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Establishment of Baseline Haematological Values for Canine Population in North-Central Nigeria: A Cross-Sectional Study in the Federal Capital Territory

Idoko SI[1]*, Orakpoghenor O[2], Fashe OZ[1], Oyeleye BS[1], Elekwachi CL[1], Adamu AM[3], Tenuche OZ[1], Olayemi OD[4], Sani NA[1], Abalaka ES[1] and Ameh AJ[5]

[1]Department of Veterinary Pathology, University of Abuja, Nigeria
[2]Department of Veterinary Pathology, Abubakar Tafawa Balewa University, Nigeria
[3]Department of Veterinary Public Health and Preventive Medicine, University of Abuja, Nigeria
[4]Department of Veterinary Parasitology and Entomology, University of Abuja, Nigeria
[5]Department of Veterinary Microbiology, University of Abuja, Nigeria

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***Corresponding author:** Idoko Sunday Idoko, Veterinary Pathology, University of Abuja, Nigeria, Tel: +2348060904664, Email: idoko.Sunday@uniabuja.edu.ng

Abstract

Population-based haematological baseline data for dogs have not been established for Veterinary Hospitals in the Federal Capital Territory (FCT), and states within north-central, Nigeria. The over reliance on established reference values from temperate countries as well as the existence of potential inter- and intra-population variation in the haemogram of different species of animals, even among population within the same country, may not reflect the diversity in genetic factors and physiological processes in dogs domesticated in FCT. Therefore, this study evaluated the haematological profiles of apparently healthy dogs in four out of the six area councils in FCT. Using a cross-sectional design, whole blood samples were collected from two hundred and fifty-seven (257) apparently healthy dogs of different breeds, sexes, and age groups following informed consent by owners. Haematological parameters were determined using an automated haematology analyzer. Outcomes revealed an overall mean packed cell volume (PCV) of 38.54 ± 9.31%, haemoglobin concentration (HB) of 13.05 ± 3.10 g/dL, and red blood cell (RBC) count of 5.52 ± 1.23 × 10^{12}/L. The mean total white blood cell (WBC) count was 10.04 ± 6.79 × 10^9/L, while platelet count averaged 159.11 ± 125.69 × 10^9/L. Sex-related differences were minimal, with comparable PCV in males (38.85 ± 9.42%) and females (38.10 ± 9.17%). Age-related trends showed progressive increases in erythrocyte parameters, with PCV rising from 33.34 ± 11.45% in puppies (0–6 months) to 39.96 ± 8.80% in adult dogs (>24 months). Marked breed-related variations were observed, with Belgian Malinois recording the highest PCV (48.78 ± 3.70%) and Nigerian indigenous dogs showing the highest WBC count (15.66 ± 7.01 × 10^9/L). These findings provide valuable baseline haematological data for dogs in the Federal Capital Territory and highlight the importance of considering breed, age, and local environmental factors when interpreting canine haematological results for improved diagnostic accuracy and clinical management.

Keywords: Age; Baseline; Breed; Dogs; Federal Capital Territory; Haematological Parameters; Sex

Abbreviations

FCT: Federal Capital Territory; PCV: Packed Cell Volume; RBC: Red Blood Cell; WBC: White Blood Cell; HB: Haemoglobin Concentration; NID: Nigerian Indigenous Dog; MCHC: Mean Corpuscular Haemoglobin Concentration; MCH: Mean Corpuscular Haemoglobin; MCV: Mean Corpuscular Volume; PCV: Packed Cell Volume.

Introduction

Haematology plays a fundamental role in veterinary diagnostics, providing insight into the physiological and pathological status of animals. The evaluation of haematological parameters provides critical information necessary for diagnosing diseases, monitoring therapeutic responses, and conducting pre-surgical assessments in clinical veterinary practice [1,2]. In dogs, haematological values can be influenced by several intrinsic and extrinsic factors, including age, sex, breed, environmental conditions, nutritional status, and underlying disease conditions [3,4]. Consequently, understanding normal reference intervals specific to regional and demographic variations is essential to accurately interpret laboratory findings and guide effective clinical decision-making.

