THE EFFECT OF TRAINING ON STEROIDHORMONE PROFILE AND METABOLIC PARAMETERS IN COMBAT SPORTS

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INTRODUCTION

From the second part of the 1970th there has been an intense investigation on endocrinology and physical activity Sutton et al. (10). Hellemans (5) conducted research on untrained and trained population, the researcher suggested that the trained ones—because of the improved adaptation—are able to maintain their homeostasis more effectively. These individuals have better endocrine sensitivity. Different stress factors effect the plasma cortisol level. For example catecolamines reacted with an increase, testosterone decreased on the effect of physical activity. Studies conducted in different intensity zones proved, that cardiorespiratorical state is a key factor for given metabolic reaction to any submaximal workout Sutton (12). From the 70th the reaction of cortisol and testosterone for various type of exertion has been documented. Bloom et al. (1) during high intensity workout measured higher cortisol values at competitive cyclists than untrained cyclists. On the contrary Bopp et al. (2) demonstrated higher values with untrained population. The related literature demonstrates, that various training programs and methods will eventually result in different hormonal reaction. The effect of exercise on testosterone and androstendione, the testosterone/cortisol ratio, and the testosterone/sex hormone binding globulin ratio have also been studied. These researches have investigated aerobic activities Gugliemi et al. (3), Kuoppasalmi et al. (6), Lac et al. (7), Maron et al. (8), Sutton et al. (11), Vanhelder et al. (13). Hakkinen et al. (4) investigated the testosterone/cortisol and the
testosterone/SHBG value after aerobic type of training. Remes et al. (9) found similar results. Remes and his co-workers found a significant increase in plasma testosterone and androstendione concentration. They also demonstrated a significant (32 percent) increase in testosterone/SHBG ratio as well.

THE PURPOSE OF THE STUDY

We conducted a study with elite judoist and karate competitors men and women, investigating steroid profile and analyzing exhaled breath condensate during maximal treadmill test. We assume, that the treadmill protocol reliably describes physical abilities for a given sport.

The purpose of our study was to analyze and compare the effect of acute physical exercise on serum and urine anabolic-catabolic hormones, and on the cyclooxygenase enzyme mediators in combat sports. We found only very limited international and hungarian literature related to this field.

PARTICIPANTS AND METHODS

We asked to participate competitors of two dynamic olympic sports, judo and karate in our study. A heterogenous group of 13 male and 16 female judoists, and 10-10 karate competitor male and female members of the hungarian national team participated in this study. The subjects completed a standardised maximal treadmill (Jaeger LE 580 C) exercise test. The judo competitors executed a so-called „multi-stage” exercise test, on the other hand the karate
competitors executed a classical „vita maxima” type exercise test. The speed was set at 8 km/h; we increased the speed in every three minute by 2 km/h, with a constant 1.5 % incline (multi-stage exercise test). There was a one minute break between each stages for collecting capillary blood samples. The other (karate) group started their test with a constant 9 km/h speed, the incline was raised from the starting 5 % to 3 % in every two minutes. There was no rest during the exercise test.

Capillary and urine samples were collected at the pre-and post exercise stages. The serum sample of 10-10 karate competitors was analysed using radio-immunoassay technique. The urine steroids were measured at the judo group, using a gas-chromatography, combined with mass-spectrometry (GC-MS) device. We tested both women and men. They demonstrated different age, women were younger than men. They both executed maximal test, although with a different testing mode, so we were able to generalize their results.

At the final stage of our study-design the judo group was measured for cyclooxigenase enzyrne mediators from the exhaled breath condensate, while executing the above mentioned maximal exercise test. The purpose of this measurements was to determine the acute exercise induced changes in the concentration of cyclooxigenase enzyme mediators, prostaglandin E\(_2\) and tromboxane B\(_2\).

