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Research Article

PHYSIOLOGICAL STATUS OF SOME SERUM ENZYMES IN KUTCHI CAMEL (*Camelus dromedarius*) DURING DIFFERENT STAGES OF LACTATION

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Abstract- The present study was undertaken to determine the baseline values of some important enzymes in clinically healthy lactating Kutchi camel during different stages of lactation. The study was carried out on 30 clinically healthy female camels of 8-10 years old with 500kg body weight 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, in mid-lactation in Group-II and in late lactation in Group-III. The blood samples were collected from each experimental animal and analyzed for serum enzyme profilet hrough spectrophotometric method. Level of AST, ALT, ALP, GGT, amylase and lipase were significantly ($p < 0.05$) decreased from early lactation to late lactation. However, non-significant ($p > 0.05$) alteration in serum CK and LDH were observed during different stages of lactation. These data may be useful as reference value for Kutchi camel.

Keywords- Kutchi camel, Blood enzymes, Lactation stages, Physiological levels

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Introduction

Camels belong to the family Camelidae, genus Camelus consists of *Camelus dromedaries* i.e. dromedary (one hump) camel and *Camelus bactrianus* i.e. bactrian (two humped) camel. Among them, mainly dromedary camels inhabiting India. India ranks 7th in camel population which is mainly confined to northern-western part of the country. There are 9 indigenous registered breeds of camels in India [1]. Gujarat possesses two breeds of camel *viz.* Kutchi and Kharai. Kutchi camels are primarily reared for carting/drafting, agricultural operation and transportation, in addition to that its hair and milk also utilized by the farmers as a secondary utility [3]. However, the decline in Kutchi camel population was recorded in last four years (19th Livestock census). Hence, the economic contribution of this breed mostly in dry and semi-arid (Kutch and Banaskantha) districts of north Gujarat should be given national priority for their conservation and enhancement [2]".Therefore, health monitoring and welfare of the Kutchi camels is necessary for enhancement of their productive and reproductive performances. The physiological level of some clinical important enzymes seems to be necessary in Kutchi camels. It is well recognized that lactation isone of the most important stages in the life of animals, which affect metabolism resulting in the alteration of the biochemical profile [4, 5]. Enzymes constitute one important component of biochemical profile [6] and controls all the biochemical processes of the body required for optimum growth, productivity and maintenance of lactation [7, 8]. Enzyme metabolism is a fundamental biological process that is vital for the survival of all species. Their specific function is to catalyze chemical reactions. Enzymes have found wide and diverse applications at which enzymes increase the rate of reactions which approach to equilibrium. Enzymes play critical role in the metabolic activities of all living organisms whether humans, animals, plants or microorganisms and are widely applied in microbial technology and their diagnosis processes. Abnormality of the enzyme metabolism system leads to a number of metabolic diseases. Hence, the enzymatic profile is a useful index of patho-physiological status and also effective indicator of the reproductive and productive performance in animals, as well as in human [9]. Simultaneously, determination of physiological levels for blood enzymes become imperative for many disease monitoring programs as it forms the basis for clinical interpretation of laboratory data [10]. However, very limited literature has found regarding the biochemical profile during different stages of lactation in Kutchi camel.

Present study was undertaken to determine the reference values of(AST, ALT, ALP, CK, GGT, LDH, Amylase and lipase) in clinically healthy lactating Kutchi camel during 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 (CITOTEST™, China) and stored at -20°C temperature for analysis.

Biochemical analysis

Serum samples were analyzed for enzyme profile by using respective kits and Clinical Analyzer-635 (Systronics India Ltd., India). The estimation of aspartate aminotransferase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP), creatine kinase (CK), gamma-glutamyl transferase (GGT), lactate dehydrogenase (LDH), amylase and lipase were procured from Agappe Diagnostics Ltd., Kerala, India.

Statistical analysis

The data generated on enzymatic profile were analyzed statistically using Duncan test by sigma stat software [11].

Results

The mean±S.E (U/L) values of enzyme assay has been presented in [Table-1].It was observed that serum AST, ALT, ALP, GGT, amylase and lipase were found to be decreased significantly($p < 0.05$) from early to mid and mid to late lactation. However, non significant alteration was found in serum CK and LDH level during different stages of lactations.

