

Activities of Diagnostic Enzymes and Lipid Content in Camel (*Camelus dromedarius*) Blood Vessels

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Abstract

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A number of tissue enzymes are a valuable tool as diagnostic agents. Alkaline phosphatase (ALP), alanine transaminase (ALT), aspartate transaminase (AST), creatine kinase (CK), glutamyl transpeptidase (GGP), lactate dehydrogenase (LDH), in addition to cholesterol and triglycerides are demonstrated to be constituents of some of the major camel blood vessels. Any damage to these blood vessels could result in a significant increase in serum values becoming a valuable diagnostic tool for vascular diseases. The enzyme activities in the blood vessels of the one-humped camel (*Camelus dromedarius*), were measured. The blood vessels were the *aorta abdominalis*, *vena cava caudalis*, *arteria carotis communis*, *arteria coronaria dextra*, *vena jugularis dextra*, *arteria pulmonalis dextra*, *vena pulmonalis dextra*, *arteria renalis*, *arteria plantaris medialis dextra*, *vena plantaris medialis dextra*. The results indicated extremely elevated activities of the enzymes ALP, ALT, AST, CK, GGT LDH (8.47, 300.93, 17.12, 1.71, 10.94 and 411.11 nKat·g⁻¹, respectively) and lipids CHO and TG (12.03 and 6.9 mmol·g, respectively) in the *a. coronaria dextra*. At the same time there was no evidence for any difference between the arteries and veins. Thus, our results provides the first preliminary reference values of some diagnostic enzymes in the blood vessel wall that may be used when evaluating damage to the vasculature resulting in the leakage of the enzymes and lipids.

Blood vessels, camel, enzymes, cholesterol, triglycerides

When there is damage to the smooth, skeletal or heart musculature, the level of some enzymes in the serum as creatine kinase (CK), lactic dehydrogenase (LDH) and aspartate transaminase (AST) are elevated. These diagnostic enzymes are therefore valuable tools used in the early detection of muscle wastage as a result of ischemia, injury or inflammation (Sacher et al. 1991). There are a considerable number of pathological conditions, which affect the major blood vessels in humans and animals. In addition to the tissue enzymes, experimental work has shown that large molecules in blood plasma can enter the vessel wall through endothelial cells, presumably by pinocytosis. Similarly, studies have shown that smaller molecules may enter the arterial wall by passing between endothelial cells at cell junctions. Therefore, to facilitate the diagnosis of vascular diseases, it was of interest to carry out a preliminary biochemical endeavor by estimating the normal levels of some diagnostic enzymes and lipids in some of the arteries and veins of the camel.

Materials and Methods

During the summer period blood vessel samples were collected from ten male adult (6-year-old) apparently healthy slaughtered camels (*C. dromedarius*) at the local slaughterhouse of Bureidah, Al-Qassim, Central region of Saudi Arabia. The animals were grazing on the natural habitat of AlQassim area. Pieces of the *aorta abdominalis*, *vena cava caudalis*, *arteria carotis communis*, *a. coronaria dextra*, *v. jugularis dextra*, *a. pulmonalis dextra*, *v. pulmonalis dextra*, *a. renalis*, *a. plantaris medialis dextra*, *v. plantaris medialis dextra* were collected. The blood

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Table 1
Enzyme activities (nkat-g) and concentrations of cholesterol and triglycerides (mmol-g) in the walls of selected arteries and veins of the camel

