Camel- International Journal of Veterinary Science : 1(1):29-36. January, 2013

Mineral indices in Algerian camels (*Camelus dromedarius*): effect of season

Aichouni Ahmed [1*], M. Belhadia[1] and H. Aggad [2]

[1]Laboratoire Bio-ressources Naturelles Locales, Chlef, Algeria
[2]Institute of Veterinary Sciences, University of Tiaret, Algeria
Corresponding Author: ahmed_aichouni@yahoo.com

Paper No. 3: MS Received: 23 August 2012 MS Accepted: 02 January, 2013

Abstract

In order to evaluate the climate influence on mineral indices in dromedaries (*Camelus dromedarius),* blood samples were collected from 40 clinically healthy animals, reared under semi-extensive conditions in the Djelfa valley, (in the south of Algeria), during the dry season (July / August) and the green season (December / January) to determine and compare the mineral indices. Statistically significant differences ($p<0.05$) depending on the season for the serum phosphorus and calcium (high during the hot season) were observed. These reference ranges for serum biochemical analysis can be used for early detection of metabolic and nutritional disorders in dromedary camels.

Keywords: Camel, Mineral indices, Season

Introduction

The dromedary camel is distributed in Africa, Middle East and Indian sub continent (Jeblawi, 2005). There are 24, 246, 291 one humped camels in the word (FAO, 2009) with 80% of them in Africa and the highest population in Somalia (7 million) and Sudan (4, 25 million). There are about change to 1,60,000 because 160.00 means 160 camels which is improbable 160.000 camels in Algeria (FAO, 2009) with highest population in the southern part of the country (Aichouni and Jeblawi, 2007).

In Algeria where the Sahara occupies most of three quarters of the total area and dominated by the extensive system camel, is towards decline during the last century, from change to 250,000 to 160,000 heads (Chehma, 2002) mainly located in the south (Damir *et al*., 2008). In recent years, national and local authorities are particularly interested in this species to ensure the safeguard and development (Damir *et al*., 2008). The development of this species is mainly confronted on the one hand, by the problem of food consisting largely by grazing rangeland Saharan, composed of canopy spontanné which is relatively lean and very sparse (Chehma, 2002) and on the other hand, the occurrence of various diseases (Benaissa, 1989).

The knowledge of diseases in the

camel requires the prior establishment of normal values of biochemical parameters (Benromdhan *et al*., 2003) specific to this species and the eventual identification of the physiological factors of variation (food, environmental conditions specific to the Sahara, genetic predisposition) before considering the impact of a disease (metabolic disorder, nutritional and dietary deficiencies, infectious diseases) on various biochemical and haematological parameters. Haematological and biochemical analysis of blood can often provide valuable information regarding heath and sickness of animals.

The standard for blood biochemical parameters in camels were determined in Tunisia (Benromdhan *et al*., 2003), Morocco (Bengoumi, 1999), Iranian (Ghodsian *et al*., 1978 ; Bdiei *et al*., 2006 and Mohri *et al*., 2008), Turkmen (Rezakhari *et al*., 1997), Pakistani (Majeed *et al*., 1980 and Ziar-ur-Rahman *et al*., 2007), Kenya (Nyang'ao *et al*., 1997 and Kuria *et al*., 2006), Sudane (Muna *et al*., 2003, Mohamed, 2004 and Damir *et al*., 2008), Kuwait (Mohamed *et al*., 1999), Emirat (Faye *et al*., 2008), Omani (Yasmin *et al*., 2010), Europe (Faye *et al*., 1995) and in Saudi Arabia (Osman and Al Busadah, 2003; Al Busadah, 2007 and Al Shami, 2009). Thus the values obtained in one country can not be taken as standard in other countries having different climate.

In Algeria haematology parameters have already been established in camels (Aichouni *et al*., 2011) but there is no published information on the Algerian camel's biochimical values (Aichouni *et al*., 2010). The objectives of this study were to determine normal values to array of biochemical parameters (mineral indices) in camels working in the southern Sahara and to establish the influence of season on them.

