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The influence of vitamin D and zinc on the mineralization matrix of human metabolism

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Abstract

The influencing factors which to prevent the viruses or to make less severe forms of the disease could be the supplements with vitamin D and Zn, the effects of vaccination against the viruses and the healthy food. Today, the food consumed by people, is usually extremely refined, containing micronutrients such as minerals or vitamins, in a very small amount or no longer have these nutrients. As a consequence, people will experience increasing deficiencies in vitamins and minerals, depending on their daily diet. Thus, most people consume highly processed foods or fast foods that contain additives. The creation of such a food habit can give great deficiencies in terms of food intake with antiviral or anti-inflammatory potential, without people knowing their vitamin D or Zn deficiencies. The determinations of vitamin D, under chromatographic specific and reproducible conditions were obtained from EDQM. Acetonitrile, n hexane and tetra-hydroxy furan. Determination of Zn content was obtained by the dithizone spectrophotometric method. The foods analysed by vitamin D were: fish oil, sardines, tuna in oil, sturgeon, swordfish, salmon, pink salmon, mushrooms, cow's milk, yogurt, soy, almond. rice milk, boiled eggs, cereals and orange juice which were fortified. The most important content of vitamin D (250 mcg / IU) was found in fish oil, then in mushrooms (6.1 mcg / IU) and in the milk with 3.5% fat. The highest zinc content was found in oatmeal (3230 mg / kg) and in legumes containing 3045 mg/kg and green beans containing 2920 mg/kg. The experimental recommended some healthy diets to promote the increase of the immunity of the human organism, rich in the vitamin D, with admissibility limits of this, between 400 IU(10 mcg) for children, 600 UI(15mcg) for adolescents, adults and 800 IU(20 mcg) for people over 70 years old.

Keywords: vitamin D, Zn good nutrients

1.Introduction

Vitamin D is a group of fat-soluble ketosteroid vitamins whose main role is to increase the intestinal absorption of calcium, magnesium and phosphate ion [1]. For the human body, the most important forms of vitamin D are vitamin D3 (cholecalciferol) and vitamin D2(ergocalciferol) [2]. Vitamin D3 is biosynthesized in the skin of vertebrates after exposure to type B ultraviolet (UVB) light from solar or artificial sources and occurs naturally in a small range of foods [3,4].

In some countries, staple foods such as milk, flour or margarine are artificially fortified with vitamin D and are also available in pill form as a dietary supplement. Food sources such as fish, eggs or meat are very rich in vitamin D and are often recommended for people suffering from vitamin D deficiency. Vitamin D is carried by the bloodstream to the liver where it is converted to calcium prohormone, calciol can be converted to calcitriol, a biologically active form of vitamin D, either in the kidneys or by macrophage monocytes in the immune system. When synthesized by a macrophage monocyte, it acts locally as a cytosine, defending the body against microbial organisms. When synthesized in the kidneys, calcitriol circulates as a hormone, regulating the concentration of calcium and phosphate in the blood, causing bone mineralization, growth and remodelling and preventing hypercalcaemic tetany. Vitamin D deficiency can lead to thin, fragile or deformed bones, while sufficiency prevents rickets in children, osteocalcin in adults and along with calcium, helps protect the elderly from osteoporosis. Vitamin D also modulates neuromuscular functions,

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reduces inflammation and influences the action of several genes, influences cell proliferation, differentiation and apoptosis [5].

Background. Vitamins D or calciferols are synthesized from provitamins by cleavage of the B ring from the sterol molecule during exposure to sunlight. Vitamin D2 is the plant-derived form (ergosterol or provitamin D2). Vitamin D3 comes either from food of animal origin (especially fatty fish or fish oil) or nutritional supplements, or is synthesized in the skin from 7-dehydrocholesterol (provitamin D3) under the action of ultraviolet radiation(5). The rate of vitamin D formation depends mainly on the duration and intensity of exposure. Activation takes place in two stages, first in the liver and then in the kidneys. Vitamin D having a fat-soluble structure is transported into the circulation in the form of a complex with a specific alpha1 globulin - vitamin D transporter protein (VDBP = vitamin D binding protein). At the liver, vitamin D undergoes the first hydroxylation to form 25-OH vitamin D (calciol), a metabolite with limited biological activity. Vitamin D-25 is then bound to a specific protein and transported to the kidney where the second hydroxylation takes place; thus, in the proximal renal tube under the action of 1-alpha hydroxylase results the most potent metabolite of vitamin D: 1,25- (OH) 2 vitamin D (calcitriol) [4].

