

Teacher Information Regarding Vitamins in Food

Correct nutrition: The importance of vitamins for a balanced diet

A balanced nutrition is a prerequisite for a healthy and effective organism. In addition to nutrients that supply energy, i.e. fats, carbohydrates, and proteins, nutrients that do not supply any energy - such as vitamins, minerals, as well as trace elements, dietary fibres, and water - are also important.

Vitamins are vital for our body to function. They are part of countless biochemical processes that take place in the body. What vitamins all have in common is that they do not contribute to the energy intake. The human body is incapable of producing the majority of vitamins; we must therefore ingest them with food and drink.

If we eat sufficient amounts of fruits, vegetables, cereals, and also occasionally meat, we will hardly experience any undersupply of vitamins. In spite of this, there may still be vitamin deficiencies! This apparently absurd situation is, among others, the result of ingesting too much industrially processed food, where the vitamins have simply disappeared. When we eat too much white bread, we will suffer from an undersupply of vitamin B₁, as the flour is produced without the outer layer of the grain - where the vitamins are actually found.

Consuming too much sugar can also lead to an undersupply of vitamin B₁. This is because our body needs vitamin B₁ in order to break down sugar for energy supply. As the sugar itself does not contain any vitamins, the body must use its available vitamin B₁ resources to break down the sugar.

Even an oversupply of vitamins can cause diseases. For this reason, there are restrictions regarding how many vitamins we should add to our food products and how many vitamin supplements we should take. Only vitamins that do not cause damage when oversupplied should be used to enrich food products.

We distinguish between water-soluble (e.g. vitamin C) and fat-soluble (e.g. beta-carotene = provitamin A) vitamins. Fat-soluble vitamins can be stored in our body fat. This has both advantages and disadvantages. The reserves can be used to compensate for undersupply. On the other hand, these vitamins can also be overdosed. For water-soluble vitamins, an oversupply is less problematic as the body gets rid of all substances it does not need with the urine. On the other hand, the body has only a small amount of reserves in times of scarcity.

Fat-soluble vitamins are:

- vitamin A (retinol) and its precursor provitamin A (β -carotene)
- vitamin D (calciferol)
- vitamin E (tocopherol)
- vitamin K (phylloquinone).

Water-soluble vitamins are:

- vitamin B₁ (thiamine)
- vitamin B₂ (riboflavin)
- vitamin B₆ (pyridoxine)
- vitamin B₁₂ (cobalamin)

- biotin
- folic acid
- niacin
- pantothenic acid
- vitamin C (ascorbic acid)

Vitamin A:

Vitamin A is necessary for growth, eye sight and the functioning of skin and mucous membranes.

Nature provides two versions of vitamin A: 1) as a ready-made vitamin in animal food products such as liver, yolk and butter and 2) as β -carotene (precursor of vitamin A) commonly found in carrots, tomatoes and other fruits and vegetables with a strong red/orange colour, as well as in green leafy vegetables. The body does not care whether it gets vitamin A or β -carotene because it can produce vitamin A from β -carotene without any problems - and in exactly the amount required. Therefore, we cannot ingest too much β -carotene. As opposed to this, too much vitamin A can lead to undesirable side effects or even poisoning.

Vitamin C (ascorbic acid):

Vitamin C has many vital functions in the human body. It is of central importance for building connective tissue, bones and teeth; and it is essential for the transport of iron in the blood stream. In addition, it prevents undesirable oxidation in certain places of our body.

Vitamin C can be found particularly in citrus fruit, but also in black currants, rose hips, capsicum, cabbage and many other fruits and vegetables. Unfortunately, vitamin C, can be destroyed during boiling. Potatoes, for example, contain vitamin C which can be better saved if they are boiled in their skin. Therefore, we should eat plenty of fresh fruit and vegetables every day; and should steam vegetable only briefly in order to minimize vitamin losses.

It is very important for our body to ingest the correct nutrients. As it is difficult to determine from the outside of food products what substances they contain we need methods to find that out. Only by knowing the composition of our food, can we achieve a balanced diet. Using the following experiments, we want to illustrate some of the detection methods.

Explanation regarding the experiment "Vitamin C – what's in a lemon!"

When exposed to air, the surface of cut-up fruit turns brown particularly fast because substances in the fruit (e.g. polyphenols) react with the oxygen in the air. This process is called oxidation (based on the Latin name oxygenium). Vitamin C prevents this reaction by reacting with oxygen itself. This means that vitamin C is oxidised and thus prevents the oxidation of the substances contained in the fruit. It is therefore also called an antioxidant.

Many fruits contain this vitamin, but lemon is particularly rich in vitamin C. If all the vitamin C in the exposed surface area is used up, the fruit turns brown. When preparing a fruit salad, we used this protective effect of vitamin C. If we pour lemon juice over the freshly prepared fruit salad, it will preserve its original colour longer.

We want to prove with this experiment that the protection is actually caused by the antioxidant effects of vitamin C and not through the lemon's acid. Therefore we will simultaneously drop vinegar on the grated apple. This way we can directly observe which treatment protects the apple best.

Explanation regarding the experiment "Where does the carrot's colour come from"

The carrot's colourful substance is β -carotene (a precursor of the important vitamin A). β -Carotene is a fat-soluble vitamin. This means that beta-carotene cannot dissolve in water. It will dissolve in oil though - which subsequently turns the oil a bright yellow colour.

This experiment also shows the importance of ingesting carrots together with some fat or oil. This way the β -carotene will be dissolved in the fat or oil and can be better absorbed by the human body. The same concept applies to salad dressing. The oil can absorb the fat-soluble substances of the salad and thus make it easier for the body to absorb the valuable substances.

β -Carotene also gives people a reddish-brownish complexion as it is stored in the fat tissue of the skin (therefore we talk about the healthy complexion of "carrot puree babies").