Materials and Methods

This study was conducted in southern Algeria, located at 34° 40'00'' N 03 ° 15'00'', in summer (hot and dry) and winter (cold and wet) of 40 healthy camels (11 males and 29 females), aged from 1 to 14 years, belonging to herds high in semi-sedentary area . Climate data (daily ambient temperature: maximum and minimum observed rainfall and relative humidity) have been collected by the station of météologique djelfa / Telsti.

Blood samples were collected from a camel's jugular vein by vein puncture and 10 millilitres of blood samples were collected from each camel using plastic disposable syringes, without anticoagulant. The blood was allowed to clot for 2h at room temperature, the sera were then separated by centrifugation at 3000 g for 10 min. The samples were subsequently transported in a cool box to the laboratory, where the serum was stored under -15°C, for no longer than 1 month while waiting for analysis. The automated biochemical analyzer (SYNCHRON CX 9PRO) was used to determine the serum concentration of : Calcium (Ca), Phosphorous (P), Sodium (Na), Magnesium(Mg) and Potassium (K).

Statistical analysis

Data were analyzed by student t-test using GLM procedure of SAS (Goodnight *et al*., 1986) and Duncan's multiple range tests was used to detect significant difference among means.

Results

The meteorological characteristics of summer and the winter season(Table 1), revealed that average summer temperatures were between 39 and 42°C, the maximum value was obtained in the second half of 'August, while those obtained during the winter (December/January) were between 27 and 36°C. Regarding the relative humidity, it was significantly higher in winter (69%-79%, the maximum value being observed in the month of December) than in summer (26%-49%, the maximum value being observed during the month of July). Consequently, while rainfall remained near zero during the dry season, they reached in the Saharan zone, 3.3 mm in December.

The effect of season on changes in serum concentration of phosphorus calcium, was highly significant ($p<0.05$) being higher during the wet season than during the dry season(Table 2). The same effect was observed on varying the concentration of Potassium and Sodium. The concentration of the latter is higher during the dry season than during the wet season. However it does not reach the record a season effect on Magnesium (Table 2).

Table 1: Changes in climatic parameters (ambient temperature, relative humidity, precipitation) during summer (July and August) and winter season (December and January).

			Temperature (°C)	Rainfall (mm	Humidity relative (%)
Summer					
	July	Minimum	39.0 ± 1.2	0 ± 0	26.0 ± 1.1
		Maximum	41.1 ± 2.0	0 ± 0	49.3 ± 0.0
	August	Minimum	39.0 ± 1.5	0 ± 0	28.2 ± 1.2
		Maximum	42.5 ± .2.1	1.0 ± 0	42.6 ± 2.9
Winter					
	December	Minimum	27.2 ± 3.2	20.2 ± 0.1	77.0 ± 3.8
		Maximum	36.2 ± 2.5	33.1 ± 1.9	79.3 ± 4.0
	January	Minimum	26.1 ± 3.3	21.3 ± 3.6	69.9 ± 3.7
		Maximum	36.0 ± 2.4	29.7 ± 2.0	75.10 ± 2.1

Table 2: Changes in serum mineral indices (P = Phosphorus, Calcium=Ca, Potassium=K, Sodium = Na, Magnesium =Mg) observed in camels during summer and winter season.

