RESEARCH ARTICLE

Clinical and Haemato-Biochemical Alterations in Dogs Diagnosed with Demodicosis in Jaipur, Rajasthan

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Abstract

Demodicosis is a common dermatological condition in dogs that produces characteristic cutaneous lesions and may also cause important haematological and biochemical alterations. This study was conducted to characterize the clinical signs, lesion distribution, and haemato-biochemical changes in demodicosis affected dogs. A total of 219 dogs with dermatological lesions were screened, out of which 30 were confirmed positive for demodicosis by standard skin-scraping examination and trichogram. Also, 10 apparently healthy dogs served as controls for the haemato-biochemical comparisons. The study revealed that alopecia, erythema, and erosions were observed in all affected dogs (100%), followed by papules (80%), hyperkeratosis (73.33%), pustules (53.33%), scars (50%), vesicles (40%), excoriation (23.33%), lichenification (20%), and hyperpigmentation (13.33%). The periocular region and back were the most frequently affected sites (93.33% each), followed by the abdomen (86.66%) and face and neck (83.33% each). The haemato-biochemical study revealed that affected dogs had lower mean haemoglobin and packed cell volume, higher total leucocyte counts, neutrophilia and eosinophilia, elevated ALT, AST, total protein, globulin, and glucose, and reduced albumin while compared to healthy dogs. These findings explains that canine demodicosis is associated with very specific patterns of skin lesions, systemic, haematological and biochemical alterations.

Key words: Canine demodicosis, Clinical signs, Haematology, Lesion distribution, Serum biochemistry.

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Introduction

Demodicosis is a common parasitic dermatological disease of dogs caused by excessive proliferation of Demodex mites, *i.e., Demodex canis, D. injai* and *D. cornei*. These microscopic mites are normally present in small numbers within the hair follicles and sebaceous glands of healthy dogs without producing clinical signs. However, genetic susceptibility, impaired cell-mediated immunity, immunosuppression, poor nutrition or systemic disorders causes excessive proliferation of the mites, resulting in clinical disease. Young dogs are more affected by juvenile-onset demodicosis, whereas the occurrence of demodicosis in adult dogs is often associated with immunosuppression (Mueller *et al.,* 2020; Salem *et al.,* 2020).

Canine demodicosis may occur in localized or generalized forms. Localized demodicosis is usually characterized by a limited number of small, circumscribed lesions, commonly involving the face or limbs. In generalized demodicosis, lesions are more extensive involves several body regions or the paws. The commonly observed clinical manifestations include alopecia, erythema, papules, pustules, scaling, hyperkeratosis, lichenification and hyperpigmentation. Excessive multiplication of mites within the hair follicles causes follicular damage and inflammation, resulting in hair loss and inflammatory skin lesions. Secondary bacterial infection causes even more extensive lesions and produce folliculitis, furunculosis, pustules, erosions, exudation and crusts. The type, severity and anatomical distribution of lesions vary according to the duration and extent of the infection (Gartner *et al.,* 2015; Kumar *et al.,* 2022; Bhusal *et al.,* 2025).

Although demodicosis primarily affects the skin, but chronic condition also leads to systemic alterations. Persistent cutaneous inflammation, secondary bacterial infection and loss of blood or protein through damaged skin causes changes in the haematological profile of affected

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dogs including reduced haemoglobin, packed cell volume and erythrocyte count, with leucocytosis, neutrophilia and eosinophilia. Biochemical changes such as reduced albumin, increased globulin and total protein, elevated glucose and increased activities of alanine aminotransferase and aspartate aminotransferase have also been reported (Salem *et al.,* 2020). These alterations may be associated with chronic inflammation, continuous antigenic stimulation, protein loss, physiological stress and hepatic or muscular involvement in affected dogs (Salem *et al.,* 2020; Kumar *et al.,* 2022; Satasiya *et al.,* 2023). This study was aimed to evaluate the clinical and haemato-biochemical alterations in dogs diagnosed with demodicosis in Jaipur, Rajasthan.

Materials and Methods

The study was conducted at the Department of Veterinary Medicine, PGIVER, Jaipur, Rajasthan (India). A total of 219 dogs presented with dermatological lesions were screened by standard skin-scraping examination and trichogram, out of which 30 dogs were confirmed positive for demodicosis. The clinical signs observed in each positive dog and their distribution over different body parts or regions were recorded systematically. During clinical examination, the presence or absence of alopecia, erythema, papules, pustules, vesicles, erosions, scars, hyperkeratosis, lichenification, hyperpigmentation, and excoriation was documented for every demodicosis-positive dog. Anatomical involvement was recorded for the face, periocular region, neck, ears, chest, axillae, abdomen, back, groin, tail, legs, and paws (Gartner *et al.,* 2015; Kumar *et al.,* 2022).