Vitamin D deficiency is also more common in elderly patients, in patients with obesity and hypertension, exactly the same patients who have a higher risk of developing complications from SARS-CoV-2 infection. In observational studies, low levels of vitamin D have been associated with an increased risk of community-acquired pneumonia in older adults and children. Vitamin D supplements can increase the level of regulatory T cells in healthy people and in patients with autoimmune diseases. Vitamin D supplements can increase the activity of regulatory T cells. In a meta-analysis of randomized clinical trials, vitamin D supplementation has been shown to protect against acute respiratory tract infections [6]. However, high levels of vitamin D are extremely harmful and can lead to hypercalcemia and nephrocalcinosis, especially in children. The role of vitamin D supplementation in the prevention or treatment of COVID-19 is not fully understood. The reason for the use of vitamin D is largely based on the immune modulating effects that could potentially protect against COVID-19 infection or reduce the severity of the disease. Ongoing observational studies evaluate the role of vitamin D in the prevention and treatment of COVID-19. Some investigative studies administer vitamin D or in combination with other agents to participants with or without vitamin D deficiency. One of these, published in late August in The Journal of Steroid Biochemistry and Molecular Biology, shows that high doses of 25 OH vitamin Serum D (the active metabolite of vitamin D) reduces the risk of COVID-19-infected patients needing intensive care, but communicates the need for more extensive trials to draw a statistically validated conclusion. So at this time there is not enough data to make recommendations or not against the use of vitamin D for the prevention or treatment of COVID-19.

Vitamin D has a very important role in the body, especially in the skeletal system - because it promotes the absorption of calcium, thus supporting the development and maintenance of bone integrity. Vitamin D deficiency can lead to demineralization of the bone matrix, but it has and still has adverse consequences. Vitamin D deficiency in the human body can lead to bone demineralization, depression. A high risk of vitamin D deficiency occurs in children because it can lead to rickets. The most dangerous age is between 6-36 months. One cause of this deficiency in the new-born is the low amount of vitamin D in breast milk [7].

Vitamin D can only be synthesized through a photochemical process, vertebrates that left the aquatic environment too early had to look for and eat food rich in vitamin D to meet their body requirements. Vitamin D3 is produced in the skin when 7-dehydrocholesterol reacts with UVB ultraviolet light at wavelengths between 270-300 nm, with peak synthesis occurring between 295-297 nm. These wavelengths are present in sunlight when the UV light index is three times higher. At this wavelength, solar daily during the spring and summer seasons, in temperate regions and rarely in arctic circles, vitamin D3 is produced in the skin. Depending on the intensity of the UVB rays and the exposure time, the balance in the skin can be formed and thus, vitamin D is unstable and can be reversibly transformed, degenerating as quickly as it was generated [5].

Vitamin D is essential for bone and mineral metabolism. Because the vitamin D receptor is also expressed on immune cells, vitamin D has the potential to modulate innate and adaptive immune responses. Vitamin D deficiency (defined as a serum concentration of 25-hydroxyvitamin D ≤20 ng / ml) is common in the world, especially in countries that do not benefit from a year-round sunshine regime, such as Romania. Vitamin D removes calcium and phosphorus from the bone, maintaining the levels of calcium and phosphorus in the blood. Adequate concentrations of Ca2 + and HPO42- promote osteoid mineralization. Severe vitamin D deficiency leads to insufficient osteoid mineralization, resulting in the development of rickets in children and osteocalcin in adults [8].

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Zinc is one of the most important minerals in the human body, increases cytotoxicity and induces apoptosis (cell death) when used in vitro. The relationship between zinc and COVID-19, including how zinc deficiency affects the severity of COVID-19 and whether zinc supplements may improve clinical outcomes are being investigated. Serum Zinc levels are difficult to measure accurately because zinc is a component of various proteins and nucleic acids. Increased intracellular zinc concentrations effectively affect the replication of RNA viruses (SARS-CoV-2 being an RNA virus). Zinc supplementation for the prevention and treatment of COVID-19 is currently being evaluated in clinical trials. The optimal dose of zinc for COVID-19 treatment is not established. The recommended dose for elemental zinc is 11 mg daily for men and 8 mg for non-pregnant women. Doses used in clinical trials for COVID-19 vary between studies, with a maximum dose of 220 mg zinc sulfate (50 mg of Zn as a chemical) twice a day. Excessive, long-term administration of zinc can cause copper deficiency, with subsequent reversible hematological defects (ie anemia, leukopenia) and potentially irreversible neurological manifestations (ie myelopathy, paresthesia, ataxia, spasticity) [9].