Table-1 *Concentration of serum enzymes during different stages of lactation in Kutchi camels*

Parameter	Group I Early Lactation	Group II Mid Lactation	Group III Late Lactation
AST (U/L)	193.10 ± 15.97^a	168.34 ± 9.12^b	140.91 ± 13.58^c
ALT (U/L)	16.13 ± 1.73^a	13.07 ± 1.64^b	9.44 ± 1.49^c
ALP (U/L)	60.70 ± 5.06^a	49.63 ± 5.04^b	39.78 ± 3.03^c
CK (U/L)	25.85 ± 1.04^a	26.18 ± 1.16^a	24.46 ± 1.26^a
GGT (U/L)	31.63 ± 2.72^a	25.48 ± 2.97^b	19.78 ± 1.90^c
LDH (U/L)	484.12 ± 24.47^a	458.51 ± 30.04^a	466.39 ± 33.42^a
Amylase (U/L)	2454.20 ± 62.19^a	2295.17 ± 58.33^b	2184.74 ± 51.91^c
Lipase (U/L)	101.76 ± 5.65^a	86.95 ± 7.28^b	75.74 ± 9.20^c

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

Discussion

AST

The AST activity found in the present study is in agreement with the reference value given by Osman and Al-Busadah [12] in she-camel. The significant variation in aspartate aminotransferase (AST) level during different stages of lactation was also recorded by Talvelkar *et al.*[13] and Balusami *et al.* [14] in buffaloes and Krsmanovic *et al.* [15] in Simmental cows. The amino-transferases are is responsible for the protein balance in the organism which is especially important in the period of intensive metabolism during the peak oflactation. During the early stage of lactation, higher AST levels may be due extensive physiological and biochemical changes of liver to counteract the adverse effects of negative energy balance. Afterwards, the continuous decrease of AST level with the advance stage of lactation may due to the damage of the cellular structure of body, which may indicate the development of fatty infiltration of liver cells, damage to hepatocytes and release of intracellular enzymes into circulation [15].

However, decreased of AST level in subsequent lactation in this study is in contrary to Kholif [16] in buffaloes, Sivaraman *et al.* [17] in jersey crossbred cows and Cozzi *et al.* [18] in Holstein dairy cows .Nevertheless non-significant difference in serum AST level was observed by Das *et al.* [19] in mehshani buffaloes, which also showed dissimilarity with the present investigation. The variations in recorded values of AST activities compared to values reported earlier may be attributed to differences in housing and feeding systems, the time for blood sample collection or a breed-specific trait [20].

ALT

In this present study, ALT value recorded is in agreement with the reference value given by Osman and Al-Busadah [12] in she-camel. The activity of ALT in blood is very important. ALT acts as a catalyst in connecting the metabolism of amino-acids and carbohydrates. The increase in ALT activity in the blood in early lactation reported in the present study may be a consequence of their increased activity in cells (primarily liver)due to an increase in hepatic metabolism, and could also be a reflection of cell structure damage[21]. During early to mid-lactation, ALT value has been decreased in current study, which is in agreement with Kholif *et al.* [16] in buffaloes, though opposite trend was found in late lactation. However, Talvelkar *et al.*[13] observed significantly increase of ALT level from early to mid-lactation in buffaloes. On the other hand, Das *et al.* [19] observed non- significant difference in serum ALT level during different stages of lactation.

ALP

Alkaline phosphatase is one of a group of enzymes which catalyzes the liberation of inorganic phosphate (Pi) from phosphate esters; it is present in almost all tissues of the body. In mature animals, serum ALP originates mainly from the liver. ALP value reported in this present study corroborates the reference value given by Osman and Al-Busadah [12] in she-camel. The continuous decrease of ALP level from early to late lactation in current study was also reported by Tharwat *et al.* [22], who observed the ALP level in serum was increased significantly at 1st week after parturition in camels. The elevation of ALP level after parturition (early lactation) may due to increase the synthesis of ALP by placenta [23] to support the fetus for its oesteoblastic activity and can also be used as a marker for gestation in cows [24].

On the other hand, contradictory results were observed by Kholif [16] and Das *et al.* [19]. Difference in ALP levels in current study and other researchers may be indicative of level of utilization of ALP enzyme at various ages, sex and physiological stages.

CK

CK levels reported in our present study are similar to that of Tharwat *et al.* [22].Creatine kinase (CK, CLK) is located mainly in muscles, the myocardium and the brain. Increased level of CLK may appear after exertion. Moreover, an increased level of CLK is one of the symptoms during myocardial infarction, muscle trauma or damage. Hence, non-significant changes in CK levels throughout the lactation may indicate absence of any stress capable of inducing muscle damage which may be indication of good farm practices. However, The CK activity noted by Osman and Al-Busadah [12] in she-camel is in contrary of the present study.