Previous studies have established haematological reference values for canine populations in various parts of the world. However, significant differences in canine haematological parameters have been reported between breeds, age categories, and sexes, necessitating region-specific baseline data [5-7]. In sub-Saharan Africa, especially in Nigeria, studies examining the haematological profiles of dogs remain relatively scarce and fragmented, with limited data available to guide clinicians in the interpretation of laboratory results. For instance, earlier investigations in Nigeria Igbokwe, et al. [4]; Ogbu, et al. [8] have reported regional differences in haematological values among dog breeds, but comprehensive evaluations encompassing a wide range of breeds, ages, and sexes within a defined geographic locale remain limited.

Breed-specific haematological studies are of particular relevance in countries like Nigeria, where a mixture of indigenous and exotic dog breeds coexist, often under varying management systems. Indigenous dogs, such as the Nigerian Indigenous Dog (NID), are typically reared under semi-intensive or extensive systems and are exposed to different environmental and parasitic challenges compared to exotic or imported breeds that are usually raised under intensive care [9]. These differences in genetics and husbandry practices may result in significant variation in blood parameters, which if not accounted for, can lead to misinterpretation of laboratory values and misdiagnosis. Similarly, age-related changes in erythrocytic and leukocytic parameters are important for distinguishing physiological variations from disease states, especially in growing puppies and ageing dogs [10].

Given the diagnostic importance of haematological values and the paucity of region-specific data, this study was conceived to evaluate the haematological profiles of dogs in the Federal Capital Territory, Nigeria, with particular focus on identifying variations associated with sex, age, and breed. The establishment of baseline haematological values in the canine population would not only contribute to the body of knowledge in veterinary haematology but also provide clinicians and pathologists in Nigeria and those within north-central Nigeria and beyond with practical reference data. Such data are vital for the improvement of diagnostic accuracy, tailoring of therapeutic interventions, and enhancement of overall animal health care delivery in diverse veterinary settings.

Materials and Methods

Study Area

The study was conducted in the Federal Capital Territory (FCT), located in the North-Central geopolitical zone of Nigeria (latitude 9° 4' 20.1504'' N and longitude 7° 29' 28.6872'' E). The FCT covers approximately 1,769 km^2 and is bordered by Niger, Kogi, Nasarawa, and Kaduna States. The FCT comprises six area councils: Abuja Municipal Area Council (AMAC), Abaji, Bwari, Gwagwalada, Kwali, and Kuje [11]. Dogs were recruited from AMAC, Bwari, Gwagwalada, and Kwali Area Councils. Owners' consent was obtained prior to sample collection.

Study Design and Animal Selection

A cross-sectional study design was used. Apparently healthy dogs of different breeds, sexes, and age groups within the study areas were enrolled. Dogs showing overt clinical signs of systemic illness were excluded based on physical examination and owner history.

Ethical Approval

Ethical approval for the study was obtained from the University of Abuja Animal Research Ethics Committee. All procedures were carried out in accordance with accepted guidelines for the use of animals in research, and informed consent was obtained from dog owners prior to sample collection.

Sample Collection

Blood samples (5 mL) were aseptically collected from the cephalic vein of properly restrained dogs using a sterile syringe and 21-gauge needle. Samples were transferred into labeled EDTA anticoagulant vacutainers, gently mixed to prevent clotting, stored in an ice-packed container, and transported to the Clinical Pathology Laboratory, Faculty of Veterinary Medicine, University of Abuja, for haematological analysis.

Laboratory Analysis

Haematological parameters were determined using an automated haematology analyzer (HI 2800, Pioway Medical Lab Equipment, China). The parameters measured included packed cell volume (PCV), haemoglobin concentration (HB), red blood cell count (RBC), mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), total white blood cell count (WBC), differential leukocyte counts, and platelet count (PLT).

Data Analyses

Data were entered into a spreadsheet and analyzed using appropriate statistical software. Descriptive statistics were computed and results expressed as mean ± standard deviation. Haematological parameters were compared across sex, age, and breed categories using appropriate inferential statistical tests, with statistical significance set at $p < 0.05$.

Results

Overall Haematological Profile

The haematological profile showed considerable variation across several parameters (Table 1). The mean packed cell volume (PCV) was 38.54 ± 9.31%, with a wide range from 4.00% to 61.00%, while the haemoglobin concentration (HB) averaged 13.05 ± 3.10 g/dL, ranging from 3.60 to 23.10 g/dL.

