Pierzak Monika, Fortunka Kamila. The role of selenium in cancer treatment, cardiovascular diseases, thyroid gland. Journal of Education, Health and Sport. 2018;8(7):516-528. eISNN 2391-8306. DOI http://dx.doi.org/10.5281/zenodo.1344459
http://ojs.ukw.edu.pl/index.php/johs/article/view/5773

The journal has had 7 points in Ministry of Science and Higher Education parametric evaluation. Part b item 1223 (26/01/2017).
1223 Journal of Education, Health and Sport eissn 2391-8306 7

Received: 02.06.2018. Revised: 18.06.2018. Accepted: 31.07.2018.

The role of selenium in cancer treatment, cardiovascular diseases, thyroid gland

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Summary

Introduction: Malignant tumors are diseases occurring in any population in the world, characterized by a high mortality [1]. In the developed countries are the second cause of death after cardiovascular diseases. Among the risk factors for many cancers, distinguished tastes bad habits. A new trend in academic research on the effects of inadequate supply of selenium in the diet at risk of developing cancer, in particular carcinoma of the colon, lung or prostate cancer. The role of selenium, looking also for prevention against cardiovascular events. Cardiovascular disease 50 years of age are the biggest threat to his countrymen. CSO data show since 1992 that the participation of these diseases in the total number of deaths decreased from 52% to 45.6% in 2012. Selenium deficiency also affects, for example, the development of thyroid disease. Autoimmune thyroiditis, hypothyroidism or crop neutral. Deiodinase are selenoenzymes, which play an essential role in the metabolism of thyroid hormones. Deiodinase, type 1, 2 is involved in the process deionization thyroxine [T4] for the active company in the form of 3,3 ', 5-triiodothyronine [T3] [34]. Selenium is a trace element was discovered in 1817 by Swedish chemist Berzelius. Until 1957 was considered, for the root of the toxic effects. Selenium is a trace element belonging to the micro [17,18,19]. As a building block and a redox active enzymes, the cytochrome is involved in metabolic processes in the cell. According to the National Academy of Sciences of the United States (NAS called. National Academy of Sciences), the average daily requirement for selenium (EAR- Estimated Average Requirements) and the recommended dose in the diet (RDA- Recommended Dietary Allowance) indicate selenium 45μg / day for adult women and adult man. Selenium is a trace element [1,8,10,12].

Keywords: selenium, cancer, cardiovascular disease, thyroid disease

Admission

Statistics related to the incidence of malignant tumors are relentless, every year morbidity and mortality due to cancer increases. Malignant tumors are diseases occurring in any population in the world and are characterized by high mortality [1]. In the developed countries are the second cause of death after cardiovascular diseases. For many years, both the incidence and mortality from cancer diseases grew. In recent years, the inhibition of this trend. Substrates of this situation I see the change in the demographic structure of the society over the years and

exposure to carcinogens, today not all identified. In Poland, on 155,000 cases and 93,000 deaths per year due to cancer [2].The incidence of cancer increases with age. Scientific research in the international arena, look for the reasons that were acting directly on the cancer incidence. Among the risk factors for many cancers, distinguished tastes bad habits. A new trend in academic research on the effects of inadequate supply of selenium in the diet at risk of developing cancer, in particular carcinoma of the colon, lung or prostate cancer. The role of selenium, looking also for prevention against cardiovascular events. Cardiovascular disease over 50 years are the biggest threat to the life of Poles, despite the fact that according to data of the Central Statistical Office since 1992. Share of these diseases in the total number of deaths decreased from 52% to 45.6% in 2012. The influence exerted on the observed changes primarily to improve the eating habits in the direction of a diet richer in fats, vegetables and fruits, as well as to improve the results of treatment [3]. Thyroid diseases are a major clinical problem, many complications charged. The thyroid gland is an organ in which the concentration of selenium per gram of tissue is 0.72 mg. From this fact clear interest in scientific research into the impact element for the development of thyroid diseases and particularly Hashimoto's thyroiditis (chronic lymphocytic thyroiditis) [4].

