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Research Article

Hematological Profiles of Dogs with Hemoparasitic Infections at a Veterinary Teaching Hospital in Sokoto (2018–2021)

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Abstract

Hemoparasitic infections remain an important cause of morbidity in dogs, particularly in tropical and subtropical regions where tick vectors are prevalent. Canine hemoparasites such as Babesia canis and Ehrlichia canis invade blood cells and can induce significant hematological disturbances, leading to anemia, immunosuppression, and, in severe cases, death. Early identification of characteristic hematological alterations during routine laboratory evaluation is therefore critical for accurate diagnosis and effective clinical management of affected animals. The present study aimed to determine the hematological alterations associated with hemoparasitic infections in dogs presented to the Veterinary Teaching Hospital, Usmanu Danfodiyo University, Sokoto, Nigeria, over a four-year period. A retrospective review of clinical case records from January 2018 to December 2021 was conducted. Data from 230 dogs presented to the hospital during this period were examined, and cases with confirmed hemoparasitic infections were identified. Hematological parameters were extracted from complete blood count (CBC) records of infected dogs and evaluated to assess alterations associated with babesiosis and ehrlichiosis. Out of the 230 cases reviewed, 19 dogs were diagnosed with hemoparasitic infections, predominantly babesiosis and ehrlichiosis. Analysis of hematological findings revealed that affected dogs commonly exhibited anemia, characterized by reduced packed cell volume and hemoglobin concentration. Additionally, eosinopenia was a consistent finding among infected cases, reflecting alterations in immune response associated with these infections. In conclusion, this study demonstrates that canine babesiosis and ehrlichiosis are associated with notable hematological changes, particularly anemia and eosinopenia. These findings underscore the diagnostic value of routine hematological examination in dogs presenting with clinical signs suggestive of hemoparasitic infections and highlight the importance of early laboratory screening in veterinary practice.

Keywords

Hemoparasite, Babesiosis, Ehrlichiosis, Complete Blood Count, Dogs

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1. Introduction

Dogs belong to the Canidae family, which includes the genus Canis and the species Canis lupus, as well as the Chordata phylum, Mammalia class, and Carnivora order. The dog was among the first animals that humans tamed. As early as 8,000 BC, they were domesticated [1]. Currently, it is unclear exactly how many dogs there are in Nigeria. [2] predicted a population of 2–5 million people. Given that aerial pictures of Ilorin alone were used to estimate the dog population density at 1:13 dogs per household [3], it is safe to assume that there are much more dogs in Nigeria than the country's official estimate of 10 million. Dogs are companion animals that, when trained, have a reputation for being extremely helpful in programs that use animals to help with therapy in hospitals, such as physical rehabilitation and psychotherapy [4]. In developed countries, dogs have been utilized to a remarkable extent to meet human needs, such as promoting health, helping the elderly, healing from illnesses, guiding the blind, helping the deaf, helping those with limited mobility, and alerting patients with epilepsy when a seizure is about to happen. In that scenario, the owner can sit down or take medicine before having a seizure [5, 6]. Dogs can be trained to pick up objects, turn lights on and off, and pull wheelchairs for people who are physically disabled. Police dogs are trained to guard police and can detect drugs, bombs, and other harmful compounds more effectively than a person. Dogs trained for search and rescue missions use their keen noses to find humans who are missing or hurt [3]. Dogs continue to be the most practical domesticated mammal in Nigeria. They are kept for a variety of purposes, such as security, hunting, providing meat, recreation, conducting biomedical research, and providing company [7]. Canines with hemoparasite infections often exhibit similar clinical signs, including fever, fatigue, appetite loss, pale mucous membranes, vomiting, and weight loss.

The study of blood's morphology and physiology is known as hematology. Hematological analysis addresses a variety of blood-related disorders, including anemia [8]. Blood is a crucial and trustworthy tool for evaluating an animal's physiological and overall health [9]. Hematological tests are frequently used to diagnose a variety of illnesses and determine an animal's nutritional state. The results of the blood tests would support the findings of the physical examination, and they would also give good support for medical judgment when combined with the medical history [10]. Blood is helpful for determining a person's overall health, conducting a clinical examination to examine physiological and pathological states, and diagnosing and predicting numerous animal diseases [11]. Hematological parameters are those that pertain to the blood and the organs that create blood [12]. The cellular component of blood, which is made up of erythrocytes, leucocytes, and thrombocytes, accounts for 45% of the total volume of blood. While over 55% of the total blood volume is made up of non-cellular components, more than 90% of it is water, while 7.9% contains several types of protein. Hormones, vitamins, and electrolytes are additional chemicals. [13]. The main plasma proteins are fibrinogen, albumin, and globulin. Although bicarbonate and chloride (CL) are the two most common electrolytes [13].