2.Material and methods

In this study, we looked at food sources that contain vitamin D as exogenous factors, which may influence the prevention of virus diseases. Thus, a number of 23 foods were tested that have an important vitamin D content: sardines in oil, tuna in oil, cooked sturgeon, swordfish, smoked salmon, canned pink salmon, smoked, cooked, canned / cooked salmon, mushrooms, cow's milk with 3.5% fat, milk with 2% fat, 1.5% fat milk, yogurt, soy milk, almond milk, rice milk, boiled eggs, two foods were fortified, cereals and orange juice. After highlighting the level of vitamin D in the 23 foods that are found as food products accessible to consumers, we estimated 6 food diets for age categories rich in vitamin D, by age categories, with admissibility limits for vitamin D 400 IU (10 mcg) in children, 600 IU (15 mcg) for adolescents and adults, men and women, and 800 IU (20 mcg) in people over 70, according to the recommendations of the American Institute of Nutrition (https: // www .Vitamin D3_ benefits -dose-required-and effects-of-deficiency.html). Then, the caloric level of these foods was calculated to establish their energy influence on human metabolism. Another exogenous factor that can stimulate the immunity of the human body, it has been shown to be zinc, this mineral being recommended in a daily dose of 11 mg in men and 8 mg in women. Thus, the foods selected to determine the need for zinc from the diet were: cereals - oats, flour and oatmeal, millet, wheat sp. Triticum durum, Triticum aestivum, wheat flour, rye, rye flour, triticale, sorrow, lentil, barley, rice, rice groats, corn, corn groats, and some legumes - peas, beans, chickpeas, lentils, soybeans, peas.

The determination of vitamin D, under chromatographic conditions, specific and reproducible method Chemicals and reagents. Vitamin D3 was obtained from EDQM. Acetonitrile, n hexane and tetra-hydroxy furan, reagents, were obtained from Merck. Purified water was also used. The equipment used was Waters HPLC 2695 auto-injector type and Waters PDA 2696 detector. The column used was Thermo BDS HypersylC18, mm x4.6 mm, particle size 5 µm. Chromatographic separation was performed at 25°C on a reverse phase column using a mobile phase consisting of solvent A (tetra hydroxy furan), solvent B (acetonitrile) and solvent C (water). Gradient elution was achieved gradually from 0 to 5 minutes 50% B and 50% C; 5-15 minutes 100% B, 15-28 minutes 25% A and 75% B; 28-35 minutes 50% B and 50% C. The flow rate was kept at 0.8 ml / min from 0-5 minutes and 28-30 minutes and 2.0 ml / min from 5-28 minutes and its detection made at 325 nm for vitamin D and related substances. The injection volume was 50 µl for vitamin D standards and samples. Validation of the method. The parameters studied for the validation of the method were the limit of detection (LDD), the limit of quantification (LDC), linearity, accuracy, precision, repeatability, robustness and specificity.

The LDC has been defined as the minimum concentration that can be determined with acceptable accuracy and precision. LDD and LDC were performed with a signal-to-noise response. Linearity was assessed by the calibration curve. To achieve the calibration curve, five standard calibration solutions were prepared and five standard calibration solutions were used in determining the purity. Accuracy and repeatability were estimated by testing six replicate samples on days 1 and 2. Accuracy was assessed by assessing the recovered substance.

The specificity was assessed by the degradation force of the sample. The samples were subjected to acid and basic degradation, thermal degradation and hydrogen peroxide. Preparation of the solution. Standard preparation: A standard vitamin D solution was made accurately by transferring 1 ml of vitamin D3 hexane standard stock solution. A standard solution was prepared for purity testing to reach a final concentration of 0.25 ppm vitamin D. Sample preparation: The test solution was performed by accurately transferring 1.0 ml of oily solution using a syringe into a graduated container. It was made up to volume with hexane. Results and discussions. LDD and LDC: Detection Limit and Quantification Limit have been determined. The results are presented in Table 1.

Table 1. Results of limit of detection (LDD) and limit of quantification (LDC)

Vitamin	**LDD**	**LDC**	**Correction coefficients r2**		**Recovery (%)**		**Accuracy**	
			Test (samples, analysis)	**Similar substances**	**Test (samples, analysis**	**Similar substances**	**Repeatability, RSD%**	**Intermediate accuracy % RSD**
Vitamin D	0,00056 µg/ml	0,0023 µg/ml	0,9997	0,9995	99,2-102,6	97,3-102,8	1,5	0,45

Linearity: The method was found to be linear for the concentration range described. When the mean peak areas were plotted against the concentration level, good correlation coefficients (r2) were obtained. Accuracy: Accuracy was assessed based on repeatability of application and measurement of data. In order to evaluate the ability of the method to produce similar results for repetitive tests for nominal concentrations, individual samples of vitamin D were tested separately. It showed relatively small standard deviations. The intermediate accuracy of the method was performed in different samples on two different days. The RSD value is 1.5%; the intermediate accuracy of the method is established. The specificity of the method was established by analysing contaminated samples under stress. The specificity was investigated to demonstrate that there is no interference between excipients, active ingredients and degradation compounds that may be present in the samples. Stress samples are evaluated against the control sample for testing and degradation (%). The presence of other ingredients in the formulations did not cause any interference with vitamin D. The robustness of the method was determined by analysing the same standards under normal operating conditions and by changing analytical conditions such as detection wavelength, mobile phase composition and flow rate. The results showed that the method is robust [10].

