Effect of feed type on some blood constituents of Sudanese growing camel *(Camelus dromedarius)* calves

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Abstract

This experiment was conducted in the Experimental Farm of the College of Veterinary Medicine and Animal Production, Sudan University of Science and Technology, Khartoum North, Sudan. The effect of feeding concentrate diets containing different ingredients, namely, groundnut cake, cotton seed cake and Kenana fattening pelleted feed, on some blood constituents was studied in Sudanese dromedary camel calves. Blood was collected weekly for five consecutive weeks as from the 4th week after the feeding trial had started. Whole blood was used for measuring erythrocyte counts, erythrocytic series, total leukocyte counts, packed cell volume, and hemoglobin concentration. In the serum samples collected from the experimental calves, the concentration of total protein, albumin, urea, uric acid, creatinine, bile, Fe, Cu, Ca, K, Na, P, and the activity of ALT, AST, and alkaline phosphatase were measured using standard methods. The serum creatinine concentration was significantly higher ($p<0.05$) in camel calves fed groundnut cakes than the calves fed cotton seed cakes and Kenana feed. All the other measurements did not vary with the feed type. The findings of this study were discussed with other researchers findings.

Introduction

Camels (*Camelus dromedarius*) are reared by nomadic pastoralists mostly in marginal ecozones of semi-desert lands in sub-Saharan areas. Thus, camels have a vital role in the subsistence economy of large sectors of rural pastoral communities. Several studies have shown that camels are good source of milk and they constitute the most important source of meat in arid areas (Knoess, 1977; Farah *et al.*, 1992). Mostly camels are raised under true nomadic husbandry systems, therefore, camel pastoralists are always moving over large areas in search of food and water for their camels. During their continuous transhumance, camels are affected by many production-limiting factors such as diseases, range and pasture limitations, water scarcity, high calf mortality and, recently, security problems (Novoa, 1970; Monod, 1975; Abbas and Musa, 1986, Abbas and Omer, 2005; Ali and Majid, 2006).

Raising edible animals with low-price meat such as camels is one way of bridging the gap between the demand for meat and the poor purchasing power in

the less developed countries (FAO, 1995). The methods of camel keeping are now fast changing due to the shrinkage of natural grazing land as a result of the establishment of mechanized irrigated or rain-fed agricultural schemes in parts of the natural camel range lands as well as the very severe and historical drought that hit several camel producing countries, particularly during 1983-1984. These natural disasters had aggravated the situation and forced many camel herders to start settling since these periods (Abbas and Omer, 2005; Darosa, 2005). Moreover, In order to keep pace with the alarming nutritional crisis, to make the ration economic and to have sustainable camel rearing practice, attempts were made to formulate least cost balanced rations for camels using non-conventional feed resources. Thereafter, attempts regarding formulation of complete rations and their densification have been taken up successfully to develop a drought proofing technology for camels (Sharma and Dhuria, 2007).

Due to the introduction of these new feed resources, it is justified to study the effect of some of these new diets on the normal blood and biochemical parameters of camels. This study is an attempt to investigate the effect of three different dietary regimes practiced in Sudan on some hematological and biochemical parameters of Sudanese growing camel calves.

Materials and Methods

The study was performed on twelve, two-year old male growing camel (*Camelus dromedarius*) calves. The calves were purchased from the local camel market, west of Omdurman and were housed in an open shade in the Experimental Farm of the College of Veterinary Medicine and Animal Production, Sudan University of Science and Technology (SUST), Khartoum North, Kuku Area, Sudan. On arrival to the farm and before starting the feeding trial, the calves were treated against both internal and external parasites and fed *Sorghum bicolar* (Abu 70) roughages.

Feeding trial: The animals were divided randomly into three equal groups of four animals each. Then each group was randomly allotted to one of the dietary regimes described in Table 1 which were formulated in the farm except Kenana feed that was purchased pre-formulated and which ingredients were not availed by the manufacturer.

Blood sampling and analysis: Three weeks after the feeding trial has started, blood was collected weekly, for five consecutive weeks by jugular veni-puncture into vacutainers containing di-sodium ethylene diamine-tetra-acetic acid (EDTA) as an anti-coagulant. More 5 ml of blood were drawn into plain, clean dry test tubes for serum analysis. Serum was separated by centrifugation and then stored at -20º C for later analysis.

The whole anti-coagulated blood was used immediately for the determination of erythrocyte count, packed cell volume (PCV), hemoglobin (Hb) concentration

and total leukocyte count (Dacie and Lewis, 1992). The erythrocytic series, mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH) and mean corpuscular hemoglobin concentration (MCHC), were calculated according to the method of Dacie and Lewis (1992).

