OPEN ACCESS
Journal of Animal Health and Production

Short Communication

Physiological Status of Some Serum Macro-Minerals in Kutchi Camel During Different Stages of Lactation

Ajay Ganpatbhai Patel, Nilufar Haque*, Abdul Lateef, Axay Babulal Joshi, Pankaj Ashokbhai Patel

Department of Physiology and Biochemistry, College of Veterinary Science & Animal Husbandry, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Dantiwada-385506, Gujarat, India.

Abstract | The present study was undertaken to determine the baseline values of some important serum macro-minerals in clinically healthy lactating Kutchi camels during different stages of lactation. The study was carried out on 30 clinically healthy female camels (*Camelus dromedarius)* from the herd maintained at Camel breeding farm, Dhori (Kutch) and categorized broadly into three groups comprising ten animals in each group: animals in early lactation in Group-I, animals in mid-lactation in Group-II and animals in late lactation in Group-III. The blood samples were collected from each experimental animal and analyzed for serum macro-mineral profile. The results shown that, level of serum calcium was significantly ($p < 0.05$) decreased from early lactation to late lactation. However, non-significant ($p > 0.05$) alteration in serum inorganic phosphorus, magnesium, sodium and potassium were observed during different stages of lactation. The findings may be useful to set basal level of macro-minerals of Kutchi camels during different phases of lactation.

Keywords | Kutchi camel, Macro-minerals, Lactation stages, Physiological levels

Editor | Asghar Ali Kamboh, Sindh Agriculture University, Tandojam, Pakistan.
Received | December 04, 2017; **Accepted** | December 26, 2017; **Published** | December 30, 2017
***Correspondence** | Nilufar Haque, Department of Physiology and Biochemistry, College of Veterinary Science & Animal Husbandry, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Dantiwada-385506, Gujarat, India; **Email:** haquenilufar@gmail.com
Citation | Patel AG, Haque N, Lateef A, Joshi AB, Patel PA (2017). Physiological status of some serum macro-minerals in kutchi camel during different stages of lactation. J. Anim. Health Prod. 5(4): 176-180.
DOI | http://dx.doi.org/10.17582/journal.jahp/2017/5.4.176.180
ISSN (Online) | 2308-2801; **ISSN (Print)** | 2309-3331

INTRODUCTION

Camel is multi-purpose animal with high productive potential. The proverbial 'Ship of the Desert' although earned its epithet on account of its indispensability as a mode of transportation and draught ability in desert, but in the present context there is an imminent threat to it's sustainable use due to growing mechanization. In the time of global warming, growing deserts and increasing scarcity of food and water, may make camel a potential candidate to overcome some of these problems. Its utilities are today subject to progressive social and economic changes. The future of the camel in India lies in conservation, providing better health care and utilization of their other untapped potential uses for improving the significance of camels, as basis of the livelihoods of the resource (Ahmad et al., 2010).

Two species of the family camelidae viz. *Camelus dromedaries* and *Camelus bactrianus* are found in India. Camel production system is prevalent in Indian states like Rajasthan,Gujarat, Haryana and parts of Madhya Pradesh, Uttar Pradesh and Punjab. With an approximate man to animal ratio of 2:1, Gujarat contributes 4.46 % of total livestock of India (Singh and Meena, 2012). Gujarat inhabits two breeds of camel viz. Kutchi and Kharai (a recently recognized breed). Kutchi breed inhabit Kutch and Banaskantha, dry and semi-arid districts of north Gujarat.

In nature, like all the members of animal and plant kingdom, camels require inorganic elements: minerals, as these are needed for their survival and efficient performance. Macro- and micronutrients are inorganic substances essential to maintain the normal function and living status in domestic animals (Sharma et al., 2006; Soetan et al., 2010). These nutrients play a critical role in physiological processes related to health, growth and reproduction, and the adequate function of the immune and endocrine

systems. There is a general consensus that low production and suboptimal reproductive efficiency of livestock is due to inadequate nutrition, particularly mineral deficiency. Macro-mineral deficiency in dairy animals results in reduced animal performance, such as impaired reproduction, a high incidence of mastitis, reduced milk yield, impaired immunity, and an increased degree of lameness due to laminitis (Dobrzański et al., 2005; Nocek et al., 2006). Physiological concentrations of the elements must always be maintained to ensure the proper cellular functions of the animal. Though, very limited research has been carried out on Kutchi camels for finding the basal levels of hemato-biochemical parameters (Joshi et al., 2017). While, scanty information is available in the published literature regarding serum levels of macro-minerals in lactating camels. Hence, the objective of this study was to determine the blood levels of macro-minerals in Kutchi camels during the different stages of lactation.

