PECULIARITIES OF CORTISOL LEVEL CHANGES IN THE BLOOD OF ATHLETES AND UNTRAINED BOYS IN RESPONSE TO HEAVY POWER TRAINING LOADS

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Abstract

This paper investigated the problem of determining the impact of heavy power load, the nature of which is significantly different from the usual parameters used in athleticism on the level of cortisol in the blood of trained athletes and untrained young men. It is established that in the early studies, the use of the power load causes a decrease in the level of cortisol in the blood of both groups. In turn, the hormonal response to the proposed power load fixed during the three months of athleticism training, shows an increase of the level of the studied hormone in the blood after a training session in comparison with the state of rest. At the same time it has been revealed that despite the high level of adaptation of trained athletes to the power load, changing of a few parameters of the training load and the mode of physical activity cause the same hormonal response as in untrained young men.

Key words: cortisol level, heavy power load, intensity, motor activity regimen.

In the process of motor activity, which is a powerful stimulus for the endocrine system, the primary role of hormones is to maintain homeostasis by regulating the interaction of various tissues and organs of the body in order to counter various types of stress [5, 11]. Hormonal changes that occur under the influence of heavy and prolonged training load emphasize the important role of the endocrine system to meet the metabolic needs of the body, resulting from physical exercises [3, 4].

It is known that the hormonal response to the fulfillment of exercises depends on a significant number of important factors: the intensity and volume of exercises, the applied force, the duration of a single exercise or a training session, the level of adaptation to a particular type of exercises, training experience, the needs of homeostasis [10].

Despite the considerable amount of publications devoted to the hormonal response to different types of physical activity [3, 4, 9, 10], data characterizing the response of the endocrine system, particularly the nature and degree of change of cortisol in the blood of untrained young men in response to the acute power load during prolonged occupation athleticism, are relatively little. At the same time, there are virtually no data on the impact of the physical condition (fitness) level to change the content of cortisol in the blood in response to power training of various kinds in the course of employment athleticism.

The purpose of this paper is to determine the characteristics of changes in the hormone cortisol level in the blood of young men at different levels of fitness in response to power training during an extended period of athleticism training.
Materials, methods and investigation arrangement.

Basic materials which were used for analytical generalization of this research were the results of own experimental and laboratory investigation.

The study involved 20 athletes aged 19-20 years, regularly engaged in athleticism over three years, as well as 20 young men of similar age without contraindications for training with weights. All study participants were divided into two groups according to the condition level. The first group included trained athletes, and the second consisted of untrained young men.

As a model of muscle activity during the 3 months of training, the load of power nature was used. Surveyed members of both groups performed exercises of the following nature: the number of weight training - 4, in each exercise 4 series on 4 reps with 1 minute rest interval, the pace of the exercise is very slow (3/6 - three seconds in the catching mode, and 6 seconds the inferior mode); exercises are performed with partial amplitude (90% of maximum) and the mass of weights, in the circumstances, amounted to 65-68% of maximum. The total duration of a single training session for representatives of each group was about 29-32 minutes.

One of the main features of the proposed model of training load is a significant difference between the parameters of its components from those which were used by the first group of athletes in training for the last three years of athleticism practicing. This fact may allow more clearly assess the impact of the proposed power load on the nature and degree of cortisol change in the blood of young men with different levels of fitness.

All the young men who participated in the studies previously completed a full medical examination and comprehensive laboratory testing (9 indicators), the results of which did not have medical contraindications to participate in the experiment.

Power loading was evaluated in terms of the value of the training components used in the course of athleticism practicing. For this purpose the method of determining the index of the training load in athleticism was used. [8] Parameters of maximum power capacity of participants in the test exercises were registered; calculating of the load indicators such as the coefficient of the internal resistance (Ra), the relative weight of weights (Wa), the value of the power load (Wn), the index of the training load (ITNA) was done. Control of the studied parameters was performed four times with one month’s interval during the three months of regular exercise of athleticism.

Laboratory studies of serum for cortisol level were performed four times during the three months of athleticism training with an interval of one month. Each time in monthly monitoring on two blood sampling was conducted: before the exercise (at rest) and immediately after the training session. The concentration of cortisol level in blood serum was measured by enzyme immunoassay in a certified medical laboratory.

