www.roavs.com EISSN: 2223-0343
RESEARCH OPINIONS IN ANIMAL & VETERINARY SCIENCES

Seasonal variation in blood calcium, phosphorus, magnesium and some metabolites in camels (*Camelus dromedaries*) raised in semi-arid region

Mutassim M Abdelrahman[1] and Akram Madanat[2]

[1]King Saud University, College of food and Agriculture Sciences, Department of Animal Production, PO Box 2460, Riyadh 11451- Saudi Arabia; [2]Ministry of Agriculture, PO Box 2099 Amman, Al Karak Veterinary Unit–Al Karak-Jordan

Abstract

A study was conducted to investigate the effect of summer and spring season on the calcium (Ca), phosphorus (P), magnesium (Mg) thyroid hormones (T3 and T4), glucose, albumin, total protein and creatinin status. Twenty healthy camels were selected from different herds during summer and spring, raised in semi-arid area and blood samples were collected. Serum was separated and analyzed for Ca, P, Mg, T3, T4 and other metabolites. Results showed a significantly ($P<0.05$) higher Ca, T3, T4 and glucose levels during spring season. A significantly ($P<0.05$) higher creatinine level in the blood serum of camels during summer was also noted. No significant change in P, Mg, albumen and total protein was noticed. Furthermore, T3 and T4 levels of the camels were significantly ($P<0.05$) lower during summer season when compared with spring. In conclusion, climatic changes may cause significant changes in some mineral concentration, thyroid hormones and other metabolites.

Keywords: Camels; macro minerals; thyroid hormones; metabolites; semi arid region

To cite this article: Abdelrahman MM and A Madanat, 2014. Seasonal variation in blood calcium, phosphorus, magnesium and some metabolites in camels (Camelus dromedaries) raised in semi-arid region. Res. Opin. Anim. Vet. Sci., 4(11): 582-586.

Introduction

Camel (*Camelus dromedaries*) is an important animal in Jordan in nomadic or semi-sedentary for all communities as a source of high quality animal protein and minerals from milk, meat and other tissues. Currently, camel production system is starting to shift towards the semi intensive system that depends mainly on feed supplement as a source of nutrients requirements. Generally in camels, many productive and reproductive features such as low growth rate, seasonal breeding, long gestation period, abortion, low milk production, high mortality rate of newborn and dams and diseases appear to be the major constraints to improve the productivity and general performance of camels. However, camels are well known by their unique anatomy and physiology which helps them to be suited for harsh environment, poor feeding and water scarcity (Wardeh, 2004).

Camels in Jordan depend exclusively upon pasture, crop residues and grain as a main source of their nutrient requirements (FAO, 1994). Obviously, their productivity is below the average due to the under nutrition and health problem. Pasture is affected by season in their nutritive value because of the environmental factors. The seasonal changes, short rainy season and long dry season affect the pasture quality and quantity. Generally, the southern region of Jordan suffers of desertification problem which leads to disappearance of many palatable grazing plants and replaced with unpalatable spiny plants. Minerals are one of the most important nutrients which are affected by the deterioration of the ecosystem. The minerals play substantial role in livestock nutrition. Certain minerals such as calcium (Ca), phosphorus (P) and magnesium (Mg) are essential in the diets of animals and influence livestock productivity (Mc Dowell, 1985; Kincaid, 1988).

***Corresponding author:** Mutassim M Abdelrahman, King Saud University, College of food and Agriculture Sciences, Department of Animal Production, PO Box 2460, Riyadh 11451- Saudi Arabia
E-mail: amutassim@ksu.edu.sa

Minerals deficiencies can result in poor growth, reproduction, wasting disease, non-infections abortion, anaemia, bone abnormalities, tetany, and many other disorders (Underwood and Suttle, 1999). The effect of minerals on metabolism can be distinguished to four stages in the development of deficiency. First stage is initial depletion which is a restricted to changes in metabolism of the element itself. Second stage: compensated metabolic phase which is a change of element-dependent function, compensated by independent system unless stress is imposed. Third stage: metabolic deficiency, which is a change of major metabolic pathways, nucleic acids, protein, carbohydrate and fat. Fourth stage: clinical deficiency, which is a stage of clinical sign, disease and death (Mertz, 1985).

No reported studies are found in the literature regarding the mineral status of camels raised in southern part of Jordan during summer and spring seasons. This information is very crucial to improve camels' productivity by correcting deficiencies through developing mineral supplementation program during specific time of the year.

The goal of this project was to assess Ca, P, Mg and some other metabolites in camels during summer and spring seasons.

Materials and Methods

This study was conducted in Al-Karak region, southern part of Jordan, located at latitude 31° 10 48 N and longitude 35°42 00 E during summer and spring seasons. This region is a semi-arid area and suffer of desertification due to many environmental and management factors.

