

THE IMPORTANCE OF CARBOHYDRATES IN HUMAN HEALTH AND MEDICINE

UGLEVODLARNING INSON SALOMATLIGI VA TIBBIYOTIDAGI AHAMIYATI

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Abstract

Carbohydrates are one of the fundamental biomolecules necessary for life. They play a critical role in providing energy, supporting cellular functions, and maintaining overall health. In medicine and biological sciences, carbohydrates are studied not only as nutritional components but also as structural and functional molecules involved in many physiological processes. This article discusses the structure, classification, biological functions, and medical importance of carbohydrates. Special attention is given to their role in metabolism, disease prevention, and modern medical research.

Annotatsiya

Uglevodlar hayot uchun zarur bo'lgan asosiy biomolekulalardan biridir. Ular energiya bilan ta'minlash, hujayra funktsiyalarini qo'llab-quvvatlash va umumiy sog'liqni saqlashda muhim rol o'ynaydi. Tibbiyot va biologiya fanlarida uglevodlar nafaqat ozuqaviy komponentlar sifatida, balki ko'plab fiziologik jarayonlarda ishtirok etadigan strukturaviy va funktsional molekular sifatida ham o'rganiladi. Ushbu maqolada uglevodlarning tuzilishi, tasnifi, biologik funktsiyalari va tibbiy ahamiyati muhokama qilinadi. Ularning metabolizm, kasalliklarning oldini olish va zamonaviy tibbiy tadqiqotlardagi roliga alohida e'tibor beriladi.

Key words: Carbohydrate, ATP, biomolecules, energy, physiological, structural, functional

Kalit so'zlar: uglevodlar, ATP, biomolekulyar, energiya, fiziologik, strukturaviy, funktsional

Introduction

Carbohydrates are organic compounds composed mainly of carbon, hydrogen, and oxygen atoms. They are one of the main macronutrients required for the proper functioning of the human body. Carbohydrates serve as the primary source of energy and are essential for many metabolic processes. In the human body, carbohydrates are broken down into glucose, which is used by cells to produce energy through cellular respiration[1]. The brain, muscles, and many organs rely heavily on glucose as their main energy source. Because of this, carbohydrates are a key component of human nutrition and medical science. In addition to energy production, carbohydrates also participate in cell signaling, immune responses, and structural support in biological

systems. Many modern medical studies examine the role of carbohydrates in diseases such as diabetes, obesity, and cardiovascular disorders. Carbohydrates are one of the most abundant organic compounds in nature [2]. They are composed mainly of carbon, hydrogen, and oxygen atoms and are typically described by the general formula $(CH_2O)_n$. Carbohydrates serve as the primary source of energy for most living organisms and are vital for the proper functioning of the human body. In human metabolism, carbohydrates are broken down into glucose which is then used in cellular respiration to produce ATP. ATP is the energy currency of the cell and is necessary for muscle contraction, nerve transmission, biosynthesis, and many other physiological processes. Beyond their energetic role, carbohydrates are also important structural and regulatory molecules. They form parts of nucleic acids, cell membranes, and extracellular matrices. Modern biomedical research has revealed that carbohydrates are involved in immune responses, cell recognition, and disease development [3].

Classification of Carbohydrates

Carbohydrates are generally classified into three major groups based on their chemical structure and complexity: monosaccharides, disaccharides, and polysaccharides. Monosaccharides are the simplest carbohydrates and cannot be broken down into smaller sugar molecules. Examples include glucose, fructose, and galactose. These sugars are rapidly absorbed in the human body and provide quick energy. Disaccharides consist of two monosaccharide molecules joined together. Common examples include sucrose, lactose, and maltose. They must be broken down during digestion before they can be absorbed. Polysaccharides are complex carbohydrates composed of many monosaccharide units. Examples include starch, glycogen, and cellulose. These carbohydrates provide long-term energy storage and structural support in living organisms [4].

Biological Functions of Carbohydrates

Carbohydrates perform several essential biological functions in the human body. First, they are the main source of energy. Glucose derived from carbohydrates is used during cellular respiration to produce ATP, the main energy molecule in cells. Second, carbohydrates act as energy storage molecules. In humans and animals, excess glucose is stored in the form of glycogen in the liver and muscles. Plants store carbohydrates as starch. Third, carbohydrates play structural roles. For example, cellulose is a structural component of plant cell walls. In animals, carbohydrates are also found in glycoproteins and glycolipids which are important for cell membranes. Fourth, carbohydrates are involved in cell communication and immune responses. Glycoproteins on cell surfaces help cells recognize each other and participate in immune defense mechanisms [5].

Medical Importance of Carbohydrates

Carbohydrates have significant importance in medical science. Many diseases are directly related to carbohydrate metabolism. One of the most common diseases associated with carbohydrate metabolism is diabetes mellitus. This condition occurs when the body cannot properly regulate blood glucose levels. Monitoring carbohydrate intake is essential for managing diabetes [6]. Carbohydrates also play a role in gastrointestinal health. Dietary fiber, which is a

type of carbohydrate, improves digestion, supports beneficial gut bacteria, and reduces the risk of colon diseases. In medical diagnostics, carbohydrate-based molecules are used as biomarkers. Glycoproteins and glycolipids are often studied in cancer research because abnormal glycosylation patterns can indicate disease. Furthermore, carbohydrates are used in pharmaceutical development. Many vaccines and drugs contain carbohydrate structures that help stimulate immune responses or improve drug delivery [7].

Carbohydrates in Nutrition

Proper carbohydrate intake is essential for maintaining health. Nutritionists recommend that carbohydrates make up approximately 45–65% of daily caloric intake [8]. However, the type of carbohydrate consumed is very important. Complex carbohydrates such as whole grains, vegetables, and legumes provide slow and steady energy release [9]. These foods also contain fiber, vitamins, and minerals. Simple sugars, on the other hand, are rapidly absorbed and can lead to sudden increases in blood glucose levels [10]. Excessive consumption of refined sugars is associated with obesity, type 2 diabetes, and cardiovascular diseases. Balanced nutrition requires choosing healthy carbohydrate sources and limiting highly processed foods [11].

Table 1. Classification of Carbohydrates

№	Type	Examples	Function
1	Monosaccharides	Glucose, Fructose	Immediate energy source
2	Disaccharides	Sucrose, Lactose	Energy after digestion
3	Polysaccharides	Starch, Glycogen, Cellulose	Energy storage and structural roles

Table 2. Healthy vs Unhealthy Carbohydrate Sources

№	Healthy Sources	Less Healthy Sources
1	Whole grains	Refined sugar
2	Vegetables	Sugary drinks
3	Fruits	Candy and sweets
4	Legumes	Highly processed snacks

Conclusion

Carbohydrates are essential biomolecules that play multiple roles in human health and medicine. They serve as the primary energy source, support structural functions, and participate in many biological processes. Understanding the classification, metabolism, and medical importance of carbohydrates is crucial for students and professionals in medical and biological sciences. Modern research continues to explore new applications of carbohydrates in disease diagnosis, drug development, and nutritional science. Proper dietary management of carbohydrates is also a key factor in preventing many chronic diseases and maintaining overall health. Carbohydrates are essential biomolecules that play multiple roles in human health and medicine. They serve

as the primary energy source, support structural functions, and participate in many biological processes.

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