Research materials were subjected to statistical analysis using the software package "Statistics" in the system “Microsoft Excel-2010” focusing on physiologically acceptable norm of cortisol in the blood serum of healthy young men the age under research in the range of 150-660 nmol/l.

Research results and discussion

Table 1 shows the values of parameters of the power load to which the representatives of the two study groups were undergone during the three months of athleticism training. Analysis of the primary outcome indicates a significant difference between values of the indicators of the relative weight weights and quantities of power load between the two groups at the beginning of the experiment, due to the different levels of development of the power capabilities of their organism and fitness as a whole.
### Table 1

**The average value of parameters of the power load to which the study participants were undergone throughout the experiment, n=40**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Control stages</th>
<th>Initial data</th>
<th>After 1 month of training</th>
<th>After 2 months of training</th>
<th>After 3 months of training</th>
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</thead>
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<td></td>
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<tr>
<td><strong>Ra, RVU (coefficient of the internal resistance)</strong></td>
<td></td>
<td>0.71 ± 0.01</td>
<td>0.71 ± 0.01</td>
<td>0.71 ± 0.01</td>
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<td>0.71 ± 0.01</td>
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<tr>
<td><strong>Wa, kg (relative weight of weights)</strong></td>
<td></td>
<td>71.27 ± 0.76</td>
<td>82.32 ± 0.97</td>
<td>93.03 ± 1.16</td>
<td>98.74 ± 0.74</td>
</tr>
<tr>
<td></td>
<td></td>
<td>45.02 ± 0.34</td>
<td>57.14 ± 0.68</td>
<td>66.13 ± 0.59</td>
<td>72.11 ± 1.04</td>
</tr>
<tr>
<td><strong>ITNA, RVU (the index of the training load in athletics)</strong></td>
<td></td>
<td>0.87 ± 0.01</td>
<td>0.87 ± 0.01</td>
<td>0.87 ± 0.01</td>
<td>0.87 ± 0.01</td>
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<td></td>
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<td>0.87 ± 0.01</td>
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<tr>
<td><strong>Wn, kg/min (the value of the power load in athletics)</strong></td>
<td></td>
<td>475.13 ± 4.37</td>
<td>548.81 ± 7.76</td>
<td>620.20 ± 8.34</td>
<td>658.26 ± 5.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>300.13 ± 8.23</td>
<td>380.93 ± 4.67</td>
<td>440.86 ± 5.81</td>
<td>480.73 ± 6.33</td>
</tr>
</tbody>
</table>

**Note:** in the numerator - the medium-group results of the control group members, in the denominator - the medium-group results of the boys of the experimental group.

At the same time, fixed for three months of training athleticism index values of the coefficient of external resistance (Ra), showing the physical activity intensity level depending on the structure of the training and the conditions of its implementation do not show any changes in comparison with the initial data. The obtained results indicate that the proposed model of power load of a certain character has remained unchanged throughout the study period.

During the three months of research, changing of the relative weight of the weights parameter (Wa), which displays the most appropriate to the body’s functionality weight of the equipment in the given characteristics of the power load, show significant positive changes both among trained athletes (from +15.51 to + 6.13%) and untrained young men (from 26.92 to 9.04%). However, the rapid growth of the test results for the first month of training, the level of its dynamics depends on the growth of the strength capacity of an organism, and become less pronounced with each subsequent month of athleticism training suggesting a possible adaptation of young men to power loads of the character.

The measure of power load in athleticism (Wn) shows a similar trend to the change in the value. This indicator shows the amount of work done per unit of time, taking into account the structural features of the training sessions and the nature of power loads.

Thus, the study results indicate that the value of performance parameters of power load and the nature of its changes in terms of the identity structures of the workout and physical activity regimen for members of both groups depend on their level of fitness.

Figure 1 graphically displays the average-group values of cortisol content in the blood of trained athletes and untrained young men at rest and after exercises (strength training) over the three months of athleticism training.

