



Vitamin F - description, effect on the body, best sources

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Abstract . The term vitamin F refers to essential fatty acids, namely linoleic and alpha-linoleic. They are ingested in the diet as saturated and unsaturated (mono- and poly-) fatty acids and play an important role in lowering cholesterol levels, regulating blood pressure, and reducing the risk of strokes and heart attacks. In addition, vitamin F is essential for brain development in the fetus, newborn, and child, and for maintaining brain function in adults.

Keywords: vitamin F , essential fatty acids, benefits, harms, beneficial properties, contraindications

Discovery history

In the late 1920s, scientists became interested in the nutritional value of fats. Prior to this , it was known that dietary fats provided energy production and contained vitamins A and D. Several scientific articles have been published that describe a previously unknown deficiency that occurs when all types of fat are excluded from the diet, and the existence of a new vitamin - F is suggested . After further experimentation, scientists found that the deficiency could be cured by taking pure "linoleic acid", and in 1930 the term "essential fatty acids" was first used [3].

Foods Rich in Vitamin F

Saturated and monounsaturated fatty acids are widely distributed in animal products such as meat and dairy products. Monounsaturated fatty acids are also present in some vegetable oils - olive, avocado, almond, canola, peanut and palm. They are considered the healthiest in the human diet because they do not raise cholesterol levels to the same extent as saturated fats, and they are less prone to spontaneous oxidation than polyunsaturated fatty acids. In addition, they do not turn into potent biologically active compounds that can disrupt the balance of various body systems, which often happens with polyunsaturated fatty acids [1].

The family of polyunsaturated fatty acids also includes two different groups - "omega-3 fatty acids" and "omega-6 fatty acids". Both substances are considered essential fatty acids because they cannot be

synthesized by humans. The initial fatty acid of the omega-3 group is alpha-linoleic acid, while for the omega-6 group it is linoleic acid [4].

Fat content of nuts and seeds [2]

Nuts and seeds	Linoleic acid	Alpha Linoleic Acid	Saturated fatty acids
Walnut	38.1	9.08	6.1
pine nut	33.2	0.16	4.9
Sunflower seeds	32.78	0.07	5.22
Sesame	23.58	0.42	7.67
Pumpkin seeds	20.7	0.18	8.67
Pecan	20.6	one	6.2
Brazilian nut	20.5	0.05	15.1
Peanut	15.6	0	6.8
pistachios	13.2	0.25	5.4
Almond	12.2	0	3.9
Hazelnut	7.8	0.09	4.5
Cashew nuts	7.7	0.15	9.2
Flaxseeds	4.32	18.12	3.2
Macadamia	1.3	0.21	12.1

Quantity in food

Product	Monounsaturated fatty acids (g/100 g)	Unsaturated fatty acids (g/100 g)	Polyunsaturated fatty acids (g/100 g)
Beef, raw meat	31.52	52.3	3.17
Chicken, raw meat	30.3	20.25	14.2
roasted peanuts	26.18	7.72	9.77
Butter, unsalted	23.43	50.49	3.01
Pickled herring	11.95	2.38	1.68
Yolk, chicken	11.74	9.55	4.2
Pickled olives	11.31	2.03	1.31
Gruyère cheese	10.04	18.91	1.73

Avocado	9.8	2.13	1.82
Sun-dried tomatoes	8.66	1.89	2.06
Roquefort cheese	8.47	19.26	1.32
eel fish	7.19	2.36	0.95
Hummus	5.34	2.56	8.81
Caviar, red or black	4.63	4.06	7.41
quail egg	4.32	3.56	1.32
Chicken egg	3.66	3.1	1.91
Tofu	1.93	1.26	4.92
Yogurt	0.89	2.1	0.09
Lentils, red or pink	0.5	0.38	1.14
Prunes	0.48	0.06	0.16
Corn, raw	0.43	0.33	0.49
Parsley	0.29	0.13	0.12
Oyster	0.25	0.47	0.53
Apricot	0.17	0.03	0.08
Ginger root	0.15	0.2	0
Mango	0.14	0.09	0.07
plums	0.13	0.02	0.04
curly cabbage	0.1	0.18	0.67
green onion	0.1	0.15	0.26
Nectarine	0.09	0.07	0.26

Daily requirement for essential fatty acids

European health authorities have developed recommendations for the intake of essential fatty acids for adults:

Omega 3	Alpha Linoleic Acid	2 grams per day
	Eicosapentaenoic acid (long chain omega-3 fatty acid)	250 mg per day
Omega 6	Linoleic acid	10 g per day.

