SEASONAL VARIATIONS IN TOTAL SERUM PROTEIN CONCENTRATION IN AN ESTUARINE RACCOON POPULATION

Authors: DOYLE, THOMAS J., HOFF, GERALD L., and BIGLER, WILLIAM J.

Source: Journal of Wildlife Diseases, 11(1) : 58-61

Published By: Wildlife Disease Association

URL: https://doi.org/10.7589/0090-3558-11.1.58

SEASONAL VARIATIONS IN TOTAL SERUM PROTEIN CONCENTRATION IN AN ESTUARINE RACCOON POPULATION

THOMAS J. DOYLE,[1] GERALD L. HOFF and WILLIAM J. BIGLER, Veterinary Public Health Section, Division of Health, Department of Health and Rehabilitative Services, State of Florida, P.O. Box 210, Jacksonville, Florida 32201, USA.

Abstract: Total serum protein (TSP) levels were recorded for the adult cohort in a population of southern Florida raccoons (*Procyon lotor marinus*) for a period of 1 year. TSP levels were found to fluctuate seasonally, with autumn levels being the highest and spring and summer levels the lowest. Values for males tended to be higher than those for females. There may be a correlation between mean TSP levels and mean body weight. In 10 male raccoons recaptured during the study period, the same pattern of fluctuation in TSP levels was observed.

INTRODUCTION

Published reports on physiological parameters of wild mammals have been largely restricted to laboratory colonies or captive individuals. Data on free-ranging animals although more meaningful, are also more difficult to obtain. In Florida, extensive investigations have been conducted on the use of the raccoon *Procyon lotor* as an environmental indicator of potential health problems. In order to do this it was necessary to establish representative baseline physiological parameters of free-ranging raccoons.[4] As an extension of that earlier work, the seasonal pattern of total serum protein (TSP) levels of the adult cohort in a population of estuarine raccoons, *P. l. marinus*, in southern Florida was monitored for 1 year.

MATERIALS AND METHODS

Adult raccoons were captured seasonally during 1973 in live traps on Marco Island off the southwest Gulf Coast of Collier County. Within 12 to 18 hours after capture, the animals were anesthetized with ketamine hydrochloride,[2] and bled from the cephalic vein, 2 to 5 minutes after administration of the drug. Convulsions were not observed in any of the animals. The serum was removed from the blood clot in less than 10 hours after the sample was drawn. All TSP levels were determined by the use of a serum protein meter[2] calibrated against raccoon serum proteins as determined by the biuret method.[4]

RESULTS

For the purposes of this study, spring was defined as March to May, summer June to August, autumn September to November, and winter as December to February. The mean temperature and total rainfall for each of these seasons during 1973 are given in Table 1.

[1] Present address: Department of Veterinary Science, College of Veterinary Medicine, University of Florida, Gainesville, Florida 32611, USA.

Reprint requests: Veterinary Public Health Section, Division of Health, Department of Health and Rehabilitative Services, State of Florida, P.O. Box 210, Jacksonville, Florida 32201 USA.

[2] Bausch and Lomb Incorp., Rochester, N.Y.

TABLE 1. Seasonal Variation of Total Serum Protein (TSP) Concentration (g/100ml) and Body Weight (g) for the Adult Cohort of a Population of Estuarine Raccoons in Florida.

Sex	Mean Temp.* Total Rainfall	Spring 23C 7.5cm	Summer 27C 64.6cm	Autumn 26C 27.9cm	Winter 18C 11.8cm
Male	N	20	19	21	17
	Mean TSP±SE	8.07±0.23	8.04±0.12	8.88±0.36	8.61±0.15
	Range	5.7 —9.5	6.9 —8.8	8.3—10.1	7.4 —10.1
	Mean Body Weight±SE	3814±216	3740±254	4330±220	3300±144
	Range	2655—6237	2551—8193	2845—8221	2410—5951
Female	N	8	9	17	25
	Mean TSP±SE	7.58±0.52	8.08±0.22	9.18±0.19**	8.17±0.19
	Range	6.6 —8.5	6.9 —8.9	7.6 —10.3	6.5 —9.8
	Mean Body Weight±SE	2813±169	2888±182	3330±225	2943±125
	Range	1984—3700	1984—3913	2268—5670	1869—4400

* U.S. Department of Commerce. Climatological data—Florida annual summary for 1973, Vol. 77, No. 13.

