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# ROLE OF ENZYMES IN THE HUMAN BODY

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***Abstract:*** *In the human body, almost all processes occur in the presence of enzymes. The situation is no different with the work of the digestive tract.*

*Digestive enzymes are macromolecular proteins. These are substances that allow complex compounds to be broken down into simpler forms. They are secreted in the gastrointestinal tract and take part in the digestion of various ingredients of consumed food. Digestive enzymes in the body are produced naturally by the digestive glands. And although each organ is responsible for its own enzyme, all compounds complement each other, and therefore it is so important that the body does not lack any of them. The digestion process begins in the oral cavity precisely due to the presence of salivary amylase produced by the salivary glands.*

***Key words:*** *xenobiotic detoxification genes, polymorphism, occupational pathology of the respiratory system.*

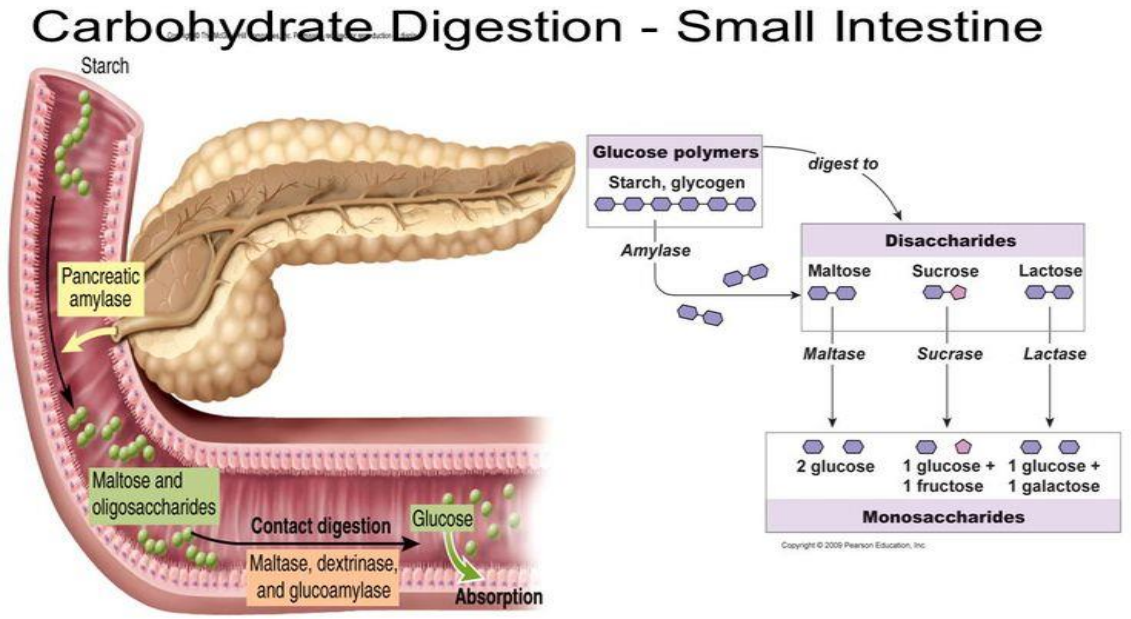
**Material and research methods:** The term “enzyme” was first proposed by the Dutch naturalist Van Helmont, who used it to designate an unknown agent that promotes alcoholic fermentation. Translated from Latin, enzyme means “leaven”; the synonym for this word in Greek is enzyme, which means “in the yeast.” Both words are associated with yeast fermentation, which is impossible without the participation of enzymes that play a key role in fermentation processes - chemical reactions associated with the digestion and breakdown of sugars [1]. By their nature, enzymes are biological catalysts for chemical and biochemical reactions that occur inside cells. Chemical reactions can occur without the participation of enzymes, but often this requires certain conditions: high temperature, pressure, the presence of metals (iron, zinc, copper and platinum, etc.), which can also act as catalysts - accelerators of chemical reactions , but their speed without enzymes will be very low.