Blood collection: Twenty five male camels (> 2years) were randomly selected from more than two herds for blood sampling during the summer and spring seasons. Blood samples were collected from the jugular vein using vacutainer tubes without heparin. Average summer temperature was 35°C and 22°C in spring. Serum was collected by centrifugation at 3000 rpm/15 min. Samples were prepared according to AOAC (2005) for minerals.

Analysis of feed: Plants samples consumed by camels (pasture, cereals, crops and by products) from different location in the southern part of Jordan (Al-Karak region) were collected. Samples were dried, ground and stored in airtight containers for subsequent analysis for crude protein, Ca, P and Mg (Table 1). The samples were digested according to the method of AOAC (2005).

Serum sample analysis: Serum samples were analyzed for glucose, total protein, creatinine, albumin, Ca, P and Mg with spectrophotometer (CSCIL-CE292, Milton town, Cambridge Rd, UK) using commercial kits (United diagnostics Industry, Dammam 31413, KSA). The levels of serum T3 and T4 were measured with commercial kits obtained from Human ELISA test kits (Gesellschaft fur Biochemica und Diagnostica, 65205 Wiesbaden, Germany). Validation of these hormones assays assessed the detection limit, standard curve and coefficient of variation of the results.

Statistical analysis: The data from this experiment were analyzed using SAS program (2002) and one way analysis of variance to compare the means. P value less than 0.05 was considered as statistically significant.

Results and Discussion

Ca concentration in serum was significantly higher ($P<0.01$) during spring when compare with summer season (Table 2). Mg and P did not show any significant change in their levels as a result of season changes. The increase in Ca concentration in serum during spring may be attributed to the availability of range plant with high levels of minerals and other nutrients (Osman and Al-Busadah, 2003; Kuria et al., 2006; Ahmed et al., 2013). P and Mg did not show the same trend as Ca which agreed with findings of Ahmed et al. (2013), who conducted a similar study in Algeria, investigating the minerals indices in camels, raised under semi-intensive system, during the dry and wet season. The mean serum concentration of Ca, P and Mg reported in this study are below the normal range reported in other studies (Al-Busadah, 2007; Yasmin et al., 2010; Ahmed et al., 2013).

Thyroid hormones play a significant role in animal body metabolism (Cassar-Malek et al., 2007; Kale et al., 2007; Todini, 2007). They stimulate protein synthesis, increase adipose tissues lipolysis and blood glucose (Chatterjea and Shinde, 2005; Todini, 2007). T3 and T4 levels of the camels were significantly lower during summer season when compared with the spring (Table 3). This result was expected since camels during summer suffer of water shortage and consequently dehydration. This finding agreed with Yagil et al. (1978) who reported that the decline in thyroid function, as gauged by hormone secretion during dehydration in the summer, aids in preservation of body water by decreasing pulmonary water loss and dropping basic metabolism. The levels of T3 and T4 for the camels in this study were similar to the levels reported by Abdelrahman et al. (2013) and Nazifi et al. (2009) in camels but higher in different ruminant species other than camels (Mohebbi-Fani et al., 2009; Colodel et al., 2010; Tajik et al., 2010).

Blood is an important index for many metabolic functions and metabolites disorder in farm animals. The

blood glucose level was significantly higher during spring compared to summer. Creatinine level was significantly lower during spring compared to summer. Moreover, there were no significant difference in albumin and total protein according to season (Table 4). The lower levels of glucose during summer were expected since southern part of Jordan suffers of rainfall shortage and consequently a limited and poor quality and quantity of natural grazing plant. So, dietary supplementation is very important during this period for camel survival. In general, blood glucose level in both seasons falls within the normal range (Mehrotra and Gupta 1989; Mohamed and Hussein, 1999).

The total protein and albumin levels in camels during both seasons were not significantly different though slightly lower during dry season. This may be explained by the way that protein contents in diet during summer are adequate to cover their requirements (Table 4). The total protein levels in the blood during both seasons fell below the normal levels as reported by Sharma (1980).

Table 1: Composition and chemical analysis of feed

Feed type	CP (%)	Calcium (%)	Phosphorus (%)	Magnesium (%)
Alfalfa hay	16.37±1.63	1.42±0.25	0.49±0.04	0.41±0.07
Barley grain	12.87±0.94	0.33±0.06	0.38±0.03	0.28±0.04
Barley straw	3.80±0.05	1.70±0.03	0.09±0.02	0.32±0.06
Wheat bran	19.25±2.20	0.43±0.05	1.02±0.09	0.55±0.04
Wheat straw	4.48±1.36	0.69±0.18	0.15±0.04	0.24±0.03
Grazing plants	18.69±9.00	2.12±1.16	0.49±0.74	0.48±0.19