Determination of Zn zinc content by the dithizone spectrophotometric method. The principle of the method. Zn^{2+}, forms with dithizone in toluene, in ammonium citrate medium at PH 9, a red-pink complex, the interfering elements in small quantities are complexed with sodium diethyldithiocarbamate, the colour intensity being measured spectrophotometrically. The sensitivity of the method is 1 µg zinc. The reagents used were: 0.25 m ammonium citrate, thymol bromine blue, ammonium hydroxide, 0.2% sodium diethyldithiocarbamate, 0.02% dithizone. Way of working. After mineralization of 5 g of the sample, place in the 100 ml separating funnel, 10 ml of water 1-5 ml of the sample to be analysed, add 10 ml of ammonium citrate, 2 drops of thymol bromine blue, and neutralize with hydroxide. of 25% ammonium, diluted 1 + 1 to light blue PH 8.5. In parallel, the control determination is made with 5 ml of the control solution of the reagents used for the dry mineralization of the samples. Colorimetry. The ammonia phase is removed from the solution obtained by zinc extraction, and a portion of the red or red-pink zinc dithionate extract is passed through the funnel mouth into a 10 mm thick cuvette and the extinction is measured by spectrophotometer at length. 530 nm wavelength from a toluene tank. The same is done with the toluene extract obtained in the control determination. The value of the extinction of the control sample is deducted from the value of the extinction of the sample to be analysed. The Zn content corresponding to the resulting extinction is read on the standard curve. Drawing the standard curve. In 7 separatory funnels introduce 0.5 ml of HCl with d = 1,18-1,19 diluted 1, as well as the quantities of working standard solution and water, according to the recommended model working standard solution 1 µg Zn/cm^3:water, cm^3:quantity of Zn, µg: separation funnel no. 1-10:15: 0; separation funnel no.2-1: 14: 1; separation funnel no.3-3-12-3; separation funnel no.4- 5-10-5; separation funnel no.5-10-5; separation funnel no.6-10-5-10; separation funnel no.7-15-0-15. Zinc was then extracted with ammonium citrate and colorimetry. The extinction value of standard 0 is subtracted from the extinction value of the other standards. Calculation and expression of results. The Zn content, in milligrams per kilogram of product is calculated by the formula Zn (mg/kg) =CxV/V1xmx100, where C is the Zn content read on the standard curve, corresponding to extinction, µg, V total volume of the solution obtained at the mineralization of the sample, cm^3, V1- the volume of the mineralization solution taken for determination, cm^3, m-mass of the sample taken for mineralization, g [11].

3.Results

The dynamics of vitamin D content (figure 1) indicates that fish oil has a concentration of 250 mcg, higher than fish types with an average content of 12.9 - 21mcg per 100 g Vitamin D. We can say that the absorption Vitamin D3 will be much more effective in the administration of fish oil than the consumption of fish as food.

Among the food rich in vitamin D, the mushrooms with 6.1 mcg / 100 stand out, being followed on the second place by the cow's milk with 3.5% fat. It is observed that milk assortments with 2% fat and 1.5% fat, yogurt, contain 1.2-1.3 mcg / 100 g of vitamin D, which can be justified by the fact that vitamin D is fat-soluble, therefore the concentration of vitamin D will be higher on fatter milk.

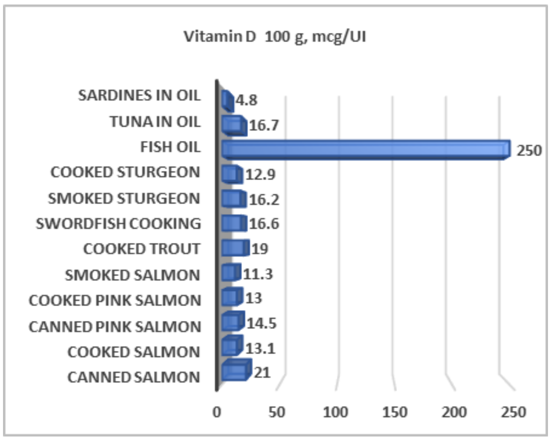

Figure 1. Dynamics of vitamin D content in fish and fish oil (own original experimental research)