Colorimetric method was adopted for the determination of serum concentration of total protein, albumin, urea, uric acid, creatinine, bile, Ca, P, Mg, Cu and Fe using commercial kits (Linear Chemicals Ltd. Spain). Serum Na and K were measured by a flame photometer (Corning 400, England).

Statistical Analysis: Data obtained were presented as means ± standard deviation, and then were subjected to one way analysis of variance to examine the effect of the diet on the studied blood parameters, as described by Gomez and Gomez (1984).

Results and Discussion

The normal feed and fodder resources of camels are constituted of natural flora (e.g. tree leaves, shrubs, bushes etc..) and products of the arid crops, particularly, leguminous straw viz., moth (*Phaseolus aconitifolius*), guar (*Cymopsis tetragonaloba*), gram (*Cicer arietinum*) and groundnut (*Arachis hypogea*). Young growing camels consume 1.33% dry matters (DM) (3.35kg/head/day) of their body weight. This amount consisted of 1.88 kg dry matter concentrate while the rest comes from wheat straw. The daily dry matter requirements of the dromedary camel for maintenance were estimated at 2.5% of the body weight with 10.88 MJ ME/kg DM (Wardeh, 1996).

Table 2 shows the effect of feeding three different diets on the haematological parameters of the experimental camels. No significant differences ($p>0.05$) were found in the investigated haematological parameters among the three groups. The results of the metabolite levels in the three groups of camels fed three different feed components are shown in Table 3. A significantly higher ($p<0.05$) serum creatinine concentration was observed in the calves fed groundnut cakes than the other two groups of camel, although all readings were within the normal range (Table 4). It is known that serum/plasma creatinine levels can be used to evaluate renal functions, especially the glomeruli, although renal tubules do not play any significant role in its excretion or absorption (Brar *et al*., 2000). Since all camel calves in the group that had significantly higher creatinine levels (G.N.C. group) were apparently healthy and since it is known that creatinine levels are known not to be affected by high protein content in the diet, causes of increased creatinine levels in the calves of this group could not be clearly explained.

Table 5 shows the effect of the diet on serum enzymes activity, electrolytes and minerals concentrations of camel calves. They followed the same trend of the hematological parameters as there were no significant differences between the three groups.

Camel nutrition workers have recommended that extensive nutritive evaluation of feed and fodder resources of camels in arid regions are still needed and they suggested nutrient requirements for various categories of camels to help in attaining better nutritional adequacy (Sharma and Dhuria, 2007). Further work is needed on concentrate feeding as more settlement of camel owners is currently being practiced.

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Table 1. Ingredients and composition of the experimental diets.

Diet / Ingredient (%)	Kenana feed (%)	Cotton seed cake (%)	Groundnut cake (%)
Sorghum grain	N.A.	30	30
Molasses	N.A.	28	29
Cotton seed cake	N.A.	27	0
Groundnut cake	N.A.	0	21
Wheat bran	N.A.	9	8
Groundnut hulls	N.A.	3	10
Urea	N.A.	1	0
Limestone	N.A.	1	1
Salt	N.A.	1	1
Total	-	100	100

Table 2. Haematological parameters in camels fed three different meals.

Parameter / Feed	WBC (Cell/mm$^{3)}$	RBC (Cell/mm$^{6)}$	PCV (%)	Hb (gm/dl)	MCV (fl)	MCH (pg)	MCHC (g/dl)
C.S.C.	12.3± 2.3	7.5± 0.9	26.5± 1.5	11.8± 1.5	35.8 ±4.1	15.8± 2.5	44.2± 5.3
Kenana feed	11.2± 3.4	7.1±1.3	26.2± 1.1	11.2 ± 1.4	37.7± 5.2	15.6 ±2.9	42.8± 5.1
Groundnut cake	10.9± 2.3	7.2± 1.1	26.4± 2.2	11.4± 1.3	37.2± 4.1	14.8 ±2.5	42.2± 4.0
Overall	11.5±2.7	7.3± 1.1	26.4± 1.6	11.5± 1.3	36.9± 4.5	15.4± 2.6	43.0± 4.8
N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

N.S. denotes non-significant difference at $p>0.05$

Table 3. Metabolite levels in camels fed three different feed components

Parameter / Feed	Total protein (mg/dl)	Urea (mg/dl)	Albumin (mg/dl)	Uric acid (mg/dl)	Creatinine (mg/dl)	Bile (mg/dl)
C.S.C	6.9± 0.7	25.0 ±1.6	3.2 ±0.4	2.8 ±0.3	1.2^{a} ±0.15	0.2± 0.1
Kenana feed	6.9± 0.5	25.6± 1.9	3.3± 0.3	2.8± 0.3	1.2^{b} ±0.13	0.2 ±0.1
Groundnut cake	7.2± 0.7	24.4± 2.2	3.3± 0.3	2.9± 0.3	1.3^{a} ±0.08	0.2± 0.1
Overall	7.0± 0.6	24.9 ±1.9	3.3 ±0.3	2.8± 0.3	1.2± 0.1	0.2 ±0.1
N.S.	N.S.	N.S.	N.S.	N.S.	*	N.S.