Analysis of results fixed at the beginning of the experiment indicates that after the hard power load, there is virtually identical at the same time sufficiently substantial reduction (average -21.3% (p<0.05)) of cortisol level in the blood of both groups independently on their level of physical fitness and athletic
experience. It can be assumed that such a contrary character of hormonal response was due to a pronounced fatigue which developed during training sessions. [5]

It is known that changes in the level of cortisol in response to execution of physical exercises with the same relative intensity do not depend on the level of fitness of a human [9]. However, trained individuals may experience a more pronounced activation of the hypothalamic-pituitary-adrenal system in response to the exercises with loads exceeding the maximum [10].

Figure 1. The nature and degree of change of cortisol in the blood of athletes and untrained young men in response to the power load during prolonged athletic training, n = 40

Thus, based on the analysis of the obtained results and review of the special literature [5, 7], we can assume that fixed at the beginning of the experiment reduction of cortisol in the blood of untrained young men in response to the hard power load, perhaps can be connected with the fatigue or non-sufficient adaptation of the body to this type of stress. At the same time, reducing the strength training-induced cortisol levels in the blood of trained athletes is also possible due to the fatigue caused by the unusual parameters of physical activity component used by the contingent.

The results of the operational control of hormonal response to the power load fixed at the expiration of the first month of athleticism training demonstrate elevated levels of cortisol in the blood of trained athletes (8.69%), as well as untrained young men (6.51%) in comparison with the state of rest. At the same
time, there have been a significant increase in the relative weight of the weights (Wa) in boys of both groups (from +15,50% (p<0,05) in trained athletes up to 26,9% (p<0,05) in untrained) which value is directly dependent on the growth of the strength capabilities of the contingent.

After the second month of regular practicing athleticism it was revealed that the nature and degree of the change in the medium-group indicators of the studied hormone in the blood after the hard power load is almost similar to the results obtained a month ago, but shows a more pronounced trend (Figure 1). In its turn, against the background of a slight decline in the growth rate of power capacity of members of both groups, the values of the controlled parameters of power load continues to increase, but with a less severe progression (Table 1).

The research results fixed in both groups after the third month of training show a similar trend of the dynamics of controlled parameters which was observed in the hard power load after the second month of the studies, but again with a more pronounced change in the level of cortisol in the blood after exercising compared with the resting level (Figure 1). So in the group of untrained young men the level of the studied hormone in the blood increased after the power load by +31,57% (p<0,05) in comparison with the state of rest, and in the group of trained athletes - by +58,13% (p<0,05). Overall, despite the rather substantial change in the content of the studied hormone in the blood in response to the hard power load, cortisol level did not exceed the limits of physiological norm.

In its turn, the results of the control of basal cortisol level in the blood which is fixed for three months of athleticism training show a significant decrease of this index in the group of trained athletes (-37,76% (p<0,05)). A similar trend is demonstrated by a controlled rate in a group of untrained young men but with a less pronounced dynamics of the reduction in blood (-19,41% (p<0,05)), which is possible due to the different amount of the training carried out in [1, 3].

Thus, the results of studies on the nature and degree of hormonal response to the hard power load during three months’ athletic activities showed that the use of small number of repetitions (4 times) with weight of weights of 65% of the maximum in high intensity of the work (Ra=0, 71 cu) during power exercise leads to increase in cortisol levels in the blood plasma for both untrained young men and trained athletes. At the same time it was revealed that despite the high level of body’s adaptation of trained athletes to power load changing of a few parameters of training load and physical activity mode causes the same hormonal response as in untrained young men.

Conclusion

1. Results of the study of hormonal response to hard power load at the beginning of the experiment in the conditions of use in the athletic practicing of training load parameters which were unusual as for untrained young men and for trained athletes show a pronounced decrease in cortisol level in blood compared with data in the rest. It is possible to assume that such a contrary character of hormonal response was due to a pronounced fatigue developed during training sessions regardless the level of fitness of participants.

2. During the three-month training of athleticism it has been found that the hormonal response to the hard power load becomes more pronounced (significant increase of cortisol in the blood) with each following month of athleticism training. At the same time it has been revealed that despite the high level of adaptation of trained athletes bodies to power load, changing of a few parameters of training load and mode of physical activity causes the same hormonal response as in untrained young men.
Literature:


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