

STUDY OF THE DEVELOPMENT OF THE SOMATOTROPIC FUNCTION OF THE PITUITARY AND ADRENAL GLAND IN ADOLESCENT BOYS

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Abstract. *In order to determine the functional reserve of the somatotrophic function of the pituitary gland and, to a certain extent, the body's ability to grow, a comparative assessment of the changes in the amount of somatotropin in the blood was carried out both in the state of rest of the body and during physical stress. In order to deepen the ideas about the regulation of height growth by hormones during puberty, the reaction of the pituitary gland (by somatotropin) and the adrenal gland (by cortisol) was studied simultaneously under conditions of physical stress and physical stress. Step-by-step increase in exercise under conditions of physical stress (work on a bicycle ergometer).*

Keywords: *hormones, pituitary gland, somatotropin, adrenal gland, cortisol, physical stress, adolescents, puberty.*

Determination of the amount of somatotropin and cortisol in blood plasma was carried out by the IFA method. The analysis revealed that under the influence of physical stress, the activity of the somatotrophic function of the pituitary gland increases. During physical stress, the amount of cortisol concentration temporarily decreases and returns to normal after a certain time. During physical exertion, the physiological reaction of the pituitary gland (with somatotropin) and the adrenal gland (with cortisol) was observed. If one of them has a low amount in the blood plasma, the concentration of the hormone in the blood increases during physical exertion, and if the amount of the second one is high in the blood plasma, physical stress decrease is observed during the ripening period.

Actuality

The growth, development and adaptation processes of the organism occur under complex hormonal control. Somatotropin plays a special role in the hormonal regulation of the functions of the growing body. The age-related aspects of the somatotrophic activity of the pituitary gland have been studied since recently [1-3]. At the same time, in most cases, these studies are of a fragmentary nature, and their shortcoming is the lack of such observations, the difference in the age structure of the groups, and the fact that the results are not always obtained using the necessary methods. In most studies, blood hormones were measured at a limited time interval, i.e., mostly in a state of relative rest [4-6]. According to modern concepts, the level of increase in the content of somatotropin in response to a stimulus is very important for the characteristics of the somatotrophic function of the pituitary gland. To study the somatotrophic function of the pituitary gland, various functional strains are usually used. At the same time, it can be concluded from the studies available in the literature that physical exertion is enough to determine hormones in the blood [6-8]. Firstly, the effect of physical stress on the body can be strictly

dosed; secondly, the positive effect of physical activity on the growth and development of the organism has been noted in many works; thirdly, physical activity leads to various changes in the activity of the pituitary gland (somatotropin). This information determines the relevance of our work. Examination of the somatotropic activity of the pituitary gland during puberty in boys at rest and during physical stress allows for a full and sufficient assessment of the functional capabilities of the pituitary gland.

The essence of the research is to study the reaction of the pituitary gland caused by changes in the secretory activity of endocrine organs under the influence of various physical stresses that lead to changes in the body's adaptive systems. At the same time, conducting a comparative assessment of the somatotropic function of the pituitary gland in adolescents during the period of growth and development in relation to physical stress of different intensity and duration, comparing the nature and dynamics of the indicators studied under physical stress, Our main tasks are to determine the specific features of the changes, to describe the general characteristics of the pituitary gland's response to the studied physical stresses, as well as to compare the reactions of the pituitary gland (somatotropin) and adrenal gland (cortisol) to various physical stresses. Under the influence of somatotropin and cortisol, energetic and homeostatic maintenance of muscle activity is observed. Cortisol is subject to a rhythmic rhythm, its highest concentration occurs in the morning and in the first half of the day. Cortisol immediately responds to physical stress, under the influence of cortisol, the level of glucose is normalized, the amount of energy reserves of the body increases, the work of the heart muscle is activated, the activity of the brain, thinking and coordination are improved. As a result, there is a sharp increase in efficiency and physical activity. Too much cortisol production can lead to fatigue and weakness over time. Because as a catabolic hormone in the body, it accelerates the process of decay in the body. The most effective way to reduce cortisol levels is to eliminate stress.

