CALCIUM IS THE MOST IMPORTANT BIOELEMENT AND THE BIOLOGICAL ROLE OF CALCIUM

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Abstract. *This article describes the calcium bioelement, its biological role in the body and toxicity.*

Keywords: *Calcium, bioelement, hormones, Parathyroid hormone (PTH), vitamin D*

Calcium is a chemical element of group II (it means "lime", "soft stone" from the Latin word calcis), one of the most common elements on Earth. Calcium compounds are found in almost all animal and plant tissues. Due to the high chemical activity of calcium in the free form in nature is not found. Calcium is the most abundant element in the body. Up to 99% of the calcium available in the body is concentrated in the bones of the skeleton, about 1% - in the composition of all organs, tissues and biological fluids. The role of calcium as a structural material has been known for centuries. Prehistoric man also suffered from osteoporosis. Calcium is not only a structural component of bone tissue. Calcium ions play a key role in muscle contraction, increase the permeability of the cell membrane for potassium ions, affect the sodium conductivity of cells, the operation of ion pumps, promote the secretion of hormones, and participate in the cascade mechanism of blood coagulation. In addition, calcium ions serve as the most important intermediaries (messenger) in the intracellular transmission of various signals. The concentration of calcium inside cells depends on its concentration in the extracellular fluid.

Calcium affects the function of the endocrine glands (especially the parathyroid glands), has an anti-inflammatory and desensitizing effect, and is in biological antagonism with sodium and potassium ions. Calcium is needed for normal excitability of the nervous system, muscle contractility, is an activator of many enzymes and hormones.

Calcium is the second element in terms of involvement in various physiological and biochemical processes occurring in the body. It plays an important role in the regulation of the permeability of cell membranes, the electrogenesis of nervous and muscle tissues, in the molecular mechanism of muscle contraction, digestive and endocrine glands, in the activation of various enzymatic systems, including those providing blood coagulation, etc. In connection with the high biological activity of calcium ions in humans, in the course of evolution, a rather effective system for regulating calcium homeostasis was developed. Parathyroid hormone (PTH), calcitonin and vitamin D are the main calcium-regulating hormones. However, other hormones also affect calcium metabolism: glucocorticosteroids, thyroid hormones, growth hormone, insulin, and estrogens. In addition to the 4 organs, parathyroid glands, kidneys, intestines and bones, each of which are important in calcium homeostasis, extracellular calcium is also considered as the 4th calcium tropic hormone. One of the important physiological processes associated with the close participation of calcium ions and calcium-regulating hormones is the control of vascular tone and blood pressure. Epidemiological studies have found that calcium intake is inversely correlated with blood pressure levels. Several potential mechanisms are known to explain the effect of calcium on blood pressure levels, and are associated with changes in the secretion of calcium-regulating hormones, including PTH and parathyroid hypertensive factor. Low plasma renin, sensitivity to dietary salt, and altered calcium metabolism are predictors of a hypotensive response to calcium supplementation. The reninangiotensin-aldosterone system and calcium-regulating hormones, especially vitamin D metabolites, work 4 in a coordinated way by changing the distribution of calcium between the intra- and extracellular spaces. Calcium-dependent receptors, which are isolated in the parathyroid glands (inhibit PTH secretion), vascular smooth muscle cells, cardiomyocytes, vascular endothelial cells, as well as in the parathyroid glands, kidneys, intestines, bones and perivascular adventitia nerves, play an important role in the systemic regulation of calcium homeostasis. One of the important effects of calcium-dependent receptors is the regulation of vascular tone and blood pressure, which is carried out through the

modulation of calcium homeostasis. It has been shown that stimulation of these receptors causes the production of nitric oxide, which is a powerful vasodilator. Calcium-dependent receptors play an important role in extracellular calcium homeostasis by regulating the rate of PTH secretion and the rate of calcium reabsorption by the kidneys. It has also been found that calcium-dependent vascular endothelial receptors activate potassium channels, which results in potassium-induced hyperpolarization of SMC vessels. All this indicates that calcium-dependent receptors may play a physiological role in the modulation of blood pressure. In addition, increased expression in the heart of a protein containing calcium-dependent receptors was also noted during myocardial ischemia and reperfusion. Also, other studies have shown the importance of the expression of calcium-dependent receptors and their signaling mechanisms in understanding the physiology and pathophysiology of the cardiovascular system.

The daily requirement of calcium in adults is 0.8–1 g per day. Calcium is an important part of the body; its total content in the human body is about 1.4% (1000 g per 70 kg of body weight). The body of a newborn contains 30 g of calcium, the amount of which increases by the period of adulthood up to 1000-1200 g. To accumulate this amount, approximately 100 to 150 mg of calcium should remain from the diet daily during childhood. The peak is reached at puberty: 200 mg for women and 280 mg for men. Then there is a decrease of 10–30 mg per day (at maturity). The ability to retain a certain level of calcium is lost (becomes negative) in women after menopause and in men by the age of 65. Recommended requirements are based on the amount of dietary calcium needed to replace losses in intestinal secretions, urine and sweat, taking into account the efficiency of intestinal absorption. Most calcium (120 mg%) is found in milk and dairy products, for example, in cheese about 1000 mg% (mg% is a milligram of a substance per 100 g of product, conventionally taken as 100%). Almost 80% of all human calcium needs are met by dairy products. Nuts, bean curd, beans, horseradish, parsley, onions, apricots, dried apricots, apples, dried peaches, pears and sweet almonds are also sources of calcium. Calcium is found in foodstuffs mainly in the form of sparingly soluble salts

(phosphates, carbonates, oxalates). Calcium is non-toxic. The lethal dose for humans has not been determined. No adverse effects have been found with calcium supplements up to 2400 mg per day other than constipation in some individuals. Clinical manifestations of calcium overdose can occur with regular intake of more than 2.5 g of calcium per day. When using large doses of calcium, it is necessary to take into account the effect of calcium supplements on iron absorption. Daily intake of more than 2400 mg of calcium may impair kidney function. Dietary calcium supplementation does not lead to an increased risk for stone formation in healthy adults, but may contribute to this in patients with absorptive or renal hypercalciuria, primary HPT, and sarcoidosis.

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