



Витамин С (аскорбиновая кислота) - описание, польза и где содержится

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Abstract. The article discusses the main properties of vitamin C and its effect on the human body. A systematic review of modern specialized literature and relevant scientific data was carried out. The best natural sources of vitamin C are indicated. The use of the vitamin in various types of medicine and the effectiveness of its use in various diseases are considered. The potentially adverse effects of vitamin C on the human body under certain medical conditions and diseases are analyzed separately.

Keywords: vitamin C, beneficial properties, potentially dangerous effects, side effects, beneficial properties, contraindications, sources

Story

The importance of vitamin C has been scientifically recognized after centuries of failures and fatal illnesses. Scurvy (a disease associated with a lack of vitamin C) haunted mankind for centuries, until finally attempts were made to cure it. Patients often experienced symptoms such as rashes, loose gums, multiple bleeding, pallor, depression, and partial paralysis.

- 400 BC Hippocrates first described the symptoms of scurvy.
- Winter 1556 - there was an epidemic of the disease that swept the whole of Europe. Few knew that the outbreak was caused by a shortage of fruits and vegetables during those winter months. Although this was one of the earliest reported scurvy epidemics, not much research has been done on a cure for the disease. Jacques Cartier, a famous explorer, noted with curiosity that his sailors, who ate oranges, limes, and berries, never got sick with scurvy, and those who had the disease recovered.
- In 1747, James Lind, a British physician, first established that there was a definite relationship between diet and the incidence of scurvy. To prove his point, he injected lemon juice into those who were given the diagnosis. After several doses, the patients were cured.
- In 1907, studies showed that when guinea pigs (one of the few animals that can contract the disease) were infected with scurvy, a few doses of vitamin C helped them recover completely.
- In 1917, a biological study was carried out to identify the antiscorbutic properties of foods.

- In 1930, Albert Szent-Györgyi proved that *hyaluronic acid*, which he extracted from the adrenal glands of pigs in 1928, has an identical structure to vitamin C, which he was able to obtain in large quantities from sweet peppers.
- In 1932, in their independent research, Heworth and King established the chemical composition of vitamin C.
- In 1933, the first successful attempt was made to synthesize ascorbic acid, identical to natural vitamin C - the first step towards the industrial production of the vitamin since 1935.
- In 1937, Heworth and Szent-Györgyi received the Nobel Prize for their research on vitamin C.
- Since 1989, the recommended dose of vitamin C per day has been established and today it is enough to completely defeat scurvy ^[3,4].

Foods rich in vitamin C

Table 1. Products with the maximum content of vitamin C ^[5-8]

Product	Quantity (mg/100 gr)
Rose hip	426
Guava	228.3
Bell pepper	Yellow -183.5 Green - 127.7 Red - 80.4
Black currant	181
Parsley	133
curly cabbage	120
Kiwi	92.7
Broccoli	89.2
Dill	85
Brussels sprouts	85
Lychee	71.5
Kohlrabi	62
pomelo	61
Papaya	60.9
snow peas	60
Strawberry	58.8
Orange	53.2
Lemon	53
Cauliflower	48.2
A pineapple	47.8
Chinese cabbage	45
Mango	36.4
Grapefruit	34.4
Lime	29.1
Spinach	28.1
Gooseberry	27.7
Mandarin	26.7
Raspberry	26.2
Blackberry	21
Cowberry	21

Raw potatoes	19.7
honey melon	eighteen
Basil	eighteen
Tomato	13.7
Blueberry	9.7

See also [Top 100 Natural Sources of Vitamin C](#).

Daily requirement for vitamin C

In 2013, the European Scientific Committee on Nutrition stated that the average vitamin C requirement for healthy levels is 90 mg/day for men and 80 mg/day for women. The ideal amount for most people has been found to be around 110 mg/day for men and 95 mg/day for women. These levels were sufficient, according to the expert panel, to balance the metabolic losses of vitamin C and maintain plasma ascorbate concentrations of about 50 $\mu\text{mol/L}$.

Age	Men (mg per day)	Women (mg per day)
0-6 months	40	40
7-12 months	fifty	fifty
1-3 years	fifteen	fifteen
4-8 years old	25	25
9-13 years old	45	45
14-18 years old	75	65
19 years and older	90	75
Pregnancy (18 years and under)		80
Pregnancy (19 years and older)	-	85
Breastfeeding (18 years and under)	-	115
Breastfeeding (19 years and older)	-	120
Smokers (19 years and older)	125	110

The recommended intake for smokers is 35 mg/day higher than for non-smokers as they are exposed to increased oxidative stress from toxins in cigarette smoke and generally have lower blood levels of vitamin C.