The main goal of our research . It is an age-related study of the somatotropic properties of the pituitary gland and adrenal gland in healthy adolescent children.

The purpose of the study : to study the somatotropic function of the pituitary gland and adrenal gland during physical stress in adolescent boys.

Material and methods

Healthy adolescent children aged 8 to 17 years were taken under observation. Children were conditionally divided into 5 age groups: 8-9 years old, 10-11 years old, 12-13 years old, 14-15 years old, 16-17 years old. The functional capabilities of the somatotropic function of the pituitary gland and the adrenal gland were studied using special tests. Physical stress was dosed individually. The physical effort required to reach a heart rate of 170 beats per minute was calculated based on the formula. The unit of power obtained from the calculations was achieved by gradually changing the frequency of the stair step. After physical exertion, the real pulse rate in practice corresponded to the calculated one - 170 beats/min. In 16-17-year-old boys, cycling ergometric loading was also performed in order to determine the functional capabilities of the pituitary gland and adrenal gland. This test was carefully calibrated to the subject's weight and performed in an incremental fashion. The activity level of pituitary and adrenal gland hormones was studied by the IFA method before loading and after loading. Blood sampling was performed 15 minutes before cycle ergometric loading.

Results and Analysis.

The results of the study showed that the initial level of somatotropin varied from 0.5 to 12.0 ng/ml, and the average value was 2.5 ± 0.2 ng/ml, that is, the hormone level was variability is preserved even after physical stress. In response to physical stress, there is an increase in the activity of the pituitary gland. The analysis revealed that physical exercises do not lead to unification of the physiological state of the body, because the secretion of somatotropic hormone fluctuates throughout the day. At the same time, the maximum amplitude of STG secretion is recorded an hour or two after going to sleep and lasts for about 2 hours. A deep and restful night's sleep increases the production of somatotropic hormone. Somatotropin's anabolic and fat-dissolving properties need to increase at night [2]. Our studies have shown that the pituitary gland shows three types of response to physical stress: an automatic increase or decrease in the amount of the hormone compared to the previous amount (a compensatory change of the hormone to the amount before the physical stress, its initial depending on the level, self-regulation occurs) This situation should be taken into account during stimulating and inhibiting hormone therapy. The body's reactivity depends on the initial level of the hormone in the blood, because there is a certain relationship between the initial hormone level and the speed of the reaction: the lower the initial level of the hormone in the plasma, the faster the reaction occurs.

Thus, the type and speed of response of the pituitary gland to the functional load in boys is determined by the initial level of its activity. As far as we can see, the types of reactions are completely equivalent from a physiological point of view. Because absolutely healthy children took part in the research, and there were differences in the condition of the subjects after testing their physical activity.

In general, regardless of the strength and volume of physical work, we observed an increase in somatotropin concentration in the blood in the first minutes after physical activity, and it takes some time for the hormone level to reach its maximum value. Therefore, the transition of the somatotropic function of the pituitary gland to a new level of activity has a clearly expressed individual character: in some patients it is relatively fast, and in others it is slower.

In addition, during the V02 analysis test, the boys were subjected to physical stress. The analysis of the overall results showed that the greater the intensity and duration of the stress, the faster the increase in pituitary activity and the maximum increase in somatotropin level. and there is a long hold on these indicators. In our studies, work on a cycle ergometer was performed for 9.8 ± 0.2 minutes. Therefore, it was noted that the reaction of the pituitary gland reached its maximum value immediately after stress. Although the increase in the concentration of somatotropin was detected immediately after the stress, the pituitary gland was kept in a long-term active mode for 45 minutes after the physical stress.

To study the development of the somatotropic function of the pituitary gland, we observed the age dynamics of the somatotropin level and the features of the response of the pituitary gland to physical load in children of different ages (Table 1).

The results of the study showed that the activity of the pituitary gland in children of different ages (before exercise) is characterized by wave-like changes. Thus, it was found that the level of somatotropin in 10-11-year-old children was much higher than in 7-9-year-old children ($P < 0.05$). At the age of 12-13, the hormone level significantly decreases compared to the previous age group ($P < 0.05$). In the next age period (14-15 years), the level of the hormone

increases again (P 4.01), but only at the age of 16-17, it almost does not change compared to the previous period (Table 1).

