CORTISOL AND ALDOSTERONE COMPARISONS OF COTTONTAIL RABBITS COLLECTED BY SHOOTING, TRAPPING, AND FALCONRY

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Source: Journal of Wildlife Diseases, 21(1) : 40-42
Published By: Wildlife Disease Association
URL: https://doi.org/10.7589/0090-3558-21.1.40
CORTISOL AND ALDOSTERONE COMPARISONS OF COTTONTAIL RABBITS COLLECTED BY SHOOTING, TRAPPING, AND FALCONRY

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ABSTRACT: Cortisol and aldosterone levels were measured in plasma of eastern cottontail rabbits (Sylvilagus floridanus) collected by three different methods, i.e., shooting, live-trapping and falconry. Cortisol levels ranged from near 0 to 27.5 µg/100 ml and aldosterone from near 0 to 220 ng/100 ml. Shot animals had significantly lower cortisol concentrations than those taken by either of the other methods. Trapped cottontails also had significantly lower aldosterone levels.

INTRODUCTION

Wildlife biologists are now routinely collecting physiologic data in addition to the normal demographic and morphometric information. Consideration of an animal’s physical and mental state is an important consideration whenever physiologic parameters are measured. Jacobson et al. (1978) demonstrated that handling wild eastern cottontail rabbits induced changes in several hematologic parameters. This paper complements those results with additional information regarding plasma cortisol and aldosterone concentrations in cottontails collected by shooting, trapping, and falconry.

The corticosteroid results presented by Jacobson et al. (1978) bring to our attention a measurable physiologic response by cottontail rabbits to confinement in a box trap. However, their variable, "serum corticoids," was measured using a corticosteroid-binding globulin prepared with 3H corticosterone (Sanders, 1974). Recent data indicate that cottontails secrete only limited amounts of corticosterone, i.e., they produce primarily cortisol (Hamilton and Weeks, 1985). Corticosteroid levels measured using a 3H corticosterone-labelled binding globulin are therefore of limited use in determining actual steroid concentrations in the cottontail, although they may reflect general changes in glucocorticoid levels. In this study, we demonstrate that capture methods have significant effects on plasma cortisol and plasma aldosterone concentrations. From an investigative perspective, these results call for care in interpreting results from capture-stressed animals.

MATERIALS AND METHODS

Rabbits were collected by falconry and trapping from Tippecanoe County, West Lafayette, Indiana or were shot on several state fish and wildlife management areas in northcentral and northwestern Indiana between February 1981 and March 1982. Cottontails were removed from 23 × 23 × 66 cm treadle-type traps 12–24 hr after capture, and a 3–5 ml blood sample was taken from the median artery or from a lateral vein of the ear with a heparinized disposable syringe. Xylene was applied to the ear to dilate vessels to allow easier extraction. Blood samples were centrifuged at 2,000 g for 15 min within 30 min of collection; plasma was stored frozen.

Animals collected by shooting were considered controls. These animals were shot from a vehicle at night with the aid of spotlights. Blood was taken by cardiac puncture immediately after collection to negate the possibilities of capture-induced hematologic changes. Subsequent handling of the sample was as above.

In addition to these two groups, rabbits were taken with a red-tailed hawk (Buteo jamaicensis) using standard falconry techniques. Blood was obtained in the same manner as for live-trapped animals. However, the time lag between the onset of the chase and sample collection was somewhat longer than for shot animals, i.e., 3–5 min. All animals were captured between 1300 and 1700 hr. Cottontails

Received for publication 23 September 1983.
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caught by falconry usually received only minor contusions and lacerations with few puncture wounds. The falconry portion of this project was an attempt to develop a system whereby normal physiologic data could be collected without killing the subject.

Concentrations of both cortisol and aldosterone were determined by radioimmunoassay (RIA). Plasma aldosterone concentrations were measured using a RIA kit produced by Abbott Laboratories (Diagnostics Division, North Chicago, Illinois 60064, USA) and cortisol with a RIA kit procured from New England Nuclear (North Billerica, Massachusetts 01862, USA).