MATERIALS AND METHODS

Location of Study

The study was conducted at Sardarkrushinagar located in Banaskantha district of North Gujarat, in collaboration with Camel Breeding Farm, Dhori (Kutch, Gujarat),which is situated between 22° 44° 8° to 24° 41° 30° North Latitude and 68° 7° 23° and 71° 46° 45°0° East Longitude in western India. The maximum annual average temperature and relative humidity of this region is 39-45°C and 63%, respectively. Kutch has wide range of climate conditions varying from dry to humid and extreme cold to hot with wide variation in landscaping.

Experimental Animals

A total of 30 clinically healthy female Kutchi camels (*Camelus dromedarius*) of 8-10 years old were selected from the herd maintained at Camel Breeding Farm, Dhori (Kutch, Gujarat). These animals were categorized into three groups based on their stage of lactation: early lactation (1-3 months), mid-lactation (4-6 months) and late Lactation (≥ 7 months). The average body weight of the animals was about 500 kg with average milk yield of 4-5 kg per day per animal. The selected animals were maintained following standard farm practices. All the camels are left free to graze in the open desert. The animals appeared clinically healthy with no physical deformities. The health status of the selected animals was evaluated based on behavior, rectal temperature, pulse rate, respiratory rate and fecal consistency. The animals were also examined for parasites and deworming of the animals was done regularly.

Collection of Blood Samples

Blood samples were collected using VACUETTE® Z serum separation tube of 9 ml capacity containing clot activator (Greiner Bio-One GmbH, Austria).After centrifugation, clear serum samples were collected in sterile screw tubes of 5ml capacity (CITOTESTTM, China) and stored at -20°C temperature for analysis.

Estimation of Macro-Minerals

The 'ready to use kits' for estimation of calcium, inorganic phosphorus, magnesium were procured from Agappe Diagnostics Ltd., Kerala, India. The kits for estimation of sodium and potassium were procured from Sigma Diagnostics (India) Pvt. Ltd., Baroda, India. All the kits were used according to manufacturers' instructions.

Statistical Analysis

The data generated on enzymatic profile were analyzed statistically using Duncan test by sigma stat software (Snedecor and Cochran,1994).

RESULTS AND DISCUSSION

Calcium (Ca)

Serum calcium (Ca) concentration recorded for Kutchi camels during different lactation stages has been presented in Table 1. Among the groups studied, the calcium concentrations were 9.17 ± 0.30, 7.94 ± 0.43 and 6.70 ± 0.38 mg/dl in early, mid and late lactation, respectively. Among the groups studied, serum calcium level appeared to be significantly ($p < 0.05$) decreased with the advancement of lactation stages. The calcium level recorded in different experimental groups was comparable with the values recorded by Kuria et al. (2013) and Singh et al. (2015) in camels. The continuous decrease of calcium level in subsequent lactation might be due to drainage of blood calcium in milk and insufficient adjustment by the parathormone through mobilization of bone calcium (Paul et al., 2011). However, the calcium level noted in the present study was found to be almost similar with the reference value given by Al- Busadah (2010) in camels but differed with the value given by Shukla et al. (2009) in Kutchi male camels.

Inorganic Phosphorus (Pi)

The serum samples of Kutchi camels during early, mid and late lactation were analyzed for inorganic phosphorus activity. The Pi concentration were3.55 ± 0.20, 3.63 ± 0.21 and 3.73 ± 0.07 mg/dlin early, mid and late lactation, respectively, which are given in Table 1. Statistical analysis revealed no significant alteration in the activity of inorganic phosphorus between the stages of lactation. The constant normal level of phosphorus in the body is due to the plasma homeostasis of inorganic phosphorus metabolism, which is controlled by absorption, urinary excretion and bone turnover (Blaine et al., 2005). This justifies, the non-significant change appeared in phosphorus level in different stages of lactation in the current study and found to be similar

Table 1: Concentration of serum macro-minerals during different stages of lactation in Kutchi camels