**RESULTS**

The concentration of anabolic hormones in the serum, such as testosterone, DHEA and androstendione have significantly
changed. The concentration of the main catabolic hormone, cortisol increased in judo players, but not in the karate group. The results of our study supports, that elite judoists were in excellent physical condition. The hormonal response due to the catabolic/anabolic effects is balanced. The karate players demonstrated no significant increase in plasma cortisol level, the intensity of the treadmill test primarily strengthened the anabolic effects. We experienced no changes in catabolic effects. The changes of serum DHEA concentration is worth to note. We suggest, that the changes in the level of DHEA and the hormonal adaptation are important demonstrators of the improved physical capacity. The change in concentration of adrenal cortex originated DHEA is less known, compared to cortisol and testosterone on the effect of exercise. We found significant increase in both groups (judo, karate), which supports that DHEA has an important effect on the adaptation of physical exercise.

The urine steroid profile showed a decrease in the level of inactive metabolites, androsterone and etiocholanolone in elite competitors. Among the analyzed hormones, we measured increase, although not significant, only in the concentration of DHEA and 11-beta-OH androsterone. This increase was negligible, so the level of 11-beta-OH androsterone eventually remained stable throughout the exercise test. We suggest, that the elevated serum concentration of DHEA and the metabolism in the liver explains the higher concentration.

The changes on the level of cyclooxygenase enzyme mediators are inversely related to exercise intensity. The changes in
TXB₂ are related to exercise intensity. We found, that physical activity has an effect on the level of PGE₂ and TXB₂ in the airways. We conclude, that these mediators have an important effect on the adaptation of the airways. The examination of biologically active substances - PGE₂ and TXB₂ - is a useful indicator of exercise-induced airway adaptation.

CONCLUSIONS

To summon our results we may conclude:

1. During acute maximal treadmill exercise test we found a significant increase in serum testosterone, androstendione and DHEA concentration in male judo and karate competitors. This increase was observable both during vita maxima and multi-stage tests. We suggest, that the change in concentration of serum testosterone, androstendione is due to the maximal exercise intensity.

2. The urine etiocholanolone concentration significantly decreased after acute physical exercise in male and female judoists.
3. The androstendione/etiocholanolone ratio is a sensitive characteristics for defining urine steroid profile.
4. Acute physical exercise did not effect the urine androsterone and DHEA concentration among male and female judoists.
5. The concentration of the urine testosterone, epitestosterone and 11-beta-OH etiocholanolone significantly decreased after exercise in females.
6. After exercise the changes in urine etiocholanolone concentration showed a positive correlation with epitestosterone levels.

Our results demonstrates, that the judo competitors-participants of the national team-were in excellent physical condition. The metabolic reaction for given load of workout is balanced, because the anabolic-catabolic effects levels out each other. At the karate group, there was no elevation in the level of cortisol, which suggests that the present exercise test primarily strengthened the anabolic effects. The catabolic effects remained literally unaltered.

Our study includes three new conclusions:

The change in concentration of adrenal cortex originated DHEA is less known, compared to cortisol and testosterone on the effect of exercise. The exercise test resulted in a significant change in hormonal concentration in both groups, which indicates that anabolic DHEA has a key role in hormonal adaptation to exercise.

We found no evidence of similar results in the related literature, so our findings are the first new conclusions of this study.

The changes on the level of cyclooxygenase enzyme mediators are inversely related to exercise intensity. The changes in \( \text{TXB}_2 \) are related to exercise intensity. We found, that physical activity has an effect on the level of \( \text{PGE}_2 \) and \( \text{TXB}_2 \) in the airways.

This findings are the second new conclusions of this study.

We conclude, that these mediators have an important effect on the adaptation of the airways. The examination of biologically
active substances - PGE$_2$ and TXB$_2$ - is a useful indicator of exercise-induced airway adaptation.

This finding are the third new conclusions of this study.

Our results provides further data about hormonal changes on the effect of physical exercise in combat sports. The changes in serum and urine steroid profile are related to the exercise-induced training adaptation.

Related literature


List of scientific publications

Scientific journals:


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