The red blood cell (RBC) count showed a mean of 5.52 ± 1.23 × 10^{12}/L, with values ranging between 1.28 and 8.47 × 10^{12}/L. The erythrocyte indices recorded include a mean corpuscular volume (MCV) of 70.22 ± 8.24 fL, mean corpuscular haemoglobin (MCH) of 24.02 ± 3.76 pg, and mean corpuscular haemoglobin concentration (MCHC) of 34.46 ± 8.10 g/dL (Table 1).

The total white blood cell (WBC) count had a mean of 10.04 ± 6.79 × 10^9/L, with counts ranging from 0.53 to 33.30 × 10^9/L. Differential counts included lymphocytes (7.17 ± 4.40 × 10^9/L), mid-sized cells (0.61 ± 0.59 × 10^9/L), and granulocytes (1.22 ± 2.16 × 10^9/L). Platelet count averaged 159.11 ± 125.69 × 10^9/L, with a striking range from 0.00 to 1078 × 10^9/L (Table 1).

Distribution Based on Sex of Dog

The sex-based analysis revealed minimal differences between males and females, with values remaining largely comparable across most indices. The mean PCV was slightly higher in males (38.85 ± 9.42%) than in females (38.10 ± 9.17%), as was the HB, which averaged 13.15 ± 3.10 g/dL in males and 12.92 ± 3.11 g/dL in females. Also, RBC counts were marginally higher in males (5.55 ± 1.24 × 10^{12}/L) compared to females (5.47 ± 1.21 × 10^{12}/L) (Table 2).

Erythrocyte indices showed minimal variation between sexes. The MCV was 69.94 ± 9.09 fL in males and 70.61 ± 6.88 fL in females, while MCH values were 23.93 ± 2.99 pg and 24.14 ± 4.66 pg in males and females, respectively. MCHC was also relatively similar (34.79 ± 9.26 g/dL in males vs. 34.00 ± 6.09 g/dL in females). Also, WBC and platelet profiles exhibited limited sex-related variation. Females had a slightly higher TWBC count (10.30 ± 7.07 × 10^9/L) than males (9.85 ± 6.60 × 10^9/L), with comparable lymphocyte, mid cell, and granulocyte counts between the sexes. Notably, platelet count was higher in females (185.1 ± 154.1 × 10^9/L) compared to males (141.2 ± 98.19 × 10^9/L) (Table 2).

Distribution Based on Age of Dog

The age-wise distribution revealed age-related trends in erythrocyte parameters. Packed cell volume progressively increased with age, from 33.34 ± 11.45% in puppies (0–6 months) to 39.96 ± 8.80% in adult dogs (>24 months). A similar trend was observed in HB, rising from 11.43 ± 4.50 g/dL in the youngest age group to 13.49 ± 3.11 g/dL in adults. Red blood cell counts also showed an upward shift with age, peaking at 5.71 ± 1.28 × 10^{12}/L in dogs older than 24 months (Table 3).

The MCV, MCH and MCHC remained relatively stable across age groups, with slight variations. MCV ranged from 68.65 ± 11.58 fL (19–24 months) to 73.31 ± 6.24 fL (13–18 months), while MCH values were consistently around 24 pg across all groups. MCHC displayed more fluctuation, particularly in the 19–24 months group (36.94 ± 14.12 g/dL). The lowest TWBC count was recorded in the 13–18 months group (5.30 ± 3.18 × 10^9/L), while the highest was observed in dogs aged 7–12 months (11.19 ± 7.58 × 10^9/L). Lymphocyte and granulocyte counts followed a similar pattern, with relatively elevated values in younger dogs. Platelet counts were highest in puppies (236.3 ± 200.2 × 10^9/L) and decreased with age, reaching 151.6 ± 118.4 × 10^9/L in dogs over 24 months (Table 3).

Distribution Based on Breed of Dog

The haematological profiles of the different dog breeds showed marked variations across several parameters. The Belgian Malinois had the highest PCV of 48.78 ± 3.70%, HB of 17.98 ± 1.70 g/dL, and RBC of 7.07 ± 0.62 × 10^{12}/L. In contrast, the Boerboel breed recorded the lowest PCV (33.70 ± 7.41%), HB (11.08 ± 3.57 g/dL), and RBC (4.42 ± 1.14 ×10^{12}/L) (Table 4).

