

Research Article



Study on Blood Metabolites and Leukocyte Indices of Kutchi Camels During Different Stages of Lactation

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Abstract | The present study determines and compares the blood metabolites and leukocyte indices at different stages of lactation. The study was carried out on 30 clinically healthy female camels (*Camelus dromedarius*) of 8-10 years old with 500kg 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: early (1-3 months, Group-I), mid-lactation (4-6 months, Group-II) and late (>7 months, Group-III) lactation. The significant ($p < 0.05$) variation were noticed in leukocytic indices viz. Total Leukocytic Count (TLC), lymphocyte, neutrophil, monocyte and eosinophil counts during early, mid and late lactation, while basophil counts did not differ. The platelet count was significantly ($p < 0.05$) higher in late lactation than early lactation and mid lactation. The findings of biochemical parameters indicated that the concentration of albumin and uric acid were significantly ($p < 0.05$) increased from early lactation to late lactation. The globulin levels were similar in all three stages of lactation ($p < 0.05$). The concentrations of total protein, and A/G (albumin to globulin) ratio were significantly ($p < 0.05$) altered during different stages of lactation. These findings of the present study may be used to assess metabolic health status of animals.

Keywords | Kutchi camel, Blood metabolites, Leukocyte indices, Lactation stages, Physiological levels

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INTRODUCTION

The pregnancy and lactation phases affect significantly the metabolic profile and so the variation recorded during different physiological phases is expected. The transition from gestation to lactation is a period of great metabolic stress for dairy animals (Rollin et al., 2010). The lactation period is important in terms of its influence on the health and the subsequent performance of dairy animals, since they develop serious metabolic and physiological changes during these periods. The health of the lactating animals can be evaluated through haematological and biochemical profile of blood. Haemato-biochemical profile within normal physiological limits reflects a good health status and is highly correlated with milk production (Coroian et al., 2011). Blood parameters analysis can

identify if there are errors in nutrition in lactating cows (Payne et al., 1970). Piccione et al. (2009) showed that during lactation the mammary gland secretory cells utilize 80% of the blood-circulating metabolites for milk synthesis, depending on infiltration spend of precursors milk compounds (i.e. glucose, free amino acids and fatty acids). Hence, hemato-biochemical analysis is highly informative as a diagnostic tool, not solely, but in combination with clinical examination or other diagnostic procedures (Roland et al., 2014). Therefore, monitoring the concentration of biochemical and haematological parameters of camel will give us a clearer picture of their nutritional and health status before the changes are visible on the animal (Carcangiu et al., 2007; Antunović et al., 2009). In view of that, our study is an attempt at providing a picture of dynamics of selected hematochemical parameters in dairy

camels during different stages of lactation, with the aim of providing new and useful information about the guidelines for the management strategies during different physiological phases. Accordingly, the present study was undertaken to study the variation in blood metabolites and leukocyte indices during different lactation stages viz. early lactation (1-3 months), mid lactation (4-6 months) and late lactation (≥ 7 months) of Kutchi camel.

MATERIALS AND METHODS

LOCATION OF STUDY

The present study was carried out in the Department of Physiology and Biochemistry, College of Veterinary Science and Animal Husbandry, Sardarkrushinagar Dantiwada Agricultural University (SDAU), Sardarkrushinagar, Gujarat in collaboration with Camel Breeding Farm, Dhori (Kutch, Gujarat). The study was approved by Animal Ethics Committee of the University.

SELECTION AND GROUPING OF EXPERIMENTAL ANIMALS

A total of 30 clinically healthy female Kutchi camels (*Camelus dromedarius*) were randomly 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 supposed to be free of endoparasites as anthelmintics are regularly fed to the animals reared at the Camel Breeding Farm, Dhori (Kutch, Gujarat) and were maintained following standard farm practices. All the camels are left free to graze in the open desert. Ad libitum feed was provided to the animals. All the animals were clinically healthy with no physical deformities. The health status of the selected animals was regularly evaluated based on behaviour, rectal temperature, pulse rate, respiratory rate and faecal consistency during the study period. The animals were also examined for parasites and deworming of the animals was done regularly.

