

The functions of beta carotene



Unlike supplements, foods rich in beta-carotene pose no lung cancer risk. Synthetic beta-carotene supplements have been found to increase the risk of both colorectal and lung cancer in smokers, especially those who also drink alcohol. A study published by an international team in the January 2004 issue of Cancer Epidemiology Biomarkers and Prevention indicates that beta-carotene consumed as part of whole foods has no such negative effects. This study, which pooled data from seven large cohort studies running between 7 and 16 years and involving a subject population of 399, 765 participants in North America and Europe, found that beta-carotene from foods was not associated with any increased risk of lung cancer among current smokers or non-smokers. Other carotenoids in foods (lutein, zeaxanthin and lycopene) were also found to have no association with lung cancer risk. (February 26, 2004)

Food sources of beta-carotene include sweet potatoes, carrots, kale, spinach, turnip greens, winter squash, collard greens, cilantro and fresh thyme. To maximize the availability of the carotenoids in the foods listed above, the foods should be eaten raw or steamed lightly.

For serving size for specific foods, see Nutrient Rating Chart below at the bottom of this page.

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Description

What is beta-carotene?

Beta-carotene is probably the most well known of the carotenoids, a phytonutrients family that represents of the one most widespread groups of naturally occurring pigments. It is one of the most abundant carotenoids in the North American diet as well as one of approximately 50 carotenoids known as “ provitamin A” compounds, able to be converted in the body into retinol, an active form of vitamin A.

While beta-carotene produces colors in the orange and yellow range, beta-carotene rich foods may be other colors besides from these two. That is because other phytonutrients pigments blend together with the beta-carotene to give the plant food its unique hue that, in addition to orange or yellow, could be other colors including pink, red or white.

How it Functions

What are the functions of beta-carotene?

- Preventing Vitamin A Deficiency

Until late in the 20th Century, the functions of carotenoids, including beta-carotene, were discussed only in terms of their potential vitamin A activity. Beta-carotene is one of approximately 50 carotenoids of the known 600, that are called “ provitamin A” compounds because the body can convert them into retinol, an active form of vitamin A.

As a result, foods that contain beta-carotene can help prevent vitamin A deficiency. In addition to alpha-carotene and beta-cryptoxanthin, beta-carotene is among the most commonly consumed provitamin A carotenoids in the North American diet.

- Antioxidant & Immune-Enhancing Activity

In recent years, carotenoids including beta-carotene have received a tremendous amount of attention as potential anti-cancer and anti-aging compounds. Beta-carotene is a powerful antioxidant, protecting the cells of the body from damage caused by free radicals. It is also one of the carotenoids believed to enhance the function of the immune system.

- Promoting Proper Cell Communication

In addition to their antioxidant and immune-enhancing activity, carotenoids including beta-carotene have shown the ability to stimulate cell to cell communication. Researchers now believe that poor communication between cells may be one of the causes of the overgrowth of cells, a condition which eventually leads to cancer. By promoting proper communication between cells, carotenoids may play a role in cancer prevention.

- Supporting Reproductive Health

It is also believed that beta-carotene may participate in female reproduction. Although its exact function in female reproduction has not yet been identified, it is known that the corpus luteum has the highest concentration of beta-carotene of any organ in the body, suggesting that this nutrient plays an important role in reproductive processes.

Deficiency Symptoms

- What are deficiency symptoms for beta-carotene?

A low dietary intake of carotenoids such as beta-carotene is not known to directly cause any diseases or health conditions, at least in the short term. However, if your intake of vitamin A is also low, a dietary deficiency of beta-carotene and/or other provitamin A carotenoids can cause the symptoms associated with vitamin A deficiency.

In addition, long-term inadequate intake of carotenoids is associated with chronic disease, including heart disease and various cancers. One important mechanism for this carotenoid-disease relationship appears to be free radicals. Research indicates that diets low in beta-carotene and carotenoids

can increase the body's susceptibility to damage from free radicals. As a result, over the long term, beta-carotene deficient diets may increase tissue damage from free radical activity, and increase risk of chronic diseases like heart disease and cancers.

Toxicity Symptoms

- What are toxicity symptoms for beta-carotene?

A tell-tale sign of excessive consumption of beta-carotene is a yellowish discoloration of the skin, most often occurring in the palms of the hands and soles of the feet. This condition is called carotenoderma, and is reversible and harmless.

High intake of carotenoid-containing foods or supplements is not associated with any toxic side effects. As a result, the Institute of Medicine at the National Academy of Sciences did not establish a Tolerable Upper Intake Level (UL) for carotenoids when it reviewed these compounds in 2000.

However, the results of two research studies indicate that those who smoke heavily and drink alcohol regularly, may increase their chance of developing lung cancer and/or heart disease if they take beta-carotene supplements in amounts greater than 20-30 milligrams per day.

Impact of Cooking, Storage and Processing

- How do cooking, storage, or processing affect beta-carotene?

In certain cases, cooking can improve the availability of carotenoids in foods. Lightly steaming carrots and spinach improves your body's ability to absorb carotenoids in these foods.

It is important to note, however, that in most cases, prolonged cooking of vegetables decreases the availability of carotenoids by changing the shape of the carotenoid from its natural trans-configuration to a cis-configuration. For example, fresh carrots contain 100% all-trans beta-carotene, while canned carrots contain only 73% all-trans beta-carotene.

Factors that Affect Function

What factors might contribute to a deficiency of beta-carotene?

Carotenoids are fat-soluble substances, and as such require the presence of dietary fat for proper absorption through the digestive tract. Consequently, your carotenoid status may be impaired by a diet that is extremely low in fat or if you have a medical condition that causes a reduction in the ability to absorb dietary fat such as pancreatic enzyme deficiency, Crohn's disease, celiac sprue, cystic fibrosis, surgical removal of part or all of the stomach, gall bladder disease, and liver disease.

Due to low consumption of fruits and vegetables, many adolescents and young adults do not take in enough beta-carotene. In addition, if you smoke cigarettes and/or drink alcohol, you may have lower than normal blood levels of beta-carotene. Statistically speaking, smokers and drinkers eat fewer foods that contain carotenoids such as beta-carotene. Also, researchers suspect that cigarette smoke destroys carotenoids. However, if you do smoke or drink, use carotenoid supplements with caution (see Toxicity section).

Drug-Nutrient