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Prevention: Do some vitamins and dietary supplements do more harm than good?



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Many people take supplements of antioxidant vitamins like vitamin C or beta-carotene in the hope that it will improve their health and prevent illnesses. There are even claims that these supplements can help people live longer by protecting them from fatal cardiovascular (heart and circulation) diseases and cancer.

How did this assumption come about? Very complex processes take place in our cells, and they can influence the development of disease. One of these processes is called oxidation, where molecules in our bodies react with the oxygen that we breathe in. "Free radicals" are produced during oxidation. These are atoms and molecules that can attack and damage cells. There is an ongoing debate about whether free radicals contribute to the development of cancer and whether antioxidants could therefore lower the risk of cancer. Antioxidants are substances that reduce the production of free radicals in our bodies.

Antioxidants are found in particularly high amounts in vitamins A, C and E, in beta-carotene and in selenium. They are mainly found in fruits and vegetables. But many people do not feel that this is enough, and believe that supplements or food products that are enriched with vitamins will be good for their health.

Trials testing long-term use of antioxidant supplements

Researchers at the Cochrane Collaboration wanted to know whether benefits of daily supplementation have been proven, or whether supplements may even be harmful. They set out to answer this specific question: Can antioxidant supplements help people live longer? They found a lot of trials - 67 in total - with more than 230,000 adults in them. This was a good basis for evaluating the benefits of supplements.

The trial participants took either one or more antioxidant supplements, a placebo (dummy tablet), or no tablet for a certain amount of time, in some cases for many years. Most of the participants were healthy when they joined the trials. A quarter of them had various illnesses, such as conditions affecting their digestive system, heart, skin or kidneys.

The trials mostly tested considerably higher doses of the antioxidant substances than are eaten in a normal balanced

diet. For almost all the trials, people took the supplements every day. These were the doses of supplements that people took in the trials:

- Vitamin C: between 60 and 2,000 mg (in 33 trials)
- Beta-carotene: from 1.2 to 50.0 mg per day (in 24 trials)
- Vitamin E: between 10 and 5,000 IU ("international units") (in 24 trials)
- Vitamin A: from 1,333 to 200,000 IU ("international units") (in 16 trials)
- Selenium: between 20 and 200 micrograms (in 21 trials).

Usually there were combinations of the vitamins in the supplement. And the trials lasted from one month to 12 years: the average length of the trials, though, was just under 3 years.

No general benefit proven - and a harmful effect cannot be ruled out

The results were worrying. Antioxidant supplements generally did not help people live longer. On the contrary, the evidence even suggests that people who took some of the supplements were more likely to die sooner. The results were the same for the participants who were healthy and those who had an illness at the beginning of the trials. But not all supplements have this effect.

The trials did not list the exact causes of death of the people who died. The researchers assumed that the main causes of death were most likely to be cancer and cardiovascular (heart and circulation) disease.

Selenium and vitamin C did not increase mortality. However, there was no clear proof that vitamin C protects against dying sooner. A benefit cannot be completely ruled out, though. In these trials, selenium reduced by a little the risk of dying within a year. Exactly who can benefit and how it works is still unclear.

Good quality research has shown, however, that supplements containing vitamin A, beta-carotene and vitamin E all increased the risk of dying. For example, in these trials looking at vitamin E supplements, it was found that, of the people who were taking these supplements, an extra 3 out of every 100 (3%) died compared to those

who were taking placebos or no supplements.

Antioxidants can have other adverse effects too. For instance, vitamin E, beta-carotene and selenium can lead to constipation, diarrhoea and flatulence. Taking very large amounts of vitamins A and C can cause itching.

Unanswered questions

Although laboratory experiments had suggested that antioxidants could have a protective effect, they actually had the opposite effect when people started taking them over long periods of time. Despite the large number of trials, there are still some questions that have not been answered. For example, it is not clear whether antioxidants benefit people who are malnourished or have certain illnesses. In addition, it is not yet known exactly what effects antioxidants have in the body, particularly when different supplements are taken together.

There are now even animal studies which indicate that free radicals could have a protective effect rather than a harmful effect. But here, too, the results should be interpreted with caution: As the experience with long-term vitamin supplementation has shown, any new theory also has to be tested in people, in good quality long-term trials.