Minerals are a group of chemicals that are necessary for maintaining the normal well-being, which is the human health. The group of these compounds are not synthesized in the human body, therefore, it becomes a necessity to provide them from the external environment in appropriate amounts, thus providing a balance in the system [5,6,7]. The content of minerals in the human body is estimated at about 4% by weight, as based on the weight in a healthy human is about 3 kg [8,9]. Minerals in the body perform many important functions, including such roles can be distinguished as the building blocks of bones, teeth, skin, hair, form the basis of changes in the metabolic processes, regulating water - electrolyte balance and maintain the acid-base balance [9].

Selenium is a trace element essential to normal body function ·, characteristics of the element

Selenium was discovered in 1817 by Swedish chemist Berzelius. Until 1957 he was recognized as the root of the toxic effects. In subsequent years, experiments on rats, involving the application of rodents, a diet rich in yeast Torula characterized by a lack of selenium. This diet in rodents led to the development of necrosis of liver cells. After changing diet rich in yeast Saccharomyces family rich source of selenium, we found that the necrotic effect was inhibited. The role of selenium in the body has become a point of research for scientists over the years. Selenium as a building block and a redox active enzyme cytochrome is involved in metabolic

processes within the cell [10,11]. Selenium gets into the body in the form of organic and inorganic. Selenates inorganic form are: Selenite and selenate VI IV as sodium selenate. The organic form is: selenomethionine and selenocysteine. Of all the forms in which the selenium present in the environment, preferably absorbable form are organic forms. In the process of absorption of all forms undergo chemical transformation [12]. Selenomethionine, can be built into the process of cysteine, as a result of what I rise selenocysteine. Non-specific incorporation of selenomethionine process is its incorporation into proteins methionine in area [13]. Selenium in organic compounds has a degree of oxidation -2 [Se-2], and in inorganic compounds has a degree of oxidation in the range of 4 to 6. Selenium excretion from the body through the lungs is performed, of which selenium is removed in the form of metyloselenium and kidneys as 1-beta-N-acetyl-D-galactosamine [13,14,15].

Feeding standards, characterization of the chemical selenium

According to the National Academy of Sciences of the United States (NAS called. National Academy of Sciences), the average daily requirement for selenium (EAR- Estimated Average Requirements) and the recommended dose in the diet (RDA- Recommended Dietary Allowance) indicate that 45 micrograms of selenium / day for adult women and an adult male. US Food and Drug Administration FDA- Food and Drug Administration indicated that the reference daily dose RDI- Reference Daily Intake is 70 μg / day intake of selenium [1,16,17,21,22].

Table 1. The standards of nutrition for the Polish population. Selenium [μg].

Group Gender / Age (patch)	SELENIUM	
	EAR	RDA
Babies		
0-0.5	**15 (AI)**	
0.5-1	**20 (AI)**	
Children		
1-3	**17**	**20**
4-6	**23**	**30**
7-9	**23**	**30**
Boys		
10-12	**35**	**40**
13-15	**45**	**55**
16-18	**45**	**55**
Men		
19-30	**45**	**55**
31-50	**45**	**55**
51-65	**45**	**55**
66-75	**45**	**55**
> 75	**45**	**55**
Girls		
10-12	**35**	**40**
13-15	**45**	**55**
16-18	**45**	**55**
Women		
19-30	**45**	**55**
31-50	**45**	**55**
51-65	**45**	**55**
66-75	**45**	**55**
> 75	**45**	**55**
Pregnancy		
<19	**50**	**60**
> 19	**50**	**60**
Lactation		
<19	**60**	**70**
> 19	**60**	**70**

Source:*M. Jarosz standards of human nutrition. (Ed). Food and Nutrition Institute. Warsaw 2017 [4].*