The need for vitamin C increases:

Vitamin C deficiency can occur when taking an amount below the recommended amount, but which is not enough to cause a complete deficiency (approximately 10 mg / day). The following populations are most at risk of getting insufficient vitamin C:

- smokers (active and passive);
- infants who consume pasteurized or boiled breast milk;
- people with a limited diet that does not include enough fruits and vegetables;

- people with severe intestinal malabsorption, cachexia, some types of cancer, kidney failure with chronic hemodialysis;
- people living in a polluted environment;
- during wound healing;
- while taking oral contraceptives.

The need for vitamin C also increases with severe stress, lack of sleep, SARS and influenza, anemia, and cardiovascular diseases ^[12].

Physical and chemical properties

The empirical formula of vitamin C is $C_6H_8O_6$. It is a crystalline powder, white or slightly yellow in color, practically odorless and very sour in taste. The melting point is 190 degrees Celsius. The active components of the vitamin are usually destroyed by heat treatment of foods, especially in the presence of traces of metals such as copper. Vitamin C may be considered the most unstable of all water-soluble vitamins, but it can withstand freezing nonetheless. Easily soluble in water and methanol, oxidizes well, especially in the presence of heavy metal ions (copper, iron, etc.). Upon contact with air and light, it gradually darkens. In the absence of oxygen, it can withstand temperatures up to 100°C ^[9-11].

Water-soluble vitamins, including vitamin C, dissolve in water and are not deposited in the body. They are excreted in the urine, so we need a constant supply of the vitamin from the outside. Water-soluble vitamins are easily destroyed during storage or food preparation. Proper storage and use can reduce the loss of vitamin C. For example, milk and grains should be stored in a dark place, and water in which vegetables have been boiled can be used as a base for soup. ^[12].

Useful properties of vitamin C

Like most other micronutrients, vitamin C has several functions. It is a powerful antioxidant and a cofactor for several important reactions. It plays an important role in the formation of collagen, the substance that makes up most of our joints and skin. Because the body can't repair itself without collagen, wound healing depends on getting enough vitamin C - which is why one of the symptoms of scurvy is unhealed open sores. Vitamin C also helps the body absorb and use iron (which is why anemia can be a symptom of scurvy even in people who consume enough iron).

In addition to these benefits, vitamin C is an antihistamine: it blocks the release of the neurotransmitter histamine, which causes swelling and inflammation in an allergic reaction. This is why scurvy usually comes with a rash, and also why getting enough vitamin C helps relieve allergic reactions ^[14].

Vitamin C has also been linked to some non-communicable diseases such as cardiovascular disease, cancer, and even Alzheimer's disease. Studies have found a link between vitamin C and a reduced risk of cardiovascular disease. Several meta-analyses of vitamin C clinical trials have shown improvements in endothelial function and blood pressure. High levels of vitamin C in the blood reduce the risk of stroke by 42%.

Recently, medicine has become interested in the possible benefits of intravenous vitamin C in maintaining quality of life in patients receiving chemotherapy. Decreased levels of vitamin C in the tissues of the eye were associated with an increased risk of cataracts, which are most common in older people. In addition, there is evidence that people who consume enough vitamin C have a lower risk of developing arthritis and osteoporosis. Vitamin C also has a high activity against lead poisoning, presumably preventing its absorption in the intestines and aiding its excretion in the urine ^[16,38].

The European Scientific Committee on Nutrition, which provides scientific advice to policy makers, has confirmed that there has been a significant improvement in health in people who have taken vitamin C. Ascorbic acid contributes to:

- protection of cell components from oxidation;
- the normal formation of collagen and the functioning of blood cells, skin, bones, cartilage, gums and teeth;
- improved absorption of iron from plant sources;
- normal functioning of the immune system;
- normal energy-intensive metabolism;
- maintaining the normal functioning of the immune system during and after intense physical activity;
- regeneration of a simplified form of vitamin E;
- normal psychological state;
- reduce feelings of tiredness and fatigue.

