

# *Dedication*

*To the soul of my father*

*And*

*To all those who supported me*

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## ABBREVIATIONS

<b>Symbol</b>	<b>Abbreviation</b>
<b>ALP</b>	Alkaline phosphatase
<b>ANOVA</b>	Analysis Of Variance
<b>AST</b>	Aspartate amino Transferase
<b>CBC</b>	Complete Blood Count
<b>CD4</b>	Cluster of Differentiation 4
<b>CK</b>	Creatinine kinase
<b>EDTA</b>	Ethylene Diamine Tetra Acetic acid
<b>EOF</b>	Erythrocyte Osmotic Fragility
<b>GGT</b>	Gamma Glutamyl Transferase
<b>Hb</b>	Hemoglobin
<b>HCT</b>	Hematocrit
<b>HPA</b>	Hypothalamic-Pituitary-Adrenalaxis
<b>IMT</b>	Immune Mediated Thrombocytopenia
<b>LDH</b>	Lactate Dehydrogenase
<b>MCH</b>	Mean Cell Hemoglobin
<b>MCHC</b>	Mean Cell Hemoglobin Concentration
<b>MCV</b>	Mean Cell Volume
<b>MHC</b>	Major Histo compatibility Complex
<b>MPV</b>	Mean Platelet Volume
<b>NK</b>	Natural Killer
<b>PCT</b>	Platelet crit
<b>PDW</b>	Platelet Distribution Width
<b>PLT</b>	Platelets
<b>PMN</b>	Poly Morph Nuclear
<b>RBC</b>	Red Blood Cell
<b>RDW</b>	Red cell Distribution Width
<b>SAM</b>	Sympathetic-Adrenal-Medullary axis
<b>SPSS</b>	Statistical Package for Social Science
<b>WBC</b>	White Blood Cell



## ABSTRACT

The current study evaluated some hematological and biochemical parameters of German shepherd dogs under Sudan condition as well as the effect of sex, season, and exercise.

Thirty three healthy dogs (14 males, 19 females) aged 2 to 4 years belonging to the Police Directorate for Dogs at Khartoum State were used in this study. Five ml of venous blood were taken from the cephalic vein and CBC analysis was immediately performed using the Sysmex KX2 hematology analyzer, Mindray BS-2000 for Biochemical parameters analysis, and Spectrophotometer AVI -574 for erythrocyte osmotic fragility determination.

Females showed highly significant ( $p \leq 0.02$ ) value for red cell distribution width (RDW) than males ( $14.68 \pm 1.95$  vs  $14.14 \pm 0.53$ ) whereas, males showed high numerical values of red cell count ( $6.60 \pm 0.81$  vs  $6.35 \pm 0.74 \times 10^{12}$ ), hemoglobin concentration, (Hb) ( $18.25 \pm 2.26$  vs  $17.09 \pm 3.71$  gm/dl), white blood cells count (WBC) ( $10.49 \pm 2.85$  vs  $9.41 \pm 2.78 \times 10^9/L$ ), Neutrophil ( $79.50 \pm 13.73$  vs  $74.23 \pm 13.79\%$ ) and Mix cells ( $52.77 \pm 12.01$  vs  $50.61 \pm 9.42\%$ ). Females showed highly significant ( $p \leq 0.02$ ) value of platelets count (PLT) ( $193.11 \pm 80.21$  vs  $170.50 \pm 43.78 \times 10^9/L$ ) and Platelet crit (PCT) ( $0.14 \pm 0.09$  vs  $0.11 \pm 0.67\%$ ) than males.

Highly positive significant ( $P \leq 0.01$ ) correlations were observed between PDW and MCH, MCV, but highly negative correlation was found between PDW and RDW, RBC in the all dogs. Moreover highly positive significant ( $P \leq 0.01$ ) correlation was found between PLT and PCT in female and all the dogs. No significant correlations found between PLT and MPV, PDW in the

two sexes. However, no significant correlations were detected between RBC and PLT, PCT, and HCT in the all dogs.

During winter PCT( $0.120\pm 0.07$ fL), PDW( $16.03\pm 0.55\%$ ), and Neutrophil( $83.16\pm 15.30\%$ ) were significantly( $P\leq 0.05$ ) increased, while the MPV( $9.42\pm 0.81$ ), Total protein( $6.94\pm 1.02$ g/dl), and globulin ( $3.47\pm 8.05$ g/dl) were decreased. Significant increase ( $P\leq 0.05$ ) in PLT ( $205.58\pm 69.31\times 10^9$ /L), triglyceride ( $159.37\pm 20.65$ mg/dl) and urea ( $44.15\pm 10.60$ mg/dl) were observed in summer. Albumin significantly ( $P\leq 0.05$ ) decreased ( $3.03\pm 0.51$ g/dl) and lymphocyte increased ( $94.45\pm 3.19\%$ ) during autumn.

RBC, HCT, MCV were decreased numerically immediately and after one hour of exercise.

Lymphocytes decreased immediately and at one hour post exercise. PLT significantly ( $P\leq 0.04$ ) increased ( $118.60\pm 39.67\times 10^9$ /L) immediately post exercise.

Hemolysis of erythrocyte started at Nacl concentration of 0.55% in all the dogs. Males erythrocytes were more resistant than females.

