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HORMONAL BALANCE AND ENDOCRINE SYSTEM FUNCTION: HYPOTHALAMIC-PITUITARY AXIS

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Annotatsiya. Ushbu maqolada endokrin tizimning inson organizmidagi asosiy vazifalari, gormonlarning kimyoviy tarkibi va ta’sir mexanizmlari, shuningdek gipotalamus-gipofizar tizim orqali gormonal muvozanatning nazorat qilinishi tahlil qilinadi. Shuningdek, gormonlarning nerv tizimi bilan o‘zaro aloqasi, stress holatlaridagi funksional o‘zgarishlar va gormonlar ta’siridagi fiziologik javoblar ilmiy asosda yoritiladi.
Kalit so‘zlar: Endokrin tizim, gormonlar, gipotalamus, gipofiz, gormonal muvozanat, stress, nerv tizimi, fiziologik ta’sir, o‘sish gormoni, somatostatin.
Abstract. This article explores the main functions of the endocrine system in the human body, the chemical nature of hormones, and their mechanisms of action. Special emphasis is placed on the regulation of hormonal balance through the hypothalamic-pituitary system, as well as the interaction of hormones with the nervous system and physiological changes during stress conditions.
Keywords: Endocrine system, hormones, hypothalamus, pituitary gland, hormonal balance, stress, nervous system, physiological response, growth hormone, somatostatin.
Аннотация. В данной статье рассматриваются основные функции эндокринной системы в организме человека, химическая природа гормонов и механизмы их действия. Особое внимание уделяется регуляции гормонального баланса через гипоталамо-гипофизарную систему, а также взаимодействию гормонов с нервной системой и физиологическим изменениям в условиях стресса.
Ключевые слова: Эндокринная система, гормоны, гипоталамус, гипофиз, гормональный баланс, стресс, нервная система, физиологическое воздействие, гормон роста, соматостатин.

Introduction.

Maintaining hormonal balance in the human body is the basis of a healthy life. The endocrine system regulates the activity of almost all systems of the body through hormones. In particular, the chemical properties of hormones and their interaction with cells ensure the continuity of vital processes. This article provides an in-depth analysis of the basic principles of hormonal regulation, control through the hypothalamic-pituitary system and its interaction with other systems in the body, in particular the nervous system. The article is relevant and highlights the participation of the endocrine system in functions such as stress, development, blood circulation and digestion.

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General functions of the endocrine system. The endocrine system, in its regulatory role, has a wide-ranging effect on the entire organism, including:

- Regulating nutrient metabolism and H,0 and electrolyte balance, which are jointly important in maintaining a constant internal environment;
- •Inducing adaptive changes in the body that help it cope with stressful situations;
- •Promoting uniform, sequential growth and development;
- •Controlling reproduction;
- • Regulating the production of red blood cells;
- Controls and integrates the activities of the circulatory and digestive systems, along with the autonomic nervous system.

The means by which a hormone exerts its ultimate physiological effect depends on whether the hormone is hydrophilic (peptide hormones and catecholamines) or lipophilic (steroid hormones and thyroid hormones). Peptide hormones, the most common chemical class of hormones, are chains of amino acids of varying lengths. Catecholamines produced by the adrenal glands are derived from the amino acid tyrosine. Steroid hormones produced by the adrenal cortex and reproductive endocrine glands are neutral lipids derived from cholesterol. Thyroid hormone produced by the thyroid gland is an iodinated derivative of tyrosine. To review, hydrophilic hormones that bind to surface membrane receptors primarily induce their physiological response by altering the activity of preexisting proteins, such as enzymes, in the target cell via second messenger systems. Lipophilic steroid hormones and thyroid hormones, on the other hand, activate genes bound to intracellular receptors, thereby leading to the formation of new proteins that carry out the desired response in the target cell. Hydrophilic hormones circulate in the blood mainly dissolved in plasma, while lipophilic hormones mainly bind to plasma proteins.

Chemical classification of hormones. Hormones secreted by different endocrine glands vary greatly in their chemical structure. However, all hormones can be divided into several chemical classes;

Amines. These are hormones derived from the amino acids tyrosine and tryptophan. They include hormones secreted by the adrenal medulla, thyroid gland, and pineal gland

Polypeptides and proteins. Proteins are large polypeptides. Antidiuretic hormone is a polypeptide of nine amino acids, too small to be called a protein. If the polypeptide chain is longer than about 100 amino acids, such as growth hormone, which has 191 amino acids, it can be called a protein. Insulin blurs the two categories because it is made up of two polypeptide chains derived from a larger molecule.