Enzymes in our body act as biological catalysts, accelerating biochemical reactions hundreds and thousands of times, they contribute to complete digestion, absorption of nutrients and cleansing of the body. Enzymes take part in almost all vital processes of the body: they help restore the endoecological balance, support the hematopoietic system, reduce thrombus formation, normalize blood viscosity, improve microcirculation, as well as the supply of tissues with oxygen and nutrients, normalize lipid metabolism, and reduce the synthesis of low-density cholesterol. More than three thousand currently known enzymes are involved in all vital

biochemical reactions. Enzyme deficiency, caused by genetic disorders or other physiological reasons, leads to poor health and serious diseases[2-4]. Many enzymes can act as decomposers and reducers, depending on the circumstances, breaking down biomolecules into fragments or recombining breakdown products back together. Thousands of different enzymes are constantly working in the human body. Only with their help is it possible to renew cells, transform nutrients into energy and building materials, neutralize metabolic waste and foreign substances, protect the body from pathogens and heal wounds. Depending on what types of body reactions enzymes catalyze, they perform different functions; most often they are divided into digestive and metabolic.

Digestives are secreted in the gastrointestinal tract, destroy nutrients, allowing them to enter the systemic bloodstream. Only in the presence of enzymes does the metabolism of fats, proteins and carbohydrates occur. Enzymes never replace each other, each of them has its own function, the main digestive enzymes are amylase, protease or pase.

*Amylase is a hydrolytic enzyme, formed mainly in the salivary glands and pancreas, then enters the oral cavity or the lumen of the duodenum, respectively, and promotes the utilization of glucose from the blood. Amylase is involved in the digestion of food carbohydrates, decomposes complex carbohydrates - starch and glycogen, and ensures the maintenance of normal blood sugar levels. It has now been proven that 86% of patients with diabetes have insufficient amylase in the intestines. Different types of amylases act on certain sugars: lactase breaks down milk sugar - lactose, maltase - maltose, sucrase breaks down beet sugar - sucrose [5].



*Protease is a proteolytic enzyme that actively participates in the processes of metabolism and digestion, breaks down food proteins and destroys almost any proteins that are not components of living cells of the body - the protein structures of viruses, bacteria and other pathogens. Protease acts in the stomach, gastric juices, and pancreatic secretions, breaking down undigested protein, cellular debris and blood toxins, as a result of which the immune system is activated to fight bacterial infection or parasites. Protease is necessary for acute and chronic inflammatory processes of the gastrointestinal tract and liver, obesity and overweight, vascular pathology, conditions before and after surgery.*Lipase is present in gastric juice, in pancreatic secretions, as well as in dietary fats and is the most important enzyme in the process of fat digestion; it is synthesized in the pancreas and secreted into the intestines, where it breaks down fats coming from food and hydrolyzes fat molecules. Lipase activity changes significantly in diseases of the pancreas, cancer and poor nutrition.

Metabolic enzymes (enzymes) catalyze biochemical processes inside cells, during which both energy production and detoxification of the body and removal of waste decay products occur. Each system, organ and tissue of the body has its own network of enzymes.

Enzymes and metabolism

Metabolism in the human body consists of two processes. The first process is “anabolism,” which means the absorption of necessary substances and energy. The second process is “catabolism” - the breakdown of waste products of the body. These important processes are in constant interaction, supporting the vital functions of the body.