In the United States, the fatty acid intake has been set at:

	Omega 3	Omega 6
Men (19-50 years old)	1.6 g/day	17 g/day
Women (19-50 years old)	1.1 g/day	12 g/day

The American Heart Association recommends eating fish (especially oily fish such as mackerel, trout, herring, sardines, tuna, and salmon) at least twice a week.

Pregnant women, breastfeeding mothers, young children and women who may become pregnant are advised not to eat certain types of fish - swordfish, shark and king mackerel - as there is a risk of high levels of hazardous substances in their meat (for example, mercury). In such cases, it is advised to use nutritional supplements.

It is important to maintain a proper balance of omega-3s and omega-6s in the diet as the two interact directly. For example, omega-3 acids (alpha-linoleic acid) help relieve inflammation in the body, and a large amount of omega-6 (linoleic acid) can, on the contrary, provoke inflammation. An imbalance of these two acids can lead to diseases, and the right combination of them maintains or even improves health. A healthy diet should contain about 2-4 times more omega-6 fatty acids than omega-3s. But experience shows that in developed countries, a typical diet includes 14-15 times more omega-6 acids, and many researchers believe that this imbalance is a significant factor in the increase in inflammatory diseases. In contrast, the "Mediterranean Diet" contains a healthier balance of these two substances and is considered more conducive to heart health [4].

At risk for developing a deficiency or imbalance of essential fatty acids are:

- newborns;
- pregnant and lactating women;
- patients with malabsorption in the gastrointestinal tract.

Beneficial features

Health Benefits

Eating enough polyunsaturated fatty acids in the form of omega-3 and omega-6 is very important as they play a critical role in:

- development and maintenance of the normal functioning of the brain;
- maintenance of vision;
- immune and inflammatory responses;
- production of hormone-like molecules.

In addition, omega-3s contribute to the maintenance of normal blood pressure, triglyceride levels, and heart health.

Essential fatty acids for disease

- **for premature babies:** omega-3 is a necessary substance in the formation of the brain, nerve cells, including the retina. It is also important for visual and neurological processes.
- **during pregnancy and breastfeeding:** the fetus in the womb and the newborn baby receives omega-3 exclusively from the mother's body, so the intake of essential fatty acids must meet the requirements of the mother and child.

- **against heart disease:** studies show that eating a large amount of omega-3s helps reduce the risk of heart disease and high blood pressure. Studies in heart attack survivors have shown that taking omega-3 supplements every day can reduce the risk of stroke and recurrent heart attacks.
- **against cancer:** a healthy balance between omega-3 and omega-6 acids plays an important role in preventing the development and growth of tumors, especially breast, prostate and rectal cancer. Fatty acids in these cases can be used both independently and in combination with other vitamins - C, E, beta-carotene and coenzyme Q 10.
- **against age-related diseases:** studies show that people who have a healthy balance between omega-3 and omega-6 in their diet and eat fish regularly have a reduced risk of developing age-related eye diseases.
- **against Alzheimer's disease:** insufficient intake of omega-3 acids may be a risk factor for the development of Alzheimer's disease and other types of dementia [5].

Interactions with other elements and beneficial food combinations

Nutritionists advise eating foods rich in cofactors that promote the absorption of essential fatty acids. They help further processing of acids after they enter the body. The key cofactors are:

- **magnesium** : sources are lightly cooked spinach, kelp, pumpkin seeds and pulp, steamed broccoli .
- **zinc** : lean beef, pork, lamb, crab, poultry, beef liver.
- **B vitamins** : seeds, seaweed, grains.
- **Biotin** : Eggs are a good source.
- **vitamin C** : greens, broccoli, sweet peppers, fresh fruits, especially strawberries and citrus fruits.

