

## PAPER DETAILS

TITLE: Comparison of behavioral and hematological parameters before and after treatment in dogs with demodicosis

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PAGES: 99-104

ORIGINAL PDF URL: <https://dergipark.org.tr/tr/download/article-file/2016429>



doi: 10.33188/vetheder.1006457

Araştırma Makalesi / Research Article

## Comparison of behavioral and hematological parameters before and after treatment in dogs with demodicosis

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### MAKALE BİLGİSİ /

#### ARTICLE INFORMATION:

#### Geliş / Received:

08 Ekim 21  
08 October 21

#### Revizyon/Revised:

03 Mart 22  
03 March 22

#### Kabul / Accepted:

10 Mart 22  
10 March 22

#### Keywords:

Blood parameters  
Demodicosis  
Dogs  
Stress behaviors

#### Anahtar Sözcükler:

Demodikozis  
Kan parametreleri  
Köpekler  
Stres davranışları

### ABSTRACT:

This study aims to compare behavioral and hematological parameters of 12 dogs with demodectic mange infection before and after the treatment. Following the parasitological examination, an appropriate treatment protocol was planned for the dogs diagnosed with demodex canis. Blood samples were collected from the cephalic vein of the dogs and transferred into vacuum tubes containing EDTA before and after the treatment. A complete blood count was performed for all dogs. Behavioral parameters before and after treatment were obtained with a video camera recording system. Compared to pre-treatment values, WBC, Mon (%), Neu (%), MCHC, and Eos (%) values were significantly lower after treatment while Lymph (%), RBC, Hb, MCV, MCH values were significantly higher after treatment, and the difference between the values was found to be statistically significant ( $P<0.01$ ). Behavior parameters related to stress were detected in fewer dogs after the treatment compared to pre-treatment. This study provided valuable inputs to the literature as the concurrent examination of blood parameters and stress behavior was performed for the first time in dogs with demodectic mange infection.

### *Demodikozisli köpeklerde tedavi öncesi ve sonrasında davranış ve hematolojik parametrelerin karşılaştırılması*

#### ÖZET:

Bu çalışmanın amacı demodektik uyuz enfeksiyonu olan 12 adet köpekte tedavi öncesi ve sonrasında hematolojik verilerle birlikte davranış parametrelerinin karşılaştırılmasıdır. Yapılan parazitolojik muayene sonucunda köpeklerde demodex canis tespit edildi ve uygun tedavi protokolü planlandı. Köpeklerden tedavi öncesinde ve tedavi tamamlandıktan sonra kan örnekleri tekniğine uygun olarak sefalik venden EDTA'lı vakumlu tüplere alındı ve tam kan sayımı yapıldı. Çalışmada tedavi öncesi ve tedavi sonrası davranış parametreleri video kamara kayıt sistemi ile elde edildi. WBC, Mon (%), Neu (%), MCHC ve Eos (%) değerlerinde tedavi sonrasında tedavi öncesine göre daha düşük, Lenf (%), RBC, Hb, MCV, MCH değerleri ise tedavi sonrasında tedavi öncesine göre daha yüksek tespit edildi ve değerler arasındaki fark istatistiksel olarak anlamlı bulundu ( $P<0.01$ ). Her bir stres davranış parametresi tedavi sonrasında tedavi öncesine göre daha az sayıda köpekte gözlemlendi. Bu çalışma demodektik uyuz enfeksiyonu olan köpeklerde kan ve stres davranış parametrelerinin birlikte incelenmesi yönüyle literatürde önemli bir yere sahip olacaktır.

**How to cite this article:** Koçkaya M. Comparison of behavioral and hematological parameters before and after treatment in dogs with demodicosis. Vet Hekim Der Derg 2022;93(2): 99-104. DOI: 10.33188/vetheder.1006457

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## 1. Introduction

Demodicosis is a parasitic inflammatory skin disease in dogs caused by the overgrowth of *Demodex canis*. In dogs with demodectic mange, some or all of the symptoms, such as alopecia, erythema, papules, pruritus, inflammation, and hyperkeratosis, may be detected. The most common symptoms observed in these dogs are itching, alopecia, erythema, papules, inflammation, and hyperkeratosis (1,2).

Examination of pain mechanisms has revealed that inflammation causes pain (3,4). The relationship between pain and common behavioral problems such as paw biting, tail chasing and aggression observed in dogs has been defined by scientific data. It has been reported that there is an increase in these behaviors in the presence of pain (5,6,7,8). Musculoskeletal pains, painful gastrointestinal disorders, and painful dermatological conditions are commonly considered significant for the problematic behavior of dogs (9,10).

