

The Rule of Omega-3 Fatty Acids in Nutrition and New Products with Omega-3

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Polyunsaturated fatty acids (PUFA) are called essential, because they are necessary for the normal functioning of the human body, but not synthesized in it, as well as in the body of other mammals, and so must come with food (vegetable oils and fish). Being part of the phospholipids of cell membranes, PUFA provide them with a certain plasticity and create the necessary matrix for the functioning of enzymes. The lack of PUFA leads to changes in the fatty acid composition of cell membranes and tissues, causing a violation of their functional stability, which is manifested in a decrease in resistance to damaging effects of atherogenic substances. This eventually leads to various diseases, including cardiovascular diseases.

At the same time, there is a competition between ω -3 PUFA and ω -6 PUFA for the enzymes responsible for the formation of double bonds (desaturases) and chain elongation (elongases). Linoleic acid is metabolized to arachidonic acid (AA; 20:4 ω -6), and α -linolenic acid to eicosapentaenoic acid (EPA; 20:5 ω -3) and docosahexaenoic acid (DHA; 20:6 ω -3). But these processes are very slow. With a high intake of ω -6 PUFA, the processes of desaturation and elongation of α -linolenic acid are slowed down. AA and EPA are further involved in the formation of eicosanoids that regulate the urogenital, cardiovascular, respiratory, immune and nervous systems, and the gastrointestinal tract. EPA and α -linolenic acid are involved in the formation of cell membranes, DHA is predominant in the cerebral cortex, retina, ovaries, sperm.

It was found that eicosanoids from AA have biological activity when they are present in very small amounts. If they are formed in large quantities, they contribute to the formation of blood clots and fat cells, of allergic reactions and inflammatory processes, cell proliferation. On the other hand, it was found that replacing saturated fats with fats rich in omega-3 fatty acids clearly reduces the risk of cardiovascular diseases, normalizes the Central nervous system, increases cognitive functions and develops associative memory, and reduces the risk of developing dementia [1].

The World Health Organization recommends adequate levels of daily intake of the sum of PUFA and separately of ω -3 and ω -6 acids (Table). As follows from the above data, the ω -6/ ω -3 ratio should not be more than 4,5.

Fatty acid	% of total energy
Σ PUFA	6 - 11
Σ ω -3 fatty acids	2,0 - 3,0
α -Linolenic acid	> 0,5
Σ ω -6 fatty acids	2,5 - 9,0
Linoleic acid	2,5

Table: Recommended dietary intakes for polyunsaturated fatty acids: Adults [2].

Analysis of the ω -6/ ω -3 ratio in the diet of peoples of different countries showed that the inhabitants of the island of Crete have this ratio of 2:1 and they have one of the highest life spans in the world. For Japanese who have a slightly lower life expectancy (83 years), the ratio is 4:1. In the United States, the ratio is about 17:1 (the 30th highest life expectancy is 78 years) and in Eastern Europe and Scandinavia, it is about 20:1 with significantly lower life expectancy levels. In Asian countries and some regions of Russia, the ratio reaches 50:1 and in these countries there is a high mortality rate from cardiovascular diseases with a low life expectancy [1,3].

Thus, the lack of consumption of ω -3 PUFA has a significant impact on the quality and duration of life.

In addition to the deficit in the consumption of ω -3 PUFA, the modern human diet is characterized by:

- Increasing calorie consumption while reducing energy losses;
- The increase in the consumption of total fat;
- Reducing the consumption of complex carbohydrates and dietary fiber with a significant increase in the consumption of sugar and simple carbohydrates;
- Reducing the consumption of proteins, antioxidants, and calcium.

In this regard, the food industry faces a global task of developing functional food products aimed at eliminating the deficit in the consumption of these nutrients. For these purposes, two preventive products have been developed.

A dietary cream based on vegetable oils with fat content of 15 - 26%. The humidity - $23.5 \pm 2\%$; the density - 750 - 900 kg/m³. Cream contain a high quantity of dietary fibers (> 6g/100g) that help reduce blood sugar, cholesterol levels and have an immunomodulatory effect instead simple carbohydrates. Additional cream contains ω -3 PUFA and tocopherols.

The reduced caloric content of the cream (200 - 300 kcal/100g), the absence of easily digestible carbohydrates, presence of a high content of dietary fibers, ω -3 PUFA and tocopherols allow it to be classified as dietary product of high nutritional value and recommended for production of desserts intended for diabetics and people with overweight or obese.

A fat spread with fat content 53 - 55%, contains a high amount of ω -3 PUFA (> 1g/100 g), included EPA and DHA, which reduce the risk of coronary heart disease and improve brain function. The positive effect is enhanced by the presence of a specially selected mixture of vitamins and antioxidants in the product, which have a synergistic effect in relation to PUFA.

Clinical studies have shown that daily consumption of this spread in the amount of 36g in place of other added oils and fats in terms of a low-calorie diet (1350 - 1550 kcal) for at least 14 days has a pronounced positive effect on blood lipid composition indicators (reduction of total cholesterol, low-density lipoproteins and very low-density lipoproteins, atherogenicity coefficient, triglycerides).

This spread is recommended for daily use by all groups of the population, especially for the elderly, in order to optimize the diet by enriching it with ω -3 PUFA, vitamins and antioxidants. It can be included in the composition of specialized diets of preventive orientation in clinical settings for patients with cardiovascular diseases, patients with type 2 diabetes with late vascular complications and patients suffering from obesity.

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