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Season influence on serum organic parameters of dromedarius (*Camelus dromaderius*) in Algeria

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Abstract

In order to evaluate the climate influence on biochemical parameters in dromedarius (*Camelus dromaderius*), blood samples were performed on 40 animals, clinically healthy, 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 organic indices (glucose, triglycerides, cholesterol, urea and creatinine). Statistical analysis showed a seasonal variation in concentrations of triglycerides and cholesterol. These are higher during the dry season (0.60 and 0.64 mmol/L) than during the wet season (0.504 and 0.51 mmol/L). However, a highly significant effect ($p < 0.05$) is recorded on the plasma glucose, serum urea and creatinine concentrations. These are higher during the wet season (4.92, 8.97 mmol/L and 115.52 µmol/L) than during the warm season (3.38, 5.32 mmol/L and 93.6 µmol/L). In conclusion, the results of this study would be useful for the preparation of serum organic indices. Nutritional status can induce significant changes in physiological responses of the camel. Available forage during the green season has improved the organic profile of the state of the body and blood of camels.

Keywords: Camel, organic indices, season.

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INTRODUCTION

In Algeria, where the Sahara occupies almost three quarter of the total area and is dominated by the extensive system camel, camels have been declining in the last century, from 250000 to 160000 heads (Chehma, 2002), and this is mainly occuring in the south (Damir et al., 2008). In recent years, national and local authorities are particularly interested in this species to ensure the safeguarding and development (Damir et al., 2008). The development of this farm is mainly confronted on the one hand, the problem of food consisting largely by grazing rangeland Saharan, composed by a canopy spontanné relatively lean and very sparse (Chehma, 2002) and on the other hand, the occurrence of various diseases. Among the latter, parasitic diseases are the major pathological dominant (Benaissa, 1989).

A major challenge facing clinicians is the establishment of normal values of biochemical parameters in the camel, specific to this species, and the eventual identification of the physiological factors of variation (influence of 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 (Benromdhane et al., 2003).

Haematological and biochemical analysis of blood can often provide valuable information regarding heath and sickness of animals. The standard of this parameters in camels were determined in Tunisia (Benromdhane et al., 2003), in Morocco (Bengoumi et al., 1999), Iranian (Ghodsian et al., 1978; Bdiei et al., 2006; Mohri et al., 2008), Turkmen (Rezakhani et al., 1997), Pakistani (Majeed et al., 1980; Zia-ur-Rahman et al., 2007), Kenyan (Nyanga'o et al., 1997; Kuria et al., 2006), Sudanese (Muna et al., 2003; Damir et al., 2008), Kuwaitian (Mohamed and Hussein, 1999), Emiratian (Faye et al., 2008), Omani (Yassmin et al., 2010), European (Faye et al., 1995) and in Saoudian camels (Osman and Al-Busadah, 2000; Al busadah, 2007; Al shami, 2009). Thus, the values obtained in one country

Table 1. Changes in climatic parameters (ambient temperature, relative humidity, precipitation) based on two periods of study: in summer (July and August) and in winter season (December and January).

Season	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

Results are expressed as mean ± standard deviation.

could not be taken as standard in other countries having different climate.

In Algeria, haematology parameters (Aichouni et al., 2011) and mineral indices (Aichouni et al., 2012) have already been established in camels but there is no published information on the Algerian camel's biochemical values (Aichouni et al., 2010). However, the objectives of this study were to determine normal values to array of organic indices in camels working in the southern Sahara and to establish the influence of season on them.

MATERIALS AND METHODS

Animals

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 camels (11 males and 29 females), apparently healthy, aged from 1 to 14 years, belonging to herds high in semi-sedentary. Climate data (daily ambient temperature: maximum and minimum observed rainfall and relative humidity) have been collected by the station of météologique djelfa / Telsti. Animals living under similar conditions of management (natural pasture) were healthy, routinely dewormed and dipped against endo- and ectoparasites.

Collection of blood samples

Blood samples were collected from a camel's jugular vein by venipuncture. 20 ml blood samples were collected from each camel using plastic disposable syringes. 10 ml of the blood sample were immediately transferred to capped and heparinized tubes (medical disposable industrial complex, (MDIC). The samples were reported in two sets:

a) One containing fluoride-oxalate for urea and glucose analysis;
b) One without anticoagulant for triglycerides "Tri", cholesterol "Chol", and creatinine "crea").

