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Chromium and its role in the human body including the antidiabetic action

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Summary
Chromium is an element belonging to micronutrients, which is about 0.012% of the coating earth. Chrome Latin language. chromium was discovered in 1798 by the French researcher Louis Nicolas Vauquelin in the periodic table element belongs to the group VI A transition having an atomic number of 24 and an atomic weight of 51.996, chrome "Chroma" in Greek means "color". It owes its name to chemical compounds, which element is formed on all oxidation; +1 to + 6 [4,7,8]. Chromium is an element which, in the environment occurs in two forms as Cr (III) and Cr (VI) [4,5,6,8]. The role of the element in the human body primarily is seen in the metabolism of carbohydrates, proteins, lipids, and especially cholesterol levels [1]. Chromium as a chemical compound in the oxidation of Cr (III) is part of enzymes, ribonucleic acids, accelerates blood coagulation and also increases the activity of B-glucuronidase. The properties element plays a key role in the antioxidant during the synthesis of RNA and DNA immune response affects the synthesis of certain vitamins and hormones. In adult women for the correct standard daily intake of chromium with the diet I recognize the value of 25 µg in men 35 µg [7,8].

Keywords: chrome, diabetes, cardiovascular disease, hypoglycemia, supplementation

Introduction

The influence of chromium and its role in the human body today is a point of discussion and the subject of study for many world-class researchers. The role of the element in the human body primarily is seen in the metabolism of carbohydrates, proteins, lipids, and especially cholesterol levels [1]. Chromium as a chemical compound in the oxidation of Cr (III) is part of enzymes, ribonucleic acids, accelerates blood coagulation and also increases the activity of B-glucuronidase [2]. The properties element plays a key role in the antioxidant during the synthesis of RNA and DNA immune response affects the synthesis of certain vitamins and hormones [1,2]. Chromium is an element belonging to micronutrients, which is about 0.012% of the coating earth [3]. In 1957 he was recognized as a chemical element, which is necessary to preserve the life and health of every living organism. Chromium as a chemical element in the form of a solid takes the form of a hard metal with a silvery color, the characteristic feature is the ability to conduct heat and electricity [4]. Chrome Latin language chromium was discovered in 1798 by the French researcher Louis Nicolas Vauquelin [5,6] in the periodic table element belongs to the group VI A transition, having atomic number 24 and the atomic mass of 51.996 [4,5]. Chrome "Chroma" from Greek means "color". It owes its name to chemical compounds, which element is formed on all oxidation; +1 to + 6 [4,7,8]. Chromium is an element which, in the environment occurs in two forms as Cr (III) and Cr (VI) [8]. As a building block, some enzymes stimulates activity other. Proper chromium concentration within the limits of the reference standards allows for the proper functioning of living organisms exceed physiological concentration of Cr (VI) is an increased risk of cancer, and is a factor increasing susceptibility to allergenic [8,9]. Bioavailability of chromium is the ability of the element to a passive or active operations in the body [4]. Bioavailability is done in two forms. The first of these is the process of chemical penetration through cell membranes, and the second is the process of absorption of substances by the respiratory or digestive tract [4,5]. Factors which affect the degree of bioavailability of the substance: The type of chemical compound, the degree of oxidation and the solubility and ability to form complexes of organic [4,5]. Chromium (III) is the most useful and important in the functioning of living organism. Element 3 at the oxidation enter complexes with such compounds as organic ligands, you can not penetrate cell membranes and is less toxic than chromium in the +6 oxidation state. Chromium 6 characterized by a strong ability to oxidation in an acid medium with a high content of organic substances [4,5]. In living organisms is converted into the form of Cr (III), which is not toxic [4,5,6,7,8]. The first reports from the world of science about the role of chromium in the body opened with the publication in 1959 [9]. It was the beginning of the discussion and research on its function and usefulness. In the human body, chromium is absorbed in the small intestine, with the capacity depending on the form in which they occur [6]. Elimination of this element from the body takes place mainly in the urine and in a small percentage of feces. The factor that mobilizes system for the removal of the element prior to the accumulation of a large physical effort [5, 6,7,8]. Trace mineral present in trace amounts in the tanks of the human body is essential for its proper functioning, allowing you to preserve life and health of living organisms [10].