The MCV, MCH and MCHC were within expected ranges but varied slightly; for instance, MCV ranged from 65.57 ± 5.82 fL in American Eskimo to 77.08 ± 4.28 fL in Labrador Cross, while MCHC was highest in Saint Bernard (37.97 ± 3.36 g/dL).

The Nigerian indigenous dog (NID) exhibited the highest TWBC count (15.66 ± 7.01 × 10^9/L), lymphocyte count (9.34 ± 5.46 × 10^9/L), and granulocyte count (2.35 ± 1.11 × 10^9/L). In contrast, the Dutch Shepherd had one of the lowest WBC (3.57 ± 1.32 × 10^9/L) and lymphocyte counts (3.21 ± 1.17 × 10^9/L). Also, the MID cells were relatively consistent, ranging from 0.12 ± 0.09 × 10^9/L in Lhasa to 1.16 ± 0.55 × 10^9/L in the NID (Table 4).

Regarding platelet counts, the Samoyed (301.0 ± 0.00 × 10^9/L) and Saint Bernard (299.3 ± 101.4 × 10^9/L) showed the highest, while the American Eskimo (70.24 ± 6.42 ×10^9/L) and Labrador Retriever (74.50 ± 82.73 × 10^9/L) had the lowest counts (Table 4).

Parameter	Mean	Range
Packed cell volume (%)	38.54 ± 9.31	12.00 - 61.00
Haemoglobin concentration (g/dL)	13.05 ± 3.10	3.60 - 23.10
Red blood cells (× 10^{12}/L)	5.52 ± 1.23	1.28 - 8.47
Mean corpuscular volume (fL)	70.22 ± 8.24	24.80 - 88.30
Mean corpuscular haemoglobin (pg)	24.02 ± 3.76	16.20 - 58.40
Mean corpuscular haemoglobin concentration (g/dL)	34.46 ± 8.10	21.00 - 94.60
Total white blood cell count (× 10^9/L)	10.04 ± 6.79	0.53 - 33.30
Lymphocyte count(×10^9/L)	7.17 ± 4.40	0.80 - 24.30
Mid cell count (×10^9/L)	0.61 ± 0.59	0.01 - 2.48
Granulocyte count (×10^9/L)	1.22 ± 2.16	0.00 - 29.00
Platelet count (×10^9/L)	159.11 ± 125.69	0.00 - 1078

Table 1: Haematological parameters of apparently healthy dogs in the Federal Capital Territory, Nigeria.

Sex of Dog		
Parameter	**Male**	**Female**
Packed cell volume (%)	38.85 ± 9.42	38.10 ± 9.17
Haemoglobin concentration (g/dL)	13.15 ± 3.10	12.92 ± 3.11
Red blood cells (×10^{12}/L)	5.55 ± 1.24	5.47 ± 1.21
Mean corpuscular volume (fL)	69.94 ± 9.09	70.61 ± 6.88
Mean corpuscular haemoglobin (pg)	23.93 ± 2.99	24.14 ± 4.66
Mean corpuscular haemoglobin concentration (g/dL)	34.79 ± 9.26	34.00 ± 6.09
Total white blood cell count (×10^9/L)	9.85 ± 6.60	10.30 ± 7.07
Lymphocyte count(×10^9/L)	7.28 ± 4.65	7.01 ± 4.03
Mid cell count (×10^9/L)	0.61 ± 0.57	0.62 ± 0.63
Granulocyte count (×10^9/L)	1.29 ± 2.59	1.11 ± 1.33
Platelet count (×10^9/L)	141.2 ± 98.19	185.1 ± 154.1

Table 2: Sex distribution of haematology of apparently healthy dogs in the Federal Capital Territory.

