

MEAN HAEMATOLOGICAL CHARACTERISTICS OF HEALTHY ADULT ONE HUMPED CAMEL (*Camelus dromedarius*) INTRODUCED INTO A SUB-HUMID CLIMATE IN NIGERIA

¹A.K. Mohammed, A.K.B. Sackey², L.B. Tekdek² and J.O. Gefu¹

¹National Animal Production Research Institute, ²Faculty of Veterinary Medicine
Ahmadu Bello University, Zaria, Nigeria

ABSTRACT

Eleven adult dromedaries introduced into a sub-humid climate in northern Nigeria were bled monthly for 36 months to establish mean haematological reference values for the zone. The mean erythrocyte value was $9.37 \pm 1.07 \times 10^{12} \text{ L}^{-1}$, haemoglobin $11.66 \pm 1.12 \text{ g dl}^{-1}$ and packed cell volume was $29.97 \pm 3.37\%$. The mean erythrocytic indices were $32.24 \pm 4.68 \text{ fl}$ for mean corpuscular volume, $12.56 \pm 1.72 \text{ pg}$ for mean corpuscular haemoglobin and $39.16 \pm 3.18 \text{ g L}^{-1}$ for mean corpuscular haemoglobin concentration. The mean leukocyte count was $13.41 \pm 2.82 \times 10^9 \text{ L}^{-1}$ while their percentage distributions were: $42.59 \pm 16.97\%$ neutrophils, $54.00 \pm 17.22\%$ lymphocytes, $0.63 \pm 0.62\%$ monocytes and $2.77 \pm 2.67\%$ eosinophils. The she-camels had significantly ($P < 0.05$) higher packed cell volume, neutrophils and eosinophils values but lower total leukocytes, lymphocytes and monocytes. Dry season samples were significantly ($P < 0.05$) higher in PCV and WBC values while neutrophils and lymphocytes were higher in the samples collected during the wet season.

Key words: Camel, dromedary, haematological values, Nigeria, sub-humid climate

Haematological analysis is a useful tool in diagnosis and prognosis in clinical veterinary practice (Coles, 1986). Unfortunately, the usefulness of this is not yet fully realised in the dromedary due to scanty information on the reference haematological values for various breeds (Lakhotia *et al*, 1964; Barakat and Abdel-Fattah, 1971; Ghosal *et al*, 1975; Ghodsian *et al*, 1978; Al-Ani *et al*, 1992; Rezakhanki *et al*, 1997; Osman and Al-Busadah, 2000). In most of the reports the animals used were from different climatic conditions resulting in contradictory values. The differences could result from different methods of analysis, season and nutritional factors, effects of sex and the rutt (Barakat and Abdel-Fattah, 1971; Bengoumi *et al*, 2003). Since values obtained in one geographical zone could not be taken as standard in other zones having different climatic conditions, the need to determine haematological values in variable environmental conditions is thus necessary (Barakat and Abdel-Fattah, 1971). The objective of this study, therefore, is to determine baseline reference values for haematological parameters in healthy adult one humped camels (*Camelus dromedarius*) and to determine the effect of sex and season on the normal haemogram in a sub humid climate.

Materials and Methods

Animals

This study was conducted in 11 healthy adult camels at the National Animal Production Research Institute, Ahmadu Bello University Shika-Zaria, Nigeria, out of which 6 were males and 5 were females. The camels were managed under a semi-intensive system involving grazing and browsing on improved pastures and the natural range for 6 to 8 hours daily. They were given 3 kg per head of concentrate supplementation twice a week. The camels were also given 0.7 kg/head of *kanwa* supplementation twice a week and water was available *ad libitum* in the grazing paddocks.

Baseline treatment

The camels were bled on arrival. Each camel was dewormed with Albenda^(R) bolus* at 5 mg per kg body weight. They were also given acaricide** bath and subsequent health problems handled as they

* Albenda^R : Each bolus contains 2g d, 1-tetramisole and 1.4 oxyclozanide

** Steladone :300g chlorofenoinphos per litre by Novartis

SEND REPRINT REQUEST TO A. K. MOHAMMED [email: abdullahikolo@yahoo.co.uk](mailto:abdullahikolo@yahoo.co.uk)

come up. Blood and faecal samples were examined for the presence of parasites. Thereafter, monthly bleeding throughout the period of the experiments were made to determine the baseline values and the effect of sex and season on the haemogram.

