



Original Research

Physiological Status of Some Serum Micro-Minerals in Kutchi Camel during Different Stages of Lactation

Ajay Patel, A. Lateef, Nilufar Haque*, Axay Joshi and Pankaj Patel

Department of Veterinary Physiology and Biochemistry, College of Veterinary Science & Animal Husbandry, SDAU, Gujarat, INDIA

*Corresponding author: haquenilufar@gmail.com

Rec. Date:	Sep 04, 2017 05:38
Accept Date:	Apr 09, 2018 16:08
DOI	10.5455/ijlr.20170904053822

Abstract

The present study was undertaken on Kutchi camels to determine values of serum micro-mineral concentration and their variations at different stages of lactation. The study was carried out on 30 clinically healthy female camels (*Camelus dromedarius*) of 8-10 years old with 500 kg body weight from the herd maintained at Camel breeding farm, Dhori (Kutch, Gujarat) 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. Current findings indicated that serum copper and zinc levels are significantly ($p < 0.05$) increased with the advancement of lactation stages. While there was no significant alteration in serum iron, molybdenum and manganese levels in early, mid and late lactations. The findings of the present study may be used to assess health status of animals.

Key words: Kutchi Camel, Lactation Stages, Micro-minerals, Physiological Levels

How to cite: Patel, A., Lateef, A., Haque, N., Joshi, A., & Patel, P. (2019). Physiological Status of Some Serum Micro-Minerals in Kutchi Camel during Different Stages of Lactation. International Journal of Livestock Research, 9(6), 233-239. doi: 10.5455/ijlr.20170904053822

Introduction

Camel production system is prevalent in Indian states like Rajasthan, Gujarat, Haryana and parts of Madhya Pradesh, Uttar Pradesh and Punjab. The traditional use of camels for draught purpose for transport of goods including agricultural material and its use in agriculture work is reduced in last few years due to advent and cheaper availability of mechanical means in desert terrains and has been a main reason restricting or declining camel number by its owners. On the other hand, their importance in respect of milk production is increasing day by day. They are very reliable milk producers during dry seasons and drought years, especially during milk scarcity from cattle, sheep and goats. However, proper dairy herd management should be designed to optimize the production of high-quality milk, while minimizing any adverse effects



on the health, welfare and reproductive performance of dairy cows. The potential of minerals to play a significant role in herd fertility and milk production is indisputable (Underwood, 1981; Faulkner, 2016). Micro-minerals are required for the synthesis of many proteins and activation of a vast array of enzyme systems (Hidiroglou, 1979; Ahuja & Parmar, 2017). 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 (Ballantine *et al.*, 2002; Dobrzański *et al.*, 2005). However, very limited information is available in the published literature regarding serum levels of micro-minerals in lactating camels. Therefore, the objective of this study was to determine the blood levels of micronutrients 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 apparently 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 Micro-minerals

The micro-minerals were analyzed by digestion of 0.2 ml blood serum sample with 1.8 ml of triple acid mixture (concentrated sulphuric acid: perchloric acid: nitric acid) in the ratio of 1:2:1 till it becomes colourless. After digestion the final volume was made up to 10 ml with triple glass distilled water. Copper, zinc, iron, manganese, and molybdenum concentration from digested samples were estimated by atomic absorption spectrophotometer (Model AAS 4141, Electronic Corporation of India Ltd.).

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

The observed mean values of different biochemical parameters during different stages of lactation in Kutchi camels are presented in Table 1.

Table 1: Serum micro-mineral concentration during different stages of lactation in Kutchi camels

Group / Parameter	Group I	Group II	Group III
	Early Lactation	Mid Lactation	Late Lactation
Copper (ppm)	0.96 ± 0.03 ^a	1.16 ± 0.01 ^b	1.30 ± 0.02 ^c
Iron (ppm)	1.12 ± 0.03	1.16 ± 0.05	1.21 ± 0.09
Zinc (ppm)	0.92 ± 0.05 ^a	1.08 ± 0.01 ^b	1.14 ± 0.03 ^c
Molybdenum (ppm)	0.029 ± 0.007	0.022 ± 0.008	0.025 ± 0.008
Manganese (ppm)	1.53 ± 0.07	1.55 ± 0.10	1.56 ± 0.11

Means with different superscript within a row differs significantly ($p < 0.05$) from each other.

Copper (Cu)

The variation in the mean ± standard error values of copper level during different stages of lactation is shown in Table 1. The data suggested that the serum copper level was significantly ($p < 0.05$) increased with the advancement of lactation stages. The copper (Cu) level noted in the present study was in parallel with the reference value given by Shukla *et al.* (2009) in Kutchi male camel. A similar phenomenon in the change of copper level in the current study was observed by Hussein *et al.* (1992) in camels, Sivaraman *et al.* (2002) in jersey crossbred cows and Kuria *et al.* (2013) in camels. Copper serve as an important index of health, pathological and reproductive status of camel. Cu impacts several aspects of animals' performance and health, such as lactation and immune function. Like Other ruminants camels also store copper mainly in liver but plasma copper concentration is slightly higher than other ruminants (Abu Damir, 1998). The low level of copper in early lactation may be due to its more utilization after parturition to combat oxidative stress of parturition (Healy and Tipton, 2007; Djokovic *et al.*, 2014). On the other hand, the results of this study appeared to be contrasting with the results recorded by Khaled and Illek (2012),

they observed copper (Cu) level in plasma remain normal in different stages of reproduction viz. late pregnancy, post-partum and early lactation.