Parameters	Group I Early Lactation	Group II Mid Lactation	Group III Late Lactation	P value
Calcium (Mg/dl)	9.17 ± 0.30[a]	7.94 ± 0.43[b]	6.70 ± 0.38[c]	P<0.001
Inorganic phosphorus (Mg/dl)	3.55 ± 0.20[a]	3.63 ± 0.21[a]	3.73 ± 0.07[a]	P=0.054
Magnesium (Mg/dl)	2.27 ± 0.23[a]	2.61 ± 0.15[a]	2.42 ± 0.17[a]	P=0.306
Sodium (mEq/L)	149.27 ± 10.00[a]	165.62 ± 11.01[a]	156.80 ± 10.30[a]	P=0.549
Potassium (mEq/L)	5.62 ± 0.14[a]	5.44 ± 0.19[a]	5.51 ± 0.12[a]	P= 0.0.727

*early lactation (1-3 months), mid-lactation (4-6 months), late Lactation (≥ 7 months)

Means with same superscript within a row do not differ significantly from each other.

with those recorded by Kholif (1999) in buffaloes, Sivaraman et al. (2002) in jersey crossbred cows, Balusami et al. (2008) in buffaloes, Khaled and Illek (2012) in Barky Ewes, Naser et al.(2014) in dairy cows, Singh et al. (2015) in camels and Novotny et al. (2016) in sows. However, the results obtained in the current study did not corroborate with the values recorded by Montemurro et al. (1997) in buffaloes, Zvorc et al. (2006) in sows, Piccione et al. (2012) in Holstein Friesian cow and Kuria et al. (2013) in camels. The level of inorganic phosphorus recorded in the current investigation was also different with the range recorded by Shukla et al. (2009) in Kutchi male camels during breeding season and also numerically higher value was recorded by Al- Busadah (2010) in lactating camels.

Magnesium (Mg)

The recorded values of Mg in present study during early, mid and late lactation were 2.27 ± 0.23, 2.61 ± 0.15 and 2.42 ± 0.17 mg/dl, respectively (Table 1). Comparison of magnesium level showed no significant alteration between early, mid and late lactation. It is well defined that, the kidney regulates the buffering capacity of bone and also the magnesium excretion (Vorman, 2003). Considering the fact, the level of magnesium (Mg) recorded in current study was found almost stable in different stages of lactation and appeared as par with the observations of Hussein et al. (1992) in camels, Kumar et al. (2001) in buffaloes, Hagawane et al. (2009) in buffaloes, Khaled and Illek (2012) in Barky Ewes, Naser et al. (2014) in dairy cows, Singh et al. (2015) in camels and Novotny et al.(2016) in sows. However, the results obtained in the present study did not confirm the observation made by Kholif (1999) in camels, Piccione et al. (2012) in Holstein Friesian cow and Kuria et al. (2013) in camels.

Sodium (Na)

The effect of lactation on serum sodium (Na) concentration in different experimental groups of Kutchi camels has been presented in Table 1. Among the groups studied, Na concentrations in early, mid and late lactation were 149.27 ± 10.00, 165.62 ± 11.01 and 156.80 ± 10.30 mEq/L (milli equivalents per liter) respectively. The data suggested that there was non-significant alteration in the level of sodium between early, mid and late lactation. Sodium (Na) level observed in different experimental groups of Kutchi camels in this study was in agreement with those results reported by Singh et al. (2015) in camels and Novotny et al. (2016) in sows. Similarly, Akhtar et al. (2010) also reported non–significant change in sodium level during pregnancy and early lactation in Nili–Ravi buffaloes. The non-significant variation among different stages of lactation in current study might be due to availability of sufficient Na for necessary functions of sodium in the body viz. generation of nerve impulses, maintenance of electrolyte balance, heart activity and certain metabolic functions (Kuria et al., 2013). However, the findings of non-significant changes among different stages of lactation in the current study were in disparate with the findings reported by Hussein et al. (1992) in camels, Kholif (1999) in buffaloes, Sivaraman et al. (2002) in jersey crossbred cows, Zvorc et al. (2006) in sows and Kuria et al. (2013) in camels.