Collection of blood samples

All camels were restrained and 5 ml blood samples were collected through jugular venipuncture into bijou bottles containing disodium salt of ethylene diamine tetraacetic acid (EDTA) as anticoagulant for haematological analysis.

Determination of haematological parameters

The packed cell volume (PCV) was determined using a Hawksley micro haematocrit centrifuge as described by Schalm *et al* (1975). Total erythrocyte and leucocyte (WBC) were determined using Coulter Counter and the haemoglobin concentration (Hb) by coulter haemoglobinometer. Differential counts were carried out on Giemsa-stained thin smears by direct microscopic counting of not less than 100 leukocytes. The corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC) and mean corpuscular volume (MCV) values were calculated from the PCV, Hb and RBC values according to formulae of Coles (1986).

Statistical analysis

Data were analysed by one-way ANOVA, using GLM procedure of SAS (Goodnight *et al*, 1986) and Duncan's multiple range test (Duncan, 1955) was used to detect significant differences among means. Students paired t-test method was used to analyse paired data.

Results

The overall mean and ranges of haematological parameters studied are presented in table 1. The mean erythrocyte value was $9.37 \pm 1.07 \times 10^{12} L^{-1}$, haemoglobin $11.66 \pm 1.12 g dl^{-1}$ and packed cell volume was $29.97 \pm 3.37\%$. The erythrocytic indices calculated were mean corpuscular volume ($32.24 \pm 4.68 fl$), mean corpuscular haemoglobin ($12.56 \pm 1.72 pg$) and mean corpuscular haemoglobin concentration ($39.16 \pm 3.18 g dl^{-1}$). The mean total white blood cell (WBC) count was $13.41 \pm 2.82 \times 10^9 L^{-1}$ while the percentage distribution of the white cells included; neutrophils $42.59 \pm 16.97\%$, lymphocytes $54.00 \pm 17.22\%$, monocytes $0.63 \pm 0.62\%$ and eosinophils $2.77 \pm 2.67\%$.

Neutrophils were however, significantly higher in the females while males had higher lymphocytes ($P < 0.05$). Dry season samples had higher PCV and WBC values while neutrophils and lymphocytes were higher in samples collected during the wet season (Table 2).

The erythrocytes in all the camels are oval (elliptocytic) in shape and exhibited various levels of anisocytosis (+), microcytosis (++) , poikilocytosis (+) and hypochromia (+) all year round while the leucocytic cells showed relative to mild lymphocytosis, relative to severe neutrophilia, and relative eosinophilia.

Discussion

The haematological values obtained in this study were within the ranges reported elsewhere for the dromedary (Abdelgadir *et al*, 1984; Mehrotra and Gupta, 1989). The mean RBC counts reported were higher than those earlier reported by Lakhotia *et al* (1964), Ghodsian *et al* (1978) and Salaheldin *et al* (1984

Table 1. Mean (\pm SD) and ranges of haematological values of the adult dromedary camels in Shika-Zaria, Nigeria.

Parameter	Mean of all camels (n =11)	Males (n = 6)	Females (n =5)	Range (n =11)
RBC $\times 10^{12} L^{-1}$	9.37 ± 1.07	9.18 ± 0.34	9.55 ± 0.01	7.5-11.9
Hb $g dl^{-1}$	11.66 ± 1.12	11.71 ± 0.33	11.56 ± 1.03	8.6-14.0
PCV %	29.97 ± 3.37	29.36 ± 0.91	30.61 ± 2.79	22-37
MCV fl	32.24 ± 4.68	32.21 ± 1.06	32.43 ± 2.64	16.8 - 40.7
MCH pg	12.56 ± 1.72	12.85 ± 0.29	12.24 ± 1.06	7.31-15.55
MCHC $g dl^{-1}$	39.16 ± 3.18	39.84 ± 0.60	38.06 ± 4.13	30.90-47.27
WBC $\times 10^9 L^{-1}$	13.41 ± 2.82	13.75 ± 1.01	12.74 ± 0.68	6.2-22.2
Neutrophils%	42.59 ± 16.97	39.85 ± 4.33	46.89 ± 5.78	15-90
Lymphocytes %	54.00 ± 17.22	57.24 ± 4.78	49.22 ± 4.53	10-83
Monocytes %	0.63 ± 0.62	0.65 ± 0.13	0.56 ± 0.11	0-2
Eosinophils %	2.77 ± 2.67	2.36 ± 0.47	3.3 ± 0.23	0-13
Total Protein	7.41 ± 0.63	7.25 ± 0.33	7.56 ± 0.37	6.0-8.5