2. Materials and Methods

2.1. Study Location

The study was carried out at the Veterinary Teaching Hospital's Small Animal Unit at Usmanu Danfodiyo University's Faculty of Veterinary Medicine in Sokoto, Nigeria. With a total size of 28,232.37 square kilometers, Sokoto State is situated in Nigeria's far northwest. The state lies between latitudes 4° to 6° north and longitudes 11° 30° to 13° 50° east. The Niger Republic borders it in the north, Zamfara State borders it in the east, and Kebbi State borders it in the south and west [14].

2.2. Study Design

Clinical case records of the small animal unit of the Veterinary Teaching Hospital of Usmanu Danfodiyo University, Sokoto, from 2018–2021 were examined. All records containing cases of hemoparasite infection in dogs were carefully studied and recorded. The dogs included in this study were assigned to two groups: dogs with hemoparasitic infection (n = 19) and dogs without hemoparasitic infection (n = 211).

2.3. Statistical Analysis

All the data generated from the records was analyzed using SPSS. A student t-test with a p-value of less than 0.05 was considered significant.

3. Result

19 dogs from the total data analyzed were infected with hemoparasite, 12 were positive with *Babesia canis* (63.16%) and 7 with *Ehrlichia canis* (36.84%). No parasitic co-infection was detected. The average hematological values obtained from dogs infected by hemiparasites are presented in Table 1. The PCV, hemoglobin, and RBC counts of all infected dogs were significantly lower when compared to those in the reference ranges, resulting in anemia, but no significant statistical difference was observed ($p > 0.05$). The MCV of dogs infected with *Babesia canis* and *Ehrlichia canis* was within the reference range.

The MCH of *Ehrlichia canis*-infected dogs was within the reference range, but in *Babesia canis*-infected dogs, it was higher compared to the reference ranges, but the statistical difference is not significant ($p > 0.05$). In addition, the MCHC of

Babesia canis-infected dogs was observed to be high, while that of *Ehrlichia canis*-infected dogs was within the reference range and showed no significant statistical difference ($p > 0.05$). Leukocytosis was not associated with either *Babesia canis* ($P > 0.05$) or *Ehrlichia canis* ($P > 0.05$) cases. The WBC differential counts revealed that neutrophils and lymphocytes are within the reference range, but there is a significant statistical difference in lymphocytes from infected dogs ($p < 0.05$). Eosinophils of *Babesia canis* infected dogs observed to be normal while in *Ehrlichia canis* Infected dogs were below the reference range but showed no significant statistical difference ($p > 0.05$). Basophils of *Babesia canis* infected dogs were observed to be above the reference range, while *Ehrlichia canis* infected dogs were within the reference range, although there was no significant statistical difference ($p > 0.05$).

Table 1. *Mean ± SEM of hematological parameters of dogs infected with Ehrlichia canis and Babesia canis compared to reference ranges.*

Parameters	*Babesia canis*	*Ehrlichia canis*
PCV (%)	21.08±6.09	28.00±10.58
Hemoglobin (g/dL)	9.84±2.84	9.01±3.41
RBC ($\times 10^6$ cells/µL)	3.15±0.91	4.03±1.52
MCV (fL)	72.09±20.81	70.99±26.83
MCH (Pg)	37.04±10.69	22.73±8.59
MCHC (%)	55.15±15.92	32.05±12.12
WBC ($\times 10^3$ cells/µL)	11.87±3.43	9.23±3.49
Neutrophil ($\times 10^3$ cells/µL)	7.75±2.24	7.30±2.76
Lymphocyte ($\times 10^3$ cells/µL)	2.67±0.77*	1.35±0.51*
Monocyte ($\times 10^3$ cells/µL)	0.52±0.15	0.28±0.11
Eosinophil ($\times 10^3$ cells/µL)	0.24±0.07	0.03±0.01
Basophil ($\times 10^3$ cells/µL)	0.20±0.06	0.00±0.00

Key: A P-value with an asterisk shows that there is a significant statistical difference at $p < 0.05$ in the mean obtained between dogs infected with *Babesia canis* and *Ehrlichia canis*. PCV= packed cell volume; WBC= white blood cell; RBC= red blood cell; MCV= mean corpuscular volume; MCH= mean corpuscular hemoglobin; MCHC= mean corpuscular hemoglobin concentration; SEM= standard error of the mean.