The demand and will absorb chromium (III)

According to studies, which were conducted by Czerwińska and Zadrużna average daily intake of chromium in the diet among the Polish population is within the range of 36.2 μg to 58.7 μg per person μg / per day [11]. The study, which included a larger population of Polish men and women, not confirm test data Czerwińska and Zadrużna [11]. Studies

involving larger population Polish, showed that the average assimilation of chromium along with diet in adults is 81μg women, while in men 111 μg [12]. A safe recommended dose of chromium (III) (ang. RDA- Recommended Dietary Allowances) in healthy human adult and is 50-200 μg / 24 h [7]. These standards set in 1989. On the basis of the average daily supply of chromium in food have been set standards sufficient micronutrient intake so. stands. AI (adequate intake) [7]. In adult women for the correct standard daily intake of chromium with the diet I recognize the value of 25 μg in men 35 μg [7,8]. Chromium should be sought primarily in products such as whole grains, eggs, nuts, asparagus, mushrooms, cheese, yeast, fruit, meat offal, beer and oysters. [10] Chromium in nutrition exists in two forms: organic and inorganic. Chromium step after absorption in the small intestine into the blood is transported to all tissues of the body. In the body element it is bound by protein complexes such as transferrin and chromodulina [7]. There are differences between organic and inorganic form during the absorption element [7]. The absorption of chromium salt (III) is quite low and is in the range of from 0.4 percent to 2.5% [7,13]. The study, which were conducted by Anderson and Kozlovsky indicate that the absorbed amount of inorganic salt of chromium (III) is inversely proportional to its concentration in the diet. When the supply of the inorganic salt of chromium (III) is low, the absorption correlates to the level of 2%, whereas if the supply of salt is about 40 micrograms / 24 hours to clear the absorption at the level ranging from 0.4 to 0.5% [7,11]. Disorders associated with the absorption of chromium in the human body are also a result of the interaction between chromium and other substances in the diet [7,11]. Compounds such as; phytates reduce the absorption of chromium from the intestine, are the opposite of: amino acids, vitamin C, oxalates and nicotinic acid, which promote the absorption of the element by the action of chelatującemu [7]. After uptake of chromium is combined with protein complexes and in this form it is transported in the bloodstream to the liver and other organs of the human body. Transferrin as the plasma protein transport vehicle for interchangeable of chromium and iron. The consequence of such a mechanism can be reduced anemia resulting from saturation of transferrin saturation with iron ions. In the course of hemochromatosis, a disease characterized by a high saturation with iron ions, can lead to a reduced binding to the transferrin chromium and consequently for economic disturbances of the carbohydrate in the form of glucose intolerance [7,14]. Chromium is eliminated from the body by glomerular filtration by the kidneys in 95%. The elimination of chromium ions occurs also through the sweat, feces via the bile or as a building block of the hair. The most common complication deficiency of chromium in the body is a decrease in the activity of insulin and impaired glucose metabolism. Symptoms which occur in the case of chromium deficiency symptoms are typical of diabetes and disorders in the field of cardiovascular diseases [12,14].

The role of chromium in the body's protection against cardiovascular disease in diabetes

Every year on diabetes affects about 11% of the world's population. Diabetes is a complex metabolic dysfunctions; carbohydrates, proteins and fats, brings a lot of negative complications disturb the proper functioning of the human. The World Health Organization (WHO), in their analysis, pointing to the disturbing fact that, providing that in 2030 for this disease entity will be made about 366 million population of the earth's population [15]. At the time of hypoglycemia one of the negative consequences of ill-treatment or uncontrolled diabetes are at high risk of the organism to oxidative stress [15,16]. Oxidative stress is the imbalance between free radicals harmful substances damaging cell membranes and antioxidants [1]. When it comes to excessive activation of free radicals, irrational consequence of the system is lipid peroxidation, and this greatly contributes to the formation of plaque and increases the risk of cardiovascular events [15,16,17]. During the non-enzymatic glycation of proteins, there is a generation of free radicals. Jain et al conducted a

study concerning the effect of chromium (III) on the indicator of oxidative stress in the body in diabetes [17]. Researchers cell line monocyte and erythrocyte organized conditions characteristic of diabetes [17,18]. They have been studying the three forms of chromium chemicals such as chloride, picolinate and niacynian and their impact on oxidative stress induced ketosis as well as high levels of glucose in the monocyte cell line U 937 [17]. The research showed that the most effective form of chromium is chromium wisteria, which led to a reduction in the secretion of IL-6, IL-8, monocyte chemoattractant protein (MCP-1), and decreased concentration of hydrogen peroxide [17,18,19]. The test results presented by the authors of a promising foothold for testing, which would allow to prove and understand the mechanism by which it is chromium (III) is responsible for reducing the risk of morbidity in the field of cardiovascular system in diabetes [17,18] .