Polyunsaturated fatty acids are susceptible to oxidation. Therefore, they are advised to consume them with a large amount of antioxidants in order to maintain fragile bonds in their chemical structure. An excellent source of antioxidants, for example, are colorful fruits and vegetables. Antioxidants that prevent fatty acid oxidation include alpha-lipoic acid (found in beef, dark green leafy vegetables), vitamin E (from whole grains of wheat, seeds, and avocados), and coenzyme Q 10 (generally produced in the liver, but in some cases, it must be taken medically). It is recommended to avoid the consumption of oxidized fatty acids - this occurs when the oil from the seeds is used for frying, exposed to light or heat. Oxidized poly- and mono-unsaturated acids are also found in ready-to-eat foods, even organic ones, such as pies, convenience foods, falafel, etc.

digestibility

In order to improve the metabolism of essential fatty acids in the body, one should:

- Maintain a healthy balance of saturated, monounsaturated and polyunsaturated fatty acids and reduce processed fats.
- optimize the ratio of consumption of omega-6 and omega-3. Many studies recommend a 4:1 ratio;
- eat enough nutrients that interact with fatty acids;
- reduce the number of factors that can interfere with the absorption of fatty acids.

How to adjust and improve nutrition?

A maximum of 30-35 percent of the daily diet should be fat.

Most of these fats should be monounsaturated fatty acids. They are found in olive oil, rapeseed oil, avocado oil, cashew, pistachio, sesame oil, as well as in the meat of “poultry” poultry. When choosing olive oil, choose an organic, cold-pressed, unfiltered oil, and store it in a cool, dark place (not the refrigerator). This oil is used for dressing salads and cooking at low temperatures. Organic cold-pressed rapeseed oil is also gaining popularity due to its health benefits. But it's best not to heat it to avoid destroying the omega-3 fatty acids.

Saturated fat can be included in the diet, but it is advisable not to exceed the recommended maximum dose of 10 percent of total calories consumed per day, or 20 grams for women and 30 grams per day for men. Saturated fats are the most suitable for cooking as they are the most stable. If you want to sauté vegetables, for example, then coconut oil, butter, lard in small amounts is a healthier choice than vegetable oil, olive oil, or a variety of seed oils. It is believed that the most useful oil for frying is coconut oil. More budget-friendly options are butter, lard, ghee, goose fat, or olive oil, depending on cooking temperature and health.

Eat foods containing natural omega-6 acids (linoleic acid). The best sources of omega-6s are raw seeds, especially sunflower seeds, pumpkin seeds, chia seeds, sesame seeds, and hemp seeds. The oils from these seeds are also very useful. It is best to store them in the refrigerator and do not heat treat. One tablespoon of raw seeds or oil from them can be consumed per day [2].

It is recommended to reduce the consumption of sugar, fructose and alcohol.

Rules for cooking essential fatty acids

Fatty acids are destroyed under the influence of three main factors - **light, air and heat**. This should be considered when preparing and storing foods rich in omega-3s and omega-6s. Frying and deep-frying expose fats to three destructive factors at once. Fats that have been exposed to heat can cause atherosclerosis, prevent air from entering the cells of the body, lower immune system function, and potentially increase the risk of cancer [7].

Application in official medicine

In official medicine, essential fatty acids are used for prevention and in the complex treatment of various diseases. Other than that, the full impact of these substances is still under investigation.

There is some evidence that omega-3 fatty acids can treat and prevent **atherosclerosis** by interfering with the formation of blood clots. They lower blood pressure and pulse rate, reduce inflammation, and improve vascular and platelet function [1].

Diabetic **patients** often have elevated levels of fat in their blood. Studies show that omega-3 fatty acids (namely, long chain acids - eicosapentanoic and docosahexaenoic acids) obtained from fish oil can reduce the amount of this oil. It should be noted that excessive consumption of fatty acids can potentially increase blood sugar levels.

Several studies have shown that consuming omega-3 vitamins has a positive effect on the health of those who suffer **from inflammatory diseases** such as **rheumatoid arthritis**. Among the effects, there was a decrease in joint pain, limited movement in the morning, and a decrease in the number of medications taken. At the moment, the impact of omega-3s on the course of diseases such as asthma and Crohn's disease is being considered.

