Some Biochemical and Haematological Indices in Different Breeds of Camels in Saudi Arabia

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Abstract:

Normal haematological and biochemical parameters have been determined in 3 breeds of Arabian camel (Camelus dromedaries) Both males and females were included in the study. Statistical analysis showed non- significant breed or sex effect. Compared to other farm animals haematological indices in the camel characteristically showed that lymphocytes were the predominant leucocytes. Packed cell volume was lower and mean corpuscular haemoglobin concentrations were in excess. Albumin/globulin ratio exceeded 1 and γ-globulin was the predominant globulin.

Introduction :

Haematological and biochemical analysis of blood can often provide valuable information regarding health and sickness of animals. Only limited information on serum biochemistry and haematology of one humped camel is available (Lakhotia *et al* 1964, Barakat & Abdel-Fattah 1971, Ghosal et al 1975, Ghodsian *et al* 1978, Al-Ani *et al* 1992, Rezakhani *et al* 1997, Osman and Al-Busadah, 2000), but in most of these studies, the number of animals used were very low and the animals were from different climatic conditions. Thus the values obtained in one country could not be taken as standard in other countries having different climate. Since the camel is an adaptable species , the standard haematological and serum biochemical values need to be determined in a number of animals in variable environmental conditions. This study is designed to investigate the haematological and biochemical indices in some breeds of Arabian camel.

Materials and Methods

a. Animals :

This study was conducted in the Camel Research center of King Faisal University in the city of Al-Ahsa, Eastern Region where the climate is subtropical with mild winter and hot summer (Laben 1980). Twenty healthy camels of each of Majaheem , Maghateer and Awarik breeds were used in this

study. The selection of these breeds was based on the finding that they are the most numerous and widely distributed camels in Saudi Arabia (Al-Eknah et al 1997) . Each breed of Animals were housed together . Animals were fed on natural pasture . In addition each camel was offered craked barley, Berseem, hay and free supply of mineral salt licks. Water was provided *ad libitum*.

b. Collection of blood samples :

Blood samples 10ml were collected from jugular vein in two sets. One containing EDTA and the other without EDTA for serum seperation .

c. Determination of haematological parameters :

Erythorcyte sedimentation rate (ESR) was determined by westeregen sedimentation tubes. Packed cell volume (PCV) was determined by microhaematocrit method . Haemoglobin (Hb), number of red blood cells (RBC) and Leucocytes (TLC) were determined by electronic counter (Model ZB1, Coulter Electronics, Hialeah, USA) . Thin blood smears for differential TLC were air dried, fixed in double distilled methanol and stained with Giemsa. At least 200 cells were counted under light microscope. Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH) and mean corpuscular haemoglobin concentration (MCHC) were calculated according to formulae of Coles (1986) .

d. Determination of biochemical parameters :

The VETTEST 8008 biochemical analyzer (Sanofi Animal Health Ltd., England) was used to determine the serum concentration of total protein, blood urea nitrogen, creatinine and cholesterol. Alanine aminotransferase (ALT), aspartate aminotransferase (AST), lactic dehydrogenase (LDH) and Creatinine kinase (CK) were determined using specific kits .

Serum calcium, copper, potassium, sodium and zinc levels were determined by Shimadzu AA6800 Atomic Absorption Spectrophotometer.

Serum protein electrophoresis was performed on cellulose acetate plate using the EA-4 electrophoresis apparatus (Shanghai Medical Apparatus and Struments Factory, Shanghai, China) according to the method of Henry et al (1974) .

Statistical analysis :

Data were analysed by one way ANOVA, using GLM procedure of SAS (Goodnight *et al* 1986) and Duncan's multiple range test was used to detect significant differences among means.

