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SELECTED CHEMICAL ANALYSES OF BLACK BEAR SERUM

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ABSTRACT

Serum of 23 black bears (*Ursus americanus*) from the Great Smoky Mountains National Park was subjected to selected chemical analyses in an attempt to establish baseline data for this species. Results of the analyses, when plotted against age, weight, or date of collection, revealed no apparent trends. Student's t-test revealed significant differences between the sexes for levels of calcium, phosphorus, and glucose.

INTRODUCTION

Previously hematological data on black bears has been obtained either from captive animals or has dealt only with whole blood parameters. King *et al.* (1960) collected blood from three wild bears and reported values for blood urea nitrogen. Erickson and Youatt (1961) presented data on serum total protein, albumin, globulin, and phosphorus; their sample consisted of four captive wild bears anesthetized four times in one year for collection of blood.

The purpose of the present study was to examine the composition of the blood serum of wild black bears trapped in the Great Smoky Mountains National Park. It is hoped that these data will help establish baseline information for future biochemical blood analyses in these animals.

METHODS

From 14 June 1974 to 8 August 1974, 24 blood samples were collected from 23 adult wild black bears (8 females, 15 males). One bear was recaptured, and a second sample taken.

Bears were captured in the Great Smoky Mountains National Park using spring snares. After the weight of each captured bear was estimated it was immobilized with M99 Etorphine at a dosage of approximately 1.9 mg/100 kg of body weight. After immobilization, basic data such as sex, weight and the general condition of the animal were recorded. One premolar was extracted and later used to estimate the age of each bear.

A 15 ml sample of blood was withdrawn from the femoral vein using an 18 gauge, 1½ inch (38 mm) needle and a 20 ml disposable syringe. After removal of the needle, the sample was gently expelled into a 20 ml stoppered glass tube and allowed to clot.

Samples were returned from the field within 2 to 5 hours after collection, and the serum was separated by centrifugation at 2400 rpm for 20 min. This process yielded 4 to 5 ml of serum, which was refrigerated and later taken to the Clinical Laboratory at The University of Tennessee Memorial Hospital. Most samples were delivered within 2 to 4 days after collection. When the specimens arrived in the Laboratory, they were immediately frozen at -20°C and were analyzed within two weeks of receipt.

In the Hospital Laboratory the serum samples were subjected to chemical analyses using the SMA 12/60® and SMA 6/60® (® Technicon, Inc., Tarrytown, N.Y.). The SMA 12/60 analyses included the following parameters: total protein, albumin, calcium, phosphorus, cholesterol, uric acid, creatinine, bilirubin, alkaline phosphatase, creatine phosphokinase (CPK), lactate dehydrogenase (LDH), and aspartate aminotransferase (SGOT). The SMA 6/60® profile included chloride, total carbon dioxide, sodium, potassium, blood urea nitrogen, and glucose. In addition electrophoresis of serum proteins on cellulose acetate using the Microzone® (Beckman Instrument Co., Inc.) electrophoresis system yielded data concerning the concentrations of albumin and the alpha, beta, and gamma globulin fractions.

RESULTS

The chemical analyses of serum utilizing the SMA 6/60® and the SMA 12/60® are summarized in Tables 1 and 2 respectively. Results obtained from electrophoresis of serum proteins are presented in Table 3. When these results were plotted against weight, age, or date of collection no apparent trends were revealed. The unpaired Student's t-test revealed a significant ($P<0.05$) difference between the sexes in calcium, phosphorus and glucose. Greater calcium and phosphorus values were obtained in males, while glucose values were greater in females. Values obtained from the SMA 12/60® analyses of LDH, CPK, SGOT, and albumin were not included in the presented data. All results are presented as means ± one S.E.

TABLE 1: *Chemical analyses of black bear serum using the SMA 6/60®*

	Age in yrs. (ave)	Weight kg	Cl^- meq/L	CO^2 meq/L	Na^+ meq/L	K^+ meq/L	BUN mg/dl	Glucose mg/dl
Female (N=9)	6.5	46	99±2.8	20±1.0[1]	138±2.2	3.9±0.1	9±3.8	178±19.0
Male (N=15)	5.0	66	94±2.4	20±0.8[2]	140±1.3	4.1±0.2	13±2.8	121±17.1
Range (N=24)	3.5-13.5	34-86	80-109	13-23	131-148	3.2-6.5	0-28	15-285