Pharmacokinetic experiments have shown that plasma vitamin C concentration is controlled by three primary mechanisms: intestinal absorption, tissue transport, and renal reabsorption. In response to increased oral doses of vitamin C, plasma vitamin C concentrations rise sharply at doses of 30 to 100 mg/day and reach a steady-state concentration (60 to 80 $\mu\text{mol/L}$) at doses of 200 to 400 mg/day per day in healthy young adults. 100% absorption efficiency is observed with oral vitamin C in doses up to 200 mg at a time. After plasma levels of ascorbic acid reach saturation, additional vitamin C is primarily excreted in the urine. Notably, intravenous vitamin C bypasses absorption controls in the gut so that very high plasma concentrations of ascorbic acid can be achieved; over time, renal excretion restores vitamin C to baseline plasma levels.

Vitamin C for colds

Vitamin C plays an important role in the immune system, which is activated when the body encounters infections. The study found that prophylactic use of ≥ 200 mg vitamin C supplementation significantly reduced the duration of cold episodes: in children, the duration of cold symptoms was reduced by about 14% and in adults it was reduced by 8%. In addition, a study in a group of marathon runners, skiers, and soldiers who train in the Arctic found that doses of the vitamin from 250 mg/day to 1 g/day reduced the incidence of colds by 50%. Most preventive studies have used a dose of 1 g/day. When treatment was started from the onset of symptoms, vitamin C supplementation did not reduce the duration or severity of the illness, even at doses of 1 to 4 g/day ^[38].

How is vitamin C absorbed?

Since the human body is unable to synthesize vitamin C, we must include it in our daily diet. Dietary vitamin C in the reduced form of ascorbic acid is absorbed through the intestinal tissues, through the small intestine, by active transport and passive diffusion using SVCT 1 and 2 carriers.

Vitamin C does not need to be digested before absorption. Ideally, about 80-90% of the vitamin C consumed is absorbed from the intestines. However, the absorption capacity of vitamin C is inversely related to intake; it tends to be 80-90% effective at fairly low intakes of the vitamin, but these percentages drop markedly at daily intakes greater than 1 gram. Given a typical dietary intake of 30-180 mg/day, absorption is typically in the 70-90% range, but increases to 98% at very low intakes (less than 20 mg). Conversely, at intakes over 1 g, absorption tends to be less than 50%. The whole process is very fast; the body takes what it needs within about two hours, and within three to four hours, the unused portion is out of the bloodstream. Everything happens even faster in people who drink alcohol or cigarettes, as well as under stress. Many other substances and conditions can also increase the

body's need for vitamin C: fever, viral illnesses, antibiotics, cortisone, aspirin, and other pain medications, exposure to toxins (eg, petroleum products, carbon monoxide) and heavy metals (eg, cadmium, lead, mercury).

In fact, the white blood cell concentration of vitamin C can be as high as 80% of the plasma concentration of vitamin C. However, the body has a limited storage capacity for vitamin C. The most common storage sites are the adrenal glands (about 30 mg), pituitary gland, brain, eyes, ovaries, and testicles. Vitamin C is also found, albeit in smaller amounts, in the liver, spleen, heart, kidneys, lungs, pancreas, and muscles. Plasma concentrations of vitamin C increase with increased intake, but up to a certain limit. Any intake of 500 mg or more is usually excreted from the body. Unused vitamin C is excreted from the body or first converted to dehydroascorbic acid. This oxidation occurs mainly in the liver and also in the kidneys. Unused vitamin C is excreted in the urine ^[13].

Interaction with other elements

Vitamin C is involved, along with other antioxidants, vitamin E and beta-carotene, in many body processes. High levels of vitamin C increase blood levels of other antioxidants, and the therapeutic effects are more significant when used in combination. Vitamin C improves the stability and utilization of vitamin E. However, it can interfere with selenium absorption and should therefore be taken at different times.

Vitamin C may protect against the harmful effects of beta- carotene supplements in smokers. Smokers tend to have low levels of vitamin C, and this can lead to accumulation of a harmful form of beta-carotene called free radical carotene, which is formed when beta-carotene acts to regenerate vitamin E. Smokers who take beta- carotene supplements may also Vitamin C should be taken.

Vitamin C aids in the absorption of iron, helping to convert it into a soluble form. This reduces the ability of food components such as phytates to form insoluble complexes with iron. Vitamin C reduces the absorption of copper. Calcium and manganese supplements may decrease vitamin C excretion, and vitamin C supplements may increase manganese absorption. Vitamin C also helps reduce folic acid excretion and deficiency, which can lead to increased vitamin B6 excretion. Vitamin C helps protect against the toxic effects of cadmium, copper, vanadium, cobalt, mercury and selenium ^[17].

Food combination for better absorption of vitamin C

Vitamin C helps to absorb the iron contained in the liver.

The iron found in parsley improves the absorption of vitamin C from lemon.