Chromium and carbohydrate metabolism

50 years of the twentieth century was a time when I first heard mention of the supposedly it is chrome played a significant role in the metabolism of carbohydrates. Studies in animals, in humans suffering from diabetes, in vitro allowed to draw conclusions supported by evidence that Cr (III) intensify the action of insulin, the tyrosine kinase activity and dynamism phosphatase transmembrane tyrosine insulin receptor, whereby glucose is rapidly absorbed and consumed by cells organism [7,8,9,17]. Scientists like Schwarz and Mertz during their studies in animals, the pig kidney isolated the component, whose function was to restore impaired glucose tolerance in rats that were fed chow prepared on the basis of yeast Torula [9,19]. This component was named GTF stands. Glucose Tolerance Factor [9]. Due to the presence of chromium (III), nicotinic acid and amino acids such as glycine, cysteine, glutamic acid GTF, chromium has become the subject of research of many researchers in the correlation of the effects of insulin resistance, and glucose intolerance, diabetes mellitus as well as disorders of carbohydrate during the whole TPN stands. Total parenteral nutrition. GTF stands. Glucose Tolerance Factor includes in its composition an active form of trivalent chromium Cr (III) [7]. Grela and coauthors in their publications they maintain and reveal the GTF is a trivalent chromium-nicotinic acid occurring glutamic acid, glycine, and cysteine. GTF effect is to improve the binding of insulin to its receptors, and with the participation of hydrogen. Researchers at the test glucose tolerance in healthy subjects and diabetics, there was an increase in plasma concentrations of chromium in healthy subjects and no growth in people with diabetes. Chromium (III) a glucose-lowering effect [7]. In the body, the biological active form of chromium Cr (III) is a low molecular weight chemical substance which binds Cr stands. Low molecular weight chromium substance- binding LMWC so. chromodulina [19,20,21]. Chromodulina is a substance which is a component of the reinforcing effect of insulin. In our study, Vincent proposed a model which showed that apochromodulina or protein that is not joined chromium is accumulated in cells that are sensitive to insulin. When it comes to increase in the concentration of that hormone levels is the consequence of the suspension of insulin binding to the insulin receptor (IR stands. Insulin receptor), which implies a modification of the spatial arrangement of insulin receptors, respectively tyrosine autophosphorylation [20]. Converted to the active form is tyrosine kinase [7,20]. The effect of insulin activates the process by which the chromium is transferred from the plasma to the center of the cell, and then combined to form the apochromoduliną holochromodulinę active form. Holochromodulina combined with the insulin receptor IR, and consequently leads to an increased tyrosine kinase activity and an increase in insulin signal multiples. When the concentration of insulin in the blood decreases provoke a decrease in activity holochromoduliny and insulin receptor IR and removal from the body via glomerular filtration in the kidneys [7,20,21,22]. successively tyrosine autophosphorylation [20]. Converted to the active form is tyrosine kinase [7,20]. The effect of insulin activates the

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Discussion

Over the years, internationally we conducted a number of interesting studies that have prove the necessity of chromium and its antidiabetic activity. The study demonstrated a significant role of chromium in the metabolism of carbohydrates, proteins and fats drag on putting pressure on the lipid fraction in the form of cholesterol. Unfortunately, these studies were not always clear to be able to say that chrome has protective effects of diabetes. This was due to the diversity of research. The studies were carried out on different species :animals, including people of different doses of chromium ration, taking into account the different timeframes, different forms of chromium with different bioavailability, in many regions of the world in which the standards of chromium in the diet significantly different. The study which confirmed the positive effect of chromium on glucose reduction, was the study of Anderson and coauthors. The subject of the study was 180 Chinese population, diabetes suplementowych chromium picolinate. We used in the study double-blind controlled using palcebo. In patients who received supplemental chromium picolinate dose of 1000 μg for four months, it was found that 34% were reduced glycated hemoglobin in 14% reduction in post-prandial glucose, insulin and 18% cholesterol [23,24]. The global publications published works in which supplementation with chromium in the direction of antidiabetic not been confirmed. Appearing studies that support a protective role of chromium in the direction of diabetes are an important starting point for scientists who seek treatment for diabetes, they are also hoping for the same patients. Which has the positive attributes of chromium (III) is its non-toxicity and ease of absorption. It is important to research in this direction continued in

order to clarify the mechanism of action and the establishment of new therapies for the treatment of a chronic disease which is diabetes.

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