ON SERUM CHEMISTRY OF BROWN BEARS IN CROATIA, YUGOSLAVIA

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Abstract: Blood samples were taken from 8 free-living European brown bears (*Ursus arctos*) from Plitvice Lakes National Park, Croatia, Yugoslavia, and 4 captive European brown bears from the Zagreb Zoological Park; zoo bears served as a control group. Up to 13 serum chemistry parameters were measured from each sample. Results revealed that the capture procedure provoked an increase of creatine kinase, creatinine, blood urea nitrogen, and serum urea. Creatine kinase was a very sensitive indicator of muscle damage. Free-living bears exhibited higher total lipid concentrations than captive bears, probably due to a more diverse diet.

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Knowledge of baseline values of brown bear serum chemistry is limited. Such baseline data are important for evaluating the influences of disease, stress (e.g., capture and immobilization), habitat quality (climate, nutrition, population density), season, sex, age, and methods of blood sample collection and analysis (Matula et al. 1980, Brannon 1985).

Some values of the blood profile of European brown bears are found in Couturier (1954), Seal et al. (1967), and Bush et al. (1980); the 1st 2 papers deal only with hematology; the last paper presents grouped values for the serum biochemistry of 4 European brown bears, 3 North American brown bears, and 1 Kodiak brown bear-polar bear hybrid (*U. arctos* x *U. maritimus*).

Different aspects of blood values of North American black bears (*U. americanus*), polar, and North American brown bears were reported by Nelson et al. (1983). Along with the hematology of brown bears, Seal et al. (1967) studied the hematology of North American black, polar, Asiatic black (*U. thibetanus*), spectacled (*Tremarctos ornatus*), sun (*Helarctos malayanus*), and sloth (*Melursus ursinus*) bears. Bush et al. (1980) studied blood gas, hematology, and biochemistry of North American black, sun, spectacled, and sloth bears. Nelson et al. (1973) deals with North American and Asiatic black bears and Brannon (1985) with North American brown bears. The blood profile of North American black bears has been studied most extensively (Hock 1966, Azizi et al. 1979, Matula et al. 1980, Palumbo et al. 1983, Nelson et al. 1984).

The purpose of this study was to provide the initial blood profile data for free-living and captive European brown bears from Croatia, Yugoslavia. We compared values of wild and zoo bears and analyzed the impact of capture on serum values.

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METHODS

Eight European brown bears were captured in foot snares in Plitvice Lakes National Park, Croatia, Yugoslavia, between November 1981 and April 1985. An additional 4 European brown bears from the Zagreb Zoological Park provided a control sample. Age, sex, weight, and sampling dates for all bears are presented in Table 1. All blood samples were taken while the bears were active (not hibernating). Blood samples were taken from bears immobilized with ketamine hydrochloride and xylazine. Young and subadult bears were easier to bleed; the femoral vein or artery was regularly used in these cases. In some adult male bears, jugular veins were used. Clotted blood samples were refrigerated at 4 C and were centrifuged within 12 hours to obtain serum; the samples were then frozen until analysis.

Depending on the amount of serum obtained, up to 13 variables for each sample were examined: glucose (Glu), lactic dehydrogenase (LDH), total protein (TP), total bilirubin (T. Bil.), serum glutamic-oxalacetic transaminase (SGOT), serum glutamic-pyruvic transaminase (SGPT), total lipids (TL), creatinine (Cre), cholinesterase (Ch. est.), creatine kinase (CK), triglycerides (Trigly), serum urea (Urea), and blood urea nitrogen (BUN). Serum samples were analyzed using Boehringer-Mannheim laboratory kits. Blood glucose was determined by Trinder's method (Trinder 1969).

Table 1. European brown bears studied in Croatia, Yugoslavia. Bears 1–8 and ET1 are free-living; Z-1 to Z-4 are captive bears.

