Vetsuisse-Fakultät, Universität Bern 2018

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Free and bound cortisol in plasma and saliva during ACTH challenge in dairy cows and horses

Plasma cortisol represents the hypothalamic-pituitary-adrenocortical (HPA) axis activity. While most plasma cortisol is supposed to be bound, only free cortisol (FC) is involved in the metabolic and immunological regulation. Its proportion relative to total cortisol (TC) is affected by various circumstances. We have established a method to assess FC in cows and horses to interpret proportional changes of cortisol in saliva and blood following controlled HPA axis activation. Synthetic ACTH was i.v. administered to 8 dairy cows and 5 horses through a jugular catheter. Blood and saliva was collected every 30 min for 3 h and analyzed for TC, saliva cortisol (SC), the ratio of free cortisol (rFC), and the concentration of FC in plasma (cFC). During the entire sampling period, plasma TC was paralleled by cFC, rFC, and SC in both species. The ratio of SC to cFC in horses remained similar during the ACTH challenge suggesting that SC is recruited from plasma FC. In cows, however, SC increased less compared to TC and FC. In conclusion, the short-term activation of the HPA axis causes not only an elevation of TC, but also increases, similar in both species, the proportion of free cortisol. Saliva cortisol closely reflected changes of FC in horses, but less accurately in cows. The concomitant evaluation of changes among cortisol fractions might give further indications on adaptation mechanisms in glucocorticoid regulation and differentiate cortisol-related health disorders.

Key words: cortisol, free cortisol, corticosteroid binding globulin, ACTH challenge, hypothalamic-pituitary-adrenocortical (HPA) axis