Table (1) Mean (±SD) and ranges of haematological values in dromedary camels

Item	Majaheem Camels (20)		Maghateer Camels (20)		Awarik Camels (20)		Mean of All camels (60)	Range (60)
	Males (9)	Females (11)	Males (10)	Female (10)	Males (10)	Female (10)		
WBC ($10^3/\mu L$)	20.1 ± 0.44	19.5 ± 0.32	18.9 ± 0.31	19.1 ± 0.41	20.2 ± 0.38	19.6 ± 0.33	19.6 ± 0.51	12.1 – 25.3
Lymphocytes(%)	50.3 ± 1.6	50.2 ± 1.7	49.6 ± 1.5	49.4 ± 1.3	50.1 ± 1.5	51.6 ± 1.4	50.13 ± 1.7	41.2 – 56.4
Monocytes (%)	6.87 ± 0.51	7.2 ± 0.50	6.7 ± 0.49	7.1 ± 0.43	7.2 ± 0.48	6.9 ± 0.44	6.99 ± 0.62	3 - 8
Neutrophils (%)	37.21 ± 1.8	38.1 ± 2.0	36.9 ± 1.3	37.1 ± 1.5	38.0 ± 1.4	37.5 ± 1.3	37.45 ± 0.71	20.3 - 45.1
Eosinophils (%)	5.1 ± 0.50	4.1 ± 0.51	6.19 ± 0.41	5.89 ± 0.43	4.21 ± 0.51	3.88 ± 0.33	4.86 ± 1.22	0.00 – 8.1
Basophils (%)	0.52 ± 0.15	0.49 ± 0.20	0.61 ± 0.11	0.51 ± 0.12	0.49 ± 0.13	0.52 ± 0.15	0.52 ± 0.19	0.00 – 2.1
RBC ($10^6/\mu L$)	8.12 ± 0.15	7.13 ± 0.14	8.2 ± 0.22	7.3 ± 0.21	7.9 ± 0.17	7.7 ± 0.16	7.72 ± 0.51	5.1 – 9.1
PCV (%)	25.0 ± 0.23	26.2 ± 0.21	24.9 ± 0.27	25.2 ± 0.25	27.3 ± 0.27	27.4 ± 0.26	25.85 ± 1.2	23.6 – 30.1
Hbg/dL	13.2 ± 0.15	12.6 ± 0.14	11.9 ± 0.18	12.4 ± 0.19	13.1 ± 0.20	13.2 ± 0.15	12.7 ± 0.51	9.2 – 14.1
ESR (mm/8hr)	8.90 ± 0.18	7.92 ± 0.20	8.1 ± 0.21	7.7 ± 0.20	8.8 ± 0.18	8.3 ± 0.18	8.1 ± 0.42	6.1 – 11.1
MCV(fL)	32.31 ± 0.73	30.11 ± 0.68	31.1 ±0.62	32.3 ± 0.66	33.1 ± 0.63	30.1 ± 0.71	31.46 ± 0.64	28.4 – 35.1
MCH (pg)	17.51 ± 0.38	16.90 ± 0.32	16.8 ± 0.31	15.9 ± 0.41	16.1 ± 0.41	17.1 ± 0.39	16.71 ± 0.73	11.2 ± 20.3
MCHC (g/dL)	52.8 ± 1.60	48.9 ± 1.51	47.7 ± 1.5	49.2 ± 1.4	47.9 ± 1.4	48.2 ± 1.4	49.1 ± 2.1	40.0 – 60.1

* Number of animals in parentheses, WBC , white blood cell count ; RBC , erythrocyte count ; PCV , packed cell volume ; Hb haemoglobin concentration ; MCV, mean corpuscular volume ; MCH , mean corpuscular haemoglobin ; MCHC , mean corpuscular haemoglobin concentration .