The primary and the most common place of occurrence of selenium in the human diet are meat and fish, cereal, dairy products and some fruits and vegetables. Vegetables, where there are selenium, cruciferous vegetables, such as garlic; broccoli, cabbage, garlic, onions, nuts,

mushrooms. The content of selenium is dependent on the presence of in soil or water in a particular region of the world topography. European countries characterized by low content of selenium in the soil, and therefore the primary source of its products are of animal origin [1,12,13,14]. Medical societies around the world agree on the need for selenium supplementation in the diet. Proper intake of selenium in the diet is one which initiates the activity of selenium protein P, which is the carrier of selenium from the liver to particular cells, tissues, [1,18,19,20]. National Health and Nutrition Examination Survey 2003-2004 published the results of research, which indicated that the average concentration of selenium in the blood of a US citizen was 136, 7 μg / L [23]. While the average concentration of selenium in the blood, a resident of Upper Silesia was 63, 5 μg / L. Average daily demand for selenium intake in Poland adopted dose of 45 μg / 24 h [1,2]. Selenium is a nonmetallic belonging to the group of chalcogens of atomic number of 34 [13]. The medium is in the form of organic and inorganic bases. In the inorganic form, present as selenates selenates VI and IV [14]. In an organic occurs in two amino acids; selenomethionine and selenocysteine. The process of formation of both amino acids was based on conversion of the sulfur atom of selenium [15]. The human genome is a 25 genes which code selenium protein [16]. Selenium in the form of selenocysteine, which is part of enzymatic proteins, involved in many critical metabolic pathways [17]. Enzymatic proteins which comprise as component building blocks are called selenium enzyme selenocysteine. In the human body there are three types of enzymes in which selenium is the active site [18]. They are: glutathione peroxidase, deiodinase iodothyronine and thioredoxin reductase. In the human system also occurs 12 individual selenium protein different roles. Glutathione peroxidase and reductase thioredoxin are enzymes which are characterized in antioxidant properties, consisting in a protective effect against the cell against reactive oxygen species. Deiodinase iodothyronine is actively involved in the metabolism of thyroid hormones. Deiodinase type 1 and 2 are involved in deionization thyroxine T4 to the active form in the form of triiodothyronine T3 [30].

Functions of glutathione peroxidase, reductase thioredoxin, deionization iodothyronine and selenium proteins in the human body

Glutathione peroxidase is responsible for the reduction of hydrogen peroxide [H_2O_2] of organic peroxides with reduced glutathione, as a transport of electrons. According to current scientific knowledge, in the body there are about eight types of peroxidase, consecutively numbered. The locus of peroxidase enzymes in the human body is the stomach, intestine, plasma, olfactory epithelium [31]. GPx1-4 peroxidase is present in all mammals, peroxidase GPx6 only been identified in the human body [30, 31]. Peroxidase GPx1 otherwise called cytosolic is the

primary and most important enzyme that protects against oxidative stress man. Protective responses as compared to the system involving GPx1 consist in reversible detachment of the well, electron attachment, as a system of oxidation-reduction, and change of reactive oxygen molecules of water [30,32]. Peroxidase GPx2 gastrointestinal in gastrointestinal tract and the liver, the role GPx2 consists of a protective effect against lipid peroxides which are formed during lipid peroxidation [30]. The extracellular peroxidase GPx3 is responsible for the reduction of peroxides in the plasma and body fluids [30,31,32]. Glutathione peroxidase hydroxides lipid GPx4 is responsible for the reduction of phospholipid peroxides. Her presence in the cell membrane protects against oxidative stress. GPx4 is also responsible for the continuity of the male sperm chromatin [30,32]. Thioredoxin reductase in the human body responsible for the reduction of thioredoxin and protein disulfides DNA synthesis and influences the process of cell apoptosis [32]. Dejonidazy iodothyronine play a vital role in the metabolism of thyroid hormones [32]. The thyroid gland is an organ in which there is the largest concentration of selenium. Selenium concentration in thyroid is 0, 72 g / gram organ. Deiodinase type 1, or 2 is involved in the process deionization thyroxine [T4] to its active form in the form of triiodothyronine [T3]. This type of reaction is the primary source of triiodothyronine for the human body. Type 3 deiodinase present in the placenta is involved in the breakdown of maternal Deiodinase type 1, or 2 is involved in the process deionization thyroxine [T4] to its active form in the form of triiodothyronine [T3]. This type of reaction is the primary source of triiodothyronine for the human body. Type 3 deiodinase present in the placenta is involved in the breakdown of maternal Deiodinase type 1, or 2 is involved in the process deionization thyroxine [T4] to its active form in the form of triiodothyronine [T3]. This type of reaction is the primary source of triiodothyronine for the human body. Type 3 deiodinase present in the placenta is involved in the breakdown of maternal T4 and T3 to inactive form, which are metabolites, which protects the fetus prior to excessive activity [32,34]. Selenium proteins are compounds, performing many important functions in the body. The most important are the functions of selenium protein P. selenium protein P is synthesized in the liver cells hepatocytes protect lipoproteins from oxidation. It is composed of the N-terminal and C-terminal [32,33]. The first part is designed to maintain the redox potential of the cell, while the second is to contribute to the transport of selenium [32]. Selenium protein W, T, H is responsible for the maintenance of homeostasis of Ca^{2+} in neurons involved in cell protection against oxidative stress, in controlling the expression of genes responsible for the production of glutathione de novo. Selenium protein K and S participate in the construction of complex protein-protein involved in the degradation of