Essential fatty acids are very important for mental health. Omega-3 is an important component of the nerve cell membrane, thanks to which they transmit information. It has been noted that in **depressed patients**, omega-3 levels were extremely low, and the ratio of omega-3 to omega-6 was very high. The use of oily fish 2-3 times a week for 5 years significantly improved the condition of patients. Improvement after taking omega-3 in combination with drugs was also noted in patients with **bipolar disorder**.

When assessing the level of fatty acids in patients with **schizophrenia**, it was noted that in each of the interviewed patients (20 people), who also took antipsychotics, the ratio of omega-3 to omega-6 was reduced. It remained so even after the death of the patient. Taking 10 grams of fish oil per day, in turn, had a positive effect on the symptoms of patients [6].

Low levels of certain fatty acids may be seen in children with **hyperactivity disorder and attention deficit disorder**. A balanced intake of omega-3 and omega-6, in general, has brought a positive result for both children with ADHD and adults.

Fatty acids are one of the most important components in the treatment of patients with **anorexia** [5].

Essential fatty acids during pregnancy

Essential fatty acids are vital building blocks of cell membranes and therefore promote the formation of new tissues. Primary fatty acids cannot be synthesized by humans, so human health depends on the intake of fatty acids from food.

The fetus in the womb is completely dependent on the level of fatty acids in her body. They affect the development of the nervous system and retina of the child. Studies show that during pregnancy, the level of fatty acids in the mother's body rapidly decreases. This is especially true for docosahexaenoic acid - it is the main structural and functional acid in the central nervous system. By the way, this acid is mobilized in the mother's body for entry into the body of the fetus, and at the birth of the first child, the level of this acid in the mother is higher than at the birth of subsequent children. This means that after the first pregnancy, the amount of docosahexaenoic acid in the mother is not restored to its previous level. It was noted that docosahexaenoic acid has a positive effect on the volume of the skull, weight and height of premature babies [8].

Omega-3 and omega-6 fatty acids are also very important for fetal development. In order to get enough of them, it is advised to include in the diet of a pregnant woman such foods as vegetable oils, fish 2 times a week, as well as vitamins, which include essential fatty acids [9].

The use of vitamin F in cosmetology

Due to their beneficial effect, especially on the skin, essential fatty acids (aka vitamin F) are of great importance in cosmetology, becoming more and more widely used components of many cosmetic products intended for daily face and body care. Deficiency of these substances can lead to excessive dryness of the skin. If vegetable oils, from which essential fatty acids are obtained, act as a cosmetic base, such products prevent moisture loss from the skin by creating a protective layer on the epidermis. In addition, they soften the stratum corneum and reduce inflammation of the skin, thereby relieving pain. In addition to this, they play a very important role in the proper functioning of the human body. Medicine recognizes the beneficial effect of vegetable oils on the biological synthesis of cell membrane components, they are involved in the transport and oxidation of cholesterol. The lack of essential fatty acids can lead to vascular fragility, deterioration of the immune system, blood clotting process and lead to atherosclerosis.

Linoleic acid (found in sunflower, soybean, saffron, corn, sesame, peanut, wheat germ and grape seed oils) improves the lipid barrier of dry skin, protects against moisture loss and normalizes skin metabolism. It has been noted that people with acne often have low levels of linoic acid, leading to clogged pores, blackheads and eczema. The use of linoic acid for oily and problematic skin leads to the normalization of the sebaceous glands, cleansing the pores and reducing the number of rashes. In addition, this acid is part of cell membranes.

Another essential fatty acid for the skin is gamma-linoleic acid (found in borage, blackcurrant, bindweed and hemp oil) and alpha-linoleic acid (found in linseed, soybean, rapeseed, walnut, wheat germ and phytoplankton oils). They are physiological components of cell membranes and mitochondria in the human body. And eicosapentaenoic and docosahexaenoic acids (both omega-3s found in fish oil) prevent the development of tumors, relieve inflammation after sunburn, reduce irritation and stimulate recovery processes.