BLOOD SAMPLE COLLECTION AND SERUM SEPARATION

Blood samples were collected during February and March month, which is considered to offer thermo-comfort zone for the animals. The whole blood samples were collected in vials containing K_3 EDTA (Tripotassium ethylene diamine tetra acetic acid) supplied by P.H. Polyplast, Thane, India, for haematological analysis.

For biochemical analysis, whole blood samples were col-

lected and harvested for serum using VACUETTE® Z Serum Clot Activator tubes of 9 ml capacity (Greiner Bio-One GmbH, Austria). After centrifugation, clear serum samples were collected in sterile screw tubes of 5ml capacity (CITOTEST™, China) and stored at -20°C temperature till analyzed.

HEMATOLOGICAL AND BIOCHEMICAL ANALYSIS

The leukocytic indices and platelet count were analyzed employing Automated Hematology Analyzer (Cell Dyn-3700, Abbott Diagnostics, USA). Estimation of biochemical parameters of the blood samples were carried out through using of ready to use kits. The kits for estimation of total protein, albumin, globulin, uric acid were procured from Agappe Diagnostics Ltd., Kerala, India.

STATISTICAL ANALYSIS

The data generated on enzymatic profile were analyzed statistically using one way ANOVA model by SigmaStat software, version 4.0, 2016.

RESULTS AND DISCUSSION

LEUKOCYTIC INDICES AND PLATELET COUNT

The mean and standard error (mean \pm S.E.) of leukocytic indices during different stages of lactation in Kutchi camels are presented in Table 1. The total leukocyte count (TLC, $10^3/\mu\text{l}$) levels in early, mid and late lactations were 8.12 ± 0.26 , 8.91 ± 0.32 and 9.69 ± 0.22 , respectively. The TLC level of late lactation was significantly ($p < 0.05$) higher as compared to early lactation, but it was non-significantly higher than mid lactation. In differential leukocyte count (DLC), lymphocyte counts (%) were 49.22 ± 1.09 , 46.63 ± 1.08 and 52.37 ± 0.70 in early, mid and late lactations, respectively. The lymphocyte count of mid lactation was significantly ($p < 0.05$) lower than that of late lactation. Neutrophil counts (%) in early, mid and late lactations were 43.41 ± 1.07 , 45.10 ± 1.16 and 38.28 ± 0.62 respectively. The neutrophil count in late lactation was significantly ($p < 0.05$) lower than that of early and mid lactations. The recorded values of monocyte counts in early, mid and late lactations were 2.43 ± 0.14 , 2.74 ± 0.18 and 3.31 ± 0.20 respectively. The monocyte count in late lactation was significantly ($p < 0.05$) higher than that of early lactation and non-significantly than mid lactation. The eosinophil counts (%) were 4.26 ± 0.16 , 4.77 ± 0.16 and 5.43 ± 0.18 in early, mid and late lactations, respectively. There was significantly ($p < 0.05$) increase in the eosinophil count from early lactation to late lactation. The values of the basophil counts (%) in early, mid and late lactations were 0.68 ± 0.16 , 0.75 ± 0.15 and 0.60 ± 0.16 , respectively. The platelet (PLT) counts ($10^3/\mu\text{l}$) during three stages of lactation in Kutchi camels were 264.70 ± 20.91 , 312.90 ± 25.58 and 398.60 ± 19.80 , respectively. The platelet count in late lactation was significantly

Table 1: Leukocytic indices and platelet count during different stages of lactation in Kutchi camels