misfolded proteins at the endoplasmic reticulum, initiate and regulate the inflammatory properties of selenium in the immune response [32]. Selenium protein N is responsible for the development and regeneration of skeletal muscle tissue. Selenium protein M takes an active part in the reduction and isomerization of di sulfide bridges, and protects neurons against oxidative stress [32]. Function selenium proteins V to the end is not known, research perceive its role towards the involvement of the enzyme in the control of fertility in men. Features selenium protein I and O are known [32]. The unit of a disease that results from an excessive concentration of selenium in the body is selenosis [35]. The disease occurs during long-term absorption element in an amount of about 400 μg / 24h. Frequent situations, during which there is a poisoning element · is irresponsible intake of selenium in the form of pharmacological agents of control. The characteristic symptoms that occur during the poisoning element is in the form of symptoms: loss of hair, nail discoloration, garlic odor originating in the mouth, diarrhea, weakness, fatigue, nausea, vomiting, musculoskeletal pain [34,35]. Recent studies report that consumption of selenium in excessive amounts can lead to the development of type II diabetes. In patients with diabetes mellitus type II studies, selenium level in plasma was significantly elevated [35,36]. Mechanisms of action of an excess concentration of the element to the development of Type II diabetes are not known until the end. Each person taking the test element, by supplementing supply in the form of pharmacological agents shall perform the assay of plasma, to prevent the unpleasant complications [35,36].

The role of selenium in the treatment of disease: immune system, cancer

Selenium is a mineral whose deficiency can lead to many negative consequences in the human organism [1,2,3]. Lack of adequate concentrations of selenium in the immune system is adjusted to mute the immune response of a host organism as compared to bacterial or viral infection [36]. Other consequences of the absence of selenium supplementation in the immune system are; to minimize the activity of T cells, NK cell (natural killer) and macrophages, to increase the capacity of platelet aggregation [32,36]. Selenium supplementation is extremely important in patients fed intravenously. Selenium is a stimulus, which the human body parenterally nourished adjusted to enhance the intensity of the humoral response by proliferation and differentiation of B-cell [32, 36]. nourishmentparenteral therapeutic method is to allow the supply of nutrients intravenously to patients who had no ability to satisfy the physiological supply of nutrients through the gastrointestinal tract. Parenteral nutrition can be dispensed by peripheral vein or central [25,26,27,28,29].

The indications for the inclusion of parenteral nutrition:

✓ Patient's condition prevents receive nutrients through the digestive tract as a result of unconsciousness or traumatic craniofacial, esophagus, stomach, intestines [25,26,27].

✓ Condition after surgery and abdominal injuries, mechanical, functional, and intestinal failure, fistula, obstruction, mechanical and paralytic, peritonitis [21,22,23,28,29].

✓ Psychiatric disorders and neoplastic diseases [24,28,29,].

✓ Feeding metered by gastrointestinal non-satisfying nutritive requirements.