For laboratory assessment, blood was collected aseptically from the 30 affected dogs and 10 apparently healthy dogs (control group) through the cephalic vein into EDTA vials for haematological analysis and Non-EDTA vials for biochemical analysis (Mueller *et al.,* 2020). Haematological analysis was performed using standard techniques described by Feldman *et al.* (2000) for estimation of haemoglobin (Hb), packed cell volume (PCV), total leucocyte count (TLC), total erythrocyte count (TEC), and differential leucocyte count (DLC). Serum was separated from blood collected in Non-EDTA vials for estimation of glucose, total protein, albumin, globulin, aspartate aminotransferase (AST), and alanine aminotransferase (ALT) using standard procedures and assay kits on a fully automated Turbochem 100 Biochemistry Analyzer (Awareness Technology, USA; marketed by CPC Diagnostics, Chennai).

The data on haemato-biochemical findings of the affected group were compared with those from the 10 apparently healthy controls. Results are expressed as mean values with their standard errors. The clinical observations were interpreted alongside the haemato-biochemical findings to assess whether the visible extent of dermatological disease was accompanied by evidence of inflammation, anaemia, protein alteration, metabolic stress, or hepatocellular involvement.

Results and Discussion

In this study the clinical expression and anatomical distribution of lesions in the 30 demodicosis-positive dogs, with significant haemato-biochemical deviations from healthy controls is documented (Table 1, 2).

Table 1: Clinical signs recorded in demodicosis-positive dogs

Clinical sign	Dogs affected (n=30)	Percentage
Alopecia	30	100.0
Erythema	30	100.0
Papules	24	80.0
Pustules	16	53.33
Vesicles	12	40.0
Erosions	30	100.0
Scars	15	50.0
Hyperkeratosis	22	73.33
Lichenification	6	20.0
Hyperpigmentation	4	13.33
Excoriation	7	23.33

Clinical Manifestations

In this study the alopecia, erythema, and erosions were recorded in all 30 demodicosis-positive dogs (100%), followed by papules in 80%, hyperkeratosis in 73.33%, pustules in 53.33%, scars in 50%, vesicles in 40%, excoriation in 23.33%, lichenification in 20%, and hyperpigmentation in 13.33% of affected dogs (Table 1). The predominance of alopecia, erythema, and papules was in close agreement with Kumar *et al.* (2022), who reported alopecia and erythema in all affected dogs and papules in approximately 80%. Gartner *et al.* (2015) likewise identified erythema as a primary lesion and reported alopecia in 76.47% of dogs.

Alopecia is an expected manifestation of follicular mite proliferation because Demodex mites occupy hair follicles and interfere with normal follicular function. Its occurrence in every affected dog indicates that hair loss was the most consistent externally visible marker in this population. Erythema in all dogs reflects cutaneous inflammation and vascular dilation, whereas the universal occurrence of erosions suggests substantial disruption of the epidermal surface. Erosions may arise from the disease process itself and by rubbing, scratching, or secondary infection (Gartner *et al.,* 2015; Salem *et al.,* 2020).

Papules, pustules, and vesicles represent inflammatory lesions of different severity and content. The high frequency

of papules and the occurrence of pustules in more than half of the dogs suggest frequent follicular inflammation and high probability of secondary bacterial involvement. Hyperkeratosis, lichenification, and hyperpigmentation are generally associated with a more chronic cutaneous response. Their variable frequencies reflect differences in disease duration, severity, host response and irritation among the dogs examined. Scarring in half of the animals indicates that tissue damage had progressed beyond a purely superficial and transient stage (Gartner *et al.,* 2015; Salem *et al.,* 2020).

Distribution of Clinical Signs

The periocular region and back were the most frequently affected sites, each showing lesions in 93.33% of dogs. The abdomen was affected in 86.66%, while the face and neck were each involved in 83.33% dogs. Lesions were also observed on the legs in 70%, groin in 60%, chest in 50%, ears in 40%, axillae in 30%, tail in 26.66%, and paws in 20% dogs (Table 2). These findings were similar with the study of Kumar *et al.* (2022), who reported frequent involvement of the periocular region (91.66%), forelimbs (95.83%), abdomen (79.16%), and face and neck (80.33%). The present abdominal involvement (86.66%) was also comparable with the 82% reported by Gartner *et al.* (2015). In contrast, Bhusal *et al.* (2025), who studied 21 demodectic dogs in Nepal, found the shoulders and chest to be the most common sites of lesions occurred (66.6%), followed by the forelimbs and hindlimbs (42.9% each) and rear parts (28.6%).