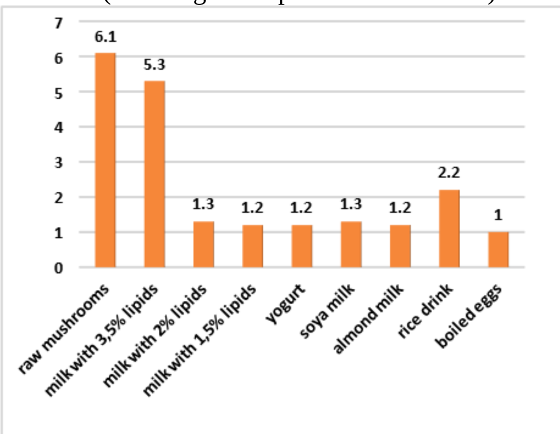

Figure 2. Evolution of vitamin D content in fungi, dairy products, eggs (own original experimental research)

However, it is sometimes recommended to consume low-fat milk, even skim milk, due to cholesterol levels, which leads to deficiencies in vitamin D intake. Rice drink with 2.2 mcg / 100g vitamin D is ranks third. In daily consumption there are also varieties of milk extracted from soy or almonds that have 1.2-1.3 mcg / 100 g of vitamin D. Eggs also contain vitamin D, obviously with lipids. That is why it is recommended to eat eggs weekly, due to the high protein content and the significant intake of vitamin D, which we do not find in other foods (figure 2).

In the case of foods such as cereals and fruit juices due to their processing the level of vitamin D decreases significantly. That is why food specialists also use the method of improving the vitamin D content of some foods, by fortification. This is how some foods like the ones studied in this experiment have an increased level of vitamin D, above the limit of biogenic accumulation. Figure 3 shows that the cereals have been fortified with vitamin D up to the limit of 10.7 mcg / 100 g, and the orange juice up to 8.6 mcg / 100 g of vitamin D. The fortification limits are accepted in international standards and guidelines. good practices used in the food industry.

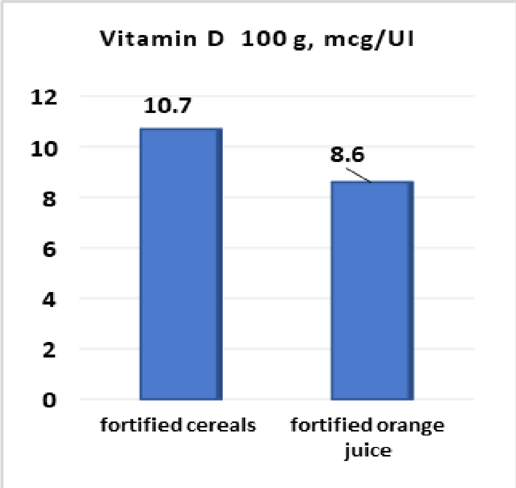

Figure 3. Dynamics of vitamin D in fortified products (own original experimental research)

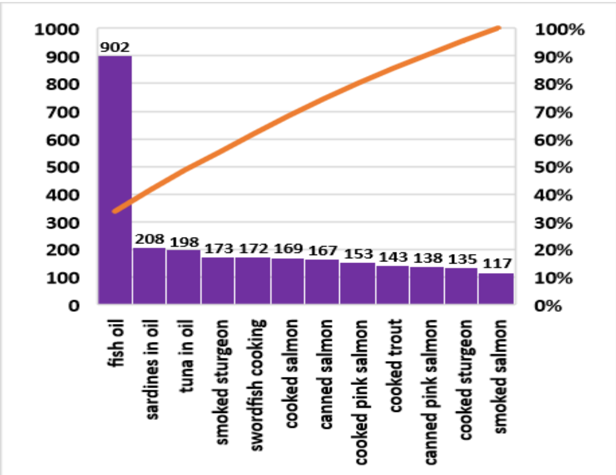

Figure 4. Dynamics of calorie content in fish and fish oil rich in vitamin D (own original experimental research)