The same effect is observed when combined:

- artichoke and sweet pepper:
- spinach and strawberries.

Vitamin C in lemon enhances the effect of kahetins in green tea.

The vitamin C in tomatoes pairs well with the fiber, healthy fats, protein, and zinc found in chickpeas.

A similar effect has a combination of broccoli (vitamin C), pork and shiitake mushrooms (sources of zinc) ^[15].

The difference between natural and synthetic vitamin C

In the rapidly growing dietary supplement market, vitamin C can be found in many forms with varying claims regarding its effectiveness or bioavailability. Bioavailability refers to the extent to which a nutrient (or drug) becomes available to the tissue for which it is intended after it has been administered. Natural and synthetic L-ascorbic acid are chemically identical and there are no differences in their biological activity. The possibility that the bioavailability of L-ascorbic acid from natural sources may differ from the biosynthesis of synthetic ascorbic acid has been investigated and no clinically relevant differences have been observed. However, getting the vitamin in the body is still desirable from natural sources, and synthetic supplements should be prescribed by a doctor. Only a specialist can determine the required amount of vitamin that the body needs. And by eating a nutritious diet of fruits and vegetables, we can easily provide our body with an adequate supply of vitamin C ^[18].

The use of vitamin C in official medicine

Vitamin C is important in traditional medicine. Doctors prescribe it in the following cases:

- with scurvy: 100-250 mg 1 or 2 times a day, for several days;
- for acute respiratory diseases: 1000-3000 milligrams per day;
- to prevent harm to the kidneys during diagnostic procedures with contrast agents: 3000 milligrams is prescribed before the coronary angiography procedure, 2000 mg on the evening of the procedure and 2000 milligrams after 8 hours;
- to prevent vascular hardening: gradual-release vitamin C is given at 250 mg twice a day, in combination with 90 mg of vitamin E. This treatment usually lasts about 72 months;
- for tyrosinemia in preterm infants: 100 mg;
- to reduce the amount of proteins in the urine in patients with type 2 diabetes: 1250 milligrams of vitamin C in combination with 680 International Units of vitamin E, every day for a month;
- to avoid complex pain syndrome in patients with fractures of the bones of the hand: 0.5 grams of vitamin C for a month and a half ^[19].

Vitamin C supplements come in a variety of forms:

- **Ascorbic acid** is, in fact, the proper name for vitamin C. This is the simplest form of vitamin C and, most often, the most reasonably priced. However, some people note that it is not suitable for their digestive system and prefer either a milder form or one that is released in the intestines within a few hours and reduces the risk of digestive upsets.
- **Vitamin C with bioflavonoids** - polyphenolic compounds found in foods high in vitamin C. They improve its absorption when taken together.
- **Mineral ascorbates** are less acidic compounds recommended for people suffering from gastrointestinal problems. The minerals with which vitamin C is combined are sodium, calcium, potassium, magnesium, zinc, molybdenum, chromium, manganese. Such drugs are usually more expensive than ascorbic acid.
- **Ester -C®**. This version of vitamin C contains mainly calcium ascorbate and vitamin C metabolites, which increase the absorption of vitamin C. Ester C is usually more expensive than mineral ascorbates.
- **Ascorbyl palmitate** is a fat-soluble antioxidant that allows molecules to be better absorbed into cell membranes ^[20].

In pharmacies, vitamin C can be found in the form of swallow tablets, chewable tablets, oral drops, soluble powder for oral administration, effervescent tablets, lyophilisate for injection (intravenous and intramuscular), ready-made injection, drops. Chewable tablets, drops, and powders are often fruit-flavored for a more pleasant taste. This makes it especially easier for children to take the vitamin ^[21].

Application in traditional medicine

First of all, traditional medicine considers vitamin C as an excellent cure for colds. It is recommended to take a solution for influenza and SARS, consisting of 1.5 liters of boiled water, 1 tablespoon of coarse salt, juice of one lemon and 1 gram of ascorbic acid (drink for one and a half to two hours). In addition, folk recipes suggest drinking teas with cranberries, raspberries, lingonberries. Vitamin C is advised to take for the prevention of cancer - for example, eating tomatoes with olive oil with garlic, pepper, dill and parsley. One of the sources of ascorbic acid is oregano, indicated for nervous excitement, insomnia, infections, as an anti-inflammatory and analgesic ^[39-41].