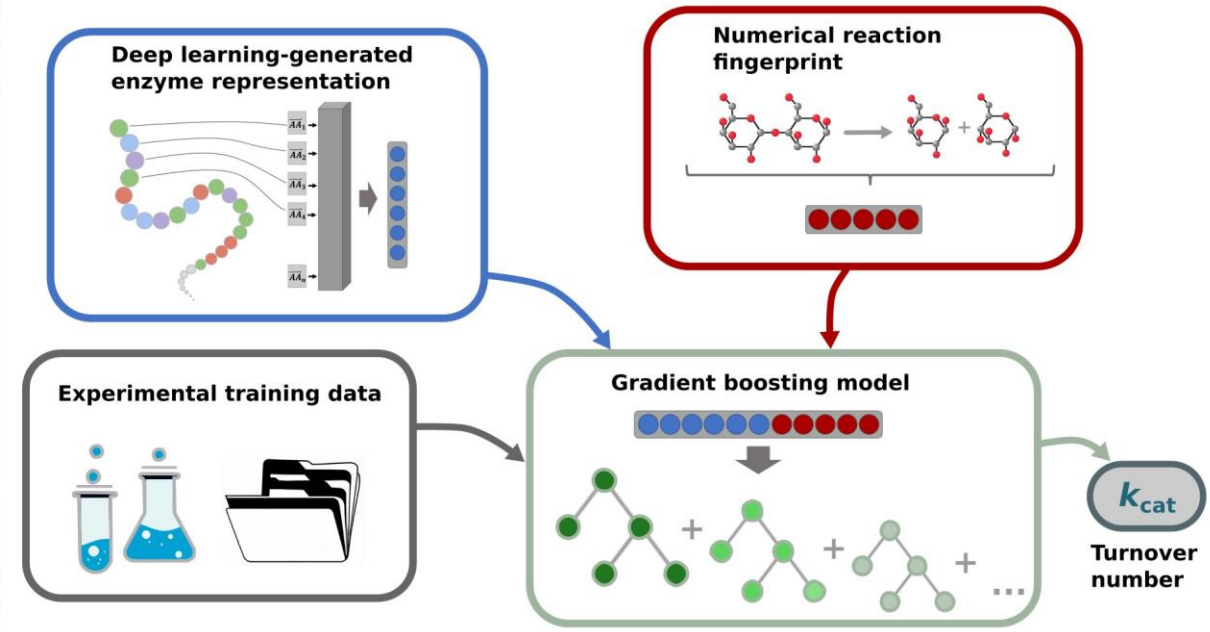
*The nervous system is the first regulatory system for maintaining the balance of metabolic processes; it processes information coming from all systems, organs and tissues of the body. Taking into account the nature of the information in metabolic processes, the nervous system makes one or another decision and sets one or another program of action.

*The endocrine system is the second regulatory system, thanks to the hormones it produces, all processes occurring in the organs and tissues of the body are activated or slowed down.

*The circulatory system is the third system that regulates metabolism, since the blood transports hormones and nutrients - vitamins, macroelements and mineral salts.

All these systems implement their program through a chain of various enzymes, thanks to which a person can adequately adapt to changing conditions of the external and internal environment. All enzymes are proteins consisting of amino acids; the

non-protein part of the enzyme molecule is called a "coenzyme"; it may contain trace elements and vitamins. All biochemical reactions involving enzymes occur in an aqueous environment in which our body is located, like in a cocoon. Some enzymes are part of the plasma membrane of cells, others are located and work inside cells, others are secreted by cells and enter the intercellular space of organs and tissues, enter the circulatory and lymphatic systems or into the lumen of the stomach, small and large intestines.




Thanks to the action of enzymes, the body stores iron, blood clots during bleeding, uric acid is converted into urine, and carbon monoxide is removed from the lungs. Enzymes help the liver, kidneys, lungs and gastrointestinal tract remove waste products and toxins from the body, promote the use of nutrients, build new muscle tissue, nerve cells, bones, skin, and restore endocrine gland tissue.

Enzymes take part in almost all vital processes of the body: they help restore the ecological balance of the body, improve the functioning of the immune system, regulate the production of interferons, exhibit antiviral and antimicrobial effects, and reduce the likelihood of developing allergic and autoimmune reactions. They also support the hematopoietic system, reduce platelet aggregation, normalize blood viscosity, improve microcirculation, as well as the supply of tissues with oxygen and nutrients. The complex effect of enzymes improves the process of digestion and absorption of food, normalizes lipid metabolism, reduces cholesterol synthesis, increases the content of high-density cholesterol, and also reduces side effects associated with taking antibiotics and hormonal drugs.

Enzymes, coenzymes and trace elements

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There are about 3,000 different enzymes in the human body, the structure of which is encoded in the genetics of each individual. The main functional characteristic of each enzyme is the speed with which it works, destroying, transforming or synthesizing certain substances. The functions of enzymes are strictly individual and each of them takes part in the activation of a specific biochemical process. Over time, enzymes lose their effectiveness and therefore must be constantly renewed. The activity of enzymes depends on many external factors: when the temperature decreases, the rate of chemical reactions decreases; when the temperature increases, the rate of chemical reactions first increases, but then begins to decrease, since at high temperatures close to boiling, denaturation occurs - the destruction of protein molecules of the enzyme. Enzymes contain some microelements - copper, iron, zinc, nickel, selenium, cobalt, manganese, etc. Without mineral molecules, enzymes are not active and cannot catalyze biochemical reactions. Activation of enzymes occurs through the addition of atoms of mineral substances to their molecules, while the attached atom of an inorganic substance becomes the active center of the entire enzymatic complex, for example: *Iron is part of important oxidative enzymes - catalase, peroxidase, carbon and nitrogen cytochromes, it connects atoms together, due to which protein molecules are formed from amino acids, in addition, iron from the hemoglobin molecule is able to bind oxygen in order to transfer it to tissues;