Items	Groups		
	Group-I Early Lactation (1-3 months)	Group-II Mid Lactation (4-6 months)	Group-III Late Lactation (≥ 7 months)
TLC (thousands/ μ l)	8.12 \pm 0.26 ^a	8.91 \pm 0.32 ^{ab}	9.69 \pm 0.22 ^b
Lymphocyte (%)	49.22 \pm 1.09 ^{ab}	46.63 \pm 1.08 ^a	52.37 \pm 0.70 ^b
Neutrophil (%)	43.41 \pm 1.07 ^b	45.10 \pm 1.16 ^b	38.28 \pm 0.62 ^a
Monocyte (%)	2.43 \pm 0.14 ^a	2.74 \pm 0.18 ^{ab}	3.31 \pm 0.20 ^b
Eosinophil (%)	4.26 \pm 0.16 ^a	4.77 \pm 0.16 ^b	5.43 \pm 0.18 ^c
Basophil (%)	0.68 \pm 0.16	0.75 \pm 0.15	0.60 \pm 0.16
PLT (thousands/ μ l)	264.70 \pm 20.91 ^a	312.90 \pm 25.58 ^a	398.60 \pm 19.80 ^b

*Means (\pm S.E) with different superscript within a row differ significantly (P < 0.05) from each other.

Table 2: Biochemical parameters during different stages of lactation in Kutchi camels

Parameters	Groups		
	Group-I Early Lactation (1-3 months)	Group-II Mid Lactation (4-6 months)	Group-III Late Lactation (≥ 7 months)
Total protein (g/dl)	6.66 \pm 0.15 ^a	6.92 \pm 0.12 ^a	7.39 \pm 0.13 ^b
Albumin (g/dl)	3.50 \pm 0.08 ^a	3.80 \pm 0.08 ^b	4.14 \pm 0.04 ^c
Globulin (g/dl)	3.16 \pm 0.09	3.12 \pm 0.05	3.25 \pm 0.11
A/G ratio	1.11 \pm 0.03 ^a	1.22 \pm 0.02 ^{ab}	1.29 \pm 0.04 ^b
Uric acid (mg/dl)	2.62 \pm 0.03 ^a	2.93 \pm 0.04 ^b	3.05 \pm 0.03 ^c

*Means (\pm S.E) with different superscript within a row differ significantly (P < 0.05) from each other.

(p < 0.05) higher than early and mid lactations. There was no significant difference between early and mid lactations.

Hematological parameters depend on many factors related to the animal's physiological status and management system, including housing hygiene and nutrition. Proper management conditions are essential for the organism to function normally. Hematological blood tests are primarily aimed to monitor the health status and to detect possible diseases (Brucka-Jastrzębska et al., 2007). In addition, these parameters can be used to evaluate animal stress and welfare levels.

The total leukocyte count (TLC) in blood circulation generally represents the outcome of the dynamic production by bone marrow, their release in the peripheral circulation and the storage in different organs or pools. Sex differences in immune function are well established in vertebrates (Kauschalendra, 2012). The value of TLC observed in this study was in agreement with the values obtained by El-Tarabany et al. (2016) in Baladi goats. The TLC found in the present study was within the range determined by Farooq et al. (2011) and reported by Mohamed and Hussein (1999). Hagawane et al. (2009) reported that increase in the level of TLC from early lactation to late lactation in lactating buffaloes was in agreement with the result obtained in present study. However, the variation in the values of TLC may be attributed to the differences in species, nutrition,

husbandry, environment and methods of assay (Osman and Al-Busadah, 2003).

The values of lymphocyte counts recorded in present study were in agreement with the values recorded by Farooq et al. (2011) in one-humped camels (*Camelus dromedarius*) kept in Cholistan desert. Hussein et al. (1992) recorded the higher leukocyte count during early lactation than mid lactation and late lactation as compared to present study. The neutrophil count observed in the current study was in agreement with the values recorded by Farooq et al. (2011). The monocyte counts found in current study were in agreement with the values reported by Hussein et al. (1992) in which monocyte counts increased from early lactation to late lactation. The eosinophil count and basophils recorded in present study were in agreement with the values recorded by Al-Busadah and Osman (2000). The values of eosinophil count recorded by Farooq et al. (2011) in one-humped camels (*Camelus dromedarius*) kept in Cholistan desert were higher than observed by current study in Kutchi camels. The values of platelet count (PLT) observed in the current study were in agreement with the values recorded by Tharwat et al. (2015) and Hussein et al. (2010) dromedary camels.