✓ Cachexia, hypercatabolism, gastrointestinal cancer, chemotherapy, sepsis like [25,26,27,28,29].

For interventional studies have shown that supplementation with selenium 200 μg per day as sodium selenite adjusted to enhance the activity of T cells and their conversion to the cytotoxic T lymphocytes and NK cell activation (ang. natural killer) and consequently enhanced their response to stimulation by an exogenous antigen and execution on tumor cells [32,36]. Malignant tumors in developed countries are the second cause of death after cardiovascular diseases. For many years, both the incidence and mortality from cancer diseases grew. The development of cancer contributes to oxidative stress disorder and protective functions of the body. Selenium in the form of selenocysteine as part of an enzyme involved in catalysing the oxidation reaction of the protein scavenges reactive oxygen species, thereby protecting the cell against the oxidative stress [32].

The role of selenium in the treatment of diseases of the thyroid gland and cardiovascular

The thyroid gland is a small organ glandular and carrying out many important functions. Its operation is based on a feedback mechanism on the axis hypothalamic-pituitary. One of the primary factors that affect the proper functioning and metabolism of the gland is iodine and as research indicates the last twenty years, also selenium [32,36]. The thyroid gland is an organ, characterized by the largest concentration of selenium in the body. Glutathione peroxidase, which are present in the thyroid gland, organ protected from oxidative stress by reduction of hydrogen peroxide, which is generated when the dual oxidase for the synthesis of thyroid hormones [32, 36]. Thyroid iodine deficiency exposes oxidative stress by increasing TSH, which stimulates the synthesis of H2O2 and the increased amount causes destruction of the thyroid and fibrosis which in turn leads to a system of immunization antigens vs those found in normal conditions inside thyrocytes [32]. Selenium deficiency affects the development of thyroid disease, for example. autoimmune thyroiditis, hypothyroidism, goitre or neutral. Deiodinase are selenium enzyme , which play an essential role in the metabolism of thyroid hormones. Deiodinase, type 1, 2 is involved in the process deiodinization thyroxine [T4] for the

active company in the form of 3,3 ', 5-triiodothyronine [T3] [34]. Peroxidase, glutathione GPx4 have the skills inhibition of the oxidation of phospholipids and esters of cholesterol associated with lipoproteins, resulting in the possibility of inhibiting the deposition of oxidized low density lipoprotein in the endothelium of the vessel, thus preventing the development of atherosclerosis and other diseases in the field of cardiovascular diseases [32,34,36].

Summary

Selenium as a trace element in such a small amount necessary for the proper functioning of the body plays an essential role in the metabolism of the whole organism by affecting various body systems. Salonen et al., Conducted a study, which show that low levels of selenium in the body of less than 45 μg is the cause of an increased risk of mortality from cardiovascular disease [37]. This is a point for consideration in subsequent research, expanding knowledge on the subject. The role of selenium is believed to be also in its protective effect against tumors. Quite an interesting study, is the study of Zhu et al. 2016. With the aim of this study was to enucleation of researchers and highlight the role of selenium in inflammatory processes, that coexist with colitis. The study was conducted in mice suffering from acute and chronic colitis, which is induced by the supply of sodium sulfate [DSS]. The authors of the study combined with the selenium pyocyanin [PC] and the whole of Se-Pc isolated from algae Spilurina platensis. The expression level of pro-inflammatory cytokines IL-6, TNF-a, MPC-1 was high in the group of mice treated with DSS in the group of mice treated with DSS and SE-Pc in acute and chronic inflammation, levels of proinflammatory cytokines was low [39, 40]. Recent studies have reported that selenium in a positive impact on chronic viral infections e.g. HIV infection, hepatitis type B and C. HIV carriers have low levels of selenium in the blood, in vitro observations show that the leveling selenium-infected individuals I inhibit the replication of the virus. The role of selenium is believed to be also in male fertility. Root takes an active part in the synthesis of testosterone and sperm. The low concentration of selenium men, manifested by decreased sperm motility disorders as well as in the area of switches. Selenium plays a significant role in the functioning of the human body, its role is underestimated [32,34,38,39, 40].

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