Table 2: Effect of season on calcium, phosphorus and magnesium concentration in camels raised in semi-arid region of Jordan

Parameters	Spring	Summer	P value
Calcium (mg/dl)	6.85±0.16	6.17±0.11	0.002
Phosphorus (mg/dl)	3.33±0.05	3.34±0.04	0.957
Magnesium (mg/dl)	1.79±0.03	1.75±0.04	0.612

Table 3: The Triiodothyronine (T3) and Thyroxine (T4) levels in camels raised in semi-arid region of Jordan

Parameters	Spring	Summer	P value
T3 (ng/dl)	209.22±6.83	185.32±11.23	0.028
T4 (ug/dl)	13.69±2.31	11.52±1.36	0.015

Table 4: Effect of season on glucose, albumin and total protein level in camels raised in semi-arid region of Jordan

Parameters	Spring	Summer	P value
Glucose (mg/dl)	54.13±0.97	50.76±0.74	0.01
Albumin (µg/dl)	3.34±0.03	3.31±0.04	0.68
Total protein (mg/dl)	7.69±0.18	7.48±0.17	0.46
Creatinine (mg/dl)	0.89±0.01	1.92±0.03	0.04

Our finding regarding total protein level agreed with Tajik et al. (2013). The albumin level was within the range when compared with previous studies (Amin et al., 2007; Patodkar et al., 2010).

The higher level of creatinine in camels' during summer in the current study disagreed with the findings of Abokouider et al. (2001) but agreed with the results of Babeker et al. (2013) who conducted similar studies in camels in Sudan. On the other hand, Salman and Afzal (2004) reported that seasons did not cause any significant effect on creatinine level in camels. The level of creatinine reported in this study was within normal range as reported in other studies (Bengoumi et al., 1999; Amin et al., 2007; El-Bahrawy and El Hassanein, 2011).

Conclusion

The results found in this study indicated that season affected the nutritional status of camels raised in semi arid areas and may induce significant change in their physiological response. It is very crucial and important to provide camels raised in semi-arid area with well formulated diets with special emphasis on minerals requirements.

Acknowledgement

This project was supported by King Saud University, Deanship of Scientific Research, College of Food and Agriculture Sciences, Research Center. Appreciation goes to Mutah University for the technical support.

References

Abdelrahman, M.M., Riyadh, S.A. and Moez, A. 2013. Selenium and iodine status of two camel breeds (Camelus dromedaries) raised under semi intensive system in Saudi Arabia. *Italian Journal of Animal Science*, 12: 83-87.

Abd-El-Salam, M.N., Mottelib, A.A., Ismail, M.N. and Mohammed, A.A. 2008. Effect of some physical factors on serum levels of calcium, phosphorus and magnesium in camels in Upper Egypt. *Journal of Camelid Science*, 1: 14-17.

Abokouider, S.N., Dabagg, N.E., Schenke, F. 2001. Studies on the camels bloods parameters in relation to season in syria. Proceedings of the 6th annual Conference on Animal Production under Arid Condition. Alain. United Arab Emirates.

Ahmed, A., Belhadia, M. and Aggad, H. 2013. Mineral indices in Algerian camels (*Camelus dromedarius*): effect of season. *Camel-International Journal of Veterinary Science*, 1: 29-36.

Al-Busadah, K.A. 2007. The biochemical and haematological indices in different breeds of

Camels in Saudi Arabia. *Scientific Journal of King Faisal University*, 8: 131-12.

Amin, A.S.A., Khalid, A., Abdoun, A. and Abdalla, M.A. 2007. Seasonal variation in blood constituents of one-humped camel *(Camelus dromedaries). Pakistan Journal of Biolological Sciences*, 10: 1250-1256.

AOAC, 2005. Official Methods for Analysis, 18th edn. Association of Official Analytical Chemists. Washington, DC.

Babeker, E.A. Elmansoury, Y.H.A. and Sullem, A.E. 2013. The influence of seasons on blood conistituents of dromedary camels (Camelus dromedaries). *Journal of Animal and feed Research*, 3 :1-8.

Bengoumi, M, Moutaoukil, F., Farge, F.D.L. and Faye, B. 1999. Thyroidal stun of the dromedary camel. Effect of some physiological factors. *Journal of Camel Practice Research*, 6: 41-43.

Cassar-Malek, I., Picard, B., Kahl S. and Hocquette, J.F. 2007. Relationship between thyroid status, tissue oxidative metabolism, and muscle differentiation in bovine fetuses. *Domestic Animal Endocrinology*, 33: 91-106.

Chatterjea, M.N. and Shinde, R. 2005. Text book of medical biochemistry. Jaypee Brothers Medical Publication, New Delhi, India.

