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Evaluation of hematological and biochemical parameters in canine demodicosis

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Abstract
Canine demodicosis caused by *Demodex canis* is one of the most common skin affection seen in canine veterinary practice. This study aimed to estimate the possible alterations in hematological, and biochemical profiles in dogs infected with demodicosis. In hematological parameters Significant decreased level of hemoglobin and erythrocyte was observed, while Total Leukocyte Count were significantly increased in dogs affected with demodicosis. In biochemical parameters there was also significant elevation in total protein and Alanine Transaminase level in demodicosis affected dogs.

Keywords: Biochemical, canine demodicosis, hematology

1. Introduction
Skin diseases are among the most prevalent health issues; they can range from short-term, self-limiting issues to long-term, persistent issues that require ongoing care. Several studies from India and abroad have indicated that skin affections make up a significant proportion of the small animal caseload (Hill *et al*., 2006; Kumar *et al*., 2006; Sarma *et al*., 2013) [1-3]. A prevalent non-contagious inflammatory parasite dermatoses called canine demodicosis is characterised by an overabundance of *Demodex canis* in the sebaceous glands and hair follicles (Haleem *et al*., 2015) [4]. Dogs often exhibit two forms of demodicosis. One or two hairless spots, notably on the face, legs, and area around the eyes, are the first signs of localised demodicosis and do not require medical attention. Generalised demodicosis is characterized by the presence of five or more local lesions that include patchy regions, erythematous lesions, scales, and papules (Gortel, 2006) [5]. Only Immunocompromised animals, older canines, and puppies between the ages of three months and a year can exhibit the infection (Sharma *et al*., 2018) [6]. Dogs' susceptibility to demodicosis is influenced by a variety of internal and external variables. Hereditary susceptibility, changes in the structure and biochemistry of the skin, immunological illnesses, breed, age, and hormonal state (hypothyroidism and hyperadrenocorticism) are examples of intrinsic factors. Diet, exercise, stress levels, and the presence of other illnesses or pathogens are examples of extrinsic variables (Thakue *et al*., 2018) [7].

2. Materials and Methods
2.1 Design of the experiment
The present work was carried out in the Department of Veterinary Medicine, College of Veterinary Science and Animal Husbandry, Kamdhenu University, Junagadh. This study enrolled 24 dogs of different age, sex and breeds. The dogs were divided into two groups: The control group including 6 apparently healthy dogs and the diseased group including 18 dogs affected with demodicosis.

2.2 Sample Collection
Approximately 2 ml blood was drawn from animals positive for *Demodex* mites and hematological analysis was performed by BC 2800 Vet auto hematology analyzer. Various parameters i.e. hemoglobin (HB), total erythrocyte count (TEC), packed cell volume (PCV), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), mean corpuscular

hemoglobin concentration (MCHC), total leucocyte count (TLC) and differential leucocyte count (DLC) were recorded.
About 4 ml blood was drawn from animals positive for *Demodex* mites and biochemical analysis was performed by biochemical analyzing reagents kits (Randox laboratories, Northern Ireland) with the use of Microlab 300 semi-automatic biochemical analyzer. Various biochemical parameters i.e. alanine amino-transferase (ALT), total protein, albumin, Creatinine and blood urea nitrogen (BUN) were recorded.

2.3 Statistical analysis
The data were analyzed using Microsoft Excel sheet and results were recorded as mean ± standard error. The diseased group data were compared with the control group data using Student's t-test, SPSS® program ver. 16 (USA). $p \leq 0.05$ was considered statistically significant.