Table (2) : Mean (±SD) and ranges of serm protein values in dromedary camels

Item	Majaheem Camels (20)		Maghateer Camels (20)		Awarik Camels (20)		Mean of All camels (60)	Range (60)
	Males (9)	Females (11)	Males (10)	Female (10)	Males (10)	Female (10)		
Total protein (g/dL)	7.75 ± 0.21	7.81 ± 0.12	7.78 ± 0.20	7.68 ± 0.22	7.72 ± 0.20	7.76 ± 0.19	7.74 ± 0.68	4.9 – 10.2
Albumin (g/dL)	4.20 ± 0.12	4.31 ± 0.11	4.33 ± 0.12	4.28 ± 0.11	4.30 ± 0.10	4.29 ± 0.10	4.29 ± 0.40	3.1 – 6.2
α-globulin (g/dL)	0.87 ± 0.02	0.79 ± 0.01	0.73 ± 0.03	0.68 ± 0.02	0.73 ± 0.03	0.76 ± 0.03	0.76 ± 0.08	0..45 – 0.96
β-gloublin (g/dl)	0.92 ± 0.06	0.93 ± 0.03	0.92 ± 0.05	0.96 ± 0.04	0.94 ± 0.05	0.93 ± 0.03	0.93 ± 0.04	0.51 – 1.1
γ-globulin (g/dL)	1.76 ± 0.03	1.78 ± 0.02	1.77 ± 0.03	1.76 ± 0.02	1.75 ± 0.04	1.78 ± 0.03	1.76 ± 0.03	0.76 – 2.1
Total globulin (g/dK)	3,55 ± 0.16	3.50 ± 0.17	3.45 ± 0.15	3.40 ± 0.16	3.42 ± 0.16	3.47 ± 0.15	3.46 ± 0.18	1.5 – 5.4
A/G	1.18 ± 0.02	1.23 ± 0.03	1.25 ± 0.02	1.26 ± 0.03	1.25 ± 0.03	1.23 ± 0.02	1.23 ± 0.07	0.8 – 1.6

* Number of animals in parenthesed ; A/G , ALbumin / globulin ratio

Table (3) : Mean (±SD) and ranges of serum biochemical values in dromedary camels

Item	Majaheem Camels (20)		Maghateer Camels (20)		Awarik Camels (20)		Mean of All camels (60)	Range (60)
	Males (9)	Females (11)	Males (10)	Female (10)	Males (10)	Female (10)		
BUN (mmoL/L)	5.3 ± 0.22	5.4 ± 0.23	4.9 ± 0.24	5.1 ± 0.22	4.8 ± 0.23	4.9 ± 0.21	5.06 ± 0.61	3.9 – 6.2
Creatinine (mmoL/L)	0.321 ± 0.04	0.41 ± 0.051	0.35 ± 0.012	0.39 ± 0.021	0.31 ± 0.022	0.38 ± 0.031	0.35 ± 0.051	0.160 – 0.533
Cholesterol (mmoL/L)	2.61 ± 0.11	2.45 ± 0.22	2.51 ± 0.11	2.31 ± 0.12	2.65 ± 0.13	2.55 ± 0.14	2.50 ± 0.21	1.91 – 4.2
Na (mmoL/L)	160.3 ± 16	140 ± 20	155.1 ± 19	162 ± 14	167 ± 15	146 ± 14	155.03 ± 19	100 – 190
K (mmoL/L)	4.6 ± 0.23	4.1 ± 0.22	3.9 ± 0.23	4.3 ± 0.33	4.4 ± 0.31	4.5 ± 0.34	4.3 ± 0.61	2.9 – 6.2
Ca (mg/dL)	10.1 ± 0.61	9.6 ± 0.51	11.2 ± 0.42	10.5 ± 0.51	11.2 ± 0.55	10.3 ± 0.51	10.48 ± 2.1	7.6 – 13.1
Cu (µg/L)	6.5 ± 0.22	6.2 ± 0.22	6.6 ± 0.23	5.9 ± 0.21	6.2 ± 0.24	6.4 ± 0.24	6.3 ± 1.1	4.2 – 8.5
Zn (µg/L)	4.1 ± 0.13	4.3 ± 0.16	4.4 ± 0.21	3.8 ± 0.22	3.9 ± 0.24	4.2 ± 0.25	4.11 ± 0.61	2.9 – 6.1
ALT (Iu/L)	10.2 ± 0.54	11.2 ± 0.56	13.4 ± 0.57	10.6 ± 0.58	10.1 ± 0.56	12.1 ± 0.55	11.23 ± 1.6	8.8 – 14.5
AST (Iu/L)	27.2 ± 1.3	31.2 ± 1.6	25.7 ± 2.1	30.1 ± 2.4	31.2 ± 2.1	28.5 ± 2.2	28.98 ± 3.1	24.1 – 35.1
LD (Iu/L)	250 ± 15	240 ± 4	260 ± 15	266 ± 16	**255** ± 14	251 ± 15	253 ± 26.1	225 – 280
CK (Iu/L)	25.3 ± 1.6	24.9 ± 1.4	25.5 ± 2.1	25.6 ± 1.7	25.4 ± 1.8	25.8 ± 1.6	25.4 ± 1.1	29.1 – 30.3