Latest Scientific Research on Vitamin C

- British scientists from the University of Salford have found that the combination of vitamin C (ascorbic acid) and the antibiotic doxycycline is effective in the fight against cancer stem cells in the laboratory. Professor Michael Lisanti explains: "We know that during chemotherapy some cancer cells develop resistance to the drug, we have been able to understand how this happens. We suspected that some cells might change their source of nutrition. That is, when one nutrient becomes unavailable due to chemotherapy, cancer cells find another source of energy. The new combination of vitamin C and doxycycline limits this process, causing the cells to "starve to death." Since both substances are non-toxic in themselves, they can drastically reduce the number of side effects compared to traditional chemotherapy ^[22].
- Vitamin C has shown its effectiveness in the fight against atrial fibrillation after heart surgery. According to researchers from the University of Helsinki, the number of post-operative fibrillation in patients who took vitamin C decreased by 44%. Also, the time spent in the hospital after surgery decreased when taking the vitamin. Note that the results were indicative in the case of intravenous administration of the drug into the body. When taken orally, the effect was significantly lower ^[23].
- Studies performed on laboratory mice and tissue culture preparations show that taking vitamin C together with anti-tuberculosis drugs significantly reduces the duration of treatment. The results of the experiment were published in the journal of the American Society for Microbiology, Antimicrobial Agents and Chemotherapy. Scientists treated the disease in three ways - anti-tuberculosis drugs, exclusively vitamin C and their combination. Vitamin C had no apparent effect on its own, but in combination with drugs such as isoniazid and rifampicin, it significantly improved the condition of infected tissues. Sterilization of tissue cultures occurred within a record seven days ^[43].
- Everyone knows that overweight and obese people are strongly advised to exercise, but unfortunately, more than half of the people do not follow this advice. However, the study presented at the 14th International Endothelin Conference may be good news for those who don't like to exercise. As it turns out, taking vitamin C daily may have similar cardiovascular benefits to regular exercise. Vitamin C can decrease the activity of the ET-1 protein, which contributes to vasoconstriction and increases the risk of cardiovascular disease. A daily intake of 500 milligrams of vitamin C has been found to improve vascular function and reduce ET-1 activity as much as a daily walk would be effective ^[24].

The use of vitamin C in cosmetology

One of the main effects of vitamin C, for which it is valued in cosmetology, is its ability to give youthful and toned skin. Ascorbic acid helps to neutralize free radicals that activate skin aging, restores water balance and tightens fine wrinkles. If you choose the right components for the mask, then vitamin C as a cosmetic product (both natural products and dosage form) can be used for any skin type.

For example, for oily skin, the following masks are suitable:

- with clay and kefir;
- with milk and strawberries;
- with cottage cheese, strong black tea, liquid vitamin C and sea buckthorn oil.

Dry skin will regain its tone after masks:

- with egg yolk, a little sugar, kiwi juice and sesame oil;
- with kiwi, banana, sour cream and pink clay;
- with vitamins E and C, honey, milk powder and orange juice.

If you have problem skin, you can try the following recipes:

- mask with cranberry puree and honey;
- with oatmeal, honey, vitamin C and milk slightly diluted with water.

For aging skin, such masks are effective:

- a mixture of vitamins C (in powder form) and E (from an ampoule);
- blackberry puree and ascorbic acid powder.

should be careful with open wounds on the skin, purulent formations, with rosacea and varicose veins. In this case, it is better to refrain from such masks. Masks should be applied to clean and steamed skin, used immediately after preparation (to avoid the destruction of active ingredients), and also apply a moisturizer and do not expose the skin to open sunlight after applying masks with ascorbic acid ^[25].

Taking a sufficient amount of vitamin C has a beneficial effect on the condition of the hair, improving blood circulation in the scalp and nourishing the hair follicles. In addition, by eating foods rich in vitamin C, we help maintain the health and beautiful appearance of the nail plates, preventing their thinning and delamination. Once or twice a week it is useful to take baths with lemon juice, which will strengthen the nails. ^[26, 27].

The use of vitamin C in industry

The chemical composition and properties of vitamin C provide a wide range of industrial applications. About a third of the total production is used for vitamin preparations in the pharmaceutical industry. The rest is mainly used as food additives and feed additives to improve the quality and stability of products. For use in the food industry, the E-300 supplement is produced synthetically from glucose. This produces a white or light yellow powder, odorless and sour in taste, soluble in water and alcohol. Ascorbic acid added to food during processing or before packaging protects color, flavor and nutrient content. In meat production, for example, ascorbic acid makes it possible to reduce both the amount of added nitrites and the nitrite content in general in the finished product. Adding ascorbic acid to wheat flour at the production level improves the quality of baking. In addition, ascorbic acid is used to increase the clarity of wine and beer, to protect fruits and vegetables from browning, and as an antioxidant in water and to protect against rancidity in fats and oils.

