among the 13 dogs affected with babesiosis, 12 (92.30%) were anaemic, while 10 of the 12 dogs suffering from ehrlichiosis (83.30%) showed evidence of anaemia. Also, it was observed that *Babesia* spp. causes more severe anaemia as compared to *Ehrlichia* spp. Male dogs exhibited a higher incidence of anaemia compared to female dogs (Table 1). The prevalence of anaemia in dogs suffering from canine babesiosis in the present study (92.30%) was higher than that of Abakpa *et al.*,[4] who reported 77.70% in dogs with the same disease. The high prevalence of anaemia observed in canine babesiosis indicated that anaemia is a hallmark of the disease.

Age-wise distribution of anaemia in dogs affected with babesiosis and/or ehrlichiosis revealed that the highest proportion of anaemia occurred in dogs aged 3–7 years (92.90%), followed by dogs older than 7 years (85.80%), whereas dogs younger than 3 years showed a comparatively lower prevalence (77.80%). In the present study, a relatively higher number of anaemic cases were observed in males compared to females; however, this difference was statistically insignificant (Table 1). Furthermore, haemoglobin, PCV and TEC

Table 1. Sex-wise and age-wise occurrence of anaemia in dogs affected with babesiosis and ehrlichiosis

	Variables	No. of Cases (n = 30)	Anaemic Dogs (%)	Non-anaemic Dogs (%)
Sex	Male	25	22 (88)	3 (12)
	Female	5	4 (80)	1 (20)
	<3 years	9	7 (77.80)	2 (22.20)
Age	3-7 years	14	13 (92.90)	1 (7.10)
	>7 years	7	6 (85.80)	1 (14.20)

Table 2. Erythrocytic parameters of dogs suffering from babesiosis and ehrlichiosis in comparison with healthy control dogs***Significant at 0.01% level (P<0.0001)

Parameter	Healthy Control (n = 6) (Mean ± SE)	Babesiosis and Ehrlichiosis (n = 30) (Mean ± SE)
TEC (x10^6/µl)	6.54 ± 0.22***	3.53 ± 0.35
Hb (g/dl)	15.02 ± 0.57***	7.99 ± 0.76
PCV (%)	38.10 ± 1.04***	22.07 ± 2.10

levels in the affected dogs were highly significantly reduced compared to healthy controls ($p < 0.0001$) (Table 2). Anaemia is regarded as a characteristic feature of canine babesiosis, arising from both intravascular and extravascular haemolysis[5]. Verma *et al.*,[6] also reported significantly low total erythrocyte count and haemoglobin levels in dogs affected with ehrlichiosis compared to healthy controls. This indicated that anaemia is a common haematological finding in both ehrlichiosis and babesiosis.

The pattern of anaemia observed in this study revealed that babesiosis and ehrlichiosis in dogs cause mild to severe anaemia. Ten out of 26 dogs (38.50%) were mildly anaemic (Hb; 8-11 g%), and 9 dogs

Table 3. Severity and classification of anaemia recorded in dogs affected with babesiosis and ehrlichiosis

	Anaemia	No. of Cases
	Mild (Hb;8-11g%)	10 (38.5%)
Severity	Moderate (Hb;5-8g%)	9 (34.6%)
	Severe (Hb;< 5g%)	7 (26.9%)
	Microcytic hypochromic	6 (23.1%)
	Microcytic normochromic	13 (50%)
Characteristics	Normocytic normochromic	4 (15.4%)
	Macrocytic hypochromic	0
	Macrocytic normochromic	3 (11.5%)

(34.60%) were moderately anaemic (Hb; 5-8 g%), while 7 (26.90%) dogs were found to be severely anaemic (Hb; 5 g%). In terms of morphology, microcytic normochromic anaemia was found in the maximum number of affected dogs, 13 (50%) affected dogs (Table 3). While no case of macrocytic hypochromic anaemia was observed. This classification was done based on the normal reference range values of MCV(65-75 fl) and MCH (22-26 pg) in healthy dogs.

Anaemia observed in the present study was predominantly of mild severity, followed by moderate and severe forms, which is consistent with the findings reported by Abakpa[4]. In the present study, babesiosis was associated with varied erythrocyte indices, including microcytic, macrocytic, and normocytic red blood cells, reflecting diverse haematological responses in affected dogs. These findings are in accordance with the observations of Abakpa *et al*[4]. In contrast, all of the dogs infected with *Ehrlichia canis* alone showed microcytic RBCs. This finding suggests that *Ehrlichia canis* infection may contribute to iron deficiency-related haematological alterations, resulting in the development of microcytic red blood cells. This observation is supported by the findings of Bottari *et al*.,[7] who reported a significant decrease in serum iron levels during the acute phase of canine monocytic ehrlichiosis compared to healthy animals.

CONFLICT OF INTEREST

The authors declare no conflict of interest in relation to this article.

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AUTHORS CONTRIBUTION

BS: conducted the experiment, analyzed the data and wrote the original manuscript. PS: conceptualize the research programme, methodology, provided resources, reviewed and edited the manuscript.