Allowed to clot for 2 h at room temperature, the sera were then separated by centrifugation at 3000 g for 10 min. The blood 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 automate biochemical analyzer (SYNCHRON CX 9PRO) was used to determine the serum concentration of organic indices.

Statistical analysis

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

RESULTS

Table 1 showed the meteorological characteristics of summer and the winter season, it appears 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, 33 mm in December.

Table 2. Changes in organic indices observed in 40 camels according to the sampling period (summer or winter).

Organic parameters	Summer	Winter	p
Glucose (mmol/L)	3.38 ± 1.1	4.92 ± 1.2	0.000
Urea (mmol/L)	5.32 ± 1.4	8.97 ± 1.5	0.000
Triglycérides (mmol/L)	0.60 ± 0.2	0.504 ± 0.2	0.003
Cholestérol (mmol/L)	0.64 ± 0.3	0.51 ± 0.2	0.002
Créatinine (µmol/L)	93.6 ± 2.3	115.52 ± 23.2	0.000

A significant effect ($p < 0.05$) was recorded for concentrations of triglycerides and cholesterol. These are higher during the dry season (0.60 and 0.64 mmol/L) than during the wet season (0.504 and 0.51 mmol/L). However, a highly significant effect ($p < 0.05$) is recorded on the plasma glucose, serum urea and creatinine concentrations. These are higher during the wet season (4.92, 8.97 mmol/L and 115.52 µmol/L) than during the warm season (3.38, 5.32 mmol/L and 93.6 µmol/L) (Table 2).

DISCUSSION

The decrease in plasma glucose concentration during the dry season can be attributed to the decrease in available forage. Food deprivation decreases the level of glucose in ruminants and monogastric mammals (Evans, 1971). Moreover, the supply of camels after fasting increases the level of plasma glucose (Wensvoort et al., 2004). There are also reports indicating the decrease of plasma glucose level during the dry season in camels citing reports by example Wilson (1984) and Abokouider et al. (2001). The plasma glucose level (dry season = 3.38mmol/L; wet season = 4.92 mmol/L) obtained in the present study (Table 2) is within the range of previous reports (Azwai et al., 1990; Mohamed and Hussein, 1999).

The islet camel have more cells secreting glucagon than insulin secreting cells (Charnot, 1967). The proportion of these cells decreased in the dehydrated camel as diabetics. However, after water deprivation for 10 days, blood glucose increased from 20 to 80% according to the authors (Banerjee and Bhattacharjee, 1963; Macfarlane et al.,1968), whereas glucosuria is zero. This hyperglycemia is due to the absence of renal excretion of glucose and decrease its use. Indeed, during dehydration, insulin decreased more than 30% (from 20 to 14 IU/L). However, the administration of a glucose solution leads to a sharp increase in insulin which reaches 40 IU/L. Injection of glucose promotes glucosuria higher animals hydrated (0.36 mmol/L) than in dehydrated animals (0.18 mmol/L) (Yagil and Berlyne, 1977). Insulin acts mainly on the storage and use of tissue glucose, but it would have no effect on the renal reabsorption. The urinary excretion of glucose is accompanied by huge water losses, as is the case in diabetics. The dromedary dehydrated reduces water loss by maintaining its high glucose and glucosuria practically zero. The hypo-insulinemia would maintain a low basal metabolism by decreasing glucose utilization (Bengoumi, 1992).

The observed increase in the concentration of serum urea during the wet season (8.97 mmol/L) can be attributed to the availability and quality of forage in court this season. Payne (1990) reported a higher level of plant crude protein during wet seasons. Additional protein ration during the dry season increases the rate of blood urea (Salman and Afzal, 2004). The serum urea concentration reported in this study is within the range of literature data (Elias and Yagil, 1984; Azwai et al., 1990).

The metabolism of urea is strongly influenced by dehydration. In domestic animals, the decrease in glomerular filtration is accompanied by a dramatic increase in uremia. However, the reabsorption of urea and recycling tract are particularly pronounced in camels (Emmanuel et al., 1976). Dehydration leads to a decrease in glomerular filtration and tubular reabsorption high urea. This results in an increase in blood urea and a fall in urinary concentration of urea (Schmidt-Nielsen et al, 1957; Mousa et al., 1983), which is not always observed (Mahmud et al., 1984). Urea appears to play an important role during dehydration in the camel. Indeed, by its osmotic effects, urea can draw water from other communities to the plasma (Yagil, 1985). Tubular reabsorption of urea is under hormonal influence of ADH. In fact, the active reabsorption of water in the collection tube is accompanied by that of the urea (Yagil and Etizion, 1979).