Mineral indices	Summer	Winter	p
Ca (mmol/l)	2.07± 0.17	2.47± 0.1	0.000
P (mmol/l)	1.94± 0.22	2.23± 0.13	0.000
K (mmol/l)	5.79± 1.0	5.55± 1.3	0.000
Na (mmol/l)	169.58 ± 12.1	146.23± 11.12	0.000
Mg (mmol/l)	1.01± 0.0	1.06± 0.1	0.457

Discussion

The camel has a physiology entirely focused anticipating periods of food shortages and water. Coping mechanisms to dehydration are complex and involve a large variety of parameters which once assembled, continue for long in this species. The resistance of the camel to dehydration and heat is proverbial. In fact, this characteristic that has long puzzled researchers is one of the most studied in camels. Most desert-adapted species have developed an escape behaviour vis-à-vis the heat and drought by burrowing into the ground during warm periods, thus limiting water loss and gain access to a relative freshness. Such behaviour is of course inconceivable for an animal like camel. Other physiological mechanisms that make this species, a remarkable biological model of resistance to aridity. We can bring these coping mechanisms towards dehydration into two main mechanisms:

- Reduction of water loss
- The maintenance of homeostasis by regulation of the concentration of the vital parameters and a maximum excretion of metabolic waste (Bengoumi *et al.,* 1999).

This study was undertaken to investigate the effect of season on blood mineral indices of camel (*Camelus dromedarius*), raised under the Saharan of Djelfa. The results obtained are useful for establishing normal indices .

The results of this study showed a seasonal variation in concentrations of serum calcium and phosphorus ($P<0.05$) (Table 2). The rise in serum concentrations of calcium and phosphorus during the wet season can be attributed to the availability of plants rich in minerals during the rainy season (Osman *et al*., 2003. and Kuria *et al*., 2006). The mean serum concentrations of phosphorous and calcium reported in this study are within the range reported previously (Wahbi *et al*., 1984; Mohamed *et al*., 1999; Al Busadah, 2007; Yassmin *et al*., 2010). Water deprivation for 10 days caused a slight decrease in serum calcium and phosphorous respectively from 2.71 to 2.57 mmol / l and 1.94 to 1.82 mmol / l (Wahbi *et al*., 18984), but the magnesium values were not modified. During dehydration, the tubular reabsorption of phosphate is not affected, that of calcium decreased slightly from 99.9 to 99% while that of magnesium is strongly reduced from 76-90 to 55%.

The comparison between the two seasons revealed no significant effect on serum magnesium. The two seasons showed a significant effect on serum Na (P <0.05).

Camel's serum sodium is higher than other domestic animals (Wahbi *et al*., 1984). Sodium metabolism is strongly influenced by dehydration. All authors report an increase in serum sodium with water deprivation, but for the urinary concentration of sodium, opinions are divided. According to some authors (Siebert *et al*., 1971), dehydration of 10 days, causes an increase in serum sodium levels of about 20%. Glomerular filtration of sodium decreases by 70%, its urinary concentration of 64% and 90% of tubular excretion. According to other authors (Yagil *et al*., 1976), water deprivation for 10 days results in a slight hypernatremia 3.5% but, in contrast, an increase in urinary sodium concentration of 42% with a decrease of the glomerular filtration 74% and its tubular excretion of 73%.

The overall effect of dehydration would be a simultaneous increase in serum sodium and natriuresis. This increase is explained by the decrease in glomerular filtration and tubular reabsorption of sodium. Indeed, the activation of the ADH during dehydration promotes a high water absorption and a slight sodium reabsorption from the digestive tract under the action of aldosterone (Yagil *et al*., 1976; Siebert *et al*., 1971). During rehydration, serum sodium and natriuresis decrease rapidly. The increase in aldosterone, after rehydration, helps prevent high renal excretion of sodium (Yagil *et al*., 1979). Average concentrations of serum potassium reported in this study during the two periods are significant ($p<0.05$) and are within the range reported previously (Mohamed *et al*., 1999 and Siebert *et al*., 1971). 10 days of dehydration causes an increase in serum potassium and kaliuresis of 3 and 14%, respectively. Glomerular filtration and excretion of potassium decreased by 66 and 57%. However, this observation does not seem consistent (Yagil *et al*., 1975; Yagil *et al*., 1976 and Mahmud *et al*., 1984). More generally, in dehydrated camels the tissue potassium content increases (Charnot, 1961) while the glomerular filtration and excretion of potassium decreased simultaneously. The metabolism of potassium depends on aldosterone which promotes its excretion in tubular sodium reabsorption with exchange. However, in dehydrated camels where the action of aldosterone is low, it seems that DHA modulate this metabolism (Yagil *et al*., 1976 and Charnot, 1958). After rehydration, the plasma concentration of potassium decreases, its tubular excretion increases in exchange with sodium (Yagil *et al*., 1976).