A balanced diet provides enough protection

The Cochrane review did not find proof that antioxidant supplements prevent cancer and other life-threatening diseases. Taking too many supplements can even increase the risk. Of course, this does not mean that these substances should be avoided. Our bodies need vitamins and minerals, which most people can get by eating a balanced diet with enough fruits and vegetables. Supplements only appear to increase risk in too high doses.

At present there are no officially binding recommendations in Germany and other European countries concerning safe upper levels for substances in supplements. However, there are plans to define upper levels for vitamins and minerals that apply throughout Europe. You can read more about supplements in our fact sheet (URL: <http://www.informedhealthonline.org/index.383.en.html>).

Author: German Institute for Quality and Efficiency in Health Care (IQWiG)

Glossary

antioxidant

Antioxidants are substances that protect the body cells against harm caused by particular aggressive atoms or molecules called free radicals. Antioxidants attach themselves to the free radicals, and stop them doing harm to other cells. The most well-known antioxidants are vitamins.

beta-carotene

Beta-carotene (or β -carotene) is the colouring that makes some fruit and vegetables yellow or orange (like carrots). It is an early chemical stage of vitamin A, and this is why it is sometimes called pro-vitamin A. The food industry uses beta-carotene as a food colouring agent. It is also an ingredient in many multi-vitamin preparations.

selenium

Selenium is a mineral that is necessary for human health. It occurs in fish, meat, grains, nuts and offal (organ meats and giblets). Selenium deficiency can be caused by a chronic stomach or bowel disease, or an unhealthy diet. The body needs selenium to produce particular elements that are essential to protect the body cells.

vitamin C

Vitamin C is water-soluble. It is also called ascorbic acid. It is the vitamin that people need to have the most of every day. It occurs primarily in fresh fruit and vegetables. Vitamin C is one of the antioxidants. This means it protects cells from damage caused by particular aggressive atoms and molecules called free radicals. The food industry uses it frequently as a conservative. A major vitamin C deficiency leads to tiredness, irritability, and symptoms in bones, cartilage and teeth.

vitamin E

Vitamin E describes a group of 8 different fat-soluble vitamins. They are antioxidants, which mean they protect cells from damage caused by aggressive types of atom or molecule called free radicals. Vitamin E occurs particularly in nuts and cold-pressed plant oils, like sunflower oil. The food industry uses it as a conservative. Because it is not water-soluble, the body only absorbs vitamin E if it comes in fats in the diet.

Cochrane Collaboration

The Cochrane Collaboration is an international network of thousands of researchers and others. They work together in teams called Cochrane Review Groups to answer questions about health care by doing systematic reviews of evidence. To achieve this, the members of the Collaboration have developed systems and methods for systematically finding and analysing the results of trials of health care interventions. The goal of the Cochrane Collaboration is to help patients, health care practitioners and others make more informed decisions about health care. You can read more about the Cochrane Collaboration at their website.

evidence

Evidence is what we call scientific proof from well-conducted, good-quality scientific trials that have been carefully designed to answer specific questions. Depending on the types of questions, different scientific research methods (types of study) are most appropriate to find reliable answers to these questions. Randomized controlled trials (RCTs), for example, are the best way to get reliable evidence on the effectiveness of medical treatments (interventions). This type of study, however, is not the best form of evidence for all possible questions, and does not provide the best answers to all kinds of questions, either. Epidemiological studies, for example, are very suitable for establishing well-founded proof for the spreading of a disease in the population.

Sources

Bjelakovic G, Nikolova D, Glud LL, Simonetti RG, Glud C. Antioxidant supplements for prevention of mortality in healthy participants and patients with various diseases. *Cochrane Database of Systematic Reviews* 2008, Issue 2. [Cochrane summary (URL: <http://www.cochrane.org/reviews/en/ab007176.html>)]

The German Institute for Quality and Efficiency in Health Care (IQWiG)

The German Institute for Quality and Efficiency in Health Care (IQWiG) was established by legislation to provide evaluations of the effectiveness, quality and efficiency of healthcare services. This includes the assessment of medicines as well as the publication of health information for consumers and patients.

Evidence basis of our health information

Our information is based primarily on systematic reviews of the effects of health care. Systematic reviews are necessary to gain an objective picture of health care. In order to do this, a clear question is formulated. Researchers then find all the relevant studies that could answer this question. They then evaluate those studies.

You can find a list of the evidence and other scientific literature on which this information is based at **www.informedhealthonline.org**

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