

Vitamin E

AT A GLANCE

Introduction

The term vitamin E describes a family of eight related, fat-soluble molecules. Among these, 'alpha-tocopherol' has the highest biological activity and is the most abundant in the human body (1). The name tocopherol derives from the Greek words tocos, meaning childbirth, and pherein, meaning to bring forth. The name was coined to highlight its essential role in the reproduction of various animal species.

Health Functions

A sufficient intake of vitamin E (alpha-tocopherol) is important as it

- functions as an antioxidant, protecting cells, tissues, and organs from damaging effects caused by 'free radicals', which are responsible for the aging process and can lead to various health conditions such as heart disease, cancer, and inflammatory conditions
- inhibits damaging blood clotting, potentially blocking blood flow
- regulates the opening of blood vessels, important for unhindered blood flow.

Disease Risk Reduction

Heart disease

Vitamin E helps to prevent arteries from clogging by blocking the conversion of cholesterol into the waxy fat deposits called 'plaque' that stick to blood vessel walls. Vitamin E also thins the blood, allowing it to flow more easily through arteries even when plaque is present.

Numerous clinical studies have reported that the amount of vitamin E ingested in food and in supplements is associated with a lower risk of heart disease, atherosclerosis and other types of cardiovascular disease.

One large clinical study in postmenopausal women showed that vitamin E supplementation had no effect on the incidence of stroke but reduced the risk of blockage of blood flow in veins by a blood clot.

Several clinical trials in individuals who were at high risk for cardiovascular events (e.g., stroke) because they had cardiovascular disease or diabetes failed to demonstrate that vitamin E provides protection.

However, there is evidence that vitamin E may reduce the risk of cardiovascular problems in diabetics with a particular type of gene found in 36% of the general population.

Eye health

Because of its antioxidant action, vitamin E may help protect against clouding of the lens of the eye

(cataracts) and a progressive deterioration in the retina, the back part of the eye (age-related macular degeneration, AMD). Both of these eye disorders tend to occur as people age, leading to impaired vision.

To minimize risk of these eye disorders, experts advocate diets high in vitamin E and vitamin C, and carotenoids.

Immune function

Vitamin E has been shown to enhance specific aspects of the immune response that appear to decline as people age. A clinical trial in elderly nursing home residents reported that daily supplementation with vitamin E lowered the risk of upper respiratory tract infections, especially the common cold, but had no effect on lower respiratory tract (lung) infections.

More research is needed to determine whether supplemental vitamin E may protect the elderly against the common cold or other infections (e.g., flu).

Cancer

Clinical studies have shown that people with cancer often have lower levels of vitamin E in the blood. In addition, population trials suggest that diets rich in antioxidants, including vitamin E, may be connected to a reduced risk of certain types of cancer.

Experiments have shown that vitamin E inhibits the growth of some cancers in test tubes and animals, particularly hormone responsive cancers such as breast and prostate cancer. While these results are encouraging, the confirmation of these findings by large-scale human studies is still pending.

More research is needed before researchers can come to any firm conclusions about whether added vitamin E, alone or together with other antioxidant micronutrients, has an impact on cancer in humans and, if so, what the optimal dosage is.

Alzheimer's disease

Since researchers believe oxidative stress contributes to the development of Alzheimer's disease, antioxidants like vitamin E could potentially help prevent this condition. The fat-soluble vitamin can readily enter the brain and exert its antioxidative properties.

Clinical studies have suggested that vitamin E supplementation, together with vitamin C, may prevent the development of Alzheimer's disease.

Other Applications

Please note:

Any dietary or drug treatment with high-dosed micronutrients needs medical supervision.

Heart disease

Results of clinical trials using vitamin E to treat heart disease have been inconsistent. More evidence is needed to determine if there are benefits of vitamin E supplementation.

Diabetes

People with diabetes are at increased risk for conditions such as cardiovascular disease. A potential factor involved in these complications may be low levels of antioxidants, which is frequently observed in these patients. Vitamin E supplements and other antioxidants may help reduce the risk of heart disease and other complications in people with diabetes.

There is evidence that vitamin E may reduce the risk of cardiovascular problems in type 2 diabetics with a particular type of gene found in 36% of the general population.

Research indicates that antioxidants might help control blood sugar levels and lower cholesterol levels in those with type 2 diabetes while protecting against the complications of eye damage ('retinopathy') and kidney damage ('nephropathy') in those with type 1 diabetes.

Non-alcoholic fatty liver disease

The term NAFLD encompasses conditions like simple liver steatosis, non-alcoholic steatohepatitis (NASH), cirrhosis, and is usually associated with metabolic syndrome, obesity, lipid disorders, insulin resistance and type 2 diabetes. There are more than a dozen published human trials reporting beneficial effects of vitamin E on different biochemical or histological markers in patients with NAFLD. Based on this evidence, several expert groups and medical societies have concluded that vitamin E administered at a daily dose of 800 IU improves liver histology in non-diabetic adults with biopsy-proven NASH, and should be considered as a first-line pharmacotherapy for this patient population. Currently there is no approved drug to treat NASH.