Iron (Fe)

When the Kutchi camels observed during different stages of lactation for the serum iron concentration, the concentration appeared to be 1.12 ± 0.03 , 1.16 ± 0.05 and 1.21 ± 0.09 ppm in early, mid and late lactation, respectively. However, statistical analysis revealed no significant alteration in the activity of iron concentration between the stages of lactation. Iron is a common element of the nature, especially in tropical conditions. Iron is related to both oxygen metabolism and energy metabolism. Also, Fe-dependent enzymes, such as catalase and peroxidase, are critical to controlling ROS. It is the most important element in the blood which contributes to haemoglobin composition. The references on plasma, serum or whole blood iron in camel are common (Faye *et al.*, 2008). This holds well in the current study as non-significant change in iron concentration occurred during different stages of lactation in the present study which was in agreement with Hussein *et al.* (1992) in camels and Kholif (1999) in buffaloes. The results of the present study also appeared to be parallel with the reference value given by Shukla *et al.* (2009) in Kutchi male camel during breeding season. However, the findings of the present study was found to be contrary with the results recorded by Faye *et al.* (2008), they observed that the iron level differ in pregnant, non-pregnant, and milking camels. Also this study appeared to be disparate with the results recorded by Saeed *et al.* (2009), they showed different values in pregnant and non-pregnant camels.

Zinc (Zn)

Among the groups studied, serum zinc level was found to be significantly ($p < 0.05$) increased with the advancement of lactation stages. The zinc level in the present study was in parallel with the reference value given by Shukla *et al.* (2009) in Kutchi male camel during breeding season. The continuous increase of zinc level in subsequent lactation in present study was in agreement with the results recorded by Hussein *et al.* (1992) in camels, Kholif (1999) in buffaloes and Kuria *et al.* (2013) in camels. This lowest level of zinc in early lactation may be linked to an active transfer of plasma zinc to the foetus (Faye *et al.*, 2008). The results of this study also appeared to be similar with the results recorded by Khaled and Illek (2012), they observed higher values of zinc in post-partum than the early lactation in Barky Ewes. Zinc is an essential component of over 70 enzymes in mammals. These enzymes are involved in protein, nucleic acid, carbohydrate, and lipid metabolism. Zinc deficiency causes loss of appetite and disturbances in metabolism as zinc is involved in protein synthesis, carbohydrate metabolism and nucleic acid metabolism. Zinc is also required for normal development and functioning of the immune system, in cell membrane stability and gene expression (Ballantine *et al.*, 2002; Kellogg *et al.*, 2004). This rapid need for Zn in synthesis of colostrum may explain why Zn concentration is lower in blood of camels during early stage of lactation. In

addition, glucocorticoids reduce Zn absorption and combine with various stressors to stimulate metallothionein synthesis, which pulls Zn into cells causing an initial drop in plasma Zn; which is subsequently followed by increased plasma Zn.

Molybdenum (Mo)

Mo is an essential element for mammals due to its involvement in the enzyme likes aldehyde oxidase, xanthine oxidase, sulfite oxidase etc. as a cofactor for these enzymes, it aids in catalyzing the oxidation of sulphar-containing amino acids, purines, pyrimidines and aldehydes. In our study, serum molybdenum (Mo) concentration of Kutchi camels in early, mid and late lactation reported were 0.029 ± 0.007 , 0.022 ± 0.008 , 0.025 ± 0.008 ppm, respectively. Though milk is one of the major excretion routes, comparison of plasma molybdenum level showed no significant alteration between early, mid and late lactation, which indicates sufficient dietary Mo intake of the animals. The non-significantly change in serum molybdenum level during early, mid and late lactation in present study were similar with the study reported by Kuria *et al.* (2013) in camels. The finding of this study was also found to be similar with the results recorded by Faye *et al.* (2008), they reported non-significant change of molybdenum level in pregnant, non-pregnant, and milking camels.

Manganese (Mn)

Mn is an essential part of a range of enzymes that are involved in 1) immune and nervous function, 2) antioxidant protection as an integral part of SOD and 3) carbohydrate and lipid metabolism. Manganese is an integral component of the enzymes: arginase, superoxide dismutase found in the mitochondria, and pyruvate carboxylase. In addition, a number of enzymes can be activated by manganese (Hansen *et al.*, 2006). Manganese can be a limiting factor of the mineral diet in ruminants. It is involved in carbohydrate, lipid and protein metabolism. In this study, there was no significant alteration in the activity of manganese between early, mid and late lactation which corroborate with the results reported by Kholif (1999) in buffaloes as wells as in pregnant, non-pregnant and milking camels by Faye *et al.* (2008).