Age (months) of Dog					
Parameter	0 – 6	12-Jul	13 - 18	19 - 24	> 24
Packed cell volume (%)	33.34 ± 11.45	38.39 ± 7.28	39.66 ± 5.73	36.61 ± 11.65	39.96 ± 8.80
Haemoglobin concentration (g/dL)	11.43 ± 4.50	12.73 ± 2.97	13.02 ± 1.85	12.81 ± 3.21	13.49 ± 3.11
Red blood cells ($\times 10^9$/L)	4.70 ± 1.65	5.45 ± 1.03	5.43 ± 0.79	5.36 ± 1.31	5.71 ± 1.28
Mean corpuscular volume (fL)	71.21 ± 3.12	70.69 ± 7.21	73.31 ± 6.24	68.65 ± 11.58	70.41 ± 6.65
Mean corpuscular haemoglobin (pg)	24.09 ± 1.24	23.66 ± 3.49	24.01 ± 1.42	24.18 ± 4.84	24.13 ± 3.51
Mean corpuscular haemoglobin concentration (g/dL)	33.89 ± 2.29	32.97 ± 3.99	32.86 ± 1.29	36.94 ± 14.12	34.07 ± 4.76
Total white blood cell count ($\times 10^9$/L)	6.41 ± 4.17	11.19 ± 7.58	5.30 ± 3.18	10.09 ± 6.57	10.22 ± 6.68
Lymphocyte count($\times 10^9$/L)	6.13 ± 4.11	8.53 ± 5.41	5.45 ± 2.77	6.86 ± 4.10	6.90 ± 4.00
Mid cell count ($\times 10^9$/L)	0.14 ± 0.10	0.68 ± 0.66	0.18 ± 0.12	0.63 ± 0.60	0.66 ± 0.57
Granulocyte count ($\times 10^9$/L)	0.15 ± 0.13	1.18 ± 1.42	0.16 ± 0.13	1.57 ± 3.70	1.23 ± 1.22
Platelet count ($\times 10^9$/L)	236.3 ± 200.2	152.5 ± 148.8	175.1 ± 47.47	166.1 ± 115.8	151.6 ± 118.4

Table 3: Age distribution of haematology of apparently healthy dogs in the Federal Capital Territory, Nigeria.

Breed of Dog	PCV (%)	HB (g/dL)	RBC ($\times 10^{12}$/L)	MCV (fL)	MCH (pg)	MCHC (g/dL)	WBC ($\times 10^9$/L)	LYM ($\times 10^9$/L)	MID ($\times 10^9$/L)	GRAN (10^9/L)	PLT ($\times 10^9$/L)
American Eskimo	42.47 ± 24.07	14.70 ± 8.50	6.30 ± 3.27	65.57 ± 5.82	23.80 ± 1.30	34.13 ± 1.21	4.80 ± 4.74	4.35 ± 4.05	0.20 ± 0.29	0.25 ± 0.41	70.24 ± 6.42
Belgian Malinois	48.78 ± 3.70	17.98 ± 1.70	7.07 ± 0.62	69.10 ± 2.28	25.46 ± 0.84	36.80 ± 1.06	6.31 ± 1.79	6.11 ± 1.67	0.14 ± 0.08	0.07 ± 0.07	103.8 ± 58.08
Boerboel	33.70 ± 7.41	11.08 ± 3.57	4.42 ± 1.14	76.92 ± 5.90	24.78 ± 1.61	32.46 ± 4.06	6.99 ± 4.50	6.58 ± 4.39	0.21 ± 0.12	0.20 ± 0.21	204.2 ± 201.8
Caucasian	40.26 ± 6.63	13.66 ± 2.68	5.68 ± 1.08	71.34 ± 5.12	24.05 ± 1.55	34.68 ± 5.67	7.78 ± 3.16	7.16 ± 2.96	0.30 ± 0.29	0.26 ± 0.41	213.5 ± 105.32
Cross	38.38 ± 7.75	12.79 ± 2.87	5.47 ± 1.28	70.92 ± 9.21	23.97 ± 4.41	33.62 ± 4.32	7.48 ± 4.75	6.07 ± 3.10	0.39 ± 0.41	1.25 ± 4.32	157.0 ± 170.1
Dutch Shepherd	45.07 ± 1.21	16.23 ± 0.59	6.31 ± 0.27	71.40 ± 1.20	25.73 ± 0.80	36.00 ± 1.04	3.57 ± 1.32	3.21 ± 1.17	0.18 ± 0.10	0.17 ± 0.08	161.3 ± 28.68
German Shepherd	40.45 ± 9.07	13.77 ± 3.28	5.52 ± 1.22	73.28 ± 5.40	25.81 ± 3.28	33.81 ± 3.52	6.52 ± 2.50	5.87 ± 2.39	0.30 ± 0.17	0.35 ± 0.28	180.7 ± 101.1
Labrador Cross	37.28 ± 2.83	11.83 ± 1.05	4.86 ± 0.59	77.08 ± 4.28	24.13 ± 1.35	31.65 ± 0.74	4.38 ± 1.16	4.13 ± 1.02	0.13 ± 0.07	0.13 ± 0.11	138.5 ± 42.35
Labrador Retriever	37.45 ± 1.77	13.35 ± 1.06	5.30 ± 0.01	70.65 ± 3.18	25.20 ± 1.84	35.60 ± 0.99	4.06 ± 0.83	3.75 ± 0.93	0.14 ± 0.01	0.18 ± 0.08	74.50 ± 82.73
Lhasa	41.41 ± 7.85	14.35 ± 2.68	5.77 ± 0.99	71.83 ± 5.62	24.91 ± 2.38	34.39 ± 4.89	4.32 ± 2.48	4.08 ± 2.35	0.12 ± 0.09	0.12 ± 0.10	145.0 ± 89.35
Nigerian indigenous dog	36.09 ± 10.46	12.10 ± 2.86	5.37 ± 1.25	67.62 ± 9.68	22.83 ± 4.21	35.07 ± 12.04	15.66 ± 7.01	9.34 ± 5.46	1.16 ± 0.55	2.35 ± 1.11	142.25 ± 122.42
Rottweiler	42.36 ± 5.27	14.09 ± 2.25	5.80 ± 0.76	72.24 ± 7.01	25.53 ± 4.54	33.23 ± 2.21	7.83 ± 3.53	7.31 ± 3.56	0.27 ± 0.11	0.25 ± 0.11	160.3 ± 90.31