The observed increase in the concentration of serum creatinine during the wet season (115.5.µmol/L) can be attributed to the higher intake of protein in the diet consumed by camels. Abokouider et al. (2001) reported one lower concentrations of creatinine during the dry season. However, Salman and Afzal (2004) reported that the level of serum creatinine showed no seasonal variation. The serum creatinine concentration reported in this study is lower than that reported by Abdelgadir et al. (1984), Mohamed and Hussein (1999) and Salman and Afzal (2004). Creatinine is filtered and entirely excreted by the kidney, it is neither secreted nor reabsorbed. The creatinine clearance to explore glomerular filtration. The

decrease in glomerular filtration rate during dehydration causes a decrease in creatinine clearance. Water deprivation for 10 days results in an increase in serum creatinine of 60%, 147% creatinine and decreased creatinine clearance of 72% (Bengoumi 1992).

The increase in the concentration of triglycerides (0.60 mmol/L) and cholesterol (0.64mmol/L) of serum during the dry season may be related to low dietary requirements. Triglycerides are known to provide the metabolic fuel for most tissues when the animal is in energy deficit (Beitz, 1993). Moreover, it was reported that reduced glucose metabolism is reflected on the performance of free fatty acids (Mayes and Bothman, 2003). This increased concentration of triglycerides and serum cholesterol during the dry season is in agreement with the bibliographic data (Mirghani, 1982; Wasfi et al., 1987; Abokouider et al., 2001).

The effect of dehydration on lipid metabolism is not well studied in camels. The camel's hump has long been considered a lipid reserve mobilized to release water during dehydration. However, the size of the bump is not affected by water deprivation. The decrease in basal metabolism inhibits lipolysis (Yagil, 1985; Bengoumi 1992).

Cholesterol increased in the dehydrated camel after hypothyroidism (Charnot, 1967). In camels dehydrated, liver fat content decreased from 13 to 2.5%, which indicates a strong mobilization of liver lipids. In contrast, triglycerides and free fatty acids concentration remain unchanged (Mahmud et al., 1984). However, severe deprivation of water for 14 days induce lipolysis indicated by the increase in the concentration of triglycerides, free fatty acids, phospholipids and cholesterol. (Bengoumi 1992). This lipomobilisation increases to the final stage of water deprivation when food intake has become zero. However, it is the tissue lipids are mobilized, the size of the bump still intact.

Conclusion

This study was undertaken to investigate the effect of season on organic indices of serum of the camel (Camelus dromedarius), raised under the Saharan of Djelfa. The results would be useful for the preparation of serum organic indices. Nutritional status can induce significant changes in physiological responses of the camel. Available forage during the green season has improved the organic profile of the state of the body and blood of camels. Findings of the current study provide baseline values that may be used by clinicians in Algeria. Values recorded for organic parameters were within the ranges reported for camels in the Maghreb and Gulf region.

REFERENCES

Abdelgadir SE, Wahbi AGA, Idris OF, 1984. Some blood and plasma constituents of the camel. In: Al busadah KA 2007. Some biochemical and haematological indices in different breeds of camels in Saudi Arabia. Sci. J. King Faisal Univ, 8:131-142.

Abokouider SN, dabagg NE, Schenke F, 2001. Studies on the camels bloods parameters in relation to season in syria. Proceedings of the 6th annual Conference on Animal Producion under Arid Condition.Alain. United Arab Emirates.

Aichouni A, Belhadia M, Aggad H, 2012. Mineral indices in Algerian camels (Camelus dromedarius): effect of season. Camel-Int J Vet Sci, 1(1):29-36.

Aichouni A, Dellal A, Jeblawi R, 2011. Season influence on blood parameters of Algerian dromedaries (*Camelus dromaderius*). Revue Méd Vét, 162(7):327-332.

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

Al-ali AK, Husayni HA, Power DM, 1988. A comprehensive biochemical analysis of the blood of the camel. Comp Biochem Physiol, B(89):35-37.

Al-Busadah KA, 2007. Some biochemical and hematological indices in different breeds of camels in Saudi Arabia. Sci J King Faisal Univ, 8: 131-141

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

Azwai SM, Saltani H, Thomas PC, Shareha AM, ElGammudi F, Mohamed SO, 1990. Note on cholesterol, glucose, urea and total protein concentration in serum of normal camels. Camel Newslett, 7, 94.