GGT

The GGT activity noted in present study is similar with the reference value given by Osman and Al-Busadah [12] in she-camel. The decrease of GGT level from early to mid- lactation in current study is covenant with Tharwat *et al.* [22] and Krsmanovic *et al.* [15]. As GGT is considered as a specific hepatic marker, the higher GGT activity during early lactation might be a long-term effect of the hepatic stress induced by the preceding pregnancy and parturition. Besides, the gradual decrease of GGT level with advancement of lactation may due to liver cell destruction as GGT is microsomal and membrane bound enzyme[25]. However, the current study is found contradictory of the findings of Cozzi *et al.* [18] who reported lower level of GGT in Holstein dairy cows.

LDH

The LDH activity noted in present study is similar with the reference value given by Osman and Al-Busadah [12] in she-camel. However, comparatively higher LDH levels were recorded by Saeed *et al.* [26] in pregnant and non- pregnant camels. Lactate dehydrogenase (LDH) activity might be a useful in vivo marker for tissue damage, injuries and diseases, because it is released duringits damage. This enzyme occurs extensively in blood cells, muscle, gut and liver cells, and it transfers hydrogen between molecules.

The current study showed non-significant alteration in the activity of LDH between early, mid and late lactation which may be indication of absence of damage or injury to tissues. However, this observation is found to be disparate with Krsmanovic *et al.* [15]. This dissimilarity of results may be due to disrupted morphological and physiological condition of liver in early lactation and also as a result of mild degree of fatty liver cell infiltration [25].

Amylase

The amylase activity noted in present study corroborate with the reference value given by Mura *et al.* [27] in camel. During early lactation period the activity of amylase has been increased to testify the tension of the functional state of pancreas in this period. A pancreas, being the organ of both external and internal secretion, plays a direct role in lipid metabolism. The higher amylase activity during early phase of lactation is related to strengthen the lipo-mobilization processes with the purpose of indemnification of negative energy balance development.

However, the amylase level in this study does not match with Wang *et al.* [28], who studied the normal value of Tibetan sheep. This dissimilarity indicates that the amylase level may be depended on breed variation. The continuous decrease of amylase level from early to late lactation in current study is also disparate with Tajik and Tahvili [29] in cows. Nonetheless, amylase concentration may differ with seasonal variation and reproductive status of the animals [30].

Lipase

Lipase is the enzyme which regulates the hydrolysis of circulating triglyceride and the uptake of fatty acids by most tissues, including the mammary gland and adipose tissue. Thus, lipase is critical for the uptake and secretion of the long-chain fatty acids in milk and for the assimilation of a high-fat milk diet by suckling young. The maximum concentration of lipase during early lactation observed in our present study may be due to the stimulation of this enzyme in mammary tissue via prolactin through VLDL for biosynthesis of milk fat. It could also have reflected the mobilization of NEFA from adipose tissue to meet the increased demands placed by milk production on maternal energy metabolism. However, the continuous decrease of lipase level in subsequent lactation in current study is contradictory with Watson *et al.* [31] in mares and Bagnicka *et al.* [32] in goats.

Conclusion

The data generated during the current investigation may be useful as reference value for the scientific community as this is the first study of its kind in case of Kutchi camel (*Camelus dromedarius*), a unique camel breed of Gujarat. It furnishes the information about the variation in biochemical indices during different lactation stages. Moreover, serum enzyme profile is getting increasingly importance in veterinary medicine for diagnostic process or as part of a specific objective in monitoring program for metabolic diseases or other diseases of livestock; hence the present investigation may also be helpful in this regard.

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Author 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. Nilufar Haque and Pankaj Patel revised the final draft of the manuscript. All authors read and approved the final manuscript.

Ethical approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Abbreviations

°C	:	Degree Celsius
ALP	:	Alkaline phosphatase
ALT	:	Alanine transaminase
AST	:	Aspartate aminotransferase
CK	:	Creatine kinase
e.g.	:	exempli gratia
et al.	:	*et alii*
etc.	:	*et cet·er·a*
GGT	:	Gamma glutamyl transferase
i.e.	:	*id est* (that is)
U/l	:	units per liter
LDH	:	Lactate dehydrogenase
ml	:	Milliliter
NEFA	:	Non esterified fatty acid
S.D.	:	Standard deviation
S.E.	:	Standard error
viz.	:	*Videlicet* (namely)
VLDL	:	Very low density lipoproteins

Conflict of Interest: None declared

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