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# THE ROLE OF MICROELEMENTS IN THE HUMAN BODY

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**Abstract**
Metal ions are required to maintain human health, as several essential biological functions in humans depend on their presence, and their absence or deficiency can lead to diseases. However, some metal ions, particularly heavy metals such as mercury and lead, can be hazardous due to their toxic effects.

**Keywords**: Microelements, calcium, magnesium, human, body, important, elements.

## Introduction

Metal ions are essential for maintaining human health, as several vital biological functions in humans depend on their presence, and their absence or deficiency can lead to disease. However, some metal ions—particularly heavy metals such as mercury and lead—can be hazardous due to their toxic effects. Even essential metal ions can become toxic when present in excess, although their presence is crucial for survival.

Currently, among the metals required for normal biological functions in humans are the major elements such as sodium (Na), potassium (K), magnesium (Mg), calcium (Ca), as well as vanadium (V), chromium (Cr), manganese (Mn), iron (Fe), cobalt (Co), nickel (Ni), copper (Cu), zinc (Zn), molybdenum (Mo), and cadmium (Cd), which belong to the metal group of the periodic table. Among these metals, the most significant ones typically present in ionic form are Fe, Co, Ni, Ca, Cu, Zn, and Cr. Deficiency in Fe and Co can lead to anemia, Cu deficiency may cause brain and heart disorders as well as anemia, Zn deficiency may result in growth retardation and skin changes, Ca deficiency causes bone disorders, and Cr deficiency reduces glucose tolerance.

Thus, an important aspect of modern medicinal bioinorganic chemistry is the study of diseases caused by deficiency or excess of various metal ions at the molecular level and the development of treatment methods. One of the most important features of metal ions is their role in drug discovery.

## Functions of Calcium, Magnesium, and Zinc in the Human Body:

**Calcium** is highly active and performs various functions in the body:

- Regulates intracellular processes
- Controls the permeability of cell membranes
- Regulates nerve conduction and muscle contraction
- Stabilizes heart function
- Promotes bone tissue formation



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- Contributes to the mineralization of teeth
- Participates in coagulation processes

**Physiological role of Magnesium:**

Magnesium enters the body through water and food, with a daily intake typically ranging from 200–400 mg. Leafy greens are particularly rich in magnesium. A portion of ionized magnesium is absorbed into the blood. Most poorly soluble magnesium salts pass into the intestines and, after binding with fatty acids, are absorbed by the body. From the blood, magnesium travels to the liver, where it is used for the synthesis of biologically active substances.

An adult human body contains approximately 140 g of magnesium, two-thirds of which is located in bone tissue. Magnesium is primarily excreted through urine (15–120 mg/day) and sweat (5–15 mg/day). It is one of the most important intracellular elements and is involved in metabolic processes. It interacts with potassium, sodium, and calcium. Normal magnesium levels in the body are necessary for:

- Supplying "energy" for vital processes
- Regulating nerve-muscle conductivity
- Maintaining smooth muscle tone

**Magnesium performs the following functions in the body:**

- Participates in the synthesis of proteins and nucleic acids
- Involved in the metabolism of proteins, fats, and carbohydrates
- Plays a role in energy transfer, storage, and utilization
- Takes part in mitochondrial processes
- Participates in neurochemical transmission in neurons and the regulation of muscle excitability
- Serves as a cofactor in numerous enzymatic reactions
- Regulates intracellular potassium balance
- Reduces acetylcholine levels in nervous tissue
- Lowers blood pressure

**Role of Zinc in the Human Body:**

The daily intake of zinc is 10–15 mg, with a toxicity threshold of about 600 mg. Zinc enters the body through food sources such as beef, liver, seafood, wheat grains, bran, cornmeal, carrots, peas, onions, spinach, and nuts. For proper zinc absorption, vitamins A and B6 are required.

The adult human body contains 1.5–3 g of zinc. It is found in many organs and tissues, particularly in the prostate gland, semen, skin, and hair. Zinc is essential for protein synthesis and plays a significant role in the formation of bones and collagen.

**In general**, microelements such as zinc, iron, manganese, copper, molybdenum, boron, chlorine, and nickel are essential, and elements like silicon (Si), sodium (Na), cobalt (Co), and strontium (Sr) are beneficial or necessary for plants. In addition to these microelements, humans and animals also require chromium (Cr), iodine (I), and selenium (Se). Microelements are used in relatively small amounts and account for less than 0.1% of the dry weight of plant tissue.



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Some microelements can become toxic when consumed in high quantities. Soil is the primary source of microelements for plants. The availability of microelements in soil depends on their chemical form and their distribution between solid and liquid phases, which are influenced by soil conditions such as pH, texture, and aeration.

In plants, microelements perform various functions. Some are structural components of enzymes or activate enzymes, and they play a role in redox reactions of plant metabolism. Microelement deficiency in plants not only limits agricultural productivity but also affects human nutrition, as plant-based foods are a major component of the human diet.

Thus, microelements perform several physiological functions in the human body, including the synthesis of enzymes, hormones, and other substances, as well as the regulation of growth. Deficiencies of microelements in soil and plants can be addressed through chemical or organic fertilization. In humans, micronutrient levels can be optimized through dietary diversification, mineral supplementation, food fortification, or increasing their concentration in food products.

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