Bear no.	Sex	Age (yrs)	Weight (kg)	Date of sampling
1	F	2	39	1 Nov 1981
2	M	4	135	17 Jun 1982
3	M	6	165	15 May 1983
5	M	7	222	9 Sep 1984
6	M	6	187	22 Apr 1985
7	M	2	55	23 Apr 1985
8	M	1	20	28 Apr 1985
ET1	F	7	82	28 Apr 1985
Z-1	F	5	94	7 Oct 1983
Z-2	F	3	47	14 Nov 1985
Z-3	M	6	121	9 Dec 1985
Z-4	F	8	132	9 Dec 1985

Standard *t*-tests were used to compare average values for different groups of bears.

RESULTS AND DISCUSSION

Serum biochemistry data for 8 free-living and 4 captive brown bears are summarized in Table 2. Some serum values varied significantly with sex and age class of the bears. Concentrations of total lipids were significantly higher ($P < 0.1$) in males than in females. Concentration of BUN was higher in adults than in young brown bears ($P < 0.05$). Seasonal differences could not be demonstrated.

There was little or no difference in glucose, total protein, total bilirubin, SGOT, SGPT, and Trigly between free-living and captive bears. The difference of creatine kinase activity in the blood of wild compared to captive bears was significant ($P < 0.05$). The enzyme creatine kinase lately has received attention because it is present in high concentrations in heart, brain, and skeletal muscles; acute vascular or traumatic damage to these tissues is promptly followed by an increase in creatine kinase activity in the serum (Jamnicky et al. 1978). The abnormally high values of creatine kinase activity in the serum of free-living brown bears was likely triggered by the disturbance and damage to skeletal muscles caused by the bears' efforts to escape from the snare.

The creatinine and LDH concentrations in wild bears were almost double compared to captive bears ($P < 0.01$ and $P < 0.1$, respectively; Table 2). BUN and urea were also higher, though not significantly so, in free-living bears. Brannon (1985) documented similar results for Alaskan brown bears and indicated they resulted from the increased protein metabolism necessary to sustain the strenuous exercise associated with capture.

Serum values for Trigly were similar in both groups of bears, but the total lipids values for wild bears were significantly higher than in captive bears ($P < 0.1$, Table 2). Lower lipid values in the blood of captive bears are probably caused by a diet relatively poor in fats and proteins.

Table 2. Average serum values for 8 free-living and 4 captive brown bears in Croatia, Yugoslavia.[a]

Blood parameters	Free-living bears			Captive bears		
	N	$\bar{x}$	SE[b]	*N*	$\bar{x}$[c]	SE[b]
Glu (mg/100 ml)	7	82.1	15.9	4	113.5	12.3
LDH (IU/1)	5	1262	155	3	726*	244
TP (g/100 ml)	6	7.98	0.75	3	6.24	0.68
T. Bil. (mg/100 ml)	8	0.327	0.104	4	0.418	0.042
SGOT (IU/1)	6	170	36	4	184.8	53
SGPT (IU/1)	7	34.0	10.3	4	24.9	8.6
TL (g/100 ml)	5	2.27	0.38	3	1.24*	0.22
Cre (mg/100 ml)	8	1.19	0.074	3	0.683***	0.078
Ch. est. (IU/1)	6	334	49	—	—	—
CK (IU/1)	6	1756	511	4	51.7**	16.4
Trigly (mg/100 ml)	5	250	53	3	359	67
Urea (mg/100 ml)	8	54.2	8.6	3	28.5	9.0
BUN (mg/100 ml)	5	20.7	3.2	3	13.3	4.2

[a] Two measurements have not been used for calculating this table because they differed more than 2 SD from the mean (600 SGOT; 13619 CK).
[b] Some SE values are small because of the discontinuous scales imposed by available laboratory techniques.
[c] Significance level of difference from free-living bears (*t*-test): * = $P < 0.10$; ** = $P < 0.05$; *** = $P < 0.01$.

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