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**Corticosterone, fear behaviour and plasma
corticosterone responses to stressors in
Japanese quail**

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Abstract

Stress responses involve activation of the hypothalamo-pituitary-adrenal (HPA) axis and the secretion of glucocorticoid hormones, and can help animals cope with changes in their environments. Corticosterone is the primary glucocorticoid in birds and has metabolic actions, and can affect behaviour and reproduction. Stimuli that activate the HPA axis are called stressors, and stressors can be classified as either physical or emotional. When animals respond to emotional stressors they also experience fear, and the magnitude of a corticosterone response to an emotional stressor is thought to be related to the degree of fearfulness that is experienced by a bird. The great majority of studies have measured plasma corticosterone responses of birds to emotional rather than physical stressors, and corticosterone responses to emotional stressors are assumed to reflect the responsiveness of the HPA axis of birds to stressors in general. The aims of the research described in this thesis were to determine the effects of corticosterone on fear behaviour, reproductive function, and plasma corticosterone responses to stressors in Japanese quail (*Coturnix coturnix japonica*), both during and after treatment, and to examine if plasma corticosterone responses to similar emotional stressors, and to different types of emotional and physical stressors are related in individual quail.

Plasma corticosterone concentrations were significantly higher in quail treated with corticosterone in their drinking water compared with controls during a 21 day treatment period, and concentrations remained elevated eight days after treatment ended. Corticosterone had little or no effect on the fearfulness of quail in tonic immobility, novel object or open field tests of fear behaviour. Body weight, food intake, egg production and egg weight were significantly lower in some corticosterone treatment groups than in controls during treatment and for up to 22 days after treatment ended. Corticosterone concentrations in quail were generally unaffected after 24 h of fasting, so the effects of elevated plasma corticosterone on corticosterone responses to a natural stressor in quail could not be determined. Corticosterone had marked effects on the physiology of quail for several weeks after treatment ended, suggesting that chronic elevations in plasma corticosterone resulting from climate change or human disturbance could have negative affects in birds even after exposure to a stressor ends.

There were significant positive relationships between the magnitudes of plasma corticosterone responses to the emotional stressors of 15, 30 or 60 min handling followed by 45, 30 or 0 min confinement respectively in individual Japanese quail. Plasma corticosterone responses to 15 min handling followed by 45 min confinement are commonly measured in domesticated species of birds, and the findings of the present study suggest that magnitudes of responses to this standardised stressor may reflect the responsiveness of the HPA axis of birds to emotional stressors in general. Treatment with insulin and treatment with lipopolysaccharide (LPS) were shown to be physical stressors in quail, and doses and blood sampling times determined in insulin and LPS dose-response tests were used in a study of plasma corticosterone responses to emotional and physical stressors in quail. There were no relationships between corticosterone responses of individual birds subjected to emotional (handling) and physical (insulin and LPS) stressors, whereas there were significant correlations in responses of the birds to the two physical stressors. These results suggest that corticosterone responses of birds to standardised emotional stressors such as handling and confinement in domesticated species or capture and restraint in free-living species may not reflect the responsiveness of the HPA axis of birds to stressors in general. Given that quail displayed consistent individual differences in their plasma corticosterone responses to emotional stressors and to physical stressors, but magnitudes of corticosterone responses to both classes of stressor were unrelated in individual quail, these findings suggest that birds may possess at least two quite distinct stress responses to help them cope with changes in their environments.

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