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CONTENT

Section: Chemistry

BIOLOGICAL FUNCTIONS AND HEALTH IMPLICATIONS OF CHLORINE

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Chlorine is a vital biogenic element that plays an essential role in the maintenance of life processes in the human body and other organisms. Although it is required in relatively small amounts, its physiological functions are fundamental to health and survival. Primarily found in the form of chloride ions (Cl^-), chlorine contributes to a variety of critical biological processes, including fluid and electrolyte balance, nerve transmission, digestion, and pH regulation. Understanding the biogenic role of chlorine not only highlights its importance in maintaining homeostasis but also emphasizes the need for adequate intake and regulation to prevent physiological disorders.

The purpose of this work is to examine the biogenic role of chlorine in the human body by analyzing its chemical properties, physiological functions, dietary sources, and the consequences of its deficiency or excess. This research aims to highlight the essential nature of chlorine in maintaining homeostasis and supporting vital biological processes such as digestion, nerve function, and electrolyte balance.

The study of chlorine's biogenic role is highly relevant due to its fundamental contribution to essential physiological functions in the human body. In an era where imbalances in diet, environmental factors, and lifestyle can lead to electrolyte disturbances, understanding the importance of chlorine helps in the prevention and management of health issues related to dehydration, acid-base imbalance, and digestive disorders. Furthermore, the widespread use of chlorine in various industries and water treatment raises concerns about both its benefits and potential risks, making this topic significant for both medical and environmental sciences.

Chlorine (Cl) is a chemical element with atomic number 17, classified within the halogen group of the periodic table. It exhibits high chemical reactivity, particularly with metals and organic substances. In its elemental state, chlorine is a diatomic, yellow-green gas with a pungent and irritating odor. However, within biological systems, chlorine is predominantly present in the form of the chloride ion (Cl^-), a chemically stable and physiologically non-toxic species at normal concentrations. Chloride is the principal extracellular anion in the human body and plays an essential role in maintaining osmotic balance, propagating nerve impulses, and regulating acid-base homeostasis. In nature, chlorine is widespread, occurring chiefly in seawater, evaporite mineral deposits, and various geological formations. Human intake of

chlorine primarily occurs through dietary consumption of sodium chloride (NaCl) and other chloride-containing compounds, ensuring its availability for vital physiological and biochemical functions.

In its ionic form as chloride (Cl^-), chlorine is integral to multiple physiological mechanisms critical for sustaining homeostasis in the human body. A key role of chloride ions involves the regulation of electrolyte distribution and osmotic gradients across cellular membranes, thereby ensuring optimal cellular hydration and function. Chloride also plays a central role in maintaining acid-base equilibrium by participating in the bicarbonate buffering system, particularly within erythrocytes, where it contributes to the fine regulation of systemic pH levels. Furthermore, chloride is essential for proper neuromuscular activity; it stabilizes the resting membrane potential and enables the conduction of electrical impulses in both nerve and muscle tissues. Insufficient chloride availability can impair these fundamental physiological functions, potentially resulting in significant clinical disturbances.

Chlorine plays an indispensable role in gastrointestinal physiology, chiefly through its participation in the synthesis of hydrochloric acid (HCl) within the stomach. Parietal cells of the gastric mucosa secrete chloride and hydrogen ions, which combine to generate the highly acidic gastric environment required for effective digestion. Hydrochloric acid facilitates the mechanical and chemical breakdown of food, denatures dietary proteins, and promotes nutrient bioavailability for intestinal absorption. Additionally, HCl is essential for the activation of pepsinogen into pepsin, a proteolytic enzyme vital for protein catabolism. Beyond its digestive function, hydrochloric acid serves as an innate immune barrier, neutralizing ingested pathogens and thereby contributing to the protection of the gastrointestinal tract and the maintenance of mucosal immunity.

Chlorine is fundamental to numerous cellular and hematological functions. Within erythrocytes, chloride is a key component of the bicarbonate exchange mechanism (the chloride shift), which is critical for systemic acid-base homeostasis. It also plays a pivotal role in regulating the distribution of fluids across intracellular and extracellular compartments, thereby maintaining osmotic equilibrium and optimal cell hydration. Furthermore, chloride ions are essential for sustaining membrane potential and are actively involved in signal transduction pathways, thereby facilitating intercellular communication and supporting a wide range of physiological cellular processes.

Chlorine is predominantly acquired through dietary intake, with sodium chloride (NaCl) being the principal source. Additional contributors include processed foods, cheeses, olives, and various marine-derived products such as seaweed. The recommended daily allowance (RDA) for chloride in adults is approximately 2,300 mg, although individual requirements may vary based on age, physiological condition, and activity level. While chloride deficiency is uncommon, it can manifest through clinical symptoms such as muscular weakness, dehydration, and disturbances in acid-base balance, particularly metabolic alkalosis. Conversely, chronic excessive intake –

typically associated with elevated dietary salt consumption – as been linked to hypertension and an increased risk of cardiovascular morbidity.

Thus, chlorine, primarily in the form of chloride ions, is a vital electrolyte that contributes to the regulation of fluid distribution, acid-base balance, and critical cellular processes, including membrane potential maintenance and signal transmission. It is mainly acquired through dietary sources such as table salt, making adequate nutrition essential for sustaining physiological stability. Both insufficient and excessive chloride levels can lead to significant health disturbances, ranging from muscle weakness and metabolic alkalosis to hypertension and increased cardiovascular risk. Therefore, maintaining an appropriate chloride intake through a balanced diet is fundamental to overall health and homeostatic regulation.

References

1. Pazen, O., Scherbina, O.N., Mykhalitchko, B.M. Combustible and toxic properties chlorine-containing organic pesticides and methods for their detection. Pojejna bezpeka (Fire safety), 18, 2011, 120-127.
2. Bedzaj, A.A., Scherbina, O.N. Mykhalitchko, B.M. “Dangerous influence of combustion products to vital human organs”, Naukove zabezpechennia diyalnosti operatyvno-riatuvalnyh pidrozdiliv. Materialy Vseukrainskoi naukovo-praktychnoi konferencii [Scientific maintenance of activity efficiently and rescue units. Materials of the All-Ukrainian scientific and practical Conference], Kharkov, NUCPU, Part 2, 2014, 65-66.
3. Haloheny ta yikhni pokhidni : navch. posibnyk / H. I. Hurina; Kharkiv. nats. un-t misk. hosp-va im. O. M. Beketova. – Kharkiv : KhNUMH im. O. M. Beketova, 2018. – 221 s.
4. Zahalna ta neorhanichna khimiia : praktykum / M. S. Slobodianyk, N. B. Ulko, K. M. Boiko, V. M. Samiilenko. – Kyiv : Lybid, 2004. – 336 s.

БІОХІМІЧНІ ВЛАСТИВОСТІ ЗОЛОТА ТА ПЕРСПЕКТИВИ ЙОГО МЕДИЧНОГО ЗАСТОСУВАННЯ

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Вступ. Із давніх часів золото привертало увагу як матеріал з унікальними властивостями, і в новітній час стало об’єктом досліджень в галузі медицини. Попри широкий інтерес людства до золота, його біологічна дія залишається