Today there is more and more controversy regarding the exogenous addition of substances that come to improve the nutritional value of food. Obviously some arguments are true because in some cases the fortification can be done with food additives obtained by chemical synthesis. In vitro studies are insufficient and do not fully demonstrate scientifically the harmful effects of substances used in food fortification, but the long-term effects of the consumption of genetically modified or fortified foods do not indicate better health, but rather a poorer health, it follows that the consumption of genetically modified and fortified foods should be done with caution and controlled, by checking the addition of additive used in fortification. The assortments of fish and fish oil rich in vitamin D obviously have a high caloric level, fish oil 902 ca /100 g because it is the lipid component extracted from fish, while the assortments of fish have caloric values of 117-208 call / 100 g. This is justified by the caloric ratio of 9.3 per gram of fat. (Figure 4) Dynamics of the calorie content of margarine, vitamin D fortified products, dairy products, rice milk, soy, almonds and eggs (figure 5) indicates a comparative level of 533 kcal/100 g of margarine compared to 902 kcal/100 g in the case of fish oil, of 248 kcal/100 g in fortified cereals compared to the assortments of fish (117-208 kcal /100 g), but also a much lower caloric level for mushrooms 31 kcal/100 g, 31-47 kcal/100 g for rice milk, soy or almonds. We also have a low caloric level in dairy products from 50 kcal /100 g in milk with 1.5% fat to 78 kcal /100 g in the case of yogurt.(figure 5)

This is why scientific nutrition recommends the consumption of assortments of evening milk, consumption of fish dishes at dinner, precisely for the lower caloric level.

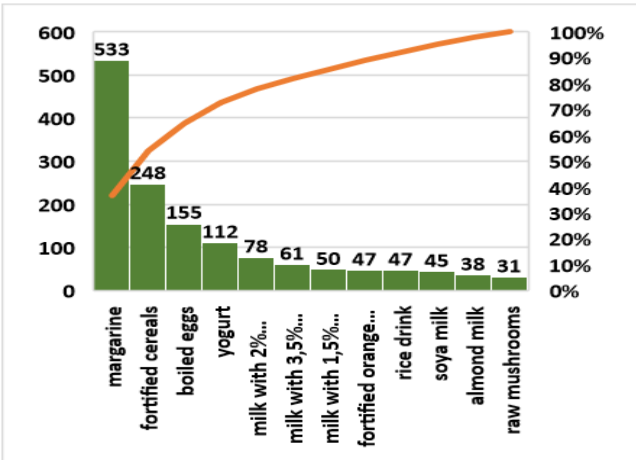

Figure 5. Dynamics of calorie content in foods rich in vitamin D (own original experimental research)

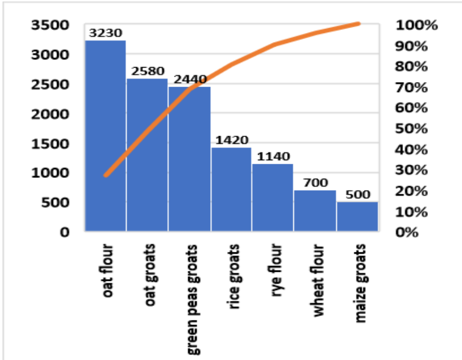

Figure 6. Dynamics of Zn content in flours and cereals obtained from cereals / vegetables (own original experimental research)

The assortments of fish and fish oil rich in vitamin D obviously have a high caloric level, fish oil 902 kcal/100 g because it is the lipid component extracted from fish, while the assortments of fish have caloric values of 117-208 kcal/100 g. This is justified by the caloric ratio of 9.3 per gram of fat. (Figure 4) Dynamics of the calorie content of margarine, vitamin D fortified products, dairy products, rice milk, soy, almonds and eggs (figure 5) indicates a comparative level of 533 kcal/100 g of margarine compared to 902 kcal /100 g in the case of fish oil, of 248 calories/100 g in fortified cereals compared to the assortments of fish (117-208 kcal /100 g), but also a much lower caloric level for mushrooms 31 kcal/100 g, 31-47 kcal / 100 g for rice milk, soy or almonds. We also have a low caloric level in dairy products from 50 kcal/100 g in milk with 1.5% fat to 78 kcal/100 g in the case of yogurt. (Figure 5) This is why scientific nutrition recommends the consumption of assortments of evening milk, consumption of fish dishes at dinner, precisely for the lower caloric level.

The values of extinctions obtained, as well as the calculated zinc contents were as follows: C oat flour = 1,153 (Zn oat flour = 3230 mg / kg), C oat groats = 6.45 (Zn oat groats = 2580 mg / kg), C green peas groats = 6.10 (Zn green peas groats = 2580 mg / kg), C rice groats = 1.775 (Zn rice groats = 1420), C rye flour = 0.407 (Zn rye flour = 1420 mg / kg), C wheat flour = 1.75 (Zn wheat flour = 700), C maize groats = 0.384 (Zn maize groats = 500 mg / kg). The Pareto diagram graphically represents the distribution of data in descending order of frequency, with a cumulative line on a secondary axis, as a percentage of the total. (figure 6).

