

## CHEMICAL STRUCTURE OF HORMONAL DRUGS AND THEIR INFLUENCE ON METABOLISM

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**Abstract:** This article examines the features of the chemical structure of various hormonal drugs and their impact on metabolic processes in the human body. Special attention is given to the mechanisms of action of insulin, thyroid, and steroid hormones, as well as their role in regulating the metabolism of proteins, fats, and carbohydrates. The biochemical aspects of hormone-receptor interactions and their pharmacological activity are analyzed. The article emphasizes the importance of hormonal agents in the therapy of endocrine diseases and the necessity of a deep understanding of their chemical nature to improve treatment effectiveness.

**Keywords:** hormonal drugs, chemical structure, metabolism, insulin, thyroid hormones, steroid hormones, receptors, metabolism, pharmacological action.

### INTRODUCTION

Hormones are the most important regulators of physiological processes in the human body. They influence metabolism, growth, development, and the maintenance of homeostasis. Modern pharmaceuticals actively use hormonal drugs to treat various diseases associated with hormonal imbalance, such as diabetes, thyroid diseases, and reproductive system disorders. Effective use of hormonal agents requires a deep understanding of their chemical structure, mechanisms of action, and interactions with cell receptors. The chemistry of hormonal drugs forms the basis for developing new therapeutic methods aimed at restoring normal physiological processes. This article reviews the chemical structure of hormonal drugs and their influence on metabolism, as well as the importance of these drugs in treating endocrine diseases.

### LITERATURE REVIEW AND METHODOLOGY

Modern research on hormonal drugs focuses on studying their chemical structure and the mechanisms of their effects on cellular receptors and various physiological processes. The chemistry of hormones and their analogs is actively studied from biochemical and pharmacological perspectives. For example, studies on insulin demonstrate the importance of its chemical structure for its ability to bind to cell receptors and elicit corresponding biological effects. Similarly, research on steroid hormones such as cortisol and testosterone shows how minor changes in their chemical structure can significantly alter their effects in the body. The literature also highlights the influence of hormones on carbohydrate, fat, and protein metabolism, emphasizing their role in regulating energy balance. Key works in this area include studies on the role of hormones in the pathogenesis of various diseases such as diabetes mellitus, obesity,

hyperthyroidism, and hypothyroidism, as well as their role in maintaining normal metabolism. The importance of a deep understanding of the chemical structure of hormonal drugs for developing new effective treatment methods is confirmed by numerous studies.

A combined approach including both theoretical and experimental methods is used to analyze the effects of hormonal drugs on metabolism. The first stage involves reviewing scientific publications and specialized journals to determine the main principles of hormone action and their chemical structure. Then, to assess the mechanisms of hormonal drugs' impact on metabolism, data on pharmacokinetics and pharmacodynamics of the drugs, as well as results from clinical studies aimed at treating endocrine diseases, are analyzed. The experimental part may include laboratory studies such as blood and urine analysis for hormone levels, as well as studying metabolic process changes in animal models. The research methodology will include biochemical tests, cell culture studies, and analysis of molecular interactions between hormones and their receptors.

## DISCUSSION AND RESULTS

Studies have shown that hormonal drugs play an important role in regulating metabolism. Even the slightest changes in the chemical structure of these drugs can affect their effectiveness and safety. For example, insulin and its analogs can vary in absorption rate and duration of action depending on their structure. Steroid hormones, such as cortisol and testosterone, may significantly alter their anti-inflammatory effects when their chemical structure changes. Thyroid hormones regulate metabolism and the basal energy level in cells, but their effectiveness requires precise dosing. The research results confirmed that hormonal drugs significantly influence metabolism. The main conclusions are as follows:

Hormonal drugs are crucial in the treatment of endocrine diseases; however, further research is needed to improve their safety and efficacy.

### Effects of hormones on human health:

Hormones play a key role in regulating various physiological processes in the human body. They influence growth, development, metabolism, reproductive function, and the maintenance of homeostasis. Even minor changes in hormone levels can lead to various diseases and disorders. Insulin regulates blood sugar levels and carbohydrate metabolism. A deficiency of insulin can cause diabetes mellitus, while an excess amount causes hypoglycemia.

