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 occurring 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 spontanée 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), Omari (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).

<table>
<thead>
<tr>
<th>Season</th>
<th>Temperature (°C)</th>
<th>Rainfall (mm)</th>
<th>Humidity relative (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>July</td>
<td>Minimum</td>
<td>39.0 ± 1.2</td>
<td>0 ± 0</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>41.1 ± 2.0</td>
<td>0 ± 0</td>
</tr>
<tr>
<td>August</td>
<td>Minimum</td>
<td>39.0 ± 1.5</td>
<td>0 ± 0</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>42.5 ± 2.1</td>
<td>1.0 ± 0</td>
</tr>
<tr>
<td>Winter</td>
<td>December</td>
<td>27.2 ± 3.2</td>
<td>20.2 ± 0.1</td>
</tr>
<tr>
<td></td>
<td>Minimum</td>
<td>36.2 ± 2.5</td>
<td>33.1 ± 1.9</td>
</tr>
<tr>
<td></td>
<td>Maximum</td>
<td>36.0 ± 2.4</td>
<td>29.7 ± 2.0</td>
</tr>
</tbody>
</table>

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.
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 = 3.38 mmol/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 Etzion, 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 Abdelgdair 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

<table>
<thead>
<tr>
<th>Organic parameters (mmol/L)</th>
<th>Summer</th>
<th>Winter</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>3.38 ± 1.1</td>
<td>4.92 ± 1.2</td>
<td>0.000</td>
</tr>
<tr>
<td>Urea</td>
<td>5.32 ± 1.4</td>
<td>8.97 ± 1.5</td>
<td>0.000</td>
</tr>
<tr>
<td>Triglycerides</td>
<td>0.60 ± 0.2</td>
<td>0.504 ± 0.2</td>
<td>0.003</td>
</tr>
<tr>
<td>Cholestérol</td>
<td>0.64 ± 0.3</td>
<td>0.51 ± 0.2</td>
<td>0.002</td>
</tr>
<tr>
<td>Créatinine</td>
<td>93.6 ± 2.3</td>
<td>115.52 ± 23.2</td>
<td>0.000</td>
</tr>
</tbody>
</table>
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 dromedari). 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**


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