Table 2: Distribution of clinical signs of demodicosis over body parts or regions in dogs

Body part/region	Dogs affected (n=30)	Percentage
Face	25	83.33
Periocular region	28	93.33
Neck	25	83.33
Ears	12	40.0
Chest	15	50.0
Axillae	9	30.0
Abdomen	26	86.66
Back	28	93.33
Groin	18	60.0
Tail	8	26.66
Legs	21	70.0
Paws	6	20.0

The marked involvement of the periocular region is compatible with the characteristic periocular alopecia, "Spectacle eye appearance" often associated with demodicosis. Frequent involvement of the back, abdomen, face, and neck demonstrated that disease in the present population was not restricted to a single typical site (Mueller *et al.,* 2020; Kumar *et al.,* 2022). Lesions on the abdomen, groin, and axillae are relevant because these relatively thin-haired or friction-prone areas and due to secondary irritation. Involvement of the legs and paws is important as it causes discomfort or locomotor difficulty (Gartner *et al.,* 2015; Kumar *et al.,* 2022).

Haematological Findings

The haematological analysis revealed several significant deviations in parameters between demodicosis-affected dogs and healthy controls (Table 3). The mean haemoglobin (Hb) level in affected dogs was significantly lower compared to the control group, indicating potential anaemia. This finding aligned with the study of Sharma *et al*. (2018) and Chakraborty and Pradhan (2015), who concluded the reduction in haemoglobin due to loss of skin protein and excessive blood loss from scratching. Similarly, the packed cell volume (PCV) was also significantly lower in demodicosis-affected dogs compared to healthy controls suggesting reduced red blood cell volume, consistent with the findings of Janus *et al.* (2014) and Kumar and Shekhar (2020). However, Satasiya *et al*. (2023) reported a significant increase in PCV among affected dogs.

Table 3: Haematological parameters in demodicosis affected and control dogs (Mean ± SE)

Parameters	Test group (n=30)	Control group (n=10)
Hb (g/dL)	10.61 ± 0.22**	13.43 ± 0.42
PCV (%)	33.70 ± 0.64**	39.70 ± 0.75
TEC ($\times10^6$/cmm)	6.75 ± 1.68ns	5.96 ± 0.20
TLC ($\times10^3$/cmm)	14.22 ± 0.15**	10.81 ± 0.23
Neutrophils (%)	71.17 ± 0.95*	66.40 ± 2.03
Lymphocytes (%)	20.93 ± 0.66*	23.60 ± 0.85
Monocytes (%)	6.10 ± 0.16ns	6.50 ± 0.27
Eosinophils (%)	5.03 ± 0.17**	3.00 ± 0.26
Basophils (%)	0.13 ± 0.06ns	0.20 ± 0.13

*significant ($p<0.05$), **significant ($p<0.01$), ns non-significant ($p>0.05$)

The total erythrocyte count (TEC) showed no significant difference between the demodicosis-affected dogs and the control group, indicating that the total number of erythrocytes may not be markedly affected by demodicosis. This finding collaborated with the study of Juneja *et al.* (2023), although other researchers like Kumar and Shekhar (2020), Satasiya *et al.* (2023), and Morwal *et al.* (2024) reported a significant decrease in TEC values.

A highly significant ($p<0.01$) increase was observed in the total leucocyte count (TLC) of demodicosis-affected dogs compared to the control group, which aligned with the findings of Salem *et al.* (2020) and Satasiya *et al.* (2023), who reported leucocytosis as a result of extended antigenic stimulation and hypersensitivity reaction. The differential leucocyte count (DLC) analysis revealed significantly higher percentages of neutrophils and eosinophils with reduced

lymphocytes percentage in affected dogs compared to healthy controls. These alterations in DLC aligned with reports of Kumar and Shekhar (2020) and Kumar *et al.* (2022), suggesting an inflammatory response and compromised immunity. Also, Dhume *et al.* (2002) suggested that eosinophilia results from hypersensitivity reactions and mast cell stimulation.

The reduction in haemoglobin and PCV, despite the absence of a significant difference in TEC, suggests that assessment of erythrocyte status should not depend on cell count alone. Chronic inflammation can modify erythropoiesis and iron availability, while loss of blood or protein from excoriated and eroded skin may further contribute to reduced red-cell indices. The differences among published studies may reflect variation in disease severity, secondary infection, nutritional status, hydration, and the proportion of dogs with localized or generalized disease (Salem *et al.,* 2020; Satasiya *et al.,* 2023).

Leucocytosis with increased neutrophil percentages is consistent with an inflammatory response and may be accentuated by secondary bacterial folliculitis or pyoderma. The higher eosinophil percentage supports a hypersensitivity or parasitic component, although eosinophilia is not specific for demodicosis. The lower lymphocyte percentage may represent a relative change associated with neutrophilia, physiological stress, or altered cell-mediated immunity. Together, these findings support interpretation of the complete leucogram rather than any single leucocyte population (Salem *et al.,* 2020; Kumar *et al.,* 2022).