Table 1.

Indicators of somatotropin level in blood plasma (ng/ml) in boys of different ages depending on physical load

Observations	Age and years				
	7-9		12-13	14-15	16-17
Before physical loading	0.5-5.7		0.7-5.7		
After physical loading	0.7-9.6	0.7-8.9			
Follow up number of children	8	23	20	27	34

Dispersion of individual indicators of hormone level in early age periods and increase of hormone amount with increasing age was observed. Especially noticeable variation in hormone levels is observed in boys aged 16-17 years.

Analyzing the response of the pituitary gland under physical stress, according to chronological age, revealed a common feature for all age groups: the concentration of somatotropin reached its highest value at 45 minutes after physical stress. The largest range of fluctuations in the activity of the pituitary gland was observed at the age of 12-13 years, the reactivity of the pituitary gland increased by an average of 2.9 times. It is precisely at this age that the period of puberty "growth" takes place intensively. At the same time, the level of somatotropin in the blood of 13-year-old children without physical exertion was recorded (1.3±0.2 ng/ml). However, 13-year-old children had the greatest increase in the blood hormone during physical exertion (in relation to body length and weight). The initial indicator of hormone concentration does not allow to assess the level of functioning of the pituitary gland. When evaluating the age dynamics of the somatotropic function of the pituitary gland, it is necessary to take into account not the initial level of somatotropin, but also the characteristics of the response of the pituitary gland (according to somatotropin).

The nature of the dynamics of age-specific changes in the level of somatotropin before and after stress indicates the heterochronic nature of the development of the somatotropic function of the pituitary gland. The analyzes carried out in each age group showed that the lowest indicators of STG concentration in the blood were recorded in 11, 14 and 17 years old compared to physical exertion, in the absence of physical exertion, the indicators of this hormone were higher in this group. was

Under the influence of physical stress, the level of changes in the concentration of somatotropin in the blood to some extent reflects not only reserve and adaptive (in terms of somatotropin) pituitary gland, but also the potential growth potential of the organism. It is known that somatotropin, which has a metabolic and morphogenetic effect, has a significant, sometimes decisive effect on the processes of growth, differentiation and formation of the body. allows to come to the conclusion that

Cortisol, which is 800/0 of adrenal hormones, plays an important role in adaptive reactions of the body. Simultaneous study of the effects of pituitary and adrenal gland hormones

in relation to various physical stresses and comparative assessment of their potentials is of particular interest and allows for a broader description of the endocrinological aspects of the state of stress response and flexibility. It is logical to compare the level of somatotropin with cortisol under stress, since somatotropin and cortisol are the final products in the chain of regulation and adaptation, regardless of the difference between somatotropin central (pituitary gland) and cortisol peripheral (adrenal gland).

Baseline cortisol levels in boys ranged from 1.3 to 105 ng/ml, with a mean of 32.5±2.5 ng/ml. In response to physical activity, a significant decrease in the activity of the adrenal gland was found. The coefficient of change of the hormone level after exercise slightly increases compared to before.

Thus, hypophysis and adrenal glands react differently under the influence of submaximal physical activity. According to studies, the reactivity of the pituitary gland under the same type of physical stress is 10 times higher than the reactivity of the adrenal gland. The response of the pituitary gland and adrenal gland to the load depended on the level of their initial activity.

The same character of the dynamics of the coefficients of changes of both hormone levels was determined in conditions of physical activity, when it reached its maximum value in the 15th minute after exercise.

Summary

1. In studying the influence of somatotropin on growth processes in boys, it is important to determine the concentration of the hormone in relation to physical stress. This condition is clearly expressed in 13-year-old boys.

2. Compared to the pituitary gland with adrenal hormones, the response observed by the pituitary gland (somatotropin) is longer and more stable, but the adrenal gland responds faster to physical boredom, which reflects the role of cortisol in the rapid mobilization of the body's adaptive capabilities under the influence of physical exertion.

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