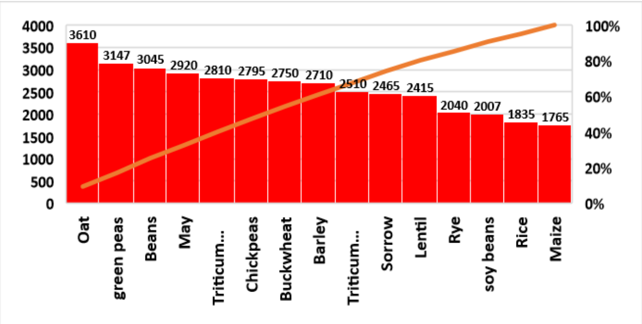

Figure 7. Dynamics of Zn content in cereals and vegetables rich in vitamin D(own original experimental research)

The values of extinctions obtained, as well as the calculated zinc contents were as follows: Coat = 2,777 (Zn oat = 3610 mg / kg), C green peas = 7,867 (Zn green peas = 3147 mg / kg), C beans = 1,0875 (Zn beans = 3045 mg / kg), C4 = 3,650 (Zn may = 2920 mg / kg), C Triticum durum = 4,683 (Zn Triticum durum = 2810 mg / kg), C chickpeas = 0.9982 (Zn chickpeas = 2795 mg / kg), C buckwheat = 3,387 (Zn buckwheat = 2730 mg / kg), C barley = 3,775 (Zn barley = 2710 mg / kg), C Triticum aestivum = 0.8965 (Zn Triticum aestivum = 2510 mg / kg), C sorrow = 2.465 (Zn sorrow = 2465 mg / kg), C lentil = 6.0375 (Zn lentil = 2415 mg / kg), C rye = 2.55 (Zn rye = 2040 mg / kg), C soy beans = 5.0175 (Zn soy beans = 2007 mg / kg), C rice = 1.412 (Zn rice = 1835 mg / kg), C maize = 4.4125 (Zn maize = 1765 mg / kg). (Figure 6) Of the experiments performed, the highest Zn content was found in oats followed by peas, beans, millet, wheat Triticum durum, chickpeas, buck peas, buckwheat, barley, Triticum aestivum, sorrows, lentil, rye, soy beans, rice, corn. The Pareto diagram represents the statistical distribution of data in descending order of frequency, with a cumulative line on a secondary axis (figure 7).

Vitamin D influences many vital functions of the human body: it regulates the metabolism of calcium and phosphorus, mineralizes bones and increases immunity. We can ensure 10-20% of the necessary vitamin D by using a diet that contains fish, egg yolk, mushrooms, dairy products. Vitamin D3 synthesized by the human body under the action of ultraviolet radiation protects the human body from respiratory diseases, by improving the body's immune response to contact with a virus, helps strengthen the bone system, is found in small amounts in certain fish species, while vitamin D2 comes from different cereal species.

In this study we aimed to establish diets and calculate the need for vitamin D expressed in mcg /IU., The amount of foods rich in vitamin D that can be consumed for the daily requirement of vitamin D. Thus, we chose 6 food diets that include the necessary of vitamin D, as follows: **diet 1 for children between 0-12 months with 400 IU (10mcg) vitamin D**, which will include food categories - milk, yogurt, eggs, which totalled the required 400 IU, 10 mcg and 600 g of food; **diet 2 for children aged 1-13 years old who has 600 IU (15 mcg) vitamin D**, which will include foods rich in vitamin D, such as dairy products, rice, eggs, which generated a diet with 600 IU8, 15 mcg vitamin D and an amount of 700 g of food; **diet 3 for teenagers 14-18 years old** includes dairy products, and fish, being selected in this case the foods most liked by teenagers, knowing that they are more sensitive to food choices during this period. This diet totalled 600 IU with 15 mcg, vitamin D and an amount of 245 g., So a lower number of calories; **diet 4 is aimed at the consumer segment aged 19-50 years** old, consists of yogurt, salmon, mushrooms, eggs, totalling 600 IU, 15 mcg vitamin D and 337 g of food, again a low caloric weight compared to diets 1 and 2 for growing and developing children; **diet 5 for people between 51 and 70 years old** has as recommended foods- yogurt, milk, mushrooms, eggs rich in vitamin D, representing 600 IU, 15 mcg, as well as a quantity of 400 g of food, with an average caloric level corroborated with the energy needs of metabolism at this age; **diet 6 for people over 70**, includes foods such as milk, eggs, fish with an increased level of 800 IU, 20 mcg vitamin D. Both diet 5 and diet 6 introduced mushrooms that have an important level of vitamin D and are appreciated by the two segments studied from a gastrointestinal and psychosomatic behavioural point of view. As determined experimentally, cereals contain significant amounts of zinc, which is why in the recommended diets are of course added bakery products or flour products made from flours or groats rich in zinc: oats, rice, oat groats, triticale. Associations of foods rich in vitamin D with a series of legumes, chickpeas, rice are also used in order to increase the level of zinc in the diet. Acceptance of these foods by some consumers, sometimes their preference to consume these foods according to sensory stimuli, appearance, consistency, taste, caloric level, not knowing in fact that the vitamin D level of these foods gives them the feeling of asking, ordering and consume mainly these foods. There are people who do not prefer to eat these foods. In this case they can be highlighted as causes, either these people do not need a high content of vitamin D, which is synthesized by their own body, or these people have a metabolic imbalance and will show vitamin D deficiencies as they progress in age, when this imbalance will manifest itself through the appearance of chronic diseases. Predetermined diets represent only 30% of the daily diets required for human consumption that must have 2000-2500 calories. These foods can be joined by other categories of foods, especially those rich in vitamin C.

