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Normal Concentrations of Twenty Serum Biochemical Parameters of She-camels, Cows and Ewes in Saudi Arabia

T.E.A. Osman and K.A. Al-Busadah
Camel Research Centre, Department of Physiology, Biochemistry and Pharmacology,
College of Veterinary Medicine and Animal Resources,
King Faisal University, P.O. Box 1757, Al-Ahsa, Saudi Arabia

Abstract: The activities of enzymes of clinical significance and the concentrations of certain electrolytes, minerals and blood constituents were determined in sera of she-camels, cows and ewes. The activities of creatine kinase, lactate dehydrogenase, aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase and gamm-glutamyltransferase were measured. The concentrations of sodium, potassium, chloride, magnesium, calcium, inorganic phosphorus, iron, glucose, cholesterol, triglycerides, urea, creatinine, total protein and albumin were determined. Means were compared by performing Duncon's Multiple Range Test. The results were compared with those reported by other investigators in camels, cattle and sheep.

Key words: Biochemical constituents, she-camels, cow, ewe

Introduction

Biochemical determination of serum constituents can provide valuable information as relating to nutrition, sex, age and physiological status of the animal. The effects of age and lactation on some biochemical constituents of Saudi Arabian camels have been studied (Osman and Al-Busadah, 2000). Many workers compared results obtained in camel sera with those of true ruminants (Abdalla *et al.*, 1988 and Haroun, 1994). It is well known that variations exist in biochemical constituents with regard to sampling procedures, analytical techniques, physical factors, environmental conditions or variations in breed (Beaunoyer, 1992). The present study was therefore undertaken a) to measure the activity of enzymes of potential clinical significance in sera of she-camels, cows and ewes, b) to determine the concentrations of selected biochemical constituents and c) to compare the values obtained in the three species and to compare our results with those reported in other countries.

Materials and Methods

Blood samples were collected by jugular venipuncture from 5 adult she-camels, 5 lactating cows and 5 lactating ewes into silicon-coated vacuum containers. The blood was allowed to clot and after centrifugation, the serum was separated and stored at –20°C until analysed. Twenty serum parameters including proteins, enzymes, electrolytes, minerals and other metabolites were determined. The various serum constituents were analysed spectrophotometrically (RA-50 Chemistry Analyser, Ames, Bayer Diagnostics) using commercial reagent kits (United Diagnostics Industry , Dammam, Kingdom of Saudi Arabia).

Statistical analysis: The data were analysed statistically using analysis of variance (ANOVA). The statistical differences between means were estimated by Duncon's Multiple Range Test. The computation was facilitated by statistical package SAS.

Results

The serum enzyme activities of creatine kinase (CK), lactate dehydrogenase (LDH), aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP) and gamma-glutamyltransferase (GGT) are shown in Table 1. Serum CK activity was significantly higher ($P < 0.05$) in camels as compared with cows and ewes. The activities of LDH and ALT were significantly higher ($P < 0.05$) in the serum of cows when compared with either she-camels and ewes. Serum AST activity was significantly higher ($P < 0.05$) in she-camels as compared with cows, but the difference between she-camels and ewes was not statistically significant. Serum ALP and GGT activities were significantly higher ($P < 0.05$) in ewes when compared with mean activities recorded for she-camels and cows. However, no statistical significant differences in mean ALP and GGT activities were found between she-camels and cows.

The mean±SE concentrations of sodium, potassium, chloride, magnesium, calcium, inorganic phosphorus and iron are shown in Table 2. The serum concentrations of sodium and chloride were significantly higher ($P < 0.05$) in

Table 1: Mean ± S.E. activities of CK, LDH, AST, ALT, ALP and GGT in the serum of she-camels (n=5), cows (n=5) and ewes (n=5)

Parameter	Unit	She camel	Cow	Ewe
CK	U L^{-1}	408.6±127.6a	119.0±15.0b	121.6±9.2b
LDH	U L^{-1}	455.0±75.9b	726.8±56.7a	382.4±23.5b
AST	U L^{-1}	164.6±39.9a	72.4±7.1b	141.6±25.4ab
ALT	U L^{-1}	17.2±3.6b	34.0±3.0a	21.0±1.4b
ALP	U L^{-1}	60.0±7.2b	49.8±3.1b	112.4±25.1a
GGT	U L^{-1}	25.6±7.8b	29.0±4.0b	77.0±3.5a

Note: Duncan's Multiple Range Test was performed at $P < 0.05$
Means with the same letter are not significantly different