	Aorta abdominalis	Vena cava caudalis	A. carotis communis	A. coronaria dextra	V. jugularis dextra	A. pulmonalis dextra	V. pulmonalis dextra	A. renalis	A. plantaris medialis dextra	V. plantaris medialis dextra
ALP	0.53 ± 0.01	1.69 ± 0.42	1.39 ± 0.07	8.47 ± 0.33	0.49 ± 0.01	0.47 ± 0.07	2.71 ± 0.14	1.64 ± 3.1	3.70 ± 0.55	1.83 ± 0.26
ALT	2.05 ± 7.80	7.80 ± 10.59	9.18 ± 1.31	300.9 ± 35.19	2.06 ± 0.36	1.60 ± 0.27	26.29 ± 1.73	9.40 ± 1.19	19.34 ± 1.37	7.29 ± 0.54
AST	0.55 ± 0.05	3.34 ± 0.55	2.58 ± 0.54	17.1 ± 21.27	1.13 ± 0.15	0.64 ± 0.11	6.28 ± 0.67	2.38 ± 0.40	5.44 ± 0.40	4.05 ± 0.67
CK	0.1 ± 40.00	0.20 ± 0.01	0.96 ± 0.19	1.7 ± 10.25	0.59 ± 0.07	0.37 ± 0.04	1.40 ± 0.49	1.47 ± 0.23	1.74 ± 0.17	0.89 ± 0.00
GGT	0.1 ± 10.00	0.26 ± 0.04	0.73 ± 0.17	10.9 ± 40.61	0.80 ± 0.07	0.13 ± 0.00	0.19 ± 0.00	0.20 ± 0.00	2.89 ± 0.43	0.45 ± 0.00
LDH	11.1 ± 91.19	80.63 ± 3.39	91.08 ± 2.75	411.1 ± 16.05	23.79 ± 1.76	11.75 ± 1.24	83.10 ± 5.99	83.46 ± 5.41	132.07 ± 2.04	47.03 ± 2.59
CHO	0.7 ± 0.001	2.7 ± 0.002	2.53 ± 0.002	12.03 ± 0.09	1.11 ± 0.001	0.67 ± 0.001	5.12 ± 0.02	2.39 ± 0.001	7.41 ± 0.003	2.3 ± 0.00
TG	0.32 ± 0.001	1.56 ± 0.00	1.14 ± 0.00	6.9 ± 0.06	0.54 ± 0.00	0.45 ± 0.00	2.85 ± 0.00	1.17 ± 0.001	3.33 ± 0.00	1.48 ± 0.001

Mean ± SEM

vessel samples were weighed, homogenized in distilled water (W/V-using an ultrasonic homogenizer, Braun- Sonic 2000-Sargent, Welch supplied with a standard cooling jacket and standard titanium probe tip) and centrifuged for 5 min at 2500 g. The supernatant fluid was stored at -20 °C until used for analysis.

The enzyme activities were estimated using BM/Hitachi autoanalyzer-902 (Boehringer Mannheim) according to the instructions of the manufacturer and the results are expressed as enzyme units per gram of wet tissue. In addition to the enzymes alkaline phosphatase (EC 3.1.3.1, ALP), alanine aminotransferase (EC 2.6.1.2, ALT), aspartate aminotransferase (EC 2.6.1.1, AST), creatine kinase (EC 2.7.3.2, CK), γ -glutamyl transpeptidase (EC 2.3.2.2, GGT) and lactic dehydrogenase (EC 1.1.1.28, LDH), the cholesterol (CHO) and triglycerides (TG) were tested. Each test was carried out in duplicate.

Results

The results are recorded as mean ± standard error concentrations and are presented in Table 1. The results clearly indicate that the enzymatic activities in the arteries are higher than in the veins. The LDH estimated in the coronaries was 35 fold higher than that estimated in the a. *abdominalis*. The LDH was also found to be the highest in concentration than the other enzymes in all of the analyzed blood vessels. The cholesterol and triglycerides were also detected in the blood vessels. The cholesterol and triglycerides levels in the aorta (0.7 and 0.32 mmol/g respectively) and a. *pulmonalis dextra* (0.67 and 0.45 mmol/g respectively) were at their lowest concentration. The a. *coronaria dextra* had the highest level of cholesterol and triglycerides (12.03 and 6.9 mmol/g respectively).