N.S. denotes non-significant difference at $p<0.05$

* denotes significance at $p<0.05$.

Table 4. Normal concentrations of some haematological and serochemical parameters of dromedary camels.

Parameter	Concentrations / References					
	Current study	Higgins and Cock (1986)	Hassan *et al.* (1968)	McGrane and Kenyon (1984)	Osman and Busadah (2000)	Nagpal *et al.* (2007)
Total leucocytes (X 10^9/litre)	11.5	2.9- 9.7	8 – 20	11.1 – 16.5	-	-
Total erythrocytes (X 10^{12}/litre)	7.5	7.6-11.0	6.5 – 12	7.2 – 11.6	-	-
Packed cell volume (%)	26.4	24 - 42	-	25 – 34	-	-
Haemoglobin concentration (g/100 ml)	11.5	11.4 – 14.2	8.9 – 15	7.8 – 15.9	--	-
Mean corpuscular volume (MCV) (fl)	36.9	27.5 - 29.4	-	-	-	-
Mean corpuscular haemoglobin (MCH) (pg)	15.4	12.1 – 13.7	-	-	-	-
Mean corpuscular haemoglobin concentration (MCHC) (g/100 ml)	43.0	42.1 – 49.6	-	-	-	-
Total serum protein (g/100 ml)	7.0	6.3 – 8.7	8.07	6.2 – 8.8	9.84	5.1
Albumin (g/100ml)	3.3	3.0 – 4.4	-	2.5 – 5.2	4.5	3.7
Globulin (g/100ml)	-	2.8 – 4.4	-	2.4 – 5.2	1.7	1.4
Blood urea (mmol/litre)	-	2.6 – 8.05	-	2.6 – 8.05	8.0	2.4
Creatinine (mmol/litre)	120	106 – 250	-	-	233.7	-
Chloride (mmol/litre)	-	-	-	-	-	101.98
Sodium (mmol/litre)	124.8	129.3 – 160.7	300 – 390	129 – 160	-	-
Potassium (mmol/litre)	3.8	3.6 – 6.1	-	3.6 – 6.1	-	-
Calcium (mmol/litre)	-	1.58 – 2.75	-	1.6 – 2.7	-	-
Inorganic phosphate (mmol/litre))	-	1.26 – 2.19	-	1.3 – 2.2	-	-
Copper (µg/100ml)	-	0.09 – 0.1	-	0.09 – 0.27	-	-
Magnesium (µmol/litre)	-	0.74 – 1.19	-	0.73 – 1.19	-	-
Ferrus (µmol/litre)	-	15 - 20	-	-	-	-

Table 5. Enzymes, electrolytes and minerals in camels fed three different feed components.

Parameter / Feed	Alkaline phosphatase (µl/ml)	ALT (µl/ml)	AST (µl/ml)	Fe (mg/dl)	Na (mg/dl)	K (mg/dl)	Ca (mg/dl)	P (mg/dl)	Cu (mg/dl)	Mg (mg/dl)
C.S.C	85.2 ±2.1	24.4 ±2.5	10.1± 2.3	31.1± 6.9	118.1± 32.9	3.7± 0.6	7.4± 0.2	3.8± 0.2	2.9± 0.3	1.7± 0.4
Kenana feed	84.2± 2.3	26.2 ±2.1	10.1± 2.2	29.2± 7.4	130.2± 14.9	3.8± 0.3	7.5± 0.1	3.7± 0.2	3.2± 0.3	1.8± 0.5
Groundnut cake	84.4± 2.6	25.4 ±2.8	9.3± 1.3	30.8± 8.5	129.2± 19.7	3.8± 0.5	7.4± 0.2	3.8± 0.2	3.2±0.3	1.7± 0.5
Overall	84.6± 2.3	25.5± 2.5	9.8± 1.9	30.6± 7.5	124.8± 23.9	3.8±0.5	7.4± 0.2	3.8± 0.2	3.1± 0.3	1.7± 0.5
N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

N.S. denotes non-significant difference at p.>0.05