*Zinc is able to connect oxygen and nitrogen atoms, as well as sulfur atoms, therefore the digestive enzymes pepsin and trypsin require the addition of a zinc atom for activation;

*Copper has the ability to break or restore bonds between carbon and sulfur atoms;

*Cobalt is capable of both destroying and restoring chemical bonds between carbon atoms;

*Molybdenum is part of nitrogen-fixing enzymes and is capable of converting atmospheric nitrogen into a bound state, which is a fairly inert substance and enters into biochemical reactions with great difficulty.

Many enzymes with large molecular weights exhibit catalytic activity only in the presence of specific low-molecular substances called coenzymes (coenzymes); the role of coenzymes is played by many vitamins and minerals that are part of the active center of the enzyme and ensure its operation. Coenzyme Q10 plays a special role in the human body - it is a direct participant in processes aimed at producing energy in the human body. Coenzyme Q10 is a cellular component involved in the

production of energy in mitochondria, intracellular power plants, and plays an important role in the body's production of adenosine triphosphoric acid (ATP), which is the primary source of energy in muscle tissue. Coenzyme Q10 increases the resistance of muscle tissue to peak loads, reduces the toxic and painful effects of hypoxia, accelerates metabolic processes and the removal of metabolic end products. Based on the results of experimental and clinical studies, it was concluded that Coenzyme Q10 also has the properties of an effective antioxidant and protector against premature aging; it can not only prolong life, but also saturate it with energy. Considering the above, we can conclude that for the full function of enzymes, a constant and continuous supply of vitamins, macro- and microelements in food is necessary. Only in this case will the enzymes and enzyme systems of the body function successfully.

Clinical trials of enzymes. Research in recent decades has proven that enzymes are necessary for the normal functioning of the body's immune system: they regulate the production of interferons, exhibit antiviral and antimicrobial effects, and also reduce the likelihood of developing allergic and autoimmune reactions. Defense mechanisms can keep the human body healthy only if the body has a sufficient number of functioning enzymes. Each enzyme in the body performs its own task: some enzymes allow the body to defend itself by activating macrophages - white blood cells capable of recognizing and destroying enemies in the body. Other enzymes help lymphocytes create specific antibodies that bind “foreign agents” - bacterial, viral and others, giving the body the opportunity to neutralize them in a timely manner. The most important role in the health of the immune system is played by proteolytic enzymes, in particular protease, which is actively involved in the processes of metabolism and digestion; it is capable of destroying almost any proteins that are not components of living cells of the body - the protein structures of viruses, bacteria and other pathogens. Protease enzymes have proven to be an excellent antiviral therapy that works on multiple levels. Many viruses are surrounded by a protective protein shell that proteases can digest, making the viruses more vulnerable to the effects of antiviral drugs. In addition, protease breaks down undigested protein, cellular debris and blood toxins, resulting in the immune system being activated to fight bacterial and viral infections.

The most common chronic viral infection in humans is herpes, translated from Greek as “creeping.” Herodotus used this name to describe blistering rashes on the skin, accompanied by itching and fever. Statistics say that 90% of the world's population are carriers of herpes infection. Herpetic infection exists in the body for a

long time, mainly in a latent form and manifests itself against the background of immunodeficiency states by lesions of the skin, mucous membranes, eyes, liver and central nervous system.

In 1995, European scientists first published the results of a study of enzyme therapy as an alternative treatment for herpes zoster - the chickenpox virus and shingles. The study was conducted on a group of 192 patients, half of whom received the standard antiviral drug Acyclovir, and the other half received enzyme therapy. As a result of the research, it was concluded that, in general, enzyme preparations showed an effectiveness identical to that of acyclovir. Since 1968, in Western countries, the herpes zoster virus has been successfully treated with enzymes.

**Conclusions.** Enzymes have a wide range of applications and can be recommended not only for improving digestion, in acute and chronic inflammatory processes in the gastrointestinal tract and liver, but also in infectious diseases, vascular pathology, conditions before and after surgical interventions. To date, numerous studies have been conducted confirming the effectiveness of enzymes in the prevention and recovery of cancer.

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