Table 2: Mean ± S.E. concentrations of Na, K, CL, Mg, Ca, P and Fe in the serum of she-camels (n=5), cows (n=5) and ewes (n=5)

Parameter	Unit	She camel	Cow	Ewe
Na	mEq. L^{-1}	168.2 ± 0.7a	139.0 ± 2.0c	162.0 ± 1.5b
K	mEq./1	4.0 ± 0.2b	4.2 ± 0.1b	5.3 ± 0.1a
Cl	mEq. L^{-1}	130.2 ± 1.9a	103.6 ± 2.0c	114.8 ± 1.5b
Mg	mEq. L^{-1}	2.16 ± 0.09b	2.68 ± 0.04a	2.84 ± 0.11a
Ca	mg dl^{-1}	9.0 ± 0.1b	9.4 ± 0.2ab	9.9 ± 0.1a
P	mg dl^{-1}	3.8 ± 0.5b	6.1 ± 0.6a	4.8 ± 0.5ab
Fe	µg dl^{-1}	80.2 ± 16.0b	168.4 ± 13.9a	178.6 ± 23.7a

Note: Duncan's Multiple Range Test was performed at $P < 0.05$
Means with the same letter are not significantly different

Table 3: Mean ± S.E. concentrations of glucose, cholesterol, trigly-cerides, urea, creatinine, total protein and albumin in the serum of she-camels (n=5), cows (n=5) and ewes (n=5)

Parameter	Unit	She Camel	Cow	Ewe
Glucose	mg dl^{-1}	134.4 ± 11.0a	49.0 ± 2.5b	65.0 ± 4.8b
Cholesterol	mg dl^{-1}	58.4 ± 8.6a	149.4 ± 10.1b	69.6 ± 5.7b
Triglycerides	mg dl^{-1}	31.4 ± 3.0a	14.6 ± 1.8b	19.4 ± 1.2b
Urea	mg dl^{-1}	49.8 ± 5.5a	17.2 ± 1.8b	52.6 ± 4.9a
Creatinine	mg dl^{-1}	1.5 ± 0.1a	1.3 ± 0.04ab	1.0 ± 0.03b
Total protein	g dl^{-1}	7.1 ± 0.3b	8.2 ± 0.1a	6.9 ± 0.1b
Albumin	g dl^{-1}	3.7 ± 0.3b	4.5 ± 0.1a	3.7 ± 0.1b

Note: Duncan's Multiple Range Test was performed at $P < 0.05$
Means with the same letter are not significantly different

she-camels when compared with either cows and ewes, and the mean values of these two electrolytes were significantly higher in ewes ($P < 0.05$) as compared with cows. Serum potassium concentration was significantly higher ($P < 0.05$) in ewes when compared with she-camels and cows. The concentrations of magnesium and iron in the serum of she-camels were significantly lower ($P < 0.05$) as compared with cows and ewes. Mean serum calcium concentration was significantly lower ($P < 0.05$) in she-camels when compared with ewes, but difference between she-camels and cows was not statistically significant. The serum concentration of inorganic phosphorus was significantly lower ($P < 0.05$) in she-camels as compared with cows, but the difference between she-camels and ewes was not statistically significant.

The serum concentrations of glucose, cholesterol, triglycerides, urea, creatinine, total protein and albumin are shown in Table 3. Mean serum glucose and triglycerides concentrations were significantly higher in she-camels when compared with their respective mean concentrations in cows and ewes. Conversely, mean serum cholesterol concentration was significantly lower ($P < 0.05$) in she-camels when compared with mean values obtained in cows and ewes. Mean serum urea concentration was significantly lower ($P < 0.05$) in cows as compared with she-camels and ewes. Mean serum creatinine concentration was significantly higher ($P < 0.05$) in she-camels as compared with ewes, but the difference between she-camels and cows was not statistically significant. The mean serum total protein and albumin concentrations were significantly lower ($P < 0.05$) in she-camels when compared with their respective values in cows, but no differences were found between she-camels and ewes.

Discussion

The present study may be the first to determine such a wide range of extracellular blood constituents in camels, cattle and sheep. All blood samples were collected, stored and analysed using exactly the same technical procedures. This is of major importance, owing to the variations observed in the biochemical parameters with regard to sampling procedures, analytical techniques and other factors (Beaunoyer, 1992). These variables play an essential role in the evaluation of results among laboratories.

