

The results of the study of the level of serum cortisol as a hormone affecting the exchange of connective tissue in children and adolescents with different clinical refraction.

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Annotation. Cortisol is a hormone that is formed in the adrenal cortex. It protects the body from stress, regulates blood pressure, participates in the metabolism of proteins, fats and carbohydrates. The release of cortisol is regulated by the adrenocorticotrophic hormone (ACTH) produced in the pituitary gland, a small gland located on the lower part of the brain. The concentrations of ACTH and cortisol in the blood are regulated by the feedback method. A decrease in the concentration of cortisol increases the production of ACTH, as a result of which the production of this hormone is stimulated until it returns to normal. An increase in the concentration of cortisol in the blood, on the contrary, leads to a decrease in the production of ACTH.

Key words. Cortisol, ACTH, CT, PVHRD

Cortisol is a hormone produced in the adrenal cortex. It protects the body from stress, regulates blood pressure levels, and participates in the metabolism of proteins, fats, and carbohydrates. The release of cortisol is regulated by adrenocorticotrophic hormone (ACTH), which is produced in the pituitary gland – a small gland located at the base of the brain. Concentrations of ACTH and cortisol in the blood are regulated by a feedback mechanism. A decrease in cortisol concentration increases ACTH production, which in turn stimulates the production of this hormone until it returns to normal. Conversely, an increase in cortisol concentration in the blood leads to a decrease in ACTH production.

Therefore, cortisol concentration in the blood can change due to increases or decreases in the secretion of either cortisol itself in the adrenal glands or ACTH in the pituitary gland, for example, in the case of a pituitary tumor secreting ACTH.

A decrease in cortisol production may be accompanied by nonspecific symptoms: weight loss, weakness, fatigue, decreased blood pressure, and abdominal pain. In combination with reduced cortisol production and severe stress, an adrenal crisis may sometimes develop, which requires emergency medical care.

The results were analyzed based on cortisol level data obtained from laboratories at the place of residence. As is known, metabolic processes in connective tissue (CT) are directly and multifactorially influenced by hormonal factors: glucocorticoids and steroid hormones (cortisol, testosterone, estradiol). Hormones regulate the synthesis and catabolism of collagen, exerting anabolic (androgens) and catabolic (cortisol and its derivatives) effects on metabolism. As noted above, studies of the pathogenesis of progressive myopia reveal disturbances in metabolism within the body's connective tissue system. Most likely, among the many causes of impaired overall connective tissue metabolism and collagen structures in the sclera, hormonal shifts are one of the leading factors.

Few studies dedicated to examining hormonal status in adolescents with progressive myopia have identified imbalances in both sex hormones (testosterone and estradiol) and glucocorticoids (primarily cortisol). It is evident that for more complete information and a reliable assessment of hormonal influence on the development of myopia and its complications, research in this direction

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should be continued. The purpose of this fragment of the work was a comparative study of cortisol levels as an active regulator of connective tissue metabolism in the blood serum of children and adolescents with various clinical refractions. To achieve this task, 155 children and adolescents aged 9 to 17 years (13.4 ± 2.1 years) with various clinical refractions were examined: 20 with mild myopia, 32 with moderate myopia, 85 with high-degree myopia, of which 36 had congenital and 49 had acquired (mainly in early childhood) myopia. In 32 children (20.6%), various forms of peripheral vitreochoroidal retinal dystrophies (PVCRD) were detected on the fundus. To assess hormonal status, cortisol levels in blood plasma were determined in the morning hours on an empty stomach using a standard method. According to laboratory practice, normal cortisol levels for children and adolescents up to 16 years old range from 83-580 nmol/L; however, these data were obtained without considering refraction. Therefore, in our study, a control group was formed consisting of 18 children with emmetropia or mild to moderate hypermetropia. The range of serum cortisol values obtained in this group was used by us as a reference interval for comparison with indicators obtained in children and adolescents with myopia. The study results are presented in Table 7 and Figure 17.

Table 1. Cortisol Levels (nmol/L) in the Blood Serum of Children and Adolescents with Various Clinical Refractions ($M \pm m$)

| Group | Mild Degree | Moderate Degree | High Degree (Full, Uncomplicated) | High Degree (Full, Complicated) | Congenital High Degree (Full, Uncomplicated) | Congenital High Degree (Full, Complicated) |
|-------------------------------|------------------|--------------------|-----------------------------------|---------------------------------|----------------------------------------------|--------------------------------------------|
| Control | 335.8 ± 40.9 | - | - | - | - | - |
| Acquired Myopia | 290.7 ± 58.6 | $250.9 \pm 26.4^*$ | $243.9 \pm 20.5^*$ | $247.6 \pm 30.1^*$ | - | - |
| Congenital High-Degree Myopia | - | - | $236.3 \pm 29.3^*$ | $339.4 \pm 33.2^{**}$ | $413.7 \pm 48.8^{**}$ | $287.4 \pm 38.6^{***}$ |

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○ Difference from control is significant, $p < 0.05$. ** - Difference from the corresponding indicator of acquired myopia is significant, $p < 0.05$. *** - Difference from the corresponding indicator of uncomplicated myopia is significant, $p < 0.05$.

As a result of our studies, it was established that in children and adolescents, as refraction strengthens, there is a relative decrease in cortisol levels in the blood serum. If in acquired mild myopia the cortisol level was 290.7 ± 58.6 nmol/L and was slightly lower than the control (335.8 ± 40.0 nmol/L), then in moderate myopia it was reduced to 250.9 ± 26.4 nmol/L, and the differences from control values became statistically significant ($p < 0.05$). The obtained data provide grounds to suggest that hormonal imbalance, namely, disruption of cortisol metabolism, may be one of the causes of general biomechanical disturbances in the connective tissue system of children and adolescents with progressive myopia, as well as a sign indicating the presence of such disturbances. Possibly,

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under certain prerequisites during the active growth period of the child, features of hormonal status that initially do not exceed normal limits, under the influence of a certain lifestyle, unbalanced nutrition, and adverse physical and psychological factors, may lead to a shift in hormonal balance, which in turn can negatively affect metabolism as a whole and, as a consequence, cause dysfunction of organs and systems, including CT, i.e., become a factor contributing to the impairment of the sclera's supportive properties.

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