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Plasma cortisol levels in captive wild felines after chemical restraint

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Abstract

Eight *Panthera onca* (Po), 13 *Felis concolor* (Fc), 7 *Felis yagouaroundi* (Fy), 7 *Felis tigrina* (Ft) and 5 *Felis pardalis* (Fp) specimens from São Paulo State zoos were used. All animals were restrained with darts containing 10 mg/kg ketamine and 1 mg/kg xylazine. Venous blood samples were collected as soon as possible (within 15-20 min) and serum was frozen until the time for cortisol quantification. Cortisol was determined using a solid phase radioimmunoassay with an intra-assay coefficient of 8.51%. Data were analyzed statistically by the Kruskal-Wallis test, followed by Dunn's multiple comparisons test, and the one-sample *t*-test, with the level of significance set at $P<0.05$. Data are reported as means ± SEM. Cortisol levels differed among the captive felines: Po = 166 ± 33^{a}, Fc = 670 ± 118^{b}, Fy = 480 ± 83^{b}, Ft = 237 ± 42^{ab}, Fp = 97 ± 12^{a} nmol/l (values followed by different superscript letters were significantly different ($P<0.001$)). Since most of the veterinary procedures on these species involve chemical restraint, these results show the necessity of preventive measures in order to minimize the effect of restraint stress on more susceptible species.

Key words
- Wild felines
- Plasma cortisol
- Captive felines

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Stress is defined as a change in homeostasis balance, usually resulting from environmental fluctuations. The animal's response to a stress stimulus may be divided into three phases: behavioral alteration, stimulation of the sympathetic system, and activation of the hypothalamic-pituitary adrenal (HPA) axis which results in a cortisol increase that can be measured to evaluate the stress response (1). Physical or chemical restraint is potentially the most stressful situation for a wild animal held in captivity (2). The method most often used for the examination of a large wild cat is chemical restraint. This procedure is necessary to insure the safety of the medical team and of the animal during a medical intervention. Basic knowledge about the biology of the species is necessary for efficient restraint and examination of wild animals. A significant increase in plasma cortisol has been observed in cats up to 20 min after the beginning of the experiment (3). The administration of ACTH was followed by an increase of 160 to 1360% in cortisol levels (4). The cats did not show a circadian rhythm of cortisol secretion (5,6). The present study was conducted in order to determine cortisol levels in captive wild felines submitted to the ketamine/xylazine restraint usually performed at zoos.

Forty adult captive felines from different São Paulo State zoos were used: 8 *Panthera*

Table 1 - Serum cortisol levels of captive felines 15-20 min after chemical restraint with ketamine (10 mg/kg)/xylazine (1 mg/kg) at different São Paulo State zoos.

Data are reported as means ± SEM for N animals. Values followed by different superscript letters were significantly different (P<0.001).

Species	Serum cortisol (nmol/l)
Panthera onca (N = 8)	166 ± 33[a]
Felis concolor (N = 13)	670 ± 118[b]
Felis yagouaroundi (N = 7)	480 ± 83[b]
Felis tigrina (N = 7)	237 ± 42[ab]
Felis pardalis (N = 5)	97 ± 12[a]
Average	333 ± 47

onca (Po), 13 *Felis concolor* (Fc), 7 *Felis yagouaroundi* (Fy), 7 *Felis tigrina* (Ft), and 5 *Felis pardalis* (Fp). All animals were restrained with darts with a short range tranquilizer blowgun and projectile syringes containing 10 mg/kg ketamine and 1 mg/kg xylazine. As soon as the animals fell, within 15-20 min, venous blood samples were collected and serum was frozen until the time for cortisol quantification with a solid phase radioimmunoassay kit (DPC, Coat-a-Count, Los Angeles, CA) at VRA-FMVZ-USP, with an intra-assay coefficient of 8.51% and sensitivity of 1.48 nmol/l. Data were analyzed statistically by the Kruskal-Wallis test to compare all animals, followed by Dunn's multiple comparisons test, and by the one-sample *t*-test to compare the mean of one species with a domestic cat reference, with the level of significance set at P<0.05. Data are reported as means ± SEM.

The results are shown in Table 1. Significant differences in cortisol levels were observed both between (P<0.001) and within (P<0.05) species.

Minimal stress during restraint is one of the aims of the zoo staff. Restraint is one of the most stressing procedures for a captive animal, with several effects on its behavior and activities. Unfortunately, the response to stress can be highly diverse among species and indeed among individuals within a species. The measurement of cortisol secretion is a reliable method to evaluate the response of the animals to a stress stimulus.

After the administration of ACTH (4,7,8) or physical restraint (3), maximal cortisol secretion was observed within 30 and 60 min in the felines. The mean plasma cortisol level observed in this experiment was 333 ± 47 nmol/l, a much higher value than observed in normal domestic cats, i.e., 35 nmol/l (9) and 87 ± 16 nmol/l (3). Po and Fp showed lower cortisol levels and Fc higher cortisol levels when compared with domestic cats (298 nmol/l) after *iv* administration of cosyntropin, a synthetic ACTH (10).

When compared with the plasma cortisol levels reported elsewhere (11) and considering that maximal cortisol secretion may occur 30 to 60 min after the stimulus, it was impossible to detect baseline levels. We now intend to evaluate the adrenal response to ACTH in each species, and to determine whether Fc has a faster activation of the HPA axis than the other wild felines evaluated or a higher stress response during restraint.

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