All the obtained results were within the normal range values, that German shepherd dogs are well adapted to the climate condition of the Sudan.

Effect of sex, season and exercise should be considered in clinical interpretation of dogs' hematological and biochemical variables.

## ملخص الدراسة

قيمت الدراسة الحالية بعض المعايير الدموية والبيوكيميائية لكلاي الراعي الألماني تحت ظروف السودان وكذلك تأثير الجنس والموسم وممارسة الرياضة.

ثلاث وثلاثون كلباً صحياً (14 ذكر و 19 أنثى) تتراوح أعمارهم بين سنتين و 4 سنوات تابعة للإدارة العامة للكلاب الشرطية بولاية الخرطوم استخدمت في هذه الدراسة .

تم أخذ خمسة مل من الدم الوريدي من الوريد الرأسي وأجري تحليل إجمالي عدد الدم

(CBC) على الفور باستخدام محلل الدم Mindray BS-2000 ,Sysmex KX2

لتحليل المعلمات البيوكيميائية ، و Spectrophotometer AVI -574 لتحديد هشاشة

كرات الدم الحمراء.

أظهرت الإناث قيمة معنوية عالية ( $p \leq 0.02$ ) في حجم توزيع الخلايا الحمراء (RDW)

مقارنة بالذكور ( $14.68 \pm 1.95$  vs  $14.14 \pm 0.53$ ) ، في حين أظهرت الذكور قيم عددية عالية

من عدد الخلايا الحمراء ( $6.60 \pm 0.81$  vs  $6.35 \pm 0.74 \times 10^{12}$ ) , تركيز الهيموجلوبين , (Hb)

(WBC) خلايا الدم البيضاء ( $18.25 \pm 2.26$  vs  $17.09 \pm 3.71$  gm/dl)

(Neutrophil) ( $10.49 \pm 2.85$  vs  $9.41 \pm 2.78 \times 10^9/L$ ) ( $79.50 \pm 13.73$  vs  $74.23 \pm 13.79\%$ )

و (Mix) ( $52.77 \pm 12.01$  vs  $50.61 \pm 9.42\%$ ) أظهرت الإناث قيمة معنوية عالية ( $p \leq 0.02$ )

من عدد الصفائح الدموية (PLT) ( $193.11 \pm 80.21$  vs  $170.50 \pm 43.78 \times 10^9/L$ ) ونسبة

الصفائح الدموية في العينه (PCT) ( $0.14 \pm 0.09$  vs  $0.11 \pm 0.67\%$ ) أكثر من الذكور.

ولوحظت ارتباطات معنوية موجبة للغاية ( $P \leq 0.01$ ) بين PDW و MCH , MCV ,

ولكن الارتباط كان سلبى للغاية بين PDW و RDW , RBC في جميع الكلاب. علاوة

على ذلك , وجدت علاقة ارتباط معنويه موجبه للغاية ( $P \leq 0.01$ ) بين PCT و PLT في

الإناث وجميع الكلاب.

خلال فصل الشتاء زاد بشكل كبير معنوي كل من PCT ( $0.120 \pm 0.07 fL$ ) ,

PDW ( $16.03 \pm 0.55\%$ ) و Neutrophil ( $83.16 \pm 15.30\%$ ) ، بينما انخفض متوسط حجم

الصفائح الدموية (MPV)  $(9.42 \pm 0.81)$  , البروتين  $(6.94 \pm 1.02 \text{g/dl})$  و القلوبولين  $(3.47 \pm 8.05 \text{g/dl})$  . في حين زادت  $\text{PLT}$   $(205.58 \pm 69.31 \times 10^9/\text{L})$  , الدهون الثلاثية  $(159.37 \pm 20.65 \text{mg/dl})$  واليوريا  $(44.15 \pm 10.60 \text{mg/dl})$  بشكل ملحوظ  $(P \leq 0.05)$  في فصل الصيف. انخفض بشكل ملحوظ الالبومين  $(3.03 \pm 0.51 \text{g/dl})$  وزادت الخلايا اللمفاوية  $(94.45 \pm 3.19\%)$  خلال الخريف.

انخفضت  $\text{RBC}$  ,  $\text{HCT}$  و  $\text{MCV}$  انخفاض غير معنوي على الفور وبعد ساعة من ممارسة الرياضة.

من ناحية أخرى , انخفضت الخلايا الليمفاوية على الفور وفي ساعة واحدة بعد التمرين وازدادت  $\text{PLT}$  معنوياً  $(P \leq 0.04)$   $(118.60 \pm 39.67 \times 10^9/\text{L})$  مباشرة بعد التمرين.

بدأ انحلال الدم في كريات الدم الحمراء عند تركيز كلوريد الصوديوم بنسبة 51% في جميع الكلاب. كانت كريات الدم الحمراء لدى الذكور أكثر مقاومة من الإناث.

جميع النتائج التي تم الحصول عليها كانت ضمن قيم المدى الطبيعي , ذلك أن كلاب الراعي الألماني تتكيف بشكل جيد مع الظروف المناخية للسودان.

ينبغي النظر في تأثير الجنس ، والموسم والتمرين في التفسير السريري لمتغيرات الكلاب الدموية والكيميائية الحيوية.