



# VITAMINS

## IN A NUTSHELL

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### VITAMIN C

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**VITAMIN C**, i.e. L-ascorbic acid, also referred to as ascorbic acid. This vitamin is soluble in water. The term „left-handed vitamin C” derives from a confusion between the configuration and the optical rotation of the particle. Active vitamin C is found only in L configuration, and rotates polarised light to the right. Synthetic vitamin C has identical properties. D-ascorbic acid isomer is rarely found in nature and does not have the properties of a vitamin<sup>1</sup>.

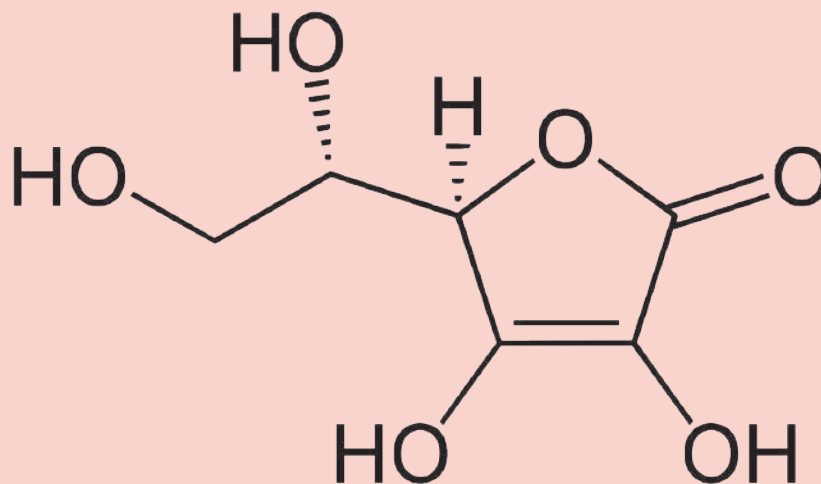


Fig. L-ascorbic acid

The ability to synthesise vitamin C is demonstrated in many organisms, both plants and animals. However, primates and e.g. guinea pigs and some fish have lost the ability to synthesise L-ascorbic acid. Both naturally and artificially, vitamin C is synthesised from D-glucose<sup>2</sup>.

## BASIC FUNCTIONS:

### VITAMIN C AS ANTI-OXIDANT

Vitamin C is an active anti-oxidant – it slows down the oxidation of lipids, proteins, carbohydrates and nucleic acids. Radical forms of hydrophobic anti-oxidants, such as  $\alpha$ -tocopherol or  $\beta$ -carotene, are regenerated by vitamin C<sup>3</sup>.

### WITAMINA C – AKTYWATOR ENZYMÓW

Vitamin C as the proton donor can activate many enzymes taking part in important metabolic pathways. In humans, those are 8 enzymes involved in the synthesis of collagen, steroid hormones, adrenaline, carnitine and norepinephrine. They are also responsible for the amidation of peptide hormones, and take part in the metabolism of tyrosine<sup>1,2</sup>.

1. Vitamin C, DrugBank.com – 19.06.2018

2. Vitamin and mineral requirements in human nutrition, Second Edition, WHO, p. 130-139

3. Normy żywienia dla populacji Polski – Instytut Żywności i Żywienia, 2017, p. 147

4. Vitamin C-Fact Sheet for Health Professionals. ods.od.nih.gov – 19.06.2018

5. Vitamin C, examine.com – 19.06.2018

6. Tabele Stathama, kuchnia-edukacyjna.com – 19.06.2018

## OTHER FUNCTIONS

Vitamin C inhibits the creation of nitrosamines in stomach acid, which have mutagenic properties. Also, it affects the absorption of calcium and iron. Vitamin C increases the absorption of non-heme iron, reducing its form to an absorbable one<sup>2,4</sup>.

It has been widely acknowledged that vitamin C helps treat colds, but many-years' studies have not provided any unambiguous answers in that respect<sup>3</sup>.

## RESULTS OF DEFICIENCY:

- Tiredness, malaise
- Gingivitis, weakening of connective tissue, haemorrhages, impaired healing of wounds
- Joint pain
- Anaemia
- Scurvy

Vitamin C deficiency manifests itself upon the intake of 10 mg/day for over a dozen weeks<sup>2</sup>. It is widely concluded that the intake of large quantities of vitamin C does not have any toxic properties; however, large quantities of L-ascorbate can lead to kidney stones or gastrointestinal conditions. In addition, vitamin C can be harmful to persons with sickle cell anaemia, or even fatal to persons with a genetic defect of glucose 6-phosphate dehydrogenase<sup>3</sup>.

## DEMAND:

Recommended dietary allowance (RDA) of vitamin C<sup>3</sup>:

| Age                    | Recommended dietary allowance (RDA) <sup>1</sup> |
|------------------------|--|
| Infants (0-12 months)  | 20 mg  |
| Children (1-8 years)   | 40-50 mg   |
| Children (9-13 years)  | 50 mg  |
| Children (14-18 years) | 65-75 mg   |
| Adults:                |  |
| women                  | 75 mg  |
| men                    | 90 mg  |
| Pregnant women         | 85 mg  |
| Lactating women        | 120 mg   |

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## SOURCES OF VITAMIN C:

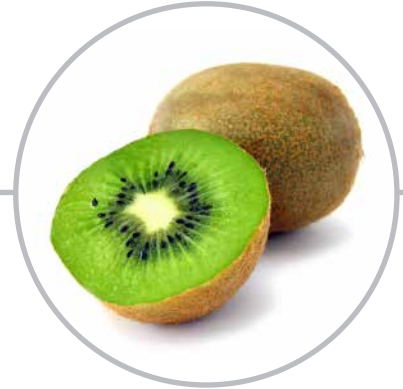
Vitamin C is found in fruits, mostly citrus fruits, but also strawberries, kiwi or blackcurrant; and vegetables, such as bell pepper, tomato or parsley<sup>3</sup>.



Red and green bell pepper



Orange or grapefruit juice



Kiwi



Broccoli



Strawberries



Tomatoes

## VITAMIN C – SUPPLEMENTATION:

In dietary supplements, the form of vitamin C is strictly regulated. Preparations can contain vitamins in the form of L-ascorbic acid or its salt: sodium, potassium, calcium ascorbate<sup>5</sup>.

In addition, vitamin C, due to its anti-oxidation properties, is added to food as a preservative. It can be recognised under following markings: E300 – ascorbic acid, E301–303 salts of ascorbic acid, E304 – palmitate or stearate esters of ascorbic acid<sup>6</sup>.



1. Vitamin C, DrugBank.com – 19.06.2018
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