Conclusion

It was concluded that despite the selectivity and adaptation of camels to arid conditions, the P and C are lower during the dry season. Therefore, it may be beneficial to provide a concentrate ration to camels kept in dry tropical conditions

References

Aichouni A.and Jeblawi RJ. 2007. A study of breeding and reproduction of camels in the Algerian south west.. Tishreen University *J for Study and Scientific Research, Biological Sciences Series*, **29**:51-62.

Aichouni A., Jeblawi RJ, Dellal A., Hammou H. and Aggad, H. 2010. Breed variation in blood constituents of the one-humped came (Camelus dromedaries) in Algeria. *J. Camelid Sci.* **3:**19-25.

Aichouni A., Jeblawi RJ, Dellal A. 2011. season Influence on blood parameters of Algerian dromedaries 'Camelus dromedarius). *Revue, Med. Vet*., 162: 7: 327- 332.

Al Busadah K.A. 2007. Some biochemical and haematological indices in different breeds of camels in Saudi Arabia.. *Sci. J. King Faisal Univ*., **8:**131-142

Al Schami S.A., 2009. Comparative determination of serobiochemical constituents in in-door and free grazing camels. *J. Anim.Vet. Adv*., **8:** 896-908.

Bdiei KK, Mostaghni M, Pourjafar and Parchami A. 2006. Serum and tissue trace elements in Irnaian camels. *Comp.Cln. Pathol*. **15:**58-61.

Benaissa R, Le dromadaire en Algérie.1989. CIHEAM - Options Mediterraneennes - Série Séminaires - **2** : 19-28

Bengoumi M, Moutaoukil F, Farge FDL and Faye B. 1999. Thyroidal stun of the dromedary camel . Effect of some physiological factors. *J. Camel Prac. Res*. **6:**41-43.

Benromdhane S., Romdhan M. N., Feki M., Sanhagi H., and Kaabachi N. 2003. Blood biochemistry in dromedary. *Revue Med. Vet*., **154:** 695-702.

Chehma A.2002. Etude floristiques des parcours du dromadaire. These de doctorat. Universite Bbadj Mokhtar, Batna. 302pp

Charnot Y.1961. Équilibre minéral tissulaire dans la déshydratation du dromadaire. *J Physiol*, **53:**793-806.

Charnot Y. 1958. Répercussion de la déshydratation sur la biochimie et l'endocrinologie du dromadaire.. Thèse ès sciences naturelles, Université Paris 6, France

Damir HA, Abbas TA. and Ali AM. 2008. Copper status in breeding and racing camels and responseto cupric oxide needle capsules. *Trop. Anim. Health Prod*., **40:**643-648.

FAO. Food and agriculture organization of the united nation. 2009. http://fao.org/.

Faye B, Rabiha M, and Askar M. 2008. Trace elements and heavy Metals Status in Arabia camels.,. In: Yassmin *et al*., 2010; Serum mineral contents of the Omani racing Arabian camels;; *J. Anim. Vet. Adv*. **9**:764-770.

Faye B, Rotovonanahary M, Chacornac JP and Soubre P., 1995. Metabolic profiles and risks of diseases in camels in temperate conditions. Comp. Biochem. *Physiol*., **112:** 67-73.

Ghodsian I, Nowrouzian I and Schels HF., 1978. A study of some haematological parameters in the Iranian camel. *Trop.Anim. Health. Prod*. **10:**109-110.