Alzheimer's disease

There is some evidence that vitamin E might help to treat forms of dementia, such as Alzheimer's disease.

Since researchers believe oxidative stress contributes to the development of Alzheimer's disease, antioxidants like vitamin E could theoretically reduce the risk or progression of the disease. Clinical studies have suggested that vitamin E supplementation improves cognitive performance in healthy individuals and in those with dementia from causes other than Alzheimer's (e.g., multiple strokes).

Eye health

Uveitis is inflammation of the uvea, the middle layer of the eye between the white outer coat of the eye and the retina. The uvea contains many of the blood vessels that nourish the eye, so inflammation in this area can affect several important parts of the eye.

Uveitis is another eye disorder for which the antioxidant vitamins E and vitamin C may be helpful. A clinical study in patients with uveitis found that those who took the vitamins E and C had better visual clarity than those who took a dummy pill ('placebo').

Other disorders

Vitamin E, along with other standard treatments, may also be beneficial for treating photodermatitis and inflammatory diseases (ulcerative colitis, pancreatitis, and osteoarthritis), slowing progression of Parkinson's disease, and avoiding miscarriage. Controlled trials are needed to clarify potential benefits of vitamin E in treating these disorders.

Intake Recommendations

The intake recommendations for vitamin E vary according to age, sex and criteria applied in individual countries. While in Europe recommendations for adults range from 4 to 15 mg alpha-tocopherol equivalents per day for men and from 3 to 12 mg per day for women, in the U.S., the recommended intake for adults has been set at 15 mg natural alpha-tocopherol per day.

The recommended vitamin E intake of 15 mg is not easily achieved even with the best nutritional intentions. This is problematic as most research studies show that intake levels are often associated with health benefits.

Supply Situation

In several European countries, a large portion of the population has a mean dietary vitamin E intake below the recommended level. Surveys estimated that more than 90% of Americans do not meet daily dietary recommendations for vitamin E. Most recently, a comprehensive review of vitamin E dietary intake levels demonstrated that the majority of reported intake values worldwide were below the recommended level.

Deficiency

Vitamin E is stored in various tissues. Because depletion of the vitamin E stores takes a very long time, no overt clinical deficiency symptoms have been noted in otherwise healthy adults.

Symptoms of vitamin E deficiency are seen in patients with fat absorption disorders or liver disease, and in newborn infants, particularly premature infants.

Symptoms of vitamin E deficiency include muscle weakness, loss of muscle mass, abnormal eye movements, impaired vision, and unsteady gait.

Chronic deficiency may also cause problems with kidney and liver function. In addition, severe vitamin E deficiency can be associated with serial miscarriages and premature delivery in pregnant women.

Although overt vitamin E deficiency is rare, marginal status is relatively common: A recent study which systematically reviewed the published literature reporting vitamin E serum concentrations,

concluded that α -tocopherol status was inadequate in a substantial part of the studied populations around the world.

Sources

Vegetable oils (olive, soya beans, palm, corn, safflower, sunflower, etc.), nuts, whole grains and wheat germ are the most important sources of vitamin E. Other sources are seeds and green leafy vegetables. The vitamin E content of vegetables, fruits, dairy products, fish and meat is relatively low.

The vitamin E content in foods is often reported as 'alpha-tocopherol equivalents' (alpha-TE). This term was established to account for the differences in biological activity of the various forms of vitamin E (1 mg of alpha-tocopherol is equivalent to 1 TE).

Safety

Vitamin E is considered safe for chronic use even at doses of up to 1,000 mg per day.

Long-term high-dose alpha-tocopherol supplementation may increase the likelihood of bleeding in some individuals. Some physicians recommend discontinuing high-dose vitamin E supplementation one month before elective surgery to decrease the risk of bleeding.

Studies have suggested that taking vitamin E supplements long-term may be associated with an increased risk of death ('mortality'). However, experts criticized that these studies were conducted on patients at high risk of a chronic potentially fatal disease, and that to generalize these findings to healthy individuals is very speculative. In addition, the effects were only observed at a very high dose of 2,000 IU/day, which is many times the recommended amount.

Moreover, many human long-term studies with much higher doses of vitamin E did not report any adverse effects. In fact, meta-analyses with neutral or beneficial outcomes on all-cause mortality have outnumbered the negative ones, and there is no consistent information on how vitamin E might increase risk of mortality.

Tolerable upper intake level

While in the European Union an upper intake level of 300 mg alpha-tocopherol equivalents per day has been established for adults, in the U.K. this level has been set at 540 mg/day for supplemental vitamin E, and in the U.S. at 1,000 mg/day of any form of supplemental alpha-tocopherol.

Drug interactions

Please note:

Because of the potential for interactions, dietary supplements should not be taken with medication without first talking to an experienced healthcare provider.

Authored by Dr Peter Engel in 2010, reviewed and updated by Dr Szabolcs Peter on 18.06.2017