Discussion

Tissue enzyme activity, cholesterol and triglycerides concentrations in different animals species have been extensively investigated by several authors (Clampitt and Hart 1978; and El-Newehy et al. 2000). The only available investigation of blood vessels enzyme was recorded in cattle by Hussein et al. (1986). In camel, the picture becomes even more obscure due to the scarcity of the available literature on their tissue enzymes. Due to the increasing investigations on camel diseases (bacterial, viral and parasites), this becomes of relevance when the camel is infected with a parasite producing extensive damage to the vascular walls. Such damage could be indicated in cases of muscular

infection with *Trichinella* larvae (Eckhart et al. 1985), testicular blood vessel injury with *Acanthocheilonema evansi* (Ramadan 1982) or during the continuous irritative situation encountered in the nasal cavity by the bot fly (Fahmy et al. 1985; Hussein et al. 1986; Zayed 1998). An extensive damage to the vascular walls (mesenteric, bronchial and portal veins and aorta) of cattle is a usual case when the animal is infected with schistosomes or onchocerca (Mahmoud and Ford 1988). Such conditions are also encountered in camel where infestation with schistosomes, onchocerca were recorded (Abdul-Salam 1995; El-Amin 1993; Soulsby 1982). In addition to the high activity of encountered enzymes in the investigated blood vessels the cholesterol and triglycerides were also relevant in our estimations of the camel vasculature, which posed a significant difference with the previous results recorded in cattle (Mahmoud and Ford 1988). In humans, chemical studies of arteries obtained from individuals show an increase in lipid content which is roughly related to the age of the individual from whom the arteries have been derived (Boyd and Craig 1983). Disease, age and species of the animal are some of the factors that affect pinocytosis, which may influence the imbibition of selected macromolecules or/and the adherence of cells to one another influencing the penetration of blood-borne particles into the arterial wall. Thus, the difference in the presence of cholesterol and triglyceride in the walls of the blood vessels and their absence in cattle. In addition, the previous record of the high content of lipids around the heart in the adult camel (Taha et al. 1994), which was considered as a reservoir for use during fasting. The damage to the skeletal or heart musculature results in a considerable increase in the level of serum CK and LDH (Brewer and Scott 1983) due to the fact that the bulk of the vessels throughout the body could be considered as an ample reservoir of enzymes liable to be released and detected during pathological situations. Thus, any damage to the vasculature could result in leakage of the enzymes and lipids and could thus be considered as a valuable tool in early diagnosis of pathological conditions.

Aktivity diagnosticky využitelných enzymů a lipidů v krevních cévách velbloudů (*Camelus dromedarius*)

Řada tkáňových enzymů je velmi cenným diagnostickým prostředkem. Bylo prokázáno, že vedle cholesterolu a triglyceridů, jsou alkalická fosfatáza (ALP), alanintransamináza (ALT), aspartáttransamináza (AST), kreatinkináza (CK), μ -glutamyltranspeptidáza (GGP) a laktindehydrogenáza (LDH) podstatnými součástmi některých velkých krevních cév velbloudů. Jakékoliv poškození těchto cév může mít za následek signifikantní nárůst sérových hodnot, což představuje cenný indikátor pro diagnostiku cévních onemocnění. V předkládané práci byly měřeny enzymové aktivity v krevních cévách dromedára (*Camelus dromedarius*). Mezi sledované krevní cévy patřily: *aorta abdominalis*, *vena cava caudalis*, *arteria carotis communis*, *arteria coronaria dextra*, *vena jugularis dextra*, *arteria pulmonalis dextra*, *vena pulmonalis dextra*, *arteria renalis*, *arteria plantaris medialis dextra* a *vena plantaris medialis dextra*. Na základě dosažených výsledků byly v *arteria coronaria dextra* zjištěny extrémně vysoké aktivity následujících enzymů: ALP, ALT, AST, CK, GGT a LDH s naměřenými hladinami 8.47, 300.93, 17.12, 1.71, 10.94 a 411.11 nKat·g a lipidů CHO a TG (12.03 a 6.9 mmol·g). V téže době však nebyl zjištěn žádný rozdíl v hodnotách mezi arteriemi a vénami. Naše výsledky tak představují první předběžné referenční hodnoty některých enzymů vhodných pro diagnostiku v krevní plazmě, které mohou být využity při hodnocení míry poškození cévního systému s následkem vyšší hladiny enzymů a lipidů.

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