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Relationship between Gonadal Steroids and Corticosterone during Blood Sampling in Saker Falcons

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ABSTRACT: Blood sampling in manually restrained or ketamine (15 mg/kg given intramuscularly) treated saker falcons (*Falco cherrug*) induced an increased concentration in plasma corticosterone. Elevated plasma progesterone, oestradiol 17β, and testosterone concentrations also were observed in some of these birds. An inverse relationship was demonstrated between levels of corticosterone and progesterone, but not with the levels of other hormones. It is suggested that progesterone measurement should be taken into consideration when studying the influence of stressors in falcons.

Key words: Blood sampling, corticosterone, *Falco cherrug*, saker falcons, gonadal steroids, stressors.

Blood collection for endocrinological analysis allows monitoring many physiological, nutritional or disease conditions in birds of prey. Light sedation with ketamine can safely restrain falcons for collection of a blood sample (Samour and D'Aloia, 1996). Although ketamine sedation has many helpful features (Bywater, 1990), there are some problems including its effects on metabolism and the endocrine system (Chiasson et al., 1973; Hellgren et al., 1985; Lumeij, 1993). These authors have reported that poultry anesthetized with ketamine exhibit reduced adrenal weight suggesting some physiological changes in adrenal function. This study was conducted to investigate the relationship of blood concentration of reproductive steroids during ketamine sedation and manual restraint of saker falcons (*Falco cherrug*).

Jugular blood samples (0.5 ml) from 25 clinically normal adult female saker falcons were obtained by venipuncture using 23 gauge needles. The birds were admitted to Salman Falcon Hospital (Al-Areen Wildlife Park, Manama, Bahrain) for routine checks during hunting season (October to February, 1995). Birds were housed singly in a large fiberglass cages located in a closed room that was maintained with 12L : 12D photoperiod. Feeding and cage cleaning were the only direct contacts by humans with the birds. Falcons were sampled while either manually restrained (Group 1, n = 12) by holding the two unfolded wings by an assistant or while under light sedation (Group 2, n = 13) using 15mg/kg of ketamine hydrochloride (Vetalar, Parke Davis Ltd, Pontypool, UK) administered intramuscularly. Blood samples were collected into heparinized tubes, then centrifuged at 3,000 rpm for 10 min and plasma was separated and stored at −20 C until analysis.

Progesterone (P), oestradiol 17β (E_2), testosterone (T), and corticosterone (C) were measured by radioimmunoassay methods previously validated and described (Harvey et al., 1981; Homeida, 1986; Homeida et al., 1988). The specificities and cross reactions of the antisera used have been reported elsewhere; the respective intra- and interassay coefficients of variation were 7 (n = 10) and 10% for P, 6 (n = 11) and 10% for E_2, 9 (n = 11) and 10% for T, and 9 (n = 9) and 10% for C. Extraction efficiencies were 87% for P, 89% for E_2, 75% for T, and 83% for C (Dobson and Dean, 1974; Harvey et al., 1981; Homeida and Al-Afaliq, 1994). Results were corrected for recovery values.

Data are given for each bird in Table 1. Pearson's correlation coeffecients were calculated to determine the association between corticosterone and other hormones (Tallarida and Murray, 1981).

Blood sampling increased levels of C (Table 1) in plasma of five ketamine-treated birds (42%) and five manually restrained falcons (38%). Activation of the

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TABLE 1. Peripheral plasma concentration of corticosterone (C), progestrone (P), oestradiol 17β (E_2), and testostrone (T) in manually restrained (Group 1) or ketamine treated (Group 2) saker falcons in Bahrain.

Bird number	Group 1				Bird number	Group 2			
	C (ηg/ml)	P (pg/ml)	E_2 (pg/ml)	T (pg/ml)		C (ηg/ml)	P (pg/ml)	E_2 (pg/ml)	T (pg/ml)
1	8.0	1,300*	150*	220*	13	23.4*	270	120*	350*
2	22.3*	220	120*	120	14	26.1*	250	85	290*
3	25.1*	260	80	250*	15	6.5	1,250*	120*	160
4	7.5	1,200*	140*	270*	16	7.5	1,200*	130*	320*
5	21.3*	230	140*	350*	17	8.2	1,300*	70	310*
6	9.2	1,100*	130*	320*	18	9.1	1,220*	140*	290*
7	9.5	1,150*	60	360*	19	7.6	1,400*	160*	300*
8	10.1	1,200*	125*	370*	20	7.1	1,100*	120*	325*
9	8.2	1,350*	120*	250*	21	6.8	1,150*	50	115
10	24.6*	270	140*	130	22	20.1*	210	150*	320*
11	7.5	1,150*	130*	315*	23	22.6*	240	120*	170
12	19.3*	350	140*	290*	24	20.5*	260	65	330*
					25	7.2	1,250*	120*	320*

* Significantly different from other birds in the group at $P < 0.001$.

pituitaryadrenal axis of birds in response to stress like bleeding is well established and is generally reflected by increased concentrations of C in plasma of the peripheral circulation of birds (Holmes and Philips, 1976; Harvey et al., 1980). Handling and blood sampling are known to be stressful in birds like hawks and guinea fowl (Mays et al., 1991; Cooper, 1991; Cooper et al., 1996). Ketamine sedation has no effect on C response to venipuncture in falcons. Similar results were observed in goshawks, pigeons, monkeys and deer sedated with ketamine (Wessen et al., 1979; Fuller et al., 1984; Lumeij, 1993).

Elevated concentrations of P, E_2, and T were observed in both Group 1 and Group 2 falcons (Table 1) suggesting an active ovarian function in some of these birds (Hartelendy et al., 1993). No relation between C and E_2 ($r = 0.17$, n = 25, $P > 0.1$) or between C and T ($r = 0.06$, n = 25, $P > 0.1$) could be domenstrated. In past studies injections of oestradiol benzoate and testosterone propionate did not alter plasma concentration of C or luteinizing hormone in chickens (Wilson and Cunningham, 1980). An inverse ($r = 45$, $n = 25$, $P < 0.001$) relationship was shown to occur between levels of P and C (Table 1) suggesting that P may inhibit the rise in C concentration. It is shown that injection of P may suppress the pituitary-adrenal system and thus modulate the pattern of C secretion in chicken (Wilson and Cunningham, 1980) due to handling and bleeding. Thus, it appears that P measurement should be taken into consideration when studying the influence of stressors in saker falcons.

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