Banerjee S, Bhattacharjee RC, 1963. Distribution of water body in the camel (*Camelus dromedarius*). Am J Physiol, 204: 1045-1047

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

Beitz D, 1993. Lipid metabolism. DUCKES of Physiology of domestic Animals. 11th Ed. pp: 453-471.

Benaissa R, 1989. The dromedary Algeria CIHEAM - Mediterranean Options - Seminar Series - no 2, pp : 19-28.

Bengoumi M, 1992. Clinical Biochemistry of the camel and its adaptation mechanisms to dehydration. PhD Thesis of Science, IAV Hassan II Rabat, Maroc.

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

Benromdhane S, Romdhane MN, Feki M, Sanhagi H, Kaabachi N, M'Bazaa A, 2003. Blood biochemistry parameters in dromedary (*Camelus dromedarius*). Revue Med Vet, 154:695-702.

Charnot Y, 1967. Régulation endocrinienne du métabolisme de l'eau chez le dromadaire. Soc Sci Nat Physiol Maroc, 47:215-226.

Chehma A, 2002. Etude floristique des parcours du dromadaire. PhD Thesis. Badj Mokhtar University, Batna. Algeria. pp. 302.

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

Elias E, Yagil R, 1984. Hematological and serum biochemical valuesin lacting camels and their born. Refuah Vet, 41:7-13.

Emmanuel B, Howard BR, Emady M, 1976. Urea degradation in the camel. Can J Anim Sci, 56:595-601.

Evans JW, 1971. Effect of fasting gestation, lactation and excice on glucose tornover in horses. J Anim Sci, 33:1001-1003.

Faye B, Rabiha M, 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 carmels. J Anim Vet Adv, 9(4):764-770.

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

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

Goodnight JH, Sal JP, Sarie RF, 1986. In SAS User's Guide. Statistics SAS Institute Inc., Cary, North Carolina, USA.

Kuria SG, Wahome RG, Wanyoike MM, Gchur CK, 2006. Effect of

mineral suuplement on plasma mineral concentration of camels in Kenya. Int J Agric Biol, 8:168-171.

Macfarlane WV, Morris RJH, Howard B, 1968. Water metabolism of merino sheep and camels. Austr J Sci, 25:112-121.

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

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

Mayes PA, Bothman KB, 2003. Lipids transport and storage. MC Grway-hil Compagnies, USA Harpers Biochemistry, 26th Ed, pp: 205-218.

Mirghani TM, 1982. Effect of fasting on camel serum lipids. Sudan J Vet Sci Anim Husb, 23:73-76.

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

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

Mousa HM, Ali KE, Hume ID, 1983. Effects of water deprivation on urea metabolism in camels, desert sheep and desert goat fed dry desert grass. Comp Biochem Physiol, 74A:715-720.

Muna AMM, Awad ME, 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.

Nyanga'o JMN, Olaho-Mukani W, Maribei JM, Omuse JK, 1997. A study of some haematological and biochemical parameters of the normal dromedary camel in Kenya. J Camel Pract Res, 4(1):31-33.

Osman TEA, Al-Busadah KA, 2000. Effect of age and lactation as some biochemical constituents of camel blood in Saudi Arabia. J Camel Pract Res, 7(2):149-152.

Payne WJA, 1990. An introduction to animal husbandry in the tropics. Longman Scientific and Technical, England.

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

Salman R, Afzal M, 2004. Seasonal variations in hematological and serum biochemical parameters in racing camels. J Camel Sci, 1:63-65.

Schmidt-Nielsen B, Schmidt-Nielsen K, Houpt TR, Jarnium SA, 1957. Body temperature of the camel and its relation to water economy. Am J Physiol, 188:103-112.

Wasfi IA, Hqfew AM, Tayeb EM, Taher AY, 1987. Thyroid hormone, cholesterol and triglycerides levels in the camel. Rev Vet Sci, 42(3):418.

Wensvoort J, Kyle DJ, Orskov ER, Bourk DA, 2004. Biochemical adaptation of camelids during fasting. J Camel Sci, 1:71-75.

Wilson RT, 1984. The camel, London and New York, Longman.

Yagil R, 1985. The desert camel: comparative physiological adaptation. Comparative animal nutrition. USA: Karger.

Yagil R, Berlyne GM, 1977. Renal handling of creatinine in various stages of hydration in the camel. Comp Biochem Physiol, 56A:15-18.

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

Yassmin EE, Hassin MA, Mansour MH, Mahgoub O, 2010. Serum mineral contents of the Omani racing Arabian camel (*Camelus dromaderius*). J Anim Vet Adv, 9(4):764- 770.

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