* Number of animals in parentheses, Bun , blood urea nitrogen ; Na , sodium ; K , potassium ; Ca, calcium ; Cu , copper ; Zn , zinc ; ALT , alanine amino transferase ; AST , aspartate amino transferase ; LD , Lactic dehydrogenase ; CK , creatine kinase

Results:

Results of erythrocytic indices and leucocytic series are shown in Table1. Statistical analysis showed non-significant breed or sex effect (P values varied between 0.1 to 0.8). Therefore results for breed and sex for each parameter were poled and one mean for all camel is given in Table1. The lymphocytes were the predominant cells of total leucocyte count (51.45 ± 1.7%) followed by the neutrophils (37.45 ± 0.71%), few monocytes (6.99 ± 0.65%) and eosinophils (4.86 ± 1.22%) and rarely basophils (0.82 ± 0.19%) were the main feature of leucocytic series. The PCV was 25.85 ± 1.2%, RBC 7.72 ± 0.51 x 10^6/µL, Hb 12.7 ± 0.51$_g$/dL and ESR 8.1 ± 0.42 mm/8 hours.

Serum protein values are shown in Table2. There was no statistical differences between either breeds or sexes (P values varied between 0.1 to 0.6). Albumin was the predominant serum protein and γ-globulin was the predominant globulin . The A/G ratio was more than one.

Non-significant difference in blood urea nitrogen, creatinine, cholesterol, enzymes and trace elements were shown among breeds and sexes (Table 3).

Discussion:

The haematological values presented in this study were within the reference ranges to those reported elsewhere for the dromedary (Abdelgadir *et al* 1984; Mehrotra and Gupta 1997). Compared to other species like horse and ruminants camels have more RBC but lower PCV (Schalm *et al* 1975). Consequently the MCHC was also higher than in any other species as the PCV is the denominator in the formula which determines MCHC (Jain 1986). The finding that RBC count was higher and PCV value was lower in the camel compared to other species is because of the smaller elliptical cells pack tighter in the camel. The RBC count was inversely proportional to MCV, the indicator of red cell size . This is in line with the belief that the smaller the size of red cells the greater their number per unit volume of blood (Kerr 1989).

The values obtained in this study for WBC count is comparable to values reported in other studies (Lakhotia *et al* 1964, Soliman and Shaker 1967, AL-Ani *et al* 1992) . However the most frequent white cells are not neutophils but lymphocytes . In this study the percentage of lymphocytes was 50.13 ± 1.7 and neutrophils was 37.45 ± 0.71. Corresponding values of lymphocyte and neutrophil counts were 29 and 58% in Iranian camels (Ghodsian *et al* 1978), 45.9 and 48.11% in Turkmen camels (Rezakhari *et al* 1997) 50 and 36.6% , in Pakistani camels (Majeed *et al* 1980) and 56 and 38% , respectively in kenyian camels (Nyang, ao *et al* 1997). These differences could be due to the different

breeds of camels used . This in part confirms Majeed *et al* (1980) findings who observed that lymphocytes and eosinophils appear together to reciprocate the neutrophils in different seasons.