In many countries, including European ones, ascorbic acid is not allowed to be used in the production of fresh meat. Due to its color-preserving properties, it can give the meat a false freshness appearance. Ascorbic acid, its salts and ascorbic palmitate are safe food additives and are allowed in food production.

In some cases, ascorbic acid is used in the photo industry for film development ^[28,29].

Vitamin C in crop production

L-Ascorbic Acid (Vitamin C) is just as important for plants as it is for animals. Ascorbic acid functions as a major redox buffer and as an additional factor for enzymes involved in the regulation of photosynthesis, hormone biosynthesis, and the regeneration of other antioxidants. Ascorbic acid regulates cell division and plant growth. Unlike a single pathway responsible for the biosynthesis of ascorbic acid in animals, plants use several pathways for the synthesis of ascorbic acid. Given the importance of ascorbic acid in human nutrition, several technologies have been developed to increase ascorbic acid content in plants by manipulating biosynthetic pathways.

Vitamin C in plant chloroplasts is known to help prevent the reduction in growth that plants experience when exposed to excessive amounts of light. Plants get vitamin C for their own health. Through the mitochondria, as a response to stress, vitamin C enters other cellular organs such as chloroplasts, where it is needed as an antioxidant and coenzyme in metabolic reactions that help protect the plant [30,31].

Vitamin C in animal husbandry

Vitamin C is vital for all animals. Some of them, including humans, primates and guinea pigs, get the vitamin from outside. Many other mammals, such as ruminants, pigs, horses, dogs, and cats, can synthesize ascorbic acid from glucose in the liver. In addition, many birds can synthesize vitamin C in the liver or kidneys. Thus, the need for its use has not been confirmed in animals that can independently synthesize ascorbic acid. However, cases of scurvy, a typical symptom of vitamin C deficiency, have been reported in calves and cows. In addition, ruminants may be more prone to vitamin deficiency than other domestic animals when ascorbic acid synthesis is impaired, as vitamin C is easily destroyed in the rumen. Ascorbic acid is widely distributed throughout all tissues, both in animals capable of synthesizing vitamin C and in those dependent on a sufficient amount of the vitamin. In experimental animals, vitamin C peaks in the pituitary and adrenal glands, with high levels also found in the liver, spleen, brain, and pancreas. Vitamin C also tends to be localized around healing wounds. Its level in tissues decreases with all forms of stress. Stress stimulates the biosynthesis of the vitamin in those animals that are capable of producing it. [32,33].

Contraindications and warnings

Vitamin C is easily destroyed by high temperatures. And because it is water-soluble, this vitamin dissolves in liquids used for cooking. Therefore, to obtain the full amount of vitamin C from foods, it is recommended to eat them raw (for example, grapefruit, lemon, mango, orange, spinach, cabbage, strawberries) or after minimal heat treatment (broccoli).

The first symptoms of vitamin C deficiency in the body are weakness and fatigue, muscle and joint pain, rapid bruising, and a rash in the form of small red-blue spots. In addition, symptoms include dry skin, swollen and discolored gums, gum bleeding, delayed wound healing, frequent colds, tooth loss, and weight loss [42].

The current recommendation is that doses of vitamin C above 2 g per day should be avoided to prevent side effects (bloating and osmotic diarrhoea). Although it is believed that excessive consumption of ascorbic acid can lead to a number of problems (eg, birth defects, cancer, atherosclerosis, increased oxidative stress, kidney stones), none of these adverse health effects have been confirmed, and there are no reliable scientific evidence that large amounts of vitamin C (up to 10 g/day in adults) are toxic or harmful to health. Gastrointestinal side effects are usually not serious and usually resolve when high doses of vitamin C are reduced. The most common symptoms of excess vitamin C are diarrhea, nausea, abdominal pain, and other gastrointestinal problems.

Some medicines can lower the level of vitamin C in the body: oral contraceptives, high doses of aspirin. Simultaneous intake of vitamin C, E, beta-carotene and selenium may lead to a decrease in the effectiveness of cholesterol-lowering drugs and niacin. Vitamin C also interacts with aluminum, which is part of most antacids, so you need to take a break between taking them. In addition, there is some evidence that ascorbic acid may reduce the effectiveness of some cancer and AIDS drugs.

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Vitamin C (ascorbic acid) - description, benefits and where it is contained

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