Potassium (K)

Potassium (K) concentration in blood serum of Kutchi camels during different lactation stages is shown in Table 1. In the present study, potassium concentration was found to be 5.62 ± 0.14, 5.44 ± 0.19 and 5.51 ± 0.12 mEq/L in early, mid and late lactation, respectively. The results showed non-significant alteration in the activity of potassium between early, mid and late lactation. It is fairly established that potassium is the third most abundant element in the animal body and is the principal cation of intracellular fluid. It is also a constituent of extracellular fluid where it influences muscle activity. Potassium is required for a variety of body functions including maintenance of osmotic balance, acid-base equilibrium and water balance as well as in several enzyme systems (Osman and Al-Busadah, 2003). This holds good in the current study also as non-significant change of potassium was observed in early, mid and late lactation in the current study and were found to be in agreement with Kholif (1999) in buffaloes, Sivaraman et al. (2002) in jersey crossbred cows and Singh et al. (2015) in camels. Similar trend was recorded by Akhtar et al. (2010), they reported non–significant change in potassium level during pregnancy and early lactation in Nili–Ravi buffaloes. The findings of non-significant variation among different stages of lactation were in disparate with Hussein et al. (1992) in camels and Kuria et al. (2013) in camels.

CONCLUSION

Macro-minerals are essential to maintain the normal function of vital biochemical processes in the dairy animal's body. Different degrees of deficiency of these inorganic substances can led to clinical and subclinical symptoms and significantly reduce productive and reproductive performance in dairy cows. Hence, the results of our work may provide a base level information of macro-elements in camels during different stages of lactation. This information can be used both in preventive diagnostics and rationalization of animal nutrition, production and reproduction of health condition under industrial way of camel husbandry.

ACKNOWLEDGMENTS

Authors are grateful to veterinary officers, Camel Breeding Farm, Bhuj, for granting of permission for blood collection from Kutchi camels. Authors are also thankful to Dean, College of Veterinary Science and A.H., SDAU, Sardarkrushinagar for providing necessary support to carry out the research work.

CONFLICT OF INTEREST

There was no conflict of interest among the authors of this research article.

AUTHORS CONTRIBUTION

Abdul Lateef and Nilufar Haque designed the experiment. Ajay Patel and Axay Joshi collected the blood sample and carried out the experiment. Ajay Patel and Nilufar Haque prepared the manuscript. Abdul Lateef ,Nilufar Haque and Pankaj Patel revised the final draft of the manuscript. All authors read and approved the final manuscript.