Serum CK, LDH, AST, ALT, ALP and GGT activities (Table 1) found in she-camels are in reasonable agreement with the values reported by Bengoumi *et al.* (1997) and Osman and Al-Busadah (2000). The activities of these enzymes are slightly higher than those given in some previous studies (Boid *et al.*, 1980; Kataria and Bhatia, 1991; Beaunoyer, 1992; Sarwar *et al.*, 1992 and Nyang'ao *et al.*, 1997). The activities of LDH, AST, ALT, ALP and GGT found in the present study fall within the normal range reported for cow and sheep (Kaneko, 1989). However, mean serum activity of CK found in cows (119.0 ± 15.0 U L^{-}1) or ewes (121.0 ± 9.3 U L^{-}1) in the present study were much higher than values of 7.4 ± 2.4 and 10.3±1.6 U L^{-}1 reported for cow and sheep, respectively (Kaneko, 1989).

In our study, serum activity of CK was significantly higher in she-camels, LDH and ALT activities were significantly higher in cow whereas ALP and GGT activities were significantly higher ewes. These findings indicate that differences in normal serum activity values of some enzymes exist between camel and true ruminants, as well as between cattle and sheep.

Most of the minerals and electrolytes concentrations obtained for she-camels were in reasonable agreement with previous studies (Tartour and Idris, 1970; Ghosal *et al.*, 1974; Wahbi *et al.*, 1979; Hussein *et al.*, 1982; Abdalla *et al.*, 1988 and Wernery *et al.*, 1999). In general

our findings on minerals and electrolytes concentrations of cows and ewes are within the normal ranges reported in the literature (Kaneko, 1989). The higher values of sodium and chloride concentrations found in she-camels are in agreement with previous reports that sodium and chloride levels are generally higher in camel sera when compared with other ruminants (Ayoub *et al.,* 1960; Bono *et al.,* 1983 and Abdalla *et al.,* 1988). Serum iron and magnesium concentrations of she-camels were significantly lower as compared with cows and ewes. Similar findings of low iron concentration in camel sera have been reported by Hussein *et al.* (1982), Abdalla *et al.* (1988) and Mohamed and Hussein (1999).

The data on serum glucose, cholesterol, triglycerides, urea, creatinine, total protein and albumin of she-camels were comparable with those reported by Soliman and Shaker (1967), Abdel Gadir *et al.* (1979), Hussein *et al.* (1982), Abdalla *et al.* (1988), Rezakhani *et al.* (1997), Mohamed and Hussein (1999) and Osman and Al-Busadah (2000). The values of the above serum parameters obtained in cows and ewes were within the normal established range for cattle and sheep (Kaneko, 1989). The glucose concentration determined in the serum of she-camels used in the present work is in excellent agreement with values obtained by Barakat and Abdel-Fattah (1970) 80-140 mg dl^{-1}, Chandrasena *et al.* (1979) 129 mg dl^{-1}, Al-Ali *et al.* (1988) 138±17.7 mg dl^{-1}, Nyang'ao *et al.* (1997) 91.8 – 178.2 mg dl^{-1} and Mohamed and Hussein (1999) 45 – 167 mg dl^{-1}. This could be the cause of high levels of blood lactic acid reported in camels (Mathur *et al.,* 1981). Serum glucose concentration of she-camels was significantly higher than values obtained in cows and ewes. The blood glucose concentration is lower and more stable in ruminants and mean values of 57.4 ±6.8 mg dl^{-1} and 68.4±6.0 mg dl^{-1} were found in cow and sheep, respectively (Kaneko, 1989; Welles *et al.,* 1992).

In the present study significantly lower serum cholesterol concentration was found in she-camels. Similar findings of low cholesterol level in the camel have been reported by Al-Ali *et al.* (1988), Manefield and Tinson (1996), Nazifi and Maleki (1998), Mohamed and Hussein (1999) and Osman and Al-Busadah (2000). Conversely, serum triglycerides concentration of she-camels was significantly higher as compared with cows and ewes. Mean serum triglycerides concentration of she-camels was much lower than the value of 79.7±8.9 mg dl^{-1} reported in adult normal Iranian camels (Nazifi and Maleki, 1998).

The present study has thus provided a comprehensive biochemical analysis of the major constituents of she-camel, cow and ewe serum. The observed biochemical values of she-camel serum were within the physiological limits described elsewhere and the variations observed between the present results and those from previous studies may be attributed to differences in breed, nutrition, husbandry, environment and methods of the assay. In the present study higher values of CK, sodium, chloride, glucose and triglycerides were found in she-camels as compared with cows and ewes. Conversely, the values of magnesium, iron and cholesterol were lower in she-camels in comparison with cows and ewes. Thus the findings obtained in the present study form a useful baseline for subsequent biochemical studies on camels, cattle and sheep in Saudi Arabia.

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