

PROJECT REVIEW

"Glucocorticoid and performance: Possible mechanisms of action"

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It is generally accepted in the sporting world that glucocorticoid use enhance maximal performance, and, as a consequence, this pharmacological class is banned by the World Antidoping Agency (WADA) after systemic administration. Literature on the ergogenic effects of glucocorticoid intake appears, however, very scarce. Indeed, as a matter of fact, research is limited to a few studies for both acute and short-term administration. Using an animal model, Gorostiaga et al. (1988) showed that a single injection of glucocorticoids (cortisol acetate, 100 mg.kg body wt⁻¹) is capable of improving endurance in female rats. In contrast, Soetens et al. (1995) did not find any significant increase of maximal performance with 1 mg ACTH injection in professional cyclists. Similarly, we showed previously (2005, submitted) that an acute therapeutic administration of oral prednisolone (20 mg) does not improve the time of cycling until exhaustion during submaximal exercise (70-75% VO₂ max and 80-85%VO₂ max) in healthy moderately trained male volunteers, despite a probable increase in lipid oxidation and decrease in CHO oxidation (in press). Regarding published studies following short-term administration of glucosteroids, only one study has focused on the effects of short-term dexamethasone intake (0,5 and 1,5 mg per day for 4.5 days) (Marquet et al., 1999) during maximal exercise without demonstrating any ergogenic effect of the treatment. We recently demonstrated (in press), however, that short-term therapeutic prednisolone intake (60 mg per day for 7 days), contrarily to acute intake, significantly improved performance in healthy men during submaximal exercise (70-75% VO₂ max). The concomitant alterations in the hormonal and metabolic exercise parameters analyzed showed that short-term administration of this drug had both central and peripheral effects. Further studies will, however, be necessary to elucidate the mechanisms of these hormonal and metabolic changes in particular after short-term intake in order to determine which changes may be associated with the marked performance improvement obtained only after this mode of administration. Moreover, to our knowledge, no study has focused on women and a specific gender response to glucocorticoid can be questioned.

We therefore propose to contribute to a wider knowledge of glucocorticoid action mechanisms during exercise with in particular investigation of:

- 1) the ergogenic impact of these drugs in women;
- 2) the endocrine and metabolic responses after short-term glucocorticoid administration during longer exercise (3 hours), with regard to the gender status of the subjects in order to elucidate the mechanism(s) of action involved in the improvement in performance.

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Results and Conclusions

We showed in the first study that short-term therapeutic prednisolone (Cor) intake (50 mg per day for 7 days) improves significantly performance in healthy recreationally women during submaximal exercise (70-75% VO₂ max). ACTH and DHEA remained completely blunted throughout the experiment with Cor vs. Placebo (Pla), whereas growth hormone and prolactin were significantly decreased with Cor during exercise. No significant difference in insulin or blood glucose values was found between the two treatments, suggesting that women may be less sensitive than men to glucocorticoid-induced insulin-resistance.

These data indicate that short-term glucocorticoid intake improved endurance performance in women, but further investigation is needed to determine whether these results are applicable to elite female athletes.

In parallel, during a long-lasting exercise (2 hrs), no significant difference in glucagon, insulin or free fatty acid values was found between the treatments. However, essential amino acids (in particular BCAA) and blood glucose were significantly higher after Cor vs Pla during the second part of exercise.

It appears therefore that proteolysis probably increases with glucocorticoid during long-lasting exercise and that the related higher plasma EAA concentrations may contribute as energy substrates.

Regarding saliva DHEA and cortisol concentrations, they decreased strongly immediately after the start of prednisone treatment, demonstrating a rapid suppression of the HPA axis. However, it is only a short-lasting suppression, as 3 days after concluding prednisone administration, both saliva DHEA and cortisol had returned to pretreatment levels.

We can therefore conclude that: 1) this is no high risk of adrenal insufficiency after such treatment (i.e., 1 week at high therapeutic dosage). 2) non invasive saliva samples may offer a practical approach to assessing pituitary-adrenal function continuously during and after short-term corticosteroid therapy.

No significant change was found in body weight, body composition or food intake after 7 days of glucocorticoid treatment, which induces however a significant leptin increase. In parallel, no significant physiological repercussions were noted.

Such glucocorticoid treatment does not promote obesity in recreationally trained women. However, further studies are necessary to understand its stimulating effects on the metabolically active hormone leptin.

Publications

Short-term glucocorticoid intake improves exercise endurance in healthy recreationally trained women.

Le Panse B, Thomasson R, Jollin L, Lecoq AM, Amiot V, Rieth N, De Ceaurriz J, Collomp K.

Eur J Appl Physiol 107(4): 437-443, 2009.

Saliva DHEA and cortisol responses following short-term corticosteroid intake.

Jollin L, Thomasson R, Le Panse B, Baillot A, Vibarel-Rebot N, Lecoq AM, Amiot V, De Ceaurriz J, Collomp K.

Eur J Clin Invest 40(2): 183-186, 2010.

Short-term glucocorticoid and metabolic responses during long-lasting exercise

Thomasson R, Rieth N, Jollin L, Lecoq AM, Amiot V, Lasne F, Collomp K.

Eur J Appl Physiol submitted

Congress Presentations

Short-term glucocorticoid intake improves exercise endurance in healthy recreationally trained women.

Collomp K, Le Panse B, Thomasson R, Jollin L, Lecoq AM, Amiot V, Rieth N, De Ceaurriz J.

Abstract accepted (April 2010) in European Congress of Sport Science (ECSS) congress, Antalya, July 2010

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