Biochemical Parameters

Biochemical analysis showed significant alterations in various serum parameters (Table 4). The mean alanine aminotransferase (ALT) level was found significantly higher in demodicosis-affected dogs compared to the control group, which indicated potential hepatocellular damage, as reported by Salem *et al.* (2020) and Satasiya *et al.* (2023). Similarly, the mean aspartate aminotransferase (AST) level was also elevated in affected dogs compared to controls, suggesting significant stress on the liver or muscles, consistent with findings by Salem *et al.* (2020) and Kumar and Shekhar (2020).

Total protein levels were found to be significantly higher in demodicosis-affected dogs compared to healthy controls, may be due to an increased immune response and chronic infection, as reported by Johnson (2019). Conversely, albumin levels were significantly lower in affected dogs compared to controls, which may be due to chronic inflammation and protein loss from skin lesions, as observed by Reddy *et al.* (2015). However, Salem *et al.* (2020) mentioned a non-significant decrease in albumin

Table 4: Biochemical parameters in demodicosis affected and control dogs (Mean ± SE)

Parameters	Test group (n=30)	Control group (n=10)
ALT (IU/L)	54.13 ± 0.49**	34.80 ± 0.84
AST (IU/L)	60.70 ± 1.55**	37.50 ± 1.62
Total protein(g/dL)	8.19 ± 0.14**	5.69 ± 0.13
Albumin (g/dL)	2.312 ± 0.066**	3.02 ± 0.133
Globulin (g/dL)	4.31 ± 0.08**	2.37 ± 0.06
Glucose (mg/dL)	101.90 ± 2.34**	86.50 ± 1.23

*significant (p<0.05), **significant (p<0.01), ns non-significant (p>0.05)

levels. The mean globulin level was significantly higher in demodicosis-affected dogs compared to controls showing a strong immune response due to parasitism or chronic inflammation, aligning with findings by Johnson (2019).

Concurrent elevation of ALT and AST indicates leakage of intracellular enzymes and may reflect hepatocellular or muscular stress in clinically affected dogs. These enzymes are not disease-specific, and their interpretation should therefore consider clinical condition, medication history, muscle injury, hydration, and other possible disorders. Nevertheless, their consistent increase in the affected group shows that demodicosis may be accompanied by changes extending beyond the skin (Kumar and Shekhar, 2020; Salem *et al.,* 2020; Satasiya *et al.,* 2023).

The combination of increased total protein and globulin with reduced albumin is compatible with chronic antigenic stimulation and inflammation. Globulin production may rise as part of the humoral immune response, whereas albumin can decline through reduced synthesis, negative acute-phase regulation, or loss across damaged skin. Because total protein can remain normal or increase despite hypoalbuminaemia, separate measurement of albumin and globulin provides more useful information than total protein alone (Reddy *et al.,* 2015; Salem *et al.,* 2020).

Finally, the mean glucose level in demodicosis-affected dogs was also found to be significantly higher compared to healthy controls, potentially due to elevated metabolic stress and glucocorticoid release in response to chronic inflammation, as reported by Salem *et al.* (2020).

Limitations

The study included 30 demodicosis-positive dogs and 10 apparently healthy controls from a single clinical setting. The results therefore describe the pattern observed in this population and may not represent every geographical area, breed distribution, or management system. Clinical signs were summarized as present or absent, and the data did not separately grade lesion severity, duration, localized versus generalized disease, pruritus intensity, or the presence and degree of secondary bacterial infection. These factors could influence both lesion morphology and laboratory values.

Future investigations could strengthen these observations by enrolling larger multicentric populations, applying standardized clinical severity scores, separating localized and generalized cases, documenting secondary infections, and evaluating changes after treatment. Correlation of lesion burden with individual haematological and biochemical variables would also help determine whether laboratory abnormalities reflect disease extent or particular clinical phenotypes.

Conclusions

The present study demonstrates that canine demodicosis produces a distinct pattern of cutaneous lesions together with measurable systemic alterations. Alopecia, erythema, and erosions were universal findings, while the periocular region and back were the most frequently affected anatomical sites. Haematological changes included reduced haemoglobin and packed cell volume, increased total leucocyte counts, and altered differential leucocyte profiles, indicating anaemia and inflammatory or immune responses. Biochemical changes included increased ALT, AST, total protein, globulin, and glucose with reduced albumin, suggesting hepatocellular involvement, chronic inflammation, and protein loss through skin lesions. Combined evaluation of clinical manifestations, lesion distribution and haemato-biochemical parameters provides a comprehensive description of the clinicopathological alterations associated with demodicosis in affected dogs.

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