** Two fetal raccoons had TSP levels of 4.9 g and 5.4 g while the mother had a level of 9.6 g/100ml.

There were no differences in mean TSP levels for males and females between spring and summer and for males between autumn and winter (t test $p < .05$) (Table 1). Significant differences were noted for both groups between summer and autumn (overall mean, $p < 0.001$) and for female raccoons between autumn and winter ($p < .001$). A relationship between mean TSP levels and mean body weights for each group of raccoons, especially the females, may exist (Table 1).

Also 10 male raccoons were recaptured at least once during the course of the investigation (Table 2). The seasonal variations within the individuals reflect the overall pattern found in the population, i.e., a relatively high level in autumn and a low level in spring and summer.

TABLE 2. Seasonal Variation of Total Serum Protein Concentration (g/100ml) in Individual Male Raccoons.

Animal No.	Spring	Summer	Autumn	Winter
1	8.5	—	8.9	—
2	8.6	—	—	8.4
3	9.3	—	9.7	—
4	7.3	—	9.1	—
5	7.5	—	10.0	—
6	6.2	—	—	7.2
7	7.6	—	9.7	—
8		8.2	8.9	—
9		8.3	8.8	—
10			8.6	8.2
Mean (n)	7.86(8)	8.25(2)	9.23(8)	7.93(3)
Overall Mean* (n)	7.92(28)	8.05(28)	9.02(38)	8.35(42)

*From all raccoons shown in Table 1.

DISCUSSION

Variations in TSP levels have been associated with reproductive phenology in cervids,[1] hibernation and nutrition in rodents,[6,7] age and chronic infectious diseases in domestic animals,[5] and extrinsic environmental changes and shifts in diurnal rhythm of physiological parameters.[8] Information about most of these variables is lacking for the raccoon population that was sampled. The breeding activity of the raccoons from spring through summer appears to coincide with the lowest TSP levels in both males and females. The influence of condition, as reflected by body weight, on the variations observed between summer and autumn needs to be evaluated. The change in mean body weight of the male raccoons between autumn and winter, however, does not conform with the pattern observed in the female segment of the population.

Researchers and diagnosticians should be aware that TSP values in raccoons vary over a relatively wide range and this variation is associated with the time of collection. Ideally TSP surveys of free-ranging wildlife should consist of monthly samples from as many cohorts as possible with electrophoretic separation of the various protein components.[4] Intensive studies of selected species may help elucidate the factors influencing seasonal variation in TSP.

LITERATURE CITED

1. ANDERSON, A. E., D. E. MEDIN and D. C. BOWDEN. 1972. Total serum protein in a population of mule deer. J. Mammal. 53: 384-387
2 BIGLER, W. J. and G. L. HOFF. 1974. Anesthesia of raccoons with ketamine hydrochloride. J. Wildl. Mgmt 38: 364-366.
3. DAVIS, K. B. and A. H. MEIER. 1974. Seasonal and daily variations of sodium, potassium, and chloride levels in the plasma and brain of the migratory white-throated sparrow, *Zonotrichia albicollis*. Physiol. Zool. 47: 13-21.
4. HOFF, G. L., W. J. BIGLER, L. E. McELDOWNEY, D. W. PETERSON, J. P. TRAPP and P. C. HUDGINS. 1974. Blood and urinary values of free-ranging raccoons (*Procyon lotor*) in Florida. Am. J. vet. Res. 35: 861-864.
5. SCHALM, O. W. 1970. Clinical significance of plasma protein concentration. J. Am. vet. med. Ass. 157: 1672-1675.
6. WENBERG, G. M. and J. C. HOLLAND. 1972 The circannual variations on the serum protein fractions of the woodchuck (*Marmota monax*). Comp. Biochem. Physiol. 42A: 989-997.
7. WHITTEN, B. K., L. E. SCHRADER, R. L. HUSTON and G. R. HONOLD. 1970. Hepatic polyribosomes and protein synthesis: Seasonal changes in a hibernator. Int. J. Biol. Chem. 1: 406-407.

Received for publication 20 June 1974