Living organisms exhibit different behaviors in the case of pain-related stress. Therefore, it is critical to evaluate behavioral changes in determining the stress, and hence welfare status, in animals. Studies have shown that dogs display different behaviors and body positions under stress, such as yawning, frequent urination and falling in the tail-ear position (11-14). Behavioral response, that is, "simply distancing oneself from danger" is the easiest way to overcome stress (15). In cases where escape is not an option, the behavior pattern is changed, allowing the animal to cope with stress. It is common knowledge that behavioral responses are the most prominent indicators in detecting stress and pain (16). Hematological and biochemical parameters levels changes occur in dogs due to demodectic mange infection (17-19). Very effective results have been obtained in the treatment methods applied to dogs with demodicosis and it is observed that skin lesions heal rapidly (20).

The current literature is insufficient in examining the behavioral changes that occur during pain-related stress in dogs with demodicosis. This study aims to examine behavioral data in the state of pain-related stress together with hematological parameters before and after treatment in dogs with demodectic mange infection.

## 2. Material and Methods

This study was approved by the Sivas Cumhuriyet University Animal Experiments Local Ethics Committee (Approval no:421 and date 08.04.2021).

Twelve dogs infected with demodectic mange in the animal shelter of Divrigi municipality were examined. Clinical appearance and agent detection were prioritized in the diagnosis. Clinically, diffuse hair loss, papules, inflammation and hyperkeratosis were observed all over the body. Skin scraping was performed with a scalped tip with glycerine for the detection of the causative agent. The scraping material was kept in 10% KOH solution. *Demodex canis* was detected in the material examined under a stereo microscope. During the study, the animals were kept in the Divrigi municipality animal shelter, fed a standard dog diet, provided with ad libitum water, and continued their routine lives. The treatment of the dogs was carried out by the responsible veterinarian of the shelter, and the same treatment protocol was applied to all dogs. In the treatment protocol, ivermectin (Cedora, VERANO) was used as a subcutaneous injection, once a week, for a total of 4 weeks, on the same day (21,22). In case of itchy sores on the skin of dogs, a skin spray containing oxytetracycline was used (Panox, VERANO). In order to avoid stress in dogs, blood samples were collected before and after the treatment protocol by the shelter's responsible veterinarian. Blood samples were taken from the cephalic vein into Vacutainer tubes containing EDTA anticoagulant. Hematological parameters in blood samples taken into tubes containing EDTA were processed with an automatic complete blood count device (Mindray BC-2800) within 24 hours and white blood cell (WBC), lymphocyte percentage (Lymph%), monocytes percentage (Mon%), neutrophil percentage (Neu%), eosinophil percentage (Eos%), red blood cell (RBC), hemoglobin (Hb), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC) were analyzed. The video footage of the dogs was recorded from the shelter video camera system and also by the responsible veterinarian before and after the treatment. Subsequently, these recordings were analyzed and evaluated using an ethogram that described stress behaviour in dogs (11,13,14). In the study, the "focal animal sampling" method

was used (23). The method was based on following a particular dog for a certain period of time. For the recording method, the 20- minute recording process was stopped at the end of each minute, and the case of exhibiting the relevant behavior at the exact moment of stopping was evaluated as “one” and the case of not showing the behavior was “zero” (13).

### Statistical analysis:

Wilcoxon test was used to compare blood parameters between groups. McNemar test was used to compare stress behaviour parameters between groups and the number of animals for which stress behavioural parameter was observed was expressed as percentage in groups. SPSS 22.00 software was used for data analysis (24).

### 3. Results

The blood parameters of dogs before and after treatment are given in Table 1. Compared to pre-treatment values, WBC, Mon (%), Neu (%), MCHC, and Eos (%) values were significantly lower after treatment ( $P<0.01$ ). Compared to pre-treatment values, Lymph (%), RBC, Hb, MCV, and MCH values were significantly higher after treatment ( $P<0.01$ ).

**Table 1:** Blood parameters before and after treatment

**Tablo 1:** Tedavi öncesi ve sonrası kan parametresi değerleri

Haematological parameters	N	Groups (median)		Significance (P)
		Before Treatment (min; max)	After Treatment (min; max)	
WBC ( $10^9/L$ )	12	17.94 (17.88; 18.00)	12.26 (12.16; 12.36)	0.002
Lenf (%)	12	20.13 (20.11; 20.15)	25.60 (25.56; 25.64)	0.002
Mon (%)	12	5.96 (5.94; 5.98)	4.63 (4.60; 4.66)	0.002
Neu (%)	12	79.08 (79.01; 79.15)	71.42 (71.38; 71.46)	0.002
RBC ( $10^{12}/L$ )	12	6.74 (6.71; 6.77)	7.93 (7.86; 7.98)	0.002
Hb (g/dL)	12	14.52 (14.50; 14.54)	17.94 (17.90; 17.98)	0.002
MCV (fL)	12	82.12 (82.08; 82.16)	82.48 (82.40; 82.56)	0.002
MCH (pg)	12	23.06 (23.01; 23.11)	23.28 (23.21; 23.35)	0.002
MCHC (g/dL)	12	28.06 (28.02; 28.10)	27.21 (27.19; 27.13)	0.002
Eos (%)	12	2.62 (2.58; 2.66)	1.71 (1.69; 1.73)	0.002