Essential fatty acids make skin more hydrated and smoother in appearance. Unsaturated fatty acids are able to penetrate into cell membranes, restore the damaged epidermal barrier and limit moisture loss. They are used as a base for creams, emulsions, cosmetic milks and creams, ointments, hair conditioners, cosmetic masks, protective lip balms, bath foams, nail care products. Many natural substances with high biological activity, such as vitamins A, D, E, provitamin A and phospholipids, hormones, steroids and natural dyes dissolve in fatty acids [10].

All of the above benefits can be achieved by taking vitamins, applying drugs to the skin, or intravenously [11]. **Each specific case requires consultation with a medical specialist.**

Vitamin F in folk medicine

In folk medicine, essential fatty acids are considered very important for the respiration of the organs. They help maintain the elasticity of cell membranes and contribute to normal lung activity. Symptoms of deficiency and imbalance of vitamin F are brittle hair and nails, dandruff, loose stools. Fatty acids are used in the form of vegetable and animal oils, seeds and nuts. The supply of vitamin F is replenished primarily from food. For example, it is advised to eat 50-60 grams of sunflower seeds in order to provide the daily requirement of fatty acids [12]. In addition, vitamin F is considered a useful remedy for inflammation and burns. For this, oils are primarily used.

Vitamin F in scientific research

For the first time, an association has been found between eating large amounts of nuts during the first trimester of pregnancy and the effects on a child's cognition, attention, and long-term memory. Spanish researchers took into account the consumption of nuts such as walnuts, almonds, peanuts, pine nuts and hazelnuts. Positive dynamics is attributed to the presence of folic acid in nuts, as well as omega-3 and omega-6. These substances tend to accumulate in neuronal tissues, in particular in the frontal part of the brain, which is responsible for memory and executive functions of the brain [13].

According to the American Journal of Respiratory and Critical Care Medicine, eating omega-3 and omega-6 fatty acids may have the opposite effect on asthma severity in children, as well as their response to indoor air pollution. Children with higher levels of omega-3s in their diets experienced fewer asthma symptoms in response to polluted air. Conversely, increased consumption of foods high in omega-6 worsened the clinical picture of sick children [14].

According to a study conducted by scientists at the University of Nebraska Medical Center (USA), omega-3 fatty acids may be able to inhibit the growth of breast cancer cells. This effect is thought to be

due to the anti-inflammatory properties of omega-3s. Thus, a diet rich in seafood may prevent the development of tumors [15].

Weight regulation

You should pay attention to the amount of carbohydrates consumed. The most important step is to eliminate sugar and, if possible, starch from the diet. Non-alcoholic sweetened drinks should also be avoided.

Fats should make up 5 to 6 percent of your energy intake.

For dressing salads and for frying, it is best to use different oils. For example, olive, sunflower oil is best suited for salads.

You should eat as little fried foods as possible, due to the chemical reactions that occur in the oil during frying [1].

Contraindications and warnings

Signs of a Vitamin D Deficiency

Some possible signs of a deficiency and/or imbalance between essential fatty acids are itching, dryness of the scalp and body, brittle nails, as well as atypical symptoms - asthma, eczema, excessive thirst and urination, aggression or violence, bad mood, anxiety, a tendency to inflammatory processes and hormonal imbalances (including cortisol, thyroid hormones and insulin). The balance of fatty acids in the body is important for every physiological process. To determine the level of fatty acids, among other things, an analysis of the red blood cell membrane or functional testing of B vitamins and minerals is carried out.

Fat imbalance carries the following risks:

- excessive consumption of trans fats can contribute to cardio-metabolic problems, which are precursors to diabetes and cardiovascular disease;
- excessively high intake of omega-6 compared to omega-3 may be associated with chronic inflammation and a number of degenerative diseases ;
- An excess of omega-3s and a lack of omega-6s can also lead to a number of health problems.

An excess of omega-3 is dangerous:

- for people suffering from blood clotting diseases or using anticoagulants;
- may cause risk of diarrhea, bloating;
- an increase in blood sugar levels.

An excess of omega-6 is dangerous:

- for people suffering from seizures;
- for pregnant;
- due to deterioration of inflammatory processes.

Interaction with other substances

It is believed that the need for vitamin E increases with an increase in the intake of essential fatty acids.

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