Saint Bernard	35.17 ± 11.75	13.67 ± 2.91	5.50 ± 1.33	66.10 ± 1.65	25.10 ± 1.80	37.97 ± 3.36	6.34 ± 1.46	5.85 ± 1.69	0.23 ± 0.10	0.29 ± 0.24	299.3 ± 101.4
Samoyed	44.70 ± 0.00	16.20 ± 0.00	5.96 ± 0.00	75.00 ± 0.00	27.20 ± 0.00	36.20 ± 0.00	9.13 ± 0.00	8.83 ± 0.00	0.17 ± 0.00	0.13 ± 0.00	301.0 ± 0.00

Table 4: Breed distribution of haematology of apparently healthy dogs in the Federal Capital Territory, Nigeria.

Discussion

The overall haematological profile in this study revealed a wide range of values across several parameters, reflecting significant physiological variation within the sampled dog population in FCT, Nigeria. The broad ranges for PCV (4.00–61.00%), HB (3.60–23.10 g/dL), and RBC (1.28–8.47 $\times 10^{12}$/L) may result from differences in breed, age, physiological state, health status, and environmental exposure. These variations emphasises the importance of contextual interpretation of haematological results, as standard reference values may not always account for such diversity. Similar ranges were reported in a study conducted in Nigeria and Ghana, highlighting the variability in canine haematological parameters in different regions due to factors such as nutrition, disease exposure, and genetics [4,5,7,8].

The erythrocyte indices (MCV, MCH, and MCHC) recorded in this study were generally within expected canine reference ranges but exhibited moderate variation, suggesting differing erythrocyte morphologies among individual dogs. Such variation could be attributed to differences in hydration status, iron metabolism, or chronic disease presence. Notably, the MCHC values ranged widely (up to 8.10 g/dL SD), potentially indicating instances of spherocytosis or haemoconcentration in some animals. These findings align with those of other studies where similar haematological dynamics in mixed-breed and indigenous dogs were reported [4,5,8], thus, emphasising the diagnostic value of erythrocyte indices in the identification of subclinical anaemia and red cell disorders.

The white blood cell (WBC) and differential counts showed a considerable range, with some dogs having counts as high as 33.30 $\times 10^9$/L. Elevated leukocyte counts could indicate inflammatory or infectious processes, while lower counts may reflect immune suppression or viral infections [12]. The high mean lymphocyte count (7.17 ± 4.40 $\times 10^9$/L) may support the possibility of active immune surveillance in many dogs. These findings is consistent with those of Ogbu KI, et al. [13] and Umeakuana PU, et al. [14], who linked increased lymphocyte activity to endemic parasitic and viral challenges in Nigerian dog populations. Such observations are critical for pathologists, as the interpretation of WBC values without consideration for regional disease burdens can lead to diagnostic errors.