Table 2. Diets rich in vitamin D, daily doses recommended for different categories of consumers (own original experimental research)

Consumer age's	Food	Quantity, g	Vitamin D, mcg	Vitamin D, UI	Consumer age's	Food	Quantity, g	Vitamin D, mcg	Vitamin D, UI
0-12 months	Milk 3,5%	100	5.3	212	19-50 years	Yogurt	100	1.2	48
	Milk 2%	100	1.3	52		Salmon	37	7.7	308
	Milk 1,5%	100	1.2	48		Mushrooms	100	6.1	164
	Boiled eggs	100	1.0	40		Boiled eggs	100	1.0	80
	Yogurt	100	1.2	48					
	Total	400	10	400		Total	337	15	600
1-13 years	Milk 3,5%	100	5.3.	212	51-70 years	Yogurt	100	1.2	48
	Milk 2%	100	1.3	52		Milk 3.5%	100	5.3	212
	Milk 1,5%	100	1.2	48		Mushrooms	100	6.1	164
	Yogurt	100	1.2.	48		Boiled eggs	100	1.0	80
	Rice drink	200	4.4.	160					
	Boiled eggs	100	1.0	80		Total	400	15	600
	Total	700	15	600		Milk 3.5%	100	5.3.	212
14-18 years	Milk 3,5%	100	5.3	212	< 70 years	Eggs	100	1.7	40
	Yogurt	100	1.2	48		Fish	101.7	9	344
	Salmon	45	8.5	340		Mushrooms	90	4.0	204
	Total	245	15	600		Total	341.7	20	800

Thus, it can be seen that the use of combinations between fish and rice dishes, shows the supplementation of vitamin D content, often found in sardines, salmon, tuna, sturgeon with zinc-rich foods, such as: rice and corn flour. Then, the use of oatmeal, rye, rice, corn, wheat rich in zinc to obtain fish from salmon, sturgeon, rich in vitamin D demonstrates the metabolic interdependence of the two microelements Zn-vitamin D in order to increase the immunity of the human body. Eggs and dairy products are foods with a medium content of vitamin D, which is why they are recommended to be consumed daily, so that the level of nutrients, vitamin D and zinc is sufficient for a healthy diet of the consumer.

Conclusions

1. The level of vitamin D in different types of food ensures the potentiation of the metabolism to prevent diseases, especially COVID 19 and increase the immunity of the human body. The degree of absorption of vitamin D3 (1 alpha, 25 di-hydroxyvitamin D3, in ethanol, being 96% CP method and of vitamin D2 1 alpha, 25-dihydroxyvitamin D2 by HPLC being 97%. These categories of foods include milk with different concentrations in fat content 1.5%, 2%, 3.5%, yogurt, mushrooms and several varieties of over.
2. Along with the consumption of foods rich in vitamin D, the population must know that vitamin D3 can be synthesized by the action of ultraviolet radiation, its assimilation being sufficient for the optimal functioning of human metabolism. Today, however, living conditions, long-distance driving from personal residence to work, orthostatic position in closed workplaces are not favourable for the synthesis of vitamin D, because in the time interval 10.00-15.00, when the population is at work, ultraviolet radiation occurs.
3. The level of zinc in the studied foods indicates which foods are rich in zinc, recommended for this purpose, thus avoiding deficiencies in micro-nutrients. Oats, groats and oatmeal are the richest in Zn, followed by peas, millet, rice, triticale. The combination of fish dishes rich in vitamin D with some flour or legume products rich in zinc justifies the trends of modern scientific gastronomy.

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