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BLOOD AND URINARY VALUES IN THE GRAY SQUIRREL

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Abstract: Uric acid, blood urea nitrogen, glucose, total serum protein, cholesterol, triglyceride, calcium, magnesium, phosphorus, and chloride concentrations in the blood plus pH, bilirubin, ketone, blood, protein and glucose levels in the urine were determined for gray squirrels captured in Jacksonville, Florida. Significant differences were not noted for any of these values when compared by the age or sex of the animals, by breeding or lactation status, by month of capture, or by habitat type. Depressed blood glucose and elevated blood urea nitrogen levels were observed in squirrels with shock syndrome.

INTRODUCTION

Gray squirrels (*Sciurus carolinensis*) are an integral part of the urban wildlife fauna in the eastern half of the United States, in addition to being a major small game species in many areas. They have been introduced into portions of western North America and to other continents. Their potential for transmission of disease to man and his pets has been largely ignored. Consequently, the Veterinary Public Health Section of the Florida Division of Health (FDH) initiated an investigation into the health of and the diseases carried by urban gray squirrels. As part of this multi-faceted study, baseline information on selected values of blood and urine were obtained through cooperative efforts with the FDH Bureau of Laboratories and the Florida Division of Animal Industry Diagnostic Laboratory, Kissimmee. These results are presented in this report.

MATERIALS AND METHODS

Squirrels were captured alive in cage-type traps baited with peanut butter and pecans. The animals were from the city of Jacksonville, Florida and were trapped

each month of 1974. Thirty-six collection sites were employed, with a minimum of five squirrels captured per site. Three sites per month were sampled.

Each squirrel was immobilized with ketamine hydrochloride and exsanguinated via cardiac puncture, yielding 8 to 10 cc of blood. One aliquot of blood was placed in sodium fluoride, one in an anticoagulant for hematological studies, and the remainder was allowed to clot for two hrs. The serum was aliquoted into three portions: 1) serology, 2) cholesterol, triglyceride and total protein concentrations, and 3) calcium, magnesium, phosphorus and chloride concentrations. Aliquots 1 and 3 were frozen at -20°C until tested. Blood in sodium fluoride and serum aliquot 2 were immediately delivered to the FDH clinical chemistry laboratory.

In addition, urine was collected from the bladders of squirrels with a needle and syringe.

Blood, in sodium fluoride, was analyzed by semiautomated techniques for blood urea nitrogen (BUN), uric acid, and glucose concentrations.^{1,10,11} Serum cholesterol and triglyceride concentrations

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were also determined by semiautomated techniques.⁹ Total serum protein concentrations were determined by the biuret reaction.⁴ Calcium and magnesium concentrations in the serum were determined by atomic absorption spectrophotometric methods⁹ while the phosphorus and chloride concentrations were measured colorimetrically.^{2,12} The urinary samples were tested for pH, bilirubin, ketones, blood, protein, and glucose, using chemical reagent strips.²

RESULTS AND DISCUSSION

A total of 287 squirrels were captured. There were 125 males and 162 females. Squirrels ranged from less than 1 to 4 years of age,⁹ with 80% being less than 2 years old.

Serological results and hematological values for the squirrels have been reported elsewhere.^{7,13} Blood and serum chemistry values are presented in Table 1. BUN, blood glucose, blood uric acid, serum cholesterol and serum triglyceride concentrations were determined for five squirrels from each of the 36 collection sites. Serum samples from the remaining 107 squirrels were measured for calcium, magnesium, phosphorus and chloride concentrations. Total serum protein concentrations were determined for only 71 squirrels. There were no significant differences (t test, $P < 0.05$) for any of these values when compared by age or sex, by breeding or lactation status, by month of capture, or by habitat type.

There are few data with which to compare the findings of this study. Twelve

TABLE 1. Blood chemical values for *Sciurus c. carolinensis*.

Determination	No. of squirrels	Mean \pm standard error of the mean	Minimum and maximum
Blood glucose (mg/100 ml)	180	139 \pm 2.7	25-255
Blood urea nitrogen (mg/100 ml)	180	20 \pm 0.7	4-70
Blood uric acid (mg/100 ml)	180	1.0 \pm 0.0	0.5-2.3
Serum cholesterol (mg/100 ml)	180	248 \pm 4.3	124-448
Serum triglycerides (mg/100 ml)	180	125 \pm 6.2	20-496
Serum calcium (mg/100 ml)	107	9.0 \pm 0.1	7.0-14.5
Serum magnesium (mg/100 ml)	107	2.5 \pm 0.1	1.3-5.3
Serum phosphorus (mg/100 ml)	107	7.3 \pm 0.2	3.1-21.8
Serum chloride (meq/L)	107	115 \pm 1.0	80-155
Serum total protein (gm/100 ml)	71	5.5 \pm 0.3	3.7-6.6

² Bili-Labstix, Ames Laboratories, Inc., Elkhart, Indiana.

gray squirrels shot in Virginia averaged 110 mg/100 ml for plasma glucose and 146 mg/100 ml for plasma cholesterol,⁵ while captive animals averaged 110 mg for plasma glucose and 148 mg for plasma cholesterol.⁶ Squirrels in the present study had significantly higher mean plasma glucose and serum cholesterol concentrations than the Virginia squirrels.

Three squirrels developed shock syndrome within seven hrs of capture. The condition was characterized by muscular incoordination, inability to maintain orientation, convulsions, unconsciousness and rectal temperatures approaching 32 C (normal rectal temperature is 36.4 C⁷).

The mean plasma glucose level was 20 mg/100 ml with a mean BUN of 58 mg/100 ml. Changes were not noted in other parameters.

Urine samples were obtained from 160 squirrels. Mean pH was 6.4 (range 6-8). Mean protein concentration was 131 mg/100 ml, although 79% of the squirrels had values between trace amounts and 100 mg/100 ml. Ketonuria was observed in 47 animals with almost all reactions being minimal. Only 2 squirrels had evidence of glucosuria and 1 of bilirubinuria. Blood was not observed in the urine.

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