Similar values of serum proteins in this study were obtained by other workers (Soliman and shaker 1967, Ghodsian *et al* 1978, Abdo *et al* 1987 , Mehrotra and Gupta 1989, AL-Ani *et al* 1992 , Nyang, ao 1997) . However the mean serum albumin concentration and A/G ratio were significantly higher than those in other ruminants (Sarwar *et al* 1992) being more than one . This probably makes it possible to maintain the high colloid osmotic pressure needed for storing water in blood or regulating water balance . Furthermore , it has been shown that the A/G ratio decreased by about 25% when camel was taken from semi – desert pasture to artificial feeding (Ghosal *et al* 1975).

The blood urea nitrogen (BUN), creatinine, cholesterol and enzymes were similar to the reference values for cattle (Zongping 2003) and the dromedary camels (Abdelgadir *et al* 1984, Wahbi *et al* 1984 , Eldiridiri *et al* 1987, Bengoumi *et al* 1999). The exceptionally high level BUN in camels in comparison to other livestock is of interest in view of camel's ability to utilize urinary nitrogen at times of poor grazing or water deprivation.

Similar value of AST has been established by several workers (Boid *et al* 1980, Eldirdiri et al 1987). AST lacks organ specificity but is present in skeletal muscle, cardiac muscle and liver of large animals and pathological changes in these organs elevate the activity of AST in the blood (Kaneko 1989). Like other animals the serum level of ALT in conjunction with other enzymes may be useful indicator for hepatic or muscular damage (Kaeneko 1989), but Kerr (1989) considers ALT as non specific index for liver investigations.

The values of CK presented here was lower than values reported else where (AL-Ali *et al* 1988, Beaunoyer 1992, Nyang'ao *et al* 1997). Skeletal muscle are the richest source of serum CK. Therefore it is the most widely used serum enzyme determination in muscular disease of large animals (Kaneko 1989). Normal LD values reported here was similar to that reported by other workers (Nyang'ao *et al* 1997). LD is not organ – specific and may be of value in conjunction with other enzymes (Coodley 1970). The sodium and potassium concentration were similar to those obtained by Rezakhani *et al* (1997) in Turkmen camel but higher than those obtained by AL-Ani *et al* (1992) in Iraqi camels. The mean values of serum calcium in this study are in agreement with those reported by soliman and Shaker (1967), AL-Ani *et al* 1992 and

Rezakhani *et al* (1997). The values of copper reported in this study are similar to those reported by Faye and Bengoumi (1997). These results confirmed the low values observed on camels in comparisons to other ruminants. It is known that camels graze more forage trees than grasses and leaves from trees are generally richer in copper than other parts of the plant (Rutagwenda *et al* 1990) . Zinc values are similar to those reported for camels (Berngoumi *et al* 1995, Faye and Bengoumi 1997), but lower than the deficiency threshold admitted to ruminants which is 7.0µg/100ml (Faye and Bengoumi 1997). Therefore it could be considered that zinc deficient threshold for camel is below 4.9µg/ml.

In Conclusion, there are few variation between the present findings and those from previous workers that may be attributed to the breed differences, nutrition, husbandry or assay methodology.

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بعض المعايير الدموية والبيوكيمائية في مختلف فصائل الجمال في المملكة العربية السعودية

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الملخص:

لقد تم قياس المعايير الدموية والبيوكيمائية في دم ثلاثة فصائل من ذكور وإناث الجمل العربي. لا توجد فروقات احصائية بالنسبة للفصلية أو الجنس. وبالمقارنة مع حيوانات المزرعة الأخرى فقد تم ملاحظة أن الخلايا الليمفاوية هي الخلايا الغالية في مجموعة كرويات الدم البيضاء. وأن هنالك عدد قليل من الخلايا المرحومة ومقدار أكبر من تركيز خضاب الدم في الخلايا. لقد كانت نسبة الاليومين للجلوبيولين أكثر من واحد وان الغاما جلوبيولين هو أكثر الجلوبيونات وجوداً.