Thyroid hormones (thyroxine and triiodothyronine) regulate metabolism and energy balance. Low levels of these hormones lead to hypothyroidism, and elevated levels cause hyperthyroidism, affecting weight, mood, and energy levels. Sex hormones (estrogen, progesterone, testosterone) regulate reproductive functions and also affect the health of bones, the heart, and the immune system. Imbalances in their levels can cause fertility problems, menopause symptoms, or sexual dysfunction.

Cortisol is a stress hormone that regulates the body's response to stress. Chronically high cortisol

levels may weaken the immune system, raise blood pressure, and cause metabolic problems.

Adrenaline and noradrenaline are hormones related to the body's stress response; they activate the sympathetic nervous system, increasing heart rate and blood pressure. Imbalances in these hormones can lead to cardiovascular disorders.

Growth hormone (somatotropin) is synthesized in the anterior pituitary and plays a crucial role in body growth. It stimulates cell division, enhances protein synthesis, and promotes bone lengthening in children and adolescents. In adults, it influences metabolism by maintaining muscle mass and fat burning.

Melatonin is produced by the pineal gland, mainly at night. It regulates biological rhythms, especially sleep and wake cycles. Melatonin promotes relaxation, helps induce sleep, and affects overall psycho-emotional state. Parathyroid hormone (PTH) is produced by the parathyroid glands. It maintains stable blood calcium levels by regulating calcium absorption in the intestines, excretion through the kidneys, and release from bone tissue. Calcium is essential for muscle function, the nervous system, and bones. Aldosterone is a hormone from the adrenal cortex that regulates water-salt balance. It promotes sodium and water retention in the body and potassium excretion. This helps maintain normal blood pressure and blood volume in vessels. Prolactin is produced by the pituitary gland. In women, it is activated during pregnancy and after childbirth, stimulating breast milk production. Prolactin also affects sexual function, mood, and the immune system in both women and men.

Oxytocin is produced by the hypothalamus and released by the posterior pituitary. Its main functions are to stimulate labor and lactation. Oxytocin is also called the "love hormone" because it enhances feelings of attachment, trust, and emotional connection between people. Vasopressin (antidiuretic hormone) regulates water balance in the body. It reduces urine output by the kidneys, helping retain fluids. Vasopressin also affects vascular tone and can raise blood pressure. Thus, hormones play a critical role in maintaining health, and their balance is essential for normal body function. Hormonal imbalances require timely diagnosis and correction to prevent more serious diseases.

#### Hormones and Their Impact on Diseases:

Hormones play a key role in the development and progression of various diseases. Disruptions in their production, secretion, or action can lead to serious pathologies.

Diabetes mellitus arises from insulin deficiency (type 1 diabetes) or reduced tissue sensitivity to insulin (type 2 diabetes). This leads to chronic hyperglycemia and damage to blood vessels, nerves, kidneys, and eyes.

Hypothyroidism and hyperthyroidism are associated with abnormal levels of thyroid hormones. Hypothyroidism causes slowed metabolism, weakness, and weight gain; hyperthyroidism leads to anxiety, tachycardia, and weight loss.

Osteoporosis often develops in postmenopausal women due to decreased estrogen levels. This results in bone fragility and increased risk of fractures.

Cushing's syndrome results from excess cortisol and causes obesity, hypertension, muscle weakness, and impaired carbohydrate metabolism.

Polycystic ovary syndrome (PCOS) is characterized by elevated androgens and disrupted menstrual cycles, which can lead to infertility and metabolic disorders.

Acromegaly, caused by excess growth hormone in adults, leads to bone thickening, enlargement of internal organs, and impaired heart function.

Thus, hormonal imbalances can be both a cause and a consequence of many diseases. Early diagnosis and hormonal correction help prevent complications and improve patients' quality of life.

#### **Conclusion:**

Hormonal drugs are an integral part of modern medicine, playing an important role in treating a wide range of diseases related to metabolic and hormonal imbalances. A deep understanding of their chemical structure and mechanism of action allows physicians to select therapy more precisely, minimize side effects, and increase treatment effectiveness. Studying the influence of hormones on metabolism emphasizes their universality and significance in maintaining human health. Disorders in hormonal regulation can be the starting point for serious diseases; however, timely intervention and a competent approach restore harmony in the body.

Thus, hormones are not merely biologically active substances but subtle regulators of life, without which the integrated functioning of the organism is impossible. Their study and rational use remain one of the most important directions in medical science and practice.

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