Platelet counts were notably variable, ranging from 0.00 to 1078 $\times 10^9$/L, which is unusually broad. Thrombocytopenia could suggest bone marrow suppression, platelet destruction (e.g., immune-mediated), or consumption (e.g., DIC), while thrombocytosis might be reactive (e.g., due to inflammation or neoplasia) [15]. A similar variability was reported by Cortese L, et al. [16] in dogs, where exposure to toxins and infectious agents can influence platelet dynamics. For clinicians, this could imply that interpretation of platelet counts must be integrated with clinical signs and other laboratory findings to avoid misclassification of thrombocytopenic or thrombocytotic states.

Sex-based differences in haematological values were minimal, aligning with previous studies that sex generally has a limited impact on canine haematology [17]. The slightly higher PCV and HB values in males could be related to testosterone-induced erythropoiesis, but the differences were not statistically or clinically significant. Similarly, the marginally higher WBC and platelet counts in females might be linked to hormonal modulation of immune responses, particularly in intact bitches. However, the consistency across sexes reinforces the applicability of shared reference intervals in clinical practice, except in specific cases where hormonal influence is suspected.

Age-related trends showed a progressive increase in erythrocyte parameters with age, reflecting bone marrow maturation and increased oxygen demand in adult dogs. Puppies had lower PCV, HB, and RBC, which may result from ongoing haematopoietic development or subclinical nutritional deficiencies. Similar observations were made in other studies involving Nigerian dog breeds, where younger dogs had lower erythrocyte values due to physiological immaturity [4,8]. This trend therefore, highlights the need for age-specific reference intervals, especially when evaluating young or geriatric animals, to avoid misdiagnosis of age-appropriate changes as pathological.

The WBC counts varied across age groups, with younger dogs exhibiting higher leukocyte levels, possibly due to greater exposure to novel antigens and a more reactive immune system. The elevated counts in the 7–12 months age group support the theory of immune priming during early development. These findings agrees with the report of McCourt MR, et al. [18], who documented increased lymphocyte activity in younger dogs. For veterinarians, such information could help in the differentiation between physiological leukocytosis in young animals and pathological leukocytosis due to infection or inflammation.

Interestingly, platelet counts declined with age, with puppies showing the highest mean counts. This observation may suggest a more active thrombopoietic response during early development or differences in platelet lifespan. Lower platelet counts in older dogs could indicate age-related marrow senescence or subclinical disease processes. The trend is in concordance with the findings of Cortese L, et al. [16], who reported decreasing thrombocyte levels with age in dogs. Such patterns are important for pathologists when considering differential diagnoses for bleeding disorders in geriatric patients.

Breed-related haematological variations were particularly striking, with Belgian Malinois showing the highest erythrocyte parameters, possibly due to their athletic nature and enhanced erythropoietin activity. These findings corroborate the work of Miglio A, et al. [6], who found elevated RBC counts in working dogs. In contrast, Boerboels had the lowest values, perhaps due to less physical activity or underlying genetic factors. For pathologists and clinicians, this reinforces the importance of breed-specific baselines when interpreting the haemogram to avoid over- or underestimating anaemic or polycythaemic conditions.

Furthermore, Nigerian indigenous dogs had the highest leukocyte and lymphocyte counts, likely reflecting their environmental exposure to endemic pathogens and greater immune system stimulation. This finding supports the results of Akinyemi T, et al. [9], who reported robust immune responses in local breeds compared to imported ones. The relatively high platelet counts in Samoyeds and Saint Bernards may be a breed specific trait, while the low values in American Eskimos could suggest breed-related hypoplateletism or genetic thrombocytopenia, but this assertion require further investigation. Such data are valuable for the development of breed-specific reference ranges, essential for accurate diagnostics, especially in diverse canine populations [19,20].

Conclusion

The data emphasises the need for careful selection of control groups in studies involving canine subjects. Also, the study contributes to the global understanding of canine haematology by providing data from a region with limited existing information. Hence, there is need for continued research in diverse geographical and ecological settings to build a comprehensive picture of canine haematological health.

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