

MEDICAL IMPORTANCE OF BIOLOGICAL CATALYSTS

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Abstract: This article provides an in-depth review of biological catalysts (enzymes), their role in metabolic reactions, structural properties, and age-related differences in enzymatic activity. Enzyme fluctuations in pathological conditions, their diagnostic value, and relevance in pediatrics, geriatrics, and obstetric medicine are highlighted.

Keywords: biological catalyst, enzyme, metabolism, pediatrics, gerontology, pregnancy, biochemistry, diagnostics, pathology.

INTRODACTION

Enzymes are one of the essential biopolymers of living organisms, regulating the chemical reactions required for all cellular activities. By accelerating metabolic processes thousands of times, they ensure the continuation of life. Without enzymes, most biochemical reactions in the human body would proceed so slowly that life would be impossible. For this reason, enzymes are often called the “engine of life.” The specificity of enzymes is manifested in their high selectivity — each enzyme catalyzes only one specific reaction. Therefore, their role in the organism is not only broad but also precisely regulated. Enzymes play a key role in energy metabolism, protein synthesis, hormone production, immune responses, DNA replication, and even the transmission of nerve impulses. In medicine, enzymes have great diagnostic value. For example, elevated ALT and AST levels indicate liver cell injury; increased amylase and lipase suggest pancreatitis; and high CK-MB and troponin levels are important diagnostic markers of myocardial infarction.

CHEMICAL STRUCTURE AND CLASSIFICATION OF BIOLOGICAL CATALYSTS

Enzymes consist mainly of proteins and possess complex three-dimensional structures. Their active site — a specific region of the molecule — interacts with the substrate and accelerates the reaction. Some enzymes require additional molecules — cofactors or coenzymes — to function properly. Vitamins, metal ions, and molecules such as NAD⁺ often serve as coenzymes.

Enzymes are classified into the following major groups:

1. Oxidoreductases — regulate oxidation–reduction reactions; essential in energy production and cellular respiration.
2. Transferases — transfer functional groups from one molecule to another.
3. Hydrolases — catalyze the hydrolytic cleavage of complex molecules; play a major role in digestion.
4. Lyases — break down molecules without using additional energy.
5. Isomerases — convert molecules into their isomeric forms.
6. Ligases — catalyze energy-dependent bond-forming reactions.

BIOCATALYTIC PROCESSES IN CHILDREN

Enzyme activity in pediatric organisms differs significantly from that in adults, as children's organs are still developing. Immaturity of the pancreas, liver, kidneys, endocrine glands, and the immune system directly affects enzyme production and activity.

Main differences:

1. Immature digestive enzymes:

Amylase and lipase levels are low, so infants digest fats and complex carbohydrates more slowly.

2. High ALP levels:

This is associated with rapid bone growth and is considered normal in pediatric laboratory results.

3. Fluctuating liver enzymes:

Mild ALT/AST elevation may be physiological in children.

4. Inherited enzyme deficiencies:

Disorders such as phenylketonuria and galactosemia can be fully controlled if detected early.

PERIOD OF STABLE ENZYME ACTIVITY IN ADULTHOOD

Adulthood is characterized by stable enzyme function, with most metabolic processes remaining in balance.

Key enzyme indicators in clinical medicine:

ALT, AST — markers of liver injury

Amylase, lipase — markers of pancreatitis

CK-MB — indicator of myocardial damage

GGT — marker of alcoholism or biliary obstruction

LDH — indicates tissue necrosis

DECLINE OF ENZYMATIC ACTIVITY IN THE ELDERLY

With aging, enzyme production naturally decreases.

Major age-related changes:

Slower detoxification → increased sensitivity to medications

Reduced antioxidant enzymes → higher risk of atherosclerosis

Decreased digestive enzymes → vitamin deficiencies

Weakened immune enzyme activity → increased susceptibility to infections

These age-related changes highlight the importance of studying enzymes in gerontology.

ENZYMATIC CHANGES DURING PREGNANCY

Metabolic processes undergo significant changes during pregnancy.

Increased ALP — due to placental production

Slight elevation of AST/ALT is possible

Deficiency of oxidative–reductive enzymes may lead to complications

Therefore, enzyme analysis is an important diagnostic tool in evaluating pregnancy.

DIFFERENCES IN ENZYME LEVELS BETWEEN HEALTHY AND DISEASED INDIVIDUALS

Disease	Altered Enzymes	Clinical Significance
Pancreatitis	Amylase, Lipase	Inflammation of the pancreas
Myocardial infarction	CK-MB, Troponin	Myocardial necrosis
Hemolysis Increased	LDH Destruction	Destruction of erythrocytes
Hepatitis	ALT, AST	Inflammation of liver cells

CONCLUSION

Biological catalysts play a central role in all vital processes, regulating metabolic reactions and ensuring proper cellular function. Age-related differences, pregnancy-related changes, and pathological conditions significantly influence enzyme levels, making them crucial diagnostic markers in modern medicine. A deep understanding of enzyme activity is essential for the future development of medical science.

REFERENCES

1. Fayzullayev N., Akmalaiuly K., Karjavov A. Catalytic synthesis of a line by acetylene hydration. *Izvestia of the NAS RK, Chemistry and Technology Series*, 2020, No. 2, pp. 23–30.
2. Obidov O.O. *Biological Chemistry*. Tashkent, 2010.
3. Fayzullaev N.I., Karjavov A.R., Yusupova S.S. Catalytic Synthesis of Acetone by Direct Acetylene Hydration. *International Journal of Advanced Science and Technology*, 2020, Vol. 29, No. 05, pp. 4507–4514.
4. Harper's *Biochemistry*, 2019.
5. Karjavov A.R., Fayzullaev N. Study of the kinetics and mechanism of the catalytic hydrochlorination of acetylene. *AIP Conference Proceedings*, 2024, Vol. 3045, No. 1, p. 060046.
6. Fayzullayev N., Akmalaiuly K., Karjavov A. Catalytic synthesis of a line by acetylene hydration. (2020), No. 440, pp. 23–30.
7. Karjavov A.R., Fayzullaev N. Determination of technological parameters for producing vinyl chloride from acetylene. *AIP Conference Proceedings*, 2024, Vol. 3045, No. 1, p. 060045.
8. Karjavov A., Fayzullaev N., Baykulov A. Production of acetone by catalytic hydration of acetylene. *E3S Web of Conferences*, 2023, Vol. 389, p. 01046.