Colodel, M.M., Martins, E., Martins, V.M.V. and Marques Júnior, A.P. 2010. Serum concentration of thyroid hormones in Crioula Lanada Serrana ewes in gestation and lactation. *Archiva Zootechnica*, 59: 509-517.

El-Bahrawy, K.A. and El Hassanein, E.E. 2011. Seasonal variations of some blood and seminal plasma biochemical parameters of male dromedary camels. *American-Eurasian Journal of Agricultural & Environmental Sciences*, 10: 354-360.

FAO. 1994. Sheep production under extensive systems in the near East: Jordan pastoral system: a case study.

Kale, M.K., Bhusari, K.P. and Umathe, S.N. 2007. Role of thyroid hormones in the generation of widespread oxidative stress. *Journal of Cell Tissue Research*, 7: 871-876.

Kincaid, R.L. 1988. Macro Minerals for Ruminants. In: D.C. Church (ed.). *Ruminant Animal Digestive Physiology and Nutrition.* pp: 326-342.

Kuria S.G., Wahome, R.G., Wanyoike, M.M. and Gchur, C.K. 2006. Effect of mineral supplement on plasma mineral concentration of camels in Kenya. *International Journal of Agriculture and Biology*, 8: 168-171.

McDowell, L.R. 1985. Nutrition of grazing ruminants in warm climates, Academic Press, Orlando, FL.

Mehrotra, V. and Gupta, M.L. 1989. Seasonal variation in certain blood constituents in camel. *Indian Journal of Animal Science*, 59: 1559-1561.

Mertz, W. 1981. The essential trace elements. *Science*, 213: 1332-1338.

Mohebbi-Fani, M., Nazifi S., Rowghani E.,Bahrami, S. and Jamshidi, O. 2009. Thyroid hormone and their correlations with serum glucose, beta hydroxybutyrate, nonestrified fatty acids, cholesterol, and lipoproteins of high yielding dairy cows at different stage of lactation cycle. *Comparative Clinical Pathology*, 18: 211-216.

Nazifi, S., Mansourian, M., Nikahval, B. and Razavi, S.M., 2009. The relationship between serum level and thyroid hormones, trace elements and antioxidant enzymes in dromedary camels (*Camelus dromedaries*). *Tropical Animal Health Production*, 41: 129-134.

Osman, T.E., Al-Busadah, K.A., 2003. Normal concentration of twenty serum biochemical parameters of She-camels, cows and ewes in Saudi Arabia. *Pakistan Journal of Biolgical Sciences*, 6: 1253-1256.

Patodkar, V.R., Somkuwar A.P., Parekar, S. and Khade, N. 2010. Influence of sex on certain biochemical parameters in nomadic camels (Camelus dromedarius) nearby Pune, in Maharashtra. *Veterinary World*, 3: 115-117.

Salman, R. and Afzal, M. 2004. Seasonal variations in haematological and serum biochemical parameters in racing camels. *Journal of Camel Science*, 1: 63-65.

SAS, 2002. SAS user's guide of statistics. SAS Inst, Carry, USA.

Sharma, C.K. 1980. Hematological and biochemical studies of anaesthesia in camels. Thesis. Sukhadia University Udaipur, India

Tajik, J., Saeed, N., Izadneshan, M. and Naghib, S.M. 2010. Evaluation of trace elements serum concentrations and their correlation together and with thyroid hormones in water Buffalo. *Australian Journal of Basic and Applied Science*, 4: 3955-3958.

Tajik, J., Sazmand, A. Hossein, H.S.M. and Rasooli, A. 2013. Serum concentrations of thyroid hormones, cholesterol and triglyceride, and their correlations together in clinically healthy camels (*Camelus dromedarius*): Effects of season, sex and age. *Veterinary Research Forum*, 4: 239-243.

Todini, L. 2007. Thyroid hormone in small ruminants: effect of endogenous, environmental and nutritional factors. *Animal*, 1: 997-1008.

Underwood, E.J. 1981. The Mineral Nutrition of Livestock. Slough, Commonwealth Agriculture Bureaux, UK. pp: 56-133.

Underwood, E.J. and Suttle, N.F. 1999. The Mineral Nutrition of Livestock, 3rd ed. CABI. Publishing, UK.

Wardeh, M.F. 2004. The nutrient requirements of the dromedary camel. *Journal of Camel Science,* 1: 37-45.

Yagil., R., Etzion, Z. and Ganani, J. 1978. Camel thyroid metabolism: Effect of season and dehydration. *Journal of Applied Physiology*, 45: 540-544.

Yasmin E.E., Hassan, M.A., Mansour, M.H. and Mahgoub, O. 2010. Serum mineral contents of the omani racing and Arabian camels (*Camelus dromedarius*). *Journal of Animal Veterinary Advanced.* 9: 764-770.