Conclusion

Micro-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 lead to clinical and subclinical symptoms and significantly reduce productive and reproductive performance in dairy cows. Hence, the results of our work may be considered as a basis for studying the dynamics of metabolism of microelements in camels during different stages of lactation. The knowledge to be obtained thus 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, Bhuji, for granting of permission for blood collection from Kutchi camels. Thanks also to Dean, College of Veterinary Science and A.H., SDAU, Sardarkrushinagar for providing necessary support to carry out the research work.

References

1. Abu Damir H. 1998. Mineral deficiencies, toxicities and imbalances in camel (*Camelus dromedaries*). *Veterinary Bulletin*. 63: 1103-1119.
2. Ahuja A and Parmar D. 2017. Role of Minerals in Reproductive Health of Dairy Cattle: A Review. *International Journal of Livestock Research*. 7(10):16-26.
3. Ballantine HT, Socha MT, Tomlinson DJ, Johnson AB, Fielding AS, Shearer JK and Van Amstel SR. 2002. Effects of feeding complexed zinc, manganese, copper, and cobalt to late gestation and lactating dairy cows on claw integrity, reproduction, and lactation performance. *The Professional Animal Scientist*. 18:211-218.
4. Djokovic RD, Kurcubic VS and Ilic ZZ. 2014. Blood serum levels of macro and micronutrients in transition and full lactation cows. *Bulgarian Journal of Agricultural Science*. 20 (3): 715-720.
5. Dobrzański Z, Górecka H, Opaliński S, Chojnacka K and Kołacz R. 2005. Trace and ultra trace elements in cow's milk and blood (in Polish). *Med. Wet.* 61 (3): 301-304.
6. Faulkner MJ. 2016. Effects of trace mineral supplementation in lactating dairy cows. Ph.D. Dis. The Ohio State University, Columbus.
7. Faye B, Seboussi R and Askar M. 2008. Trace elements and heavy metals status in Arabian camel. Springer Netherlands. 2: 97-106.
8. Hansen SL, Spears JW, Whisnant CS and Lloyd KE. 2006. Growth, reproductive performance, and manganese status of beef heifers fed varying concentrations of manganese. *Journal of Animal Science*. 84: 3375-3380.
9. Healy J and Tipton K. 2007. Ceruloplasmin and what it might do. *Journal of Neural Transmission*. 114: 777-781.
10. Hidioglou M. 1979. Element deficiencies and fertility in ruminants: a review. *Journal of Dairy Science*. 62:1995-2206
11. Hussein MF, Salah MS, Mogawer HH and Gar ElNabi AR. 1992. Effect of Lactation on the Haemogram and Certain Blood Constituents of the Dromedary Camel. *Journal of Applied Animal Research*. 1(1): 43-50.
12. Kellogg DW, Tomlinson DJ, Socha MT and Johnson AB. 2004. Review: effects of zinc methionine complex on milk production and somatic cell count of dairy cows: twelve-trials summary. *The Professional Animal Scientist*. 20: 295-301.
13. Khaled NF and Illek J. 2012. Changes in Selected Blood Minerals, Vitamins and Thyroid Hormones in Barky Ewes during Late Pregnancy, Post-Partum and Early Lactation. *Journal of Applied Biological Sciences*. 6(2): 5-8.
14. Kholif AM. 1999. Effect of number and stage of lactation on blood serum parameters of lactating buffaloes. *Egyptian Journal of Dairy Science*. 27(1): 37-52.
15. Kuria SG, Tura IA, Amboga S and Walaga HK 2013. Status of minerals in camels (*Camelus dromedarius*) in northeastern Kenya as evaluated from the blood plasma. *Livestock Research for Rural Development*. 25(8): 1-5.
16. Saeed A, Khan IA and Hussein MM. 2009. Change in biochemical profile of pregnant camel (*Camelus dromedarius*) at term. *Comparative Clinical Pathology*. 18: 139-143.
17. Shukla MK, Siddiquee GM, Latif A and Parekar SS. 2009. Plasma trace mineral concentration of Kutchi camels. *Indian Journal Animal Research*. 18(2): 28-30.



18. Sivaraman T, Shanmugasundaram S, Arunachalam S and Sivakumar T. 2002. Effect of order of lactation on blood constituents in jersey crossbred cows. *Indian Journal Animal Research*. 36(2): 128 – 130.
19. Snedecor GW and Cochran WG. 1994. *Statistical Methods*. 8th ed. Iowa state Univ. Press, Ames, Iowas.
20. Underwood EJ. 1981. *The mineral nutrition of livestock*, 2nd edn. Commonwealth Agricultural Bureaux, Farnham Royal, pp 135–142.