3. Results and Discussion
The confirmative diagnosis was done by the microscopic examination of the skin scrapping which showed the presence of cigar-shaped *Demodex spp*. Haematological and biochemical parameters were estimated, the values of which are given in Table 1 & Table 2 respectively. There was a significant reduction in the Total Erythrocyte Count as well as Hemoglobin concentration were decreased in the diseased animals as compared to the healthy animals. The reduction was found to be highly significant. On the other hand, there was a significant increase in the Packed Cell Volume in the patients affected with demodicosis, which may be due to an increase in the Total Leukocyte Count. These findings were in agreement with the studies of Sharma *et al.* 2018 [6] and Bhardwaj *et al.* 2012 [8].
The Mean Corpuscular Volume, Mean Corpuscular Hemoglobin and Mean Corpuscular Hemoglobin Concentration were on the higher side in the diseased animal than in the healthy animals. The Total Leukocyte count showed an elevation in the animals affected with demodicosis as compared to the healthy animals. An increase in the TLC of diseased animals is contributed by a rise in levels of circulatory neutrophils, eosinophils and basophils. On the contrary, there was a significant decline in the concentration of lymphocytes and monocytes. Similar results were also observed by Thakur *et al.* 2018 [7] and Salem *et al.* 2020 [9].

Table 1: Comparison of the haematological parameters between healthy and demodectic dogs

	Healthy (N = 6)	Diseased (N = 15)	P Value
TEC (10^6/mcl)	7.588 ± 0.189	4.958 ± 0.257	0.000007***
Hb (g/dl)	15.826 ± 0.293	11.572 ± 0.619	0.000471***
PCV (%)	49.53 ± 0.689	58.794 ± 25.326	0.000131***
MCV (FL)	68.56 ± 1.765	71.874 ± 1.319	0.179139
MCH (PG)	19.688 ± 0.518	23.373 ± 1.199	0.074577
MCHC (g/dl)	34.103 ± 0.689	36.041 ± 1.489	0.433881
TLC	11883.33 ± 738.090	13566.11 ± 795.494	0.228978
Neutrophils (%)	66.5 ± 3.373	71.722 ± 0.976	0.057002
Lymphocytes (%)	25 ± 2.594	18 ± 1.117	0.008511**
Eosinophils (%)	2.666 ± 0.333	6.388 ± 0.421	0.000043***
Monocytes (%)	7.333 ± 0.421	3.833 ± 0.584	0.001927***
Basophils (%)	0	0.055 ± 0.055	0.540884

*$p \leq 0.05$, **$p \leq 0.01$, *** $p \leq 0.001$, TEC – Total Erythrocyte Count, Hb – Hemoglobin, PCV – Packed Cell Volume, MCV – Mean Corpuscular Volume, MCH – Mean Corpuscular Hemoglobin, MCHC – Mean Corpuscular Hemoglobin Concentration, TLC – Total Leukocyte Count

Various biochemical parameters were estimated from healthy as well as diseased animals, the values of which are mentioned in Table 2. The level of total protein as well as Alanine Transaminase was elevated significantly in the diseased animals with relation to healthy animals. Whereas, there was not a significant change in the concentrations of albumin, creatinine and Blood Urea Nitrogen between the two groups of healthy and diseases animals. The results of Haleem *et al.* 2015 [4] and Reddy *et al.* 2015 [10] were accordance with our findings.

Table 2: Comparison of the biochemical parameters between healthy and demodectic dogs

	Healthy (N = 6)	Diseased (N = 15)	P Value
Total protein (g/dl)	6.225 ± 0.107	6.856 ± 0.119	0.006036**
Albumin (g/dl)	3.515 ± 0.118	3.068 ± 0.117	0.037454*
Creatinine (mg/dl)	0.941 ± 0.052	0.861 ± 0.030	0.183237
ALT (IU/L)	19.15 ± 1.135	29.585 ± 1.133	0.000036***
BUN (mg/dl)	19.773 ± 0.800	19.946 ± 1.273	0.93412

*$p \leq 0.05$, **$p \leq 0.01$, ***$p \leq 0.001$, ALT – Alanine Transaminase, BUN – Blood Urea Nitrogen

4. Conclusion
In conclusion, the most consistent hematological and biochemical alteration associated with canine demodicosis were reduced level of hemoglobin and total erythrocyte, while increased level of total leukocyte, total protein and Alanine Transaminase.

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