

International Journal of Advanced Biochemistry Research



ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating (2026): 5.29
IJABR 2026; 10(7): 501-503
www.biochemjournal.com
Received: 22-04-2026
Accepted: 26-05-2026

H Basavakumar
MVSc Scholar, Department of
Veterinary Medicine,
Veterinary College, Hebbal,
Karnataka, India

Chetan Kumar GK
Assistant Professor,
Department of Veterinary
Medicine, Veterinary College,
Hebbal, Bengaluru,
Karnataka, India

Veeregowda BM
Professor, Department of
Veterinary Microbiology,
Veterinary College, Hebbal,
Bengaluru, Karnataka, India

Haemato-biochemical and vitamin d status in dogs affected with demodicosis

H Basavakumar, Chetan Kumar GK and Veeregowda BM

DOI: <https://www.doi.org/10.33545/26174693.2026.v10.i7g.9068>

Abstract

Canine demodicosis is a common dermatological disease caused by proliferation of *Demodex* mites, with immunosuppression playing a crucial role in its pathogenesis. The present study aimed to evaluate haematological, biochemical and Vitamin D alterations in dogs affected with demodicosis. Blood samples were collected from affected dogs and compared with apparently healthy controls. Significant reductions in haemoglobin, packed cell volume and total erythrocyte count were recorded in demodectic dogs, accompanied by leucocytosis, neutrophilia and lymphopenia. Biochemical analysis revealed hypoproteinaemia, hypoalbuminemia, hyperglobulinemia and decreased albumin:globulin ratios. Vitamin D deficiency was observed in 21.43% of affected dogs. These findings suggest that canine demodicosis is associated with marked alterations in haematological and biochemical indices, reflecting chronic inflammation and impaired immune function. Vitamin D supplementation may serve as a potential adjunctive therapy to improve clinical outcomes.

Keywords: *Demodex canis*, canine demodicosis, haematology, biochemistry, vitamin D

Introduction

The dog (*Canis lupus familiaris*), a domesticated member of the family Canidae, is one of the most popular companion animals. However, dogs are highly prone to dermatological disorders due to constant exposure of the skin to environmental agents. These disorders not only compromise the cosmetic value of affected animals but also their general health. Among these, canine demodicosis is a major skin disease caused by the over-proliferation of *Demodex* mites, which are otherwise considered commensals of the canine cutaneous microflora. *Demodex canis* is the predominant etiological species, while *D. injai* and *D. cornei* are less frequently associated (Gortel *et al.*, 2006) ^[1]. The mites inhabit hair follicles and sebaceous glands, feeding on sebum, keratinocytes and cellular debris.

The pathogenesis of demodicosis is complex, involving immune dysregulation, cutaneous barrier rupture, inflammation and hypersensitivity reactions (Ferrer *et al.*, 2014) ^[2]. T-cell exhaustion and altered cytokine signaling, particularly the immunosuppressive role of interleukin-10, have also been implicated (Esch *et al.*, 2013) ^[3].

Canine demodicosis is diagnosed using skin scraping, trichography, acetate tape impression and occasionally PCR-based techniques for mite speciation (Muller *et al.*, 2020; Zhao and Wu, 2012) ^[4, 5]. The disease remains therapeutically challenging due to acaricide resistance and frequent recurrences (Paterson *et al.*, 2009) ^[4].

Haemato-biochemical profiling can provide insights into the systemic impact of demodicosis. Previous studies have reported anaemia, leucocytosis, hypoalbuminemia, hyperglobulinemia and altered liver enzyme activities in affected dogs (Sakina *et al.*, 2012; Kumar and Shekar, 2020; Salem *et al.*, 2020) ^[6, 7, 16]. Vitamin D, a key modulator of immune function and skin barrier integrity, has recently gained attention as an adjunctive therapy in canine dermatological diseases (Klinger *et al.*, 2018) ^[8].

The present study was undertaken to investigate haemato-biochemical changes and Vitamin D status in dogs naturally affected with demodicosis.

Materials and Methods

Dogs presented to department of veterinary medicine, Veterinary college Hebbal presented with clinical signs suggestive of demodicosis are subjected to skin scraping examination.

Corresponding Author:
H Basavakumar
MVSc Scholar, Department of
Veterinary Medicine,
Veterinary College, Hebbal,
Karnataka, India

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Fourteen dogs confirmed for demodicosis via skin scraping examination are included in the study. Six apparently healthy were chosen as control group.

2ml of blood collected aseptically from the cephalic or saphenous veins of dogs suffering with demodicosis. For haematological analysis, samples were preserved in EDTA-coated vacutainers. For biochemical and Vitamin D analysis, blood was collected in clot-activated vacutainers, allowed to clot, and centrifuged at 3000 rpm for 20 minutes to separate serum. Serum was stored in deep freezer (-20° C) for further use. Haemato-biochemical parameters like Hb, PCV, TLC, TEC, DLC, MCV, MCHC, ALT, Creatinine, total protein, albumin, globulin, A:G ratio Vitamin D levels of affected and healthy dogs were studied. Mean values of haematological, biochemical and Vitamin D parameters were compared between groups.