REFERENCES

- Ahmad S, Yaqoob M, Hashmi N, Ahmad S, Zaman MA, Tariq M (2010). Economic Importance of Camel: Unique Alternative under Crisis. Pak. Vet. J. 30: 1-7.
- Akhtar MS, Farooq AA, Muhammad SA, Lodhi Hayat CS, Aziz MM (2010). Serum electrolyte and mineral variations during pregnancy and lactation in Nili-Ravi buffalo. Biol. Trace Elem. Res. 137(3): 340-343. https://doi.org/10.1007/s12011-009-8581-9
- Al-Busadah (2010). Serum Concentration of Aluminum, Calcium, Magnesium and Phosphorous in Camels. Scientific J. King Faisal University. Basic Appl. Sci.11(1): 1431.
- Balusami C, Sivakumar T, Akila N (2008). A study on blood biochemical profiles of lactating buffaloes. Indian Vet. J. 85(9): 1011-1012.
- Blaine J, Chonchl M, Levi M (2005). Renal cortal of calcium, phosphate and magnesium homeostasis. Clin. J. Am. Soc. Nephrol. 10: 1257-72. https://doi.org/10.2215/CJN.09750913
- Dobrzański Z, Górecka H, Opaliński S, Chojnacka K, Kołacz R (2005). Trace and ultra trace elements in cow´s milk and blood (in Polish). Med. Wet. 61 (3): 301-304.
- Hagawane SD, Shinde SB, Rajguru DN (2009). Haematological and blood biochemical profile in lactating buffaloes in and around Parbhani city. Vet. World. 2(12): 467-469.
- Hussein MF, Salah MS, Mogawer HH, Gar El Nabi AR (1992). Effect of Lactation on the Haemogram and Certain Blood Constituents of the Dromedary Camel. J. Appl. Anim. Res. 1(1): 43-50. https://doi.org/10.1080/09712119.1992.9705907
- Joshi A, Haque N, Lateef A, Patel A, Patel P, Bhalakiya N (2017). Study on blood metabolites and leukocyte indices of kutchi camels during different stages of lactation. J. Anim. Health Prod. 5(3): 92-96.
- Khaled NF, Illek J (2012). Changes in Selected Blood Minerals, Vitamins and Thyroid Hormones in Barky Ewes during Late Pregnancy, Post-Partum and Early Lactation. J. Appl. Biol. Sci. 6(2): 5-8.
- Kholif AM (1999). Effect of number and stage of lactation on blood serum parameters of lactating buffaloes. Egypt J. Dairy Sci. 27(1): 37-52.
- Kumar R, Sharma IJ, Quari MA (2001). Status of haemogram, plasma proteins, minerals and electrolytes during anorexia and sub-clinical ketosis in cows and buffaloes. Indian J. Anim. Sci. 71(2): 118-121.
- Kuria SG, Tura IA, Amboga S, Walaga HK (2013). Status of minerals in camels (Camelus dromedarius) in northeastern Kenya as evaluated from the blood plasma. Livest. Res. Rural Dev. 25(8): 1-5.
- Montemurro N, Pacelli C, Borghese A (1997) Blood metabolites change in milking buffalo cows. Bubalus Bubalis. 3: 69-78.
- Naser EM, Mohamed G, Elsayed H (2014). Effect of lactation stages on some blood serum biochemical Parameters and milk composition in dairy cows. Assiut. Vet. Med. J. 60(142): 83-88.
- Nocek JE, Socha MT, Tomlinson DJ (2006). The effect of trace mineral fortification level and source on performance of dairy cattle. J. Dairy Sci. 89: 2679-2693. https://doi.org/10.3168/jds.S0022-0302(06)72344-X
- Novotny J, Reichel P, Kosa B, Sipos B (2016). Excretion pf calcium, phosphorus, magnesium and sodium in lactating sows. Folia Vet. 60(2): 61-65.
- Osman EA, Al-Busadah KI (2003). A Final reporton Trace-Elements Status in Saudi Arabian Camels: A comparative study. 4(2): 7-14.
- Paul RK, Gottam GS, Pareek S (2011). Effect of lactation and pregnancy on serum biochemical and haematological profiles of surti buffaloes. Vet. Pract.12(1): 94-96.
- Piccione G, Messina V, Marafioti S, Casella S, Giannetto C, Fazio F (2012). Changes of some haematochemical parameters in dairy cows during late gestation, post-partum, lactation and dry periods. Vet. Zootech. Lith. 58(80): 59-64.
- Sharma MC, Kumar P, Joshi C, Kaur H (2006). Status of serum minerals and biochemical parameters in cattle of organized farms and unorganized farms of Western Uttar Pradesh. J. Anim. Vet. Adv. 1 (1): 33-41. https://doi.org/10.3923/ajava.2006.33.41
- Shukla MK, Pathan MM, Siddiquee GM, Khan MJZ, Latif A (2009). Biochemical profile of uncastrated male kutchi

camel during the breeding season. 6(1): 1-3.
- Singh KM, Meena MS (2012). Livestock value chains: Prospects, challenges and policy implications. In: Bhatt BP, Sikka AK, Mukherjee J, Islam Adlul and Dey A ed. Status of Agricultural development in Eastern India. pp. 493-508.
- Singh S, Dedar R K, Legha RA, Bala PA, Patil NV (2015). Minerals and electrolytes profile in Lactating and pregnant Indian camels. . J. Camel Pract. Res. 22(1): 121-24. https://doi.org/10.5958/2277-8934.2015.00019.3
- Sivaraman T, Shanmugasundaram S, Arunachalam S, Sivakumar T (2002). Effect of order of lactation on blood constituents in jersey crossbred cows. Indian J. Anim. Res. 36(2): 128 – 130.
- Snedecor GW, Cochran WG (1994). Statistical Methods. 8th ed. Affiliated East-West Press, New Delhi and Iowa State University Press, Ames, Iowa.
- Soetan KO, Olaiya CO, Oyewole OE (2010). The importance of mineral elements for humans, domestic animals and plants: A review. African J. Food Sci. 4(5): 200-222.
- Vorman J (2003). Magnesium: nutrition and metabolism. Mol. Aspects Med. 24(1-3): 27-37. https://doi.org/10.1016/S0098-2997(02)00089-4
- Zvorc Z, Mrljak V, Susic V, Gotal J (2006). Haematological and biochemical parameters during pregnancy and lactation in sows. Vet. Arh. 76(3): 245-253.