Table 2. Dry and wet season mean (\pm SD) haematological values of the adult dromedary camels in Shika- Zaria, Nigeria.

Parameter	Dry season (n = 11)	Wet season (n = 11)
RBC $\times 10^{12} L^{-1}$	9.39 \pm 1.14	9.53 \pm 0.98
Hb g dl^{-1}	11.81 \pm 1.2	11.38 \pm 1.05
PCV %	30.69 \pm 3.08	28.79 \pm 3.55
MCV fl	33.36 \pm 4.21	30.54 \pm 4.91
MCH pg	12.88 \pm 1.71	12.06 \pm 1.65
MCHC g dl^{-1}	38.71 \pm 2.84	39.84 \pm 3.54
WBC $\times 10^9 L^{-1}$	13.92 \pm 2.97	12.63 \pm 2.41
Neutrophils%	39.28 \pm 15.08	47.64 \pm 18.63
Lymphocytes %	56.23 \pm 16.61	50.58 \pm 17.83
Monocytes %	0.73 \pm 0.62	0.44 \pm 0.61
Eosinophils %	3.30 \pm 2.99	1.97 \pm 1.85
Total Protein	7.36 \pm 0.61	7.49 \pm 0.65

a,b) from India and Sudan. The mean corpuscular haemoglobin values in this study were low due to the large number of red blood cells in the camels as reported earlier (Salaheldin *et al*, 1984 a, b). The RBC in camel, unlike that of the other domestic animals is oval in shape and exhibited various degrees of anisocytosis, eliptocytosis, microcytosis, poikilocytosis and hypochromia in this study as was reported by Salaheldin *et al* (1984b).

The haemoglobin values agree with those reported by Lakhotia *et al* (1964), Ghodsian *et al* (1978) in Iranian and Salaheldin *et al* (1984 a,b) in Sudanese camels, respectively; but lower than those obtained by Banerjee *et al* (1962) and Soliman and Shaker (1967) in some Indian camels. The PCV values obtained in this study were low compared to those reported by Soliman and Shaker (1967) on Sudanese camels, but they were in agreement with Banerjee *et al* (1962) in some Indian camels. The discrepancy might be due to haemodilution as a result of regular water availability to the camels round the year in the institute as reported by Kerr (1989). The white blood cell (WBC) counts obtained were comparable to values reported in earlier studies (Lakhotia, *et al*, 1964, Soliman and Shaker 1967, Al-Ani *et al*, 1992). However, the most frequent white cells were the lymphocytes as against the predominantly neutrophils reported by Ghodsian *et al* (1978) and Rezakhanki *et al* (1997) for Iranian and Majeed *et al* (1980) for Pakistani camels, respectively. Also, the values in this study are in close agreement with that of Mutugi *et al* (1993) and Nyangao *et al* (1997) for Kenyan camels. The observed differences could be due to climate, age and breed differences of the camels used. The mild leucocytosis observed in this study could be either physiological or emotional

(Schalm *et al*, 1975) because during sampling, some of the camels were excited which resulted in increased muscular activity.

It is hoped that values obtained in this study may serve as guide to large animal clinicians in sub-humid zone of Nigeria where haematological reference values for the one humped camel is scanty.