[1] N=7
[2] N=12

TABLE 2: *Chemical analyses of black bear serum using the SMA 12/60®.o*

	Age in yrs. (ave)	Weight kg	Total protein gm/dl	Ca^{++} mg/dl	I. phos. mg/dl	Chol. mg/dl	Uric acid mg/dl	Creat. mg/dl	Bilirubin mg/dl	Alk. phos. mll/ml
Female (N=9)	6.5	46	6.9±0.2	7.6±0.1	5.3±0.5	248±6.1	2.0±0.1	1.6±0.1	0.4±0.1	50±7.0
Male (N=15)	5.0	66	7.3±0.2	8.5±0.2	6.6±0.3	249±9.0	2.3±0.2	1.7±0.1	0.3±0.0	58±7.3
Range (N=24)	3.5-13.5	34-86	6.2-9.7	6.9-9.4	2.9-9.5	190-312	1.5-4.4	1.2-3.0	0.2-1.5	20-112

* Values for albumin, creatine phosphokinase (CPK), lactate dehydrogenase (LDH) and aspartate aminotransferase (SGOT) are not included.

TABLE 3: *Fractionation of black bear serum proteins using electrophoresis on cellulose acetate.*

	Age in yrs. (ave)	Weight kg	Albumin gm/dl	Globulin		
				Alpha gm/dl	Beta gm/dl	Gamma gm/dl
Female (N=8)	6.6	46	3.5±0.2	0.9±0.2	1.4±0.2	1.2±0.3
Male (N=13)	5.2	68	3.8±0.1	0.9±0.1	1.2±0.1	1.2±0.2
Range (N=21)	3.5-13.5	34-86	1.9-4.5	0.5-1.5	0.8-2.3	0.6-3.1

DISCUSSION

The results from four of the channels of the SMA 12/60® were not included in this report. The use of snares unavoidably produced muscle tissue trauma which probably resulted in the release of enzymes such as CPK, LDH, and SGOT from damaged cells (Tietz, 1970). In addition the unknown effect of the immobilizing drug M99 on enzyme activity combined with the elapsed time between collection and centrifugation of samples probably altered the results of these tests, so these data were not included. Also, the measurement of albumin on the SMA 12/60® utilizes a dye-binding reaction which is insensitive to non-human albumin, so the electrophoretically determined values were presented instead.

Although glucose levels were also subjected to the variables described above, the only factor which might introduce significant error into the results was the length of time between collection and centrifugation of the sample, during which time red cell metabolism causes a decrease in glucose concentration (Tietz, 1970). Erickson and Youatt (1961) suggested that glucose levels may be influenced by seasonally available foods, and Beeman (1971) reported that 39 percent of the summer food volume of black bears in the Park consists of high energy berries, which might explain some of the relatively high (>250 mg/dl) values found in the present study.

All of the bears exhibited disproportionate values for calcium and phosphorus when compared to normal ranges for human beings. These relatively low calcium and relatively high phosphorus concentrations are unexplainable at the present time. Erickson and Youatt (1961) suggested that elevated phosphorus levels during the summer might be a characteristic of this species.

Blood urea nitrogen values obtained in the present study are in general agreement with the values obtained by King *et al.* (1960), although both studies show considerable variations in this substance. Elevated BUN levels were consistently observed in injured bears. Total protein, phosphorus, and globulin values generally agree with values reported by Erickson and Youatt (1961). However, their reported serum albumin levels during July (5.0 gm/dl) are greater than values obtained in this study. Values for bilirubin reported in this study are probably underestimations due to the light-sensitive nature of this compound (Tietz, 1970) and the length of time between collection and analyses of the samples.

When the data were subjected to statistical analyses concerning relationships between age, weight, or date of collection and the measured parameters, no significant correlations were discovered. However, when the animals were grouped according to sex and the data were examined using the Student's *t*-test, the significant ($P \leq 0.05$) differences described above were observed in calcium, phosphorus, and glucose concentrations. In all cases, however, the significance of the observed differences cannot be accurately evaluated due to inadequate sample sizes.

The values reported in this study represent baseline data that will be used as a reference point for future studies of the serum biochemistry of the black bear.

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THE STATE OF AIR POLLUTION IN TENNESSEE

July 1, 1975, represented a milestone in the efforts to obtain cleaner air in Tennessee. The 1970 CLEAN AIR ACT established that day as the attainment date for the National Ambient Air Quality Standards (NAAQS).

It should be noted that substantial reductions in suspended particulates and sulfur dioxide emissions in the State have been realized since 1970. At present, the strategies being developed to deal with the Nation's energy problems may provide a major challenge for a cleaner environment.

The efforts of the Air Pollution Control Board and its staff, plus concerned citizens and citizen groups have accomplished this improvement in air quality.

Harold E. Hodges, P.E.
Director Division of Air Pollution Control
"Air Currents" September, 1975

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