Goodnight J. H, Sal J.P. and Sarie R. F., 1986 In SAS User's Guide. Statistics SAS Institute Inc., Cary, North Carolina, USA

Jeblawi R.J. 2005. Horse and mineral camels.. Publication of Tishreen University 335p.

Kuria SG, Wahome RG, Wanyoike MM and Gchur CK., 2006, Effect of mineral supplement on plasma mineral concentration of camels in Kenya. *Int. Agric. Biol.*, **8:**168-171.

Majeed M, Hur G, Raman Z and A. Ahmed., 1980. Effect of sex and season on 10 haematological values of normal adulte humped camels. *Rev. Elev. Med. Vet. Paye. Trop*. **33:**135-141.

Mahmud HM, Abdulhamid HM, Locatelli A., 1984. Water deprivation effects on the hematological and hematochemical pictures of (Camelus domedarius). *Rev Elev Méd Vét Pays Trop*., **37**: 313-317.

Mohri M, Moosayian HR and Hadian MJ., 2008. Plasma biochemistry of one humped camel: effect of anticoagulant and comparaison with serum: *Res. Vet. Sci.*, **85:** 554-558.

Muna Ahmed MM, Awad ME and Barri MES., 2003. Some micromineral profile in the serum of female camels as affected by the physiological state. Pak. *J. Biol. Sci*, **6:**1853-1855.

Mohamed H.E., 2004. The zink and Copper cintent of the plasma biochemistry of one-humped camel: effects of anticoagulants and comparaison with serum. *Res. Vet. Sci*. **85:**554-558

Mohamed HA, and Hussein AN. 1999. Studies on normal haematological and serum biochemical values of racing camels in Kuwait. *Vet. Res. Commun*. **23:** 241-248.

Nyang'ao j. M. N., Olaho-Mukani, J. M. Maribei and J. K., 1997. *J. Camel Prac Res*, 31-33.

Osman TEA and Al busadah KA., 2003. Effect of age and lactation as some biochemical constituents of camel blood in Saudi Arabia. *J. Camel Prac Res*. **7:**149-152.

Rezakhani A, Habibabadi SN, Ghojogh .M., 1997. Studies on normal haematological and
biochemical parameters of Turkmen camel in Iran. *J.Camel Prac . Res*, **4:** 41-44.

Siebert BD, Macfarlane WV., 1971. Water turnover and renal function of dromedaries in the desert. *Physiol Zool*; **44**: 225-240.

Wahbi AGA, Abdelgadir SE and Idris OF., 1984. The plasma electrolytes and minerals of normal camels in the Sudan. In: Al busadah K.A 2007. Some biochemical and haematological indices in different breeds of camels in Saudi Arabia. *Sci. J. King Faisal Univ*., **8:**131-142.

Yagil R and Berlyne GM., 1977. Renal handling of creatinine in various stages of hydration in the camel. *Comp Biochem Physiol*; **56A**: 15-8.

Yagil, R and Berlyne GM., 1976. Sodium and potassium metabolism in the dehydrated and rehydrated bedouin camel. *J Appl. Physiol.*, **41** : 457-61.

Yagil R and Etzion Z., 1979. The role of antidiuretic hormone and aldosterone in the dehydrated and rehydrated bedouin camel. *Comp Biochem Physiol* ; **63A:** 275-278.

Yagil R, Etzion Z and Berlyne GM, 1975. Acid base parameters in the dehydrated camel. *Tijdschr Diergeneesk*; 100:1105-8.

Yassmin Elhag Eltahir, Hassin Mohamed Ali, Mansour MH and Mahgoub., 2010, Serum Mineral Contents of the Omani Racing Arabian Camel (Camelus dromaderius), *J. Anim. Vet. Adv*. **9** : 764-770.

Zia-ur-Rahman N, Ahmed SA, Bukhari N, Akhtar and Haq I.U., 2007. Serum hormonal, electrolytes and trace elements profiles ine the rutting and non-ruttin one humped male camel. *Anim. Reprod.Sci*. **101:**172-178.