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EFFECTIVE METHODOLOGY FOR TEACHING STUDENTS THE FUNDAMENTALS OF CHEMICAL BALANCE IN THE HUMAN BODY

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Annotation. This article presents an effective methodological approach to developing students' knowledge and skills related to the biological functions of chemical elements in the human body and their importance in maintaining chemical balance. The paper highlights the roles of calcium, sodium, potassium, magnesium, and iron in human health, their recommended daily intake, concentrations in water and food sources, and emphasizes that these elements should not be consumed in their pure metallic form but as biologically absorbable compounds. The article also explores how practical and contextual teaching strategies can enhance scientific literacy and real-life application of chemical concepts among students.

Key words: chemical balance, calcium, sodium, potassium, magnesium, iron, health, nutrition, water quality, compounds, students, methodology, scientific literacy, education.

Introduction

In the modern education system, one of the most pressing tasks is to develop knowledge and skills based on interdisciplinary integration and aligned with real-life needs. In particular, promoting a healthy lifestyle, ensuring biological safety, fostering ecological awareness, and enhancing scientific literacy are among the priority directions of contemporary education [1]. From this perspective, providing students with in-depth and accurate knowledge about chemical balance in the human body is of significant scientific and practical importance.

The maintenance of chemical balance involving elements such as calcium, sodium, potassium, magnesium, and iron is essential for the stable functioning of vital physiological processes in the human body. A deficiency or excess of these elements can lead to various diseases and physiological disorders. Therefore, equipping students with scientifically grounded knowledge about the biological functions of these essential chemical elements, the necessity of maintaining their balance, and their importance for health is one of the key directions in modern chemistry and biology education [2].

This article examines methodological approaches for effectively teaching students the fundamentals of chemical balance in the human body, utilizing innovative lesson formats, as well as contextual and practical methods. It also analyzes didactic solutions aimed at fostering students' conscious attitudes

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toward health, developing independent analytical skills, and promoting interdisciplinary connections through the integration of relevant educational strategies.

Main Part

Human health is largely dependent on the balance of chemical substances in the body, particularly the balance of mineral elements. The intake of these substances in appropriate amounts and their proper absorption into the body are integral components of a healthy lifestyle [3]. By providing students with a deep understanding of these topics, it becomes possible to develop their scientific literacy, ecological awareness, and the ability to approach real-life problems with conscious and informed thinking.

The sodium element primarily enters the human body in the form of table salt (sodium chloride – NaCl). Salt plays a crucial role in maintaining the body's fluid balance, transmitting nerve impulses, and regulating muscle contractions. However, excessive consumption of salt can lead to cardiovascular diseases, hypertension, and kidney-related problems. According to the recommendations of the World Health Organization (WHO), the daily salt intake for a healthy individual should not exceed 5 grams. Within the educational process, helping students to visualize this amount in practical measurements — for example, showing that it is approximately equal to half a teaspoon of salt — enhances comprehension and makes the topic more memorable. This approach not only supports understanding but also links theoretical content to real-world application, which is essential in forming health-conscious attitudes among students.

Calcium, on the other hand, is a major structural component of bones and teeth in the human body, and it plays an important role in the functioning of the heart, nervous system, and muscular system. The daily calcium requirement varies depending on age, but for an average adult, it should be around 1000–1200 mg per day. The main dietary sources of calcium include dairy products, fish, green leafy vegetables, and mineral waters. Notably, the calcium content in drinking water is of particular importance. According to World Health Organization (WHO) standards, the normal range for calcium in drinking water is 20–80 mg/l. Some sources permit levels up to 100–200 mg/l, but excessive concentrations may increase the risk of kidney stone formation.

In the educational process, it is equally important to provide students with clear understanding of the chemical forms in which calcium should be consumed. Common calcium compounds include calcium carbonate ($CaCO_3$), calcium citrate ($Ca_3(C_6H_5O_7)_2$), calcium lactate, and calcium phosphate. Among these, calcium citrate is considered the most bioavailable form, particularly recommended for individuals with digestive issues. Calcium carbonate, while widely available and cost-effective, requires adequate stomach acid for proper absorption. Therefore, it is advisable to explain to students, through examples, which forms of calcium are more suitable under different health conditions, helping them make informed decisions about their diet and supplementation [4].

In chemistry education, teaching these topics effectively involves the use of practical exercises, experiments, data analysis, and visual tools such as graphs and quantitative information. These methods help students deeply understand the subject matter. For instance, conducting laboratory work to determine the calcium content in water, analyzing salt composition, or studying food labels for mineral content are practical approaches that strengthen students' knowledge and help them develop skills to apply their learning in real-life situations.

Sodium, potassium, magnesium, and iron are chemically essential elements for the human body. However, from a chemical standpoint, these elements are metals, and in their pure (elemental) metallic form, they cannot be absorbed by the human body and may even be toxic. Therefore, they are consumed only in the form of compounds, either through food sources or dietary supplements. Explaining to students the compound forms of these elements and how they are absorbed by the body plays a crucial role in developing their chemical literacy. Understanding the bioavailability,

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functionality, and health implications of these compounds enables students to connect chemical knowledge with practical and health-related decisions.

