

## SEASONAL CHANGES IN HYPOTHALAMO-PITUITARY-ADRENAL AXIS FUNCTION OF RED DEER STAGS. (CERVUS ELAPHUS)

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Red deer stags undergo dramatic physical and behavioural changes from the nonbreeding to the breeding season (rut). To determine the effect of these changes on HPA axis function, endogenous cortisol secretion and cortisol response to exogenous ACTH were measured in six free ranging red deer (*Cervus elaphus*) stags, during November (velvet growth), February (pre rut), April (mid rut) and July (post rut). Plasma cortisol profiles were obtained from integrated 20 min blood samples collected over 24 hr by a remote blood sampling device (Drapac) from animals at pasture. The next day the Drapac system administered a bolus iv infusion of ACTH<sub>1-24</sub> (0.04 IU/kg) and collected integrated 10 min blood samples for 190 min from the same animals at pasture.

Unstimulated cortisol concentrations over 24 hr had a mean pulse frequency of  $0.80 \pm 0.02$  pulses/hr with no difference between seasons or across animals. Pulse amplitude differed across animals ( $P \leq 0.01$ ) and between seasons ( $P \leq 0.001$ ) with higher amplitude peaks observed in November ( $17.2 \pm 1.3$  ng/ml) than at other times (February,  $8.8 \pm 1.3$ ; April,  $5.1 \pm 1.3$ ; July,  $6.2 \pm 1.3$  ng/ml). The mean 24 hr cortisol concentration was also higher in November ( $12.5 \pm 0.9$  ng/ml) than February ( $6.3 \pm 0.9$  ng/ml), April ( $4.0 \pm 0.9$  ng/ml) or July ( $4.2 \pm 0.9$  ng/ml). There was no evidence of a circadian rhythm in plasma cortisol.

Peak cortisol concentrations following ACTH challenge were greater ( $P < 0.05$ ) in November ( $55.8 \pm 2.7$  ng/ml) and lower ( $P < 0.01$ ) in April ( $33.7 \pm 1.8$  ng/ml) than those in February and July ( $48.7 \pm 2.0$  ng/ml and  $45.4 \pm 2.0$  ng/ml, respectively). Season also affected area under the cortisol response curve, with the response during April ( $266.6 \pm 15.3$  ng/ml/190min) being less ( $P < 0.05$ ) than other times of year (February,  $366.1 \pm 15.3$  ng/ml/190min; July,  $340.7 \pm 15.3$  ng/ml/190min and November,  $387.8 \pm 21.2$  ng/ml/190min).

The current data demonstrate a strong seasonal effect on HPA axis function in the red deer stag. The apparent decline in HPA axis activity during the breeding season may be due to the inhibitory effect of testosterone on HPA axis activity, changes in metabolic function between rutting and nonrutting stags, or the effects of chronic social/nutritional stress experienced during the rut.