4. Discussion

Two significant hemoparasitic disorders that affect dogs all around the world are canine babesiosis and ehrlichiosis. Most veterinary hospitals often use microscopic analysis of blood films linked to hematological profile to identify blood parasite infections [15]. Using this method, the study discovered that the most frequent blood parasite infecting dogs brought to the Veterinary Teaching Hospital, Usmanu Danfodiyo University, Sokoto, was Babesia canis (63.16%, n = 12), followed by Ehrlichia canis (36.84, n = 7). In order to help with the clinical identification of these canine blood parasite infections in Sokoto, this study also provided hematological profiles for every organism found.

According to the study's findings, dogs infected with Babesia canis were more likely than dogs infected with Ehrlichia canis to exhibit low PCV, hemoglobin, and RBC volumes. Furthermore, neither group of infected dogs' MCV, MCH, or MCHC levels showed a statistically significant change. Dogs infected with Ehrlichia canis may have normocytic normochromic anemia, a non-regenerative anemia caused by bone marrow malfunction, according to the results of RBC parameters [16]. Ehrlichiosis was indeed linked to irreversible bone marrow damage, according to a prior study [17]. Additionally, in addition to immune-mediated hemolytic anemia (IMHA), an infection with Ehrlichia canis may cause anemia due to the development of antibodies against erythrocytes [17]. The acquired RBC indices were in line with earlier findings [18].

As evidenced by reduced PCV, hemoglobin, and RBC quantities when compared to reference ranges, infected dogs exhibited regenerative anemia in the majority of canine babesiosis cases reported in this study. Babesia canis infections were linked to macrocytic anemia (high MCV), which was a direct result of parasitizing Babesia organisms and harming red blood cells. In dogs infected with *Babesia canis,* no significant difference was observed in leukocytes, neutrophils, lymphocytes, monocytes, and eosinophils, which differs from what other previous studies found [19]. Furthermore, eosinopenia was the main WBC abnormality in dogs with ehrlichiosis in this study, which was similar to findings from

other reports [20]. But leukocytes, neutrophils, and monocytes are all within the reference range, which differs from what other previous studies of [21].

These findings corroborate the idea that hemoparasitic infections can be identified by hematological abnormalities. Veterinarians can diagnose canine blood parasite infections clinically using the hematological values presented here. It should be mentioned that the hematological profiles for canine hemoparasitic infections obtained in this investigation differed from those previously reported.

5. Conclusion

This study demonstrates that canine hemoparasitic infections are associated with distinct hematological alterations. Dogs diagnosed with canine ehrlichiosis commonly exhibited anemia and eosinopenia, whereas babesiosis was primarily characterized by anemia and basophilia. Furthermore, the findings indicate that dogs with reduced packed cell volume, hemoglobin concentration, and red blood cell counts below established reference ranges are at a significantly higher risk of hemoparasitic infection compared with dogs presenting normal hematological profiles. These results emphasize the diagnostic value of routine hematological evaluation in the early detection and management of canine hemoparasitic diseases.

Abbreviations

PCV	Pack Cell Volume
Hb	Hemoglobin
RBC	Red Blood Cell
WBC	White Blood Cell
MCV	Mean Corpuscular Volume
MCH	Mean Corpuscular Hemoglobin
MCHC	Mean Corpuscular Hemoglobin Concentration

Author Contributions

Abdulazeez Nafisat: Conceptualization, Resources, Supervision, Writing – original draft

Dahiru Ashiru: Funding acquisition, Supervision

Bashir Saidu: Funding acquisition, Supervision

Shehu Zaid: Conceptualization, Methodology

Conflicts of Interest

The authors declare no conflicts of interest.

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