Sodium enters the human body primarily in the form of sodium chloride (NaCl), commonly known as table salt. This compound plays a crucial role in maintaining the body's water-salt balance, transmitting nerve impulses, and facilitating muscle contraction. Sodium can also be found in some food products as sodium bicarbonate ($NaHCO_3$), also known as baking soda; however, NaCl remains the primary source of sodium in the human diet.

Potassium, on the other hand, enters the body in the form of compounds such as potassium chloride (KCl), potassium citrate ($K_3C_6H_5O_7$), and potassium phosphate. Potassium citrate and potassium chloride are particularly important for regulating heart function, while potassium phosphate plays a role in cellular energy metabolism. Potassium is abundantly found in natural foods such as bananas, oranges, potatoes, and spinach, making these items significant dietary sources of this essential mineral.

Magnesium is also an essential metal for the human body, but it is not consumed in its pure metallic form. Instead, it is ingested in the form of salts such as magnesium oxide (MgO), magnesium citrate ($Mg_3(C_6H_5O_7)_2$), magnesium lactate, and magnesium chloride ($MgCl_2$). Among these, magnesium citrate and magnesium lactate are considered the most bioavailable and beneficial forms for the body. These compounds play a key role in muscle relaxation, heart function, and nervous system stability.

Iron enters the human body in the form of various organic and inorganic compounds, such as ferrous sulfate ($FeSO_4$), ferrous fumarate, ferrous gluconate, and sometimes iron citrate. Ferrous sulfate and ferrous gluconate are widely used to treat iron deficiency anemia. Iron is also naturally present in many animal and plant-based food sources, including meat, liver, spinach, peas, and beans — all of which are excellent sources of dietary iron. To improve iron absorption, it is recommended to consume it alongside foods rich in vitamin C, as vitamin C enhances the bioavailability of non-heme iron.

This information helps students understand that essential chemical elements in the human body are not biologically active in their pure metallic form, but rather in the form of specific salts or organic compounds. Learning which forms to consume under different physiological conditions is crucial for making informed health decisions.

Such topics are best reinforced through practical learning activities, such as analyzing mineral content on food labels, writing the chemical formulas of compounds, or observing the physical and chemical properties of selected substances in laboratory experiments. These methods enable students to gain a deep and applied understanding of the subject matter.

Conclusion

The balance of chemical substances in the human body is a fundamental component of a healthy lifestyle. When this balance is disrupted, various physical and psychological health problems may arise. In particular, maintaining adequate levels of essential elements such as calcium, sodium, potassium, magnesium, and iron is crucial for the stable functioning of vital physiological processes. Therefore, teaching students the biological roles of these elements, their recommended daily intake, and the specific compound forms in which they should be consumed is one of the key responsibilities of modern science education. Delivering this knowledge in a systematic and scientifically grounded manner is essential to fostering health-conscious, informed, and scientifically literate individuals.

These elements, being metallic in nature, should never be consumed in their pure form; rather, they must be introduced into the body only through salts or organic compounds. For example, forms such as ferrous sulfate, calcium carbonate, sodium chloride, potassium citrate, or magnesium lactate are absorbable by the human body and serve beneficial physiological functions. In addition, it is essential to teach students specific regulatory standards, such as the recommendation that daily salt (sodium chloride) intake should not exceed 5 grams, and that calcium levels in drinking water should fall

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within the range of 20–80 mg/l, according to international health guidelines. Understanding these benchmarks helps students build critical knowledge and decision-making skills related to personal and public health.

Through the subjects of chemistry and biology, students can internalize these concepts, relate them to real-life challenges, and enhance their scientific literacy via practice-oriented learning. This approach not only increases their engagement with science, but also contributes to the formation of a healthy generation, the development of ecological awareness, and the practical integration of sustainable development goals into education.

References:

1. Ergashev A., Rudenko I., Davletov S., Azizov A., Akinshina N., Eshchanov R., Karimov B., Saruk O., Volkov A., Botman Y., Raximov A., Salixov P., Mambetullaeva S., Xodjaeva G., Begdullaeva Barqaror taraqqiyotva tabiatshunoslik asoslari. – Toshkent: “Baktria press”, 2016. - 300 b.
2. Ataullayev Zokir Maxsudovich, Masharipov Vafa Ametovich, Eshchanov Ruzumboy Abdullayevich, Barqaror taraqqiyot tushunchalari vositasida kimyo fanlarini o‘qitishni xalqaro baholash tizimiga moslashtirish // «Urganch davlat pedagogika instituti axborotnomasi» ilmiy-nazariy va metodik jurnal, dekabr №1-son 2024-yil 172-177-betlar.
3. D.O. Shirinova, V.A. Masharipov, R.A. Eshchanov, Z.M. Ataullayev, “Umumta’lim maktablarida kimyo fanining ayrim mavzularini barqaror taraqqiyot tushunchalari bilan uyg‘un holda o’qitish uslubi”, “IMPRESS MEDIA” bosmaxonasi, 19.04.2025.
4. Shirinova D.O., Eshchanov R.A., Ataullayev Z.M., Ubaydulloyev F.B., Barqaror taraqqiyot tushunchalari hamda oksidlar mavzusini uyg‘unlikda o‘qitishda “assesment” metodi / Ta’lim muhitining transformatsiyasi: zamonaviy o‘qitishda raqamli texnologiyalarning o‘rni, xalqaro ilmiy-amaliy konferensiya, 2025-yil 16-aprel 989-995-betlar.