Glycoproteins. These molecules consist of a protein attached to one or more carbohydrate groups. Examples include follicle-stimulating hormone (FSH) and luteinizing hormone (LH).

Steroids. Steroid hormones are formed from cholesterol after an enzyme cleaves off the side chain attached to the five-carbon "D" ring. Steroid hormones include testosterone, estradiol, progesterone, and cortisol.

The nervous system and the endocrine system are closely related in both structure and function. Stimuli integrated by the central nervous system influence the release of many hormones via efferent neurons, as previously described for insulin. In addition, specialized groups of neurons secrete neurohormones, and two endocrine structures are included in the anatomy of the brain: the pineal gland and the pituitary gland.

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One of the most interesting connections between the brain and the endocrine system is the effect of emotions on hormone secretion and function. For centuries, doctors have noted cases in which emotional states have affected health or normal physiological processes. Today, women know that the timing of their menstrual cycles can change due to stressors such as travel or final exams. In infants, a condition known as "failure to thrive" can often be environmental or emotionally related. Stress increases the secretion of some pituitary hormones and decreases the production of others. The interaction between stress, the endocrine system, and the immune system is being actively studied by scientists.

Hypothalamus controls pituitary secretion. Almost all pituitary secretion is controlled by hormonal or neural signals from the hypothalamus. In fact, when the pituitary gland is removed from its normal position below the hypothalamus and transplanted to another part of the body, its rate of secretion of various hormones (except prolactin) is greatly reduced. Secretion from the posterior pituitary is controlled by neural signals originating in the hypothalamus and terminating in the posterior pituitary. In contrast, secretion from the anterior pituitary is controlled by hormones. Hypothalamic-releasing and hypothalamic-inhibiting hormones (or factors) are secreted within the hypothalamus and then transported to the anterior pituitary via small blood vessels called the hypothalamic-hypophyseal portal vessels. In the anterior pituitary, these releasing and inhibitory hormones act on the cells of the gland to control their secretion.

The hypothalamus receives signals from many sources in the nervous system. Thus, when a person experiences pain, part of the pain signal is transmitted to the hypothalamus. Similarly, when a person experiences severe depression or anxiety, part of the signal is transmitted to the hypothalamus. Olfactory stimuli, such as pleasant or unpleasant odors, transmit strong signals to the hypothalamus directly and via the amygdaloid nuclei.

Even the concentration of nutrients, electrolytes, water, and various hormones in the blood stimulate or inhibit different parts of the hypothalamus.

Thus, the hypothalamus is the center that integrates information about the body's internal well-being, and much of this information is used to control the secretion of many globally important pituitary hormones.

The role of the hypothalamic-pituitary axis in growth hormone activity. The hormone increases lean body mass and reduces body fat, but does not statistically significantly increase muscle strength or mental status. There are also diurnal variations in growth hormone secretion during these stages of development. Growth hormone is at relatively low levels during the day, unless specific stimuli for its release are present. During sleep, however, large pulsatile bursts of growth hormone secretion occur. Therefore, it is not surprising that growth hormone secretion is under the control of the hypothalamus. The hypothalamus controls the production of growth hormone, growth hormone-releasing hormone (GHRH), and somatostatin, which inhibits growth hormone release. Thus, the balance between the effects of these hypothalamic factors on the pituitary determines the level of growth hormone release. The stimuli for growth hormone secretion discussed below can therefore act by increasing hypothalamic secretion of GHRH, decreasing somatostatin secretion, or both. A third regulator of growth hormone secretion is ghrelin. The main site of synthesis and secretion of ghrelin is the stomach, but it is also produced in the hypothalamus and has growth hormone-stimulating activity. It is also involved in the regulation of food intake.

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Growth hormone secretion, like that of other anterior pituitary hormones, is under feedback control. It acts on the hypothalamus to counteract the release of GHRH. Growth hormone also increases circulating IGF-I, and IGF-I, in turn, has a direct inhibitory effect on growth hormone secretion from the pituitary gland. It also stimulates the secretion of somatostatin.

Conclusion. In conclusion, the endocrine system is one of the central control mechanisms that maintains the stability of the internal environment of the body. The diversity of hormones and the regulatory processes carried out by them adapt the body to changes in the external and internal environment. The hypothalamic-pituitary connection plays a central role, controlling the concentration of hormones and ensuring physiological stability. Disturbances in this system can lead to various diseases and imbalances.

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