References

- Abdelgadir SE, Wahbi AA and Idris OF (1984). Some blood and plasma constituents of the camel. In: W.R. Cockrill (Editor). The Camelid - An All Purpose Animal. (Scandinavian Institute of African studies, Uppsala, Sweden). pp 438-443.
- Al-Ani FK, Al-Azzawi WARA, Jermukly MS and Razzaq KK (1992). Studies on some haematological parameters of camel and llama in Iraq. Bulletin of Animal Health and Production in Africa 40:103-106.
- Banerjee S, Bhattacharjee RC and Singh TI (1962). Haematological studies in the normal adult Indian camel (*Camelus dromedarius*). American Journal of Physiology 203:1185-1187.
- Barakat MZ and M Abdel-Fattah (1971). Seasonal and sexual variations of certain constituents of normal camel blood. Zentralblatt fur Veterinarmedizin A 18:174-178.
- Bengoumi M, Moutaouakil F, Farge F, Faye B and Farge FDL (2003). Seasonal variations of the plasma thyroid hormone concentrations and the body temperature in the dromedary camel. Journal of Camel Practice and Research 10(2):115-119
- Cheesbrough M (1991). Medical Laboratory Manual for Tropical Countries. Volume 1, 2nd Edition. Cambridge University Press, England. pp 465-545
- Coles EH (1986). Veterinary Clinical Pathology. 4th Edition. WB Saunders Co. Philadelphia.
- Duncan DB (1955). Multiple Range and Multiple F tests. Biometrics 11:1-42.
- Ghodsian I, Nowrouzian I and Schels HF (1978). A study of some haematological parameters in the Iranian camel. Tropical Animal Health and Production 10:109-110.
- Ghosal AK, Appanna TC and Dwarknath PK (1973). Studies on the seasonal variations in the blood of Indian camel. (*Camelus dromedarius*). Indian Journal of Animal Science 43:642-644.
- Goodnight JH, Sal JP and Sarle RF (1986). In: SAS User's Guide. Statistics. SAS Institute Inc., Box 8000 CARY, North Carolina, USA.
- Kerr MG (1989). Veterinary Laboratory Medicine, Clinical Biochemistry and Haematology. Oxford, London, Edinburgh, Boston, Melbourne, Blackwell Scientific Publications.
- Lakhotia RL, Bhargava AK and Mehrotra PN (1964). Normal ranges for some blood constituents of the Indian camel. Veterinary Record 76:121-122.
- Mehrotra V and Gupta ML (1989). Seasonal variations in certain blood constituents in camel. Indian Journal of Animal Science 59:1559-1561.

- Mutugi MW, Olaho-Mukani W, Kuto B, Alushula H and Njogu AR (1993.) Haematological characteristics of the one-humped camel (*Camelus dromedarius*) in Kenya. *Bulletin of Animal Health and Production in Africa* 41:181-184
- Nyangao JMN, Olaho-Mukani W, Maribet JM and Omuse JK (1997). A study of some haematological and biochemical parameters of the normal dromedary camel in Kenya. *Journal of Camel Practice and Research* 4:31-33.
- Osman TEA and Al-Busadah K (2000). Effects of age and lactation on some biochemical constituents of camel blood in Saudi Arabia. *Journal of Camel Practice and Research* 7:149-152.
- Rezakhanki A, Habibabadi SN and Ghjobh MM (1997). Studies on normal haematological and biochemical parameters of Turkmen camel in Iran. *Journal of Camel Practice and Research* 4:41-44.
- Salaheldin EA, Wahbi AGA and Idris OF (1984a). Some blood and plasma constituents of the camel. In: W.R. Cockrill (Editor). *The Camelid An All Purpose Animal*. (Scandinavian Institute of African Studies, Uppsala, Sweden). pp 438-443.
- Salaheldin EA, Wahbi AGA and Idris OF (1984b). A note on the haematology of adult Sudanese dromedaries. In: W.R. Cockrill (editor). *The Camelid an All Purpose Animal*. (Scandinavian Institute of African Studies, Uppsala, Sweden). pp 444-448.
- Schalm OW, Jain NC and Carrol WJ (1975). *Veterinary Haematology* (3rd. Edition), Lea and Febiger, Philadelphia, U.S.A. pp 807.
- Soliman MK and Shaker M (1967). Cytological and biochemical studies on the blood of adult she-camels. *Indian Veterinary Journal* 44:989-995.