L: liter, dL: deciliter, fL: femtoliter, g: gram, pg: pictogram

The stress behavior parameters of dogs before and after the treatment are given in Table 2. For each stress behavior, the number of animals showing the behavior after treatment was less than pre-treatment and the reduction in the number of dogs showing behaviour strained lips was statistically significant. While the number of dogs showing yawning behavior before the treatment was 3, no dogs showed yawning behavior after the treatment.

**Table 2:** Number of animals showing stress behaviors before and after treatment**Tablo 2:** Tedavi öncesi ve sonrası stres davranışları gösteren hayvanların sayısı

Stress Behavior Parameters	Before Treatment (n, %)	After Treatment (n, %)	Significance (P)
Lowering the tail position	8 (66.66)	5 (41.66)	0.250
Lowering the body position	4 (33.33)	2 (16.66)	0.500
Yawning	3 (25)	0 (0)	0.250
Avoidance	5 (41.66)	1 (8.33)	0.125
Strained lips	9 (75)	2 (16.66)	0.016*
Attention deficiency	6 (50)	1 (8.33)	0.063
Increased frequency of urination	5 (41.66)	1 (8.33)	0.125

\*:P&lt;0.05

#### 4. Discussion and Conclusion

This study is expected to contribute significantly to the literature since the blood and stress related behaviors were analyzed together for the first time in dogs with demodectic mange infection. Demodectic mange infections are common in dogs, and positive results are obtained in treatments. The dogs responded to the treatment method applied in the present study, as in similar studies (18,20-22). Hematological and biochemical changes occur in dogs due to demodectic mange infection. The present study determined that the high values of WBC, Mon (%), Neu (%), MCHC, Eos (%) reduced with the treatment, similar to the findings of other studies (17-19). Again, similar to other studies, the low lymph (%), RBC, Hb, MCV, MCH values before treatment were determined to increase after treatment (17-19). Changes in WBC, Mon (%), Neu (%), Eos (%), Lymph (%), RBC parameters occurred due to general skin infection, antigenic reaction, and stress. Changes in Hb, MCV, MCH, and MCHC levels occurred due to anemia caused by skin lesions. This anaemia might be due to the stress arising from the disease (25,26). With the treatment method applied, RBC, Hb, MCV, MCH, WBC, Mon (%), Neu (%), MCHC, Eos (%), Lymph (%) values reached normal values, and the results were similar to other studies (17-19,25,26).

Different body part pains are commonly considered significant for the problematic behavior of dogs (9,10). Studies have shown that dogs display different behaviors and body positions in stressful situations (11-14,27). Similarly, in the current study, the number of animals showing stress behavior after treatment was less than pre-treatment. This finding can be explained by the development of stress in dogs due to demodectic mange infection and the stress subsequently causing behavioral changes. Treatment reduces the negative effects of the infection on dogs, leading to a decrease in the number of dogs in which stress and stress behaviors are observed.

In conclusion, blood parameters change in dogs with demodectic mange infection, and the infection causes behavioral changes by generating stress in dogs. The findings of this study will contribute to the treatment of these dogs in clinical applications. Stress hormones levels could not be examined due to limited opportunities in the study, it is recommended to examine stress hormones in similar studies.

#### Conflict of Interest

The author declared that there is no conflict of interest.

#### Funding

This research received no grant from any funding agency/sector.

## Authors' Contributions

Idea / concept: Mustafa KOÇKAYA  
 Experiment design: Mustafa KOÇKAYA  
 Supervision / Consultancy: Mustafa KOÇKAYA  
 Data collecting: Mustafa KOÇKAYA  
 Data analysis and interpretation: Mustafa KOÇKAYA  
 Literature search: Mustafa KOÇKAYA  
 Writing the article: Mustafa KOÇKAYA  
 Critical review: Mustafa KOÇKAYA

## Ethical Statement

This study was approved by the Sivas Cumhuriyet University Animal Experiments Local Ethics Committee (Approval no: 421 and date 08.04.2021).

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