Results and Discussion

The mean values of Hb, PCV and TEC were significantly lower in dogs suffering with demodicosis when compared with the healthy groups which is indicative of anemia in the affected group. Similar findings were observed by Sakina *et al.* (2012) [6], Haleem *et al.* (2015) [9], Katariya *et al.* (2018) [11], Kumar and Shekar (2020) [7], Kamalu (2022) [10]. There were no significant variations in MCV, MCH MCHC levels between dogs affected by demodicosis and those in the healthy control group. Anaemia in demodectic dogs may be due to stress arising from the disease, involving chronic inflammation, nutritional deficiencies and increased metabolic demand. Significant increase in leucocytes was observed. Thushara *et al.* (2016) [12], Bhushal *et al.* (2025) [14], Haleem *et al.* (2015) [9], Kumar and Shekar (2020) [7] and Kamalu (2022) [10] The elevated leukocyte count observed in this study may be due to the host's inflammatory reaction to Demodex mite infestation, compounded by secondary bacterial infections and opportunistic pathogens. Additionally, immune system imbalance and physiological stress likely contributed to the increased leukocytic activity. Differential leucocyte count (DLC) analysis revealed significant increase in neutrophils and decrease in lymphocytes in dogs with demodicosis compared with healthy group and respectively. This indicates that dogs with

demodicosis had neutrophilia and lymphopenia. Haleem *et al.* (2015) [9], Bhushal *et al.* (2025) [14] and Reddy *et al.* (2024) [15] also reported neutrophilia and lymphopenia in demodectic dogs. In the present study, Neutrophilia is commonly associated with acute or chronic inflammation and it likely results from the host's innate immune response to Demodex mite infestation and secondary bacterial infections. The observed lymphopenia may be attributed to immunosuppressive mechanisms, either due to the disease itself or therapeutic interventions.

The present study revealed significant biochemical alterations in dogs affected with canine demodicosis. There was notable hypoproteinaemia, hypoalbuminemia, hyperglobulinemia and a markedly reduced albumin: globulin (A: G) ratio when compared with healthy dogs. Similar to our study Thakur *et al.* (2020) [13] and Reddy *et al.* (2024) [15] were also reported hypoproteinaemia, hypoalbuminemia. This hypoproteinaemia, hypoalbuminemia may be due to protein catabolism resulting from chronic inflammation and trauma to the skin caused by multiplication of mites. Reddy *et al.* (2024) [15], Salem *et al.* (2020) [16], Sakin *et al.* (2012) [6], Kumar and Shekhar (2020) [7] also reported reduced albumin level and elevated globulin concentration. This altered albumin and globulin concentration indicates immune dysregulation suggesting a compensatory response to demodicosis. In the present study, a non-significant elevation in ALT and normal creatinine levels were observed. A non-significant elevation in ALT was in consistent with Kumar and Shekar (2020) [7] and Salem *et al.* (2020) [16] who documented an elevated ALT levels suggestive of hepatic stress. Similarly, Salem *et al.* (2020) [16] reported stable renal parameters suggesting that renal function may remain largely unaffected in uncomplicated cases of canine demodicosis.

In the present study 78.5 percent of dogs diagnosed with demodicosis had normal level of Vitamin-D whereas 21.43 percent dogs had low level of Vitamin-D. Vitamin D is essential for skin barrier function, immunomodulation and antimicrobial defence. In the present study

21.43 percent of dogs had lower level of vitamin D indicates that supplementation of Vitamin D in these animals may offer better clinical outcome.

Hematological values in healthy and demodectic dogs (Mean ± SE)

Parameters	Demodectic dogs (n = 14)	Healthy control dog (n = 6)
Hb (gm/dl)	11.72 ± 0.48	14.23 ± 0.25
TEC (106/μL)	5.47 ± 0.27	7.03 ± 0.11
PCV (%)	37.54 ± 1.43	41.78 ± 0.98
MCV (fl)	67.59 ± 2.33	66.62 ± 1.93
MCH (pg)	22.19 ± 0.6	23.35 ± 0.67
MCHC g/dl	32.98 ± 0.6	35.83 ± 0.67
Platelet count(103/μL)	364 ± 30.56	269.76 ± 29.65
TLC (103/μL)	18.51 ± 2.02	13.12 ± 0.4
Neutrophils (%)	71.83 ± 0.78	62.74 ± 0.28
Lymphocytes (%)	20.07 ± 0.70	28.08 ± 0.07
Eosinophils (%)	2.03 ± 0.12	4.30 ± 0.23
Monocytes (%)	6.06 ± 0.21	4.88 ± 0.17

Biochemical values in healthy and demodectic dogs (Mean $\pm$ SE)

Parameters	Demodectic dogs (n = 14)	Healthy control dog (n = 6)
Total protein (g/dl)	5.35 $\pm$ 0.05	6.34 $\pm$ 0.03
Albumin (g/dl)	1.53 $\pm$ 0.05	3.08 $\pm$ 0.03
Globulin (g/dl)	3.82 $\pm$ 0.04	3.26 $\pm$ 0.04
A:G ratio	0.40 $\pm$ 0.02	0.95 $\pm$ 0.01
ALT (IU/L)	29.68 $\pm$ 3.68	19.16 $\pm$ 1.14
Creatinine (mg/dl)	0.8 $\pm$ 0.05	0.95 $\pm$ 0.05

Vitamin-D level in dogs affected with canine demodicosis

Range (ng/ml)	Number of dogs (n = 14)	Values (ng/mL)	Mean $\pm$ SE (ng/mL)
< 20	3 (21.43%)	19.28, 19.55, 18.55	19.13 $\pm$ 0.30
> 20	11 (78.57%)	26.61, 29.60, 25.38, 43.29, 31.78, 35.17, 39.86, 34.70, 30.73, 34.44, 32.89	33.36 $\pm$ 1.62

Conclusion

Canine demodicosis is associated with anaemia, leucocytosis, neutrophilia, lymphopenia, hypoproteinaemia, hypoalbuminemia and hyperglobulinemia. Vitamin D deficiency, though observed in only a subset of dogs, may exacerbate immune dysfunction. Routine haematological and biochemical evaluation, alongside Vitamin D assessment, can serve as valuable diagnostic and prognostic tools. Vitamin D supplementation, in combination with acaricidal and supportive therapy, may improve clinical recovery and reduce recurrence.

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