



MEDICINAL SUBSTANCES CONTAINING BIOMETALS AND THEIR APPLICATION IN MEDICINE

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ABSTRACT

Biometals play a crucial role in various biochemical and physiological processes in the human body. Medicinal substances containing biometals are widely used in modern medicine due to their therapeutic properties. These compounds contribute to enzymatic reactions, cellular metabolism, and the maintenance of homeostasis. This article discusses the classification of biometals, their synergistic and antagonistic interactions, and their applications in treating various diseases. Specific examples of medicinal substances containing biometals, such as iron, zinc, copper, magnesium, calcium, and silver compounds, are highlighted, along with their pharmacological effects and clinical significance. Understanding the role of biometals in medicine can contribute to the development of more effective treatment strategies and improved patient care.

KEYWORDS

Biometals, medicinal substances, pharmacology, synergistic interaction, antagonistic interaction, therapeutic applications, enzymatic activity, metal ions, homeostasis, clinical medicine.

INTRODUCTION

All elements present in the biosphere, in general, can also be found in the human body. Elements that directly participate in vital biological processes or are part of the composition of these substances are called biologically active or biogenic elements. The classification of biogenic elements is based on their electronic structure, the amount present in an organism, their functional significance, and other related concepts. Biogenic elements are divided into s, p, and d elements based on their electronic configuration. According to their quantity in the body, biogenic elements are classified as follows:

- Macrobiogenic elements – elements that constitute 1% or more of the total mass of an organism. These include O, C, H, N, Ca, and P.
- Oligobiogenic elements – elements that make up between 0.01% and 1% of the organism's composition. These include Mg, Fe, K, Na, Cl, and S.

The function of biogenic elements in living organisms, their accumulation, and absorption depend on various factors. Among these are synergistic and antagonistic factors.

- Synergistic interaction refers to when one element enhances the effect of another element.
- Antagonistic interaction occurs when one element reduces the effect of another element.
- Synergistic and antagonistic interactions have highly diverse and complex mechanisms. Some examples of these interactions include:

- A reduction in Cu levels in the body leads to decreased Fe absorption. Therefore, when treating iron deficiency anemia, patients are often prescribed iron supplements along with copper salts. This is an example of synergistic interaction.
- As an example of antagonistic interaction, an increase in zinc levels in the body can reduce the absorption of Ca, Mg, Na, and K ions. Similarly, an increase in Al^{3+} levels can decrease the absorption of Ca, Mg, and K, while an increase in Ni and Co reduces H, P, Ca, and K levels.

Additionally, disturbances in the quantitative ratios of Mo-Cu, Ni-Cu, Cu-Mo, SO_4^{2-} -I⁻, Co-Cu, and Cu-Ca in the body can lead to a deficiency of one of these elements.

Many medicinal substances contain biogenic metal ions. Examples of such medicinal substances include:

- 0.85% NaCl solution – used as a physiological solution in cases of dehydration and significant blood loss, administered intravenously.
- Hypertonic NaCl solution (3%, 5%, 10%) – used in surgical procedures.
- NaHCO_3 (sodium bicarbonate) – used to treat increased acidity of gastric juice and ulcers of the stomach and duodenum.
- NaCl (sodium chloride) – used in the treatment of cardiac arrhythmias, myocardial infarction, and hypoanemia.
- CH_3COOH (acetic acid) – used for hypoanemia.
- MgO (magnesium oxide) – used for gastrointestinal diseases.
- $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ (magnesium sulfate) – used in hypertension, atherosclerosis, biliary tract disorders, and gastrointestinal dyskinesia.
- $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$ (calcium chloride) – used for hypocalcemia, skin diseases, allergic conditions, nephritis, and poisoning with magnesium salts and oxalic acid.
- Calcium gluconate – also used in the treatment of the above conditions.
- $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (copper sulfate) – used for the treatment of conjunctivitis, anemia, and vitiligo in low doses.
- AgNO_3 (silver nitrate, also known as lapis) – used for treating erosions, ulcers, conjunctivitis, and trachoma.
- $\text{ZnSO}_4 \cdot \text{H}_2\text{O}$ (zinc sulfate) – used for treating conjunctivitis and chronic laryngitis.
- HgCl_2 (mercury(II) chloride) – used in dermatological treatments.
- KMnO_4 (potassium permanganate) – used for wound cleansing, mouth and throat rinsing, and as a disinfectant in gynecology and urology.
- Vitamin B₁₂ (cyanocobalamin) – used in the treatment of anemia, radiation sickness, liver diseases, radiculitis, neuralgia, migraines, and skin diseases.
- Iron supplements (such as iron glycerophosphate, iron lactate, and Ferramid) – used to treat various forms of anemia.

CONCLUSION

In conclusion, medicinal substances containing biometals play a crucial role in human life. Therefore, every individual must take responsibility for their own health, as well as the health of their family and loved ones.

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