In our study, it has been observed that the leukocyte count has been gradually increased with advancement of lactation. This may indicate lesser migration of leukocytes from

blood into milk for phagocytosis and mammary gland defense against pathogens in mid and late stage of lactation as compared to early stage which can be correlated with gradual decline in milk yield with progress of lactation. However, the changes of all hematological parameters in blood of camels during lactation were very small and were in the physiological values for camel.

BIOCHEMICAL PARAMETERS

Biochemical test is a pre-symptomatic diagnostic aid capable of giving early warning of certain types of metabolic derangement in dairy animals. In the present study, the concentrations (g/dl) of serum total protein during early, mid and late lactations were 6.66 ± 0.15 , 6.92 ± 0.12 and 7.39 ± 0.13 respectively (Table 2). The serum total protein concentrations level recorded in late lactation was significantly ($p < 0.05$) higher than early and mid lactation. The present findings are in agreement with those reported by Dowelmadina et al. (2012) and Ayuob et al. (2003). The albumin concentration (g/dl) recorded during different stages of lactation in Kutchi camel was 3.50 ± 0.08 (Early lactation), 3.80 ± 0.08 (Mid lactation) and 4.14 ± 0.04 (late lactation). Among these three groups the albumin concentration in late lactation was significantly ($p < 0.05$) higher than early lactation and mid lactation. The albumin level in present study was agreed with the values obtained by Dowelmadina et al. (2012) in lactating camels after parturition and Saeed et al. (2009) in pregnant camels. Levels of serum globulin (g/dl) during different stages of lactation in Kutchi camels were 3.16 ± 0.09 , 3.12 ± 0.05 and 3.25 ± 0.11 in early lactation, mid lactation and late lactation, respectively. The globulin concentration in late lactation was non-significantly higher than early lactation and mid lactation. The globulin level in this study was within the range determined by Saeed et al. (2009) and Dowelmadina et al. (2012). The A/G ratio of late lactation was significantly ($p < 0.05$) higher than early lactation and non-significantly than mid lactation. The values of albumin/globulin (A/G) ratio observed in current study during early lactation, mid lactation and late lactation in Kutchi camels were agreed with the values reported by the Hussein et al. (1992) in dromedary camels during all three stages of lactation. The level of uric acid (mg/dl) obtained was 2.62 ± 0.03 , 2.93 ± 0.04 and 3.05 ± 0.03 during early lactation, mid lactation and late lactation, respectively (Table 2). The uric acid level (mg/dl) in late lactation was significantly ($p < 0.05$) higher than early lactation and mid lactation which corroborated with the reports of Omer et al. (2006) in lactating Sudanese camels.

Plasma proteins are the key components of plasma and they play crucial role in maintaining homeostasis. The lower level recorded during early lactation may reflect the more maternal requirements of proteins for milking and providing immunoglobulins. Besides, the increasing trend

of total protein level of serum with the progress of lactation is due to the more catabolism of protein for milk synthesis. Uric acid is derived from the metabolism of nucleic acids via the intermediary purines. The amount of uric acid in most mammals, in contrast to humans, is small as most of this compound is converted in the liver to its more water-soluble oxidation product allantoin. Increase in blood uric acid levels in middle and late lactation periods could be either due to increased deamination or increased protein intake (Roubies et al., 2006).

CONCLUSION

Determination of biochemical metabolites in blood serum can provide valuable information regarding nutrition and physiological status of dairy animals in relation to stage of lactation. Our data confirm that the lactation period is the most sensible for the dairy animals from the metabolic point of view, therefore the information, provided in this paper, advances the continuous investigation in animal welfare. However, the values of serum different biochemical parameters are in the accepted range of reference values. Moreover, since most economical losses occur due to wrong management of the dairy animals, this study could be a useful tool in preventing the deficiencies typical of high production ruminants.

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

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