Analysis of variance, using the transformation logarithm(X + 1) to normalize the data and correct heterogeneity of variances, was employed to determine differences between sexes and among collection methods and seasons. Differences among means were examined with Tukey's Honestly Significant Differences Test and the Scheffe Multiple Comparison Test. Because of possible variabilities introduced by age and reproductive state on plasma aldosterone concentrations due to differences in sodium balance between suckling young and lactating females, only adult rabbits were used in determining statistical differences with significance at α = 0.05. Plasma samples from 147 different rabbits were assayed for cortisol and aldosterone; individual samples were analyzed in duplicate and results averaged. The inter-assay coefficient of variability (CV) among five cortisol assays was 19.3%, while the intra-assay CV was 9.2%. The inter-assay CV among eight aldosterone RIA's was 28.9% and the intra-assay CV was 13.4%.

RESULTS AND DISCUSSION

Cortisol

Cortisol concentrations varied from near 0 to 27.5 μg/100 ml plasma. Shot animals had significantly lower cortisol concentrations than animals collected by either falconry or trapping (Fig. 1). Samples from shot animals should represent the best estimates of normal corticosteroid concentrations, since death was instantaneous, and these are hereafter specified as normal. In contrast to these levels, average cortisol values in trapped animals were approximately four times higher (Fig. 1). In one sample of 14 individuals captured by falconry, ten appeared healthy

24 hr after capture and showed no serious wounds at necropsy. The other four were killed at or shortly after capture because of injuries. We had hoped that blood samples taken from these animals would yield corticosteroid levels comparable to those of shot animals. Unfortunately, the data indicate that, on the average, the blood samples were not taken quickly enough to achieve normal physiologic levels of cortisol. Plasma cortisol concentration apparently had already begun to increase and therefore yielded mean values intermediate between the other two collection methods (Fig. 1). We suggest that capture and/or handling results in high cortisol levels. Thus, glucocorticoid concentrations from animals exposed to live-trapping or handling by investigators are of value only in comparison to samples from other rabbits in similar situations and are not indicative of values in free-ranging cottontails.

Aldosterone

Aldosterone concentrations were quite variable, ranging from near 0 to 220 ng/100 ml plasma. Statistical procedures were employed as discussed above, with no significant differences found between sexes. The effect of seasons and collection methods were significant. Trapped animals had significantly lower plasma concentrations of aldosterone than those collected by either shooting or falconry (Fig. 2). Dif-
different responses to capture in circulating levels of cortisol and aldosterone suggest that when an animal is stressed psychologically, priorities in corticosteroid release may shift from mineralocorticoids to glucocorticoids. Shifts in the opposite direction, i.e., a decrease in glucocorticoids and an increase in mineralocorticoids, have been demonstrated in sodium-deplete animals (Tait et al., 1970; Braverman and Davis, 1973).

In conclusion, assuming that the best estimates of normal corticosteroid concentrations are from shot animals (Scoggins et al., 1970), normal cortisol values were overestimated and aldosterone values were underestimated in blood samples taken from trapped or falconry-captured cottontail rabbits. The opposite responses of these closely-related steroids to capture and handling indicate a need for specificity in quantification of these hormones whenever possible in physiological studies dealing with the effects of investigator-induced stress. The inverse relationship between plasma cortisol and aldosterone levels seen in comparisons of shot and live-trapped individuals further suggests that there is a preferential release of glucocorticoids during and following capture. Increased production of one type of corticosteroid may inhibit release of the other.

ACKNOWLEDGMENTS

We thank Alan Parker for his help with the falconry portion of the project. Gary Fraser offered his time and support to all phases of the study. Marty Johnson contributed her laboratory expertise in RIA methodology. Journal Article 9616, Agricultural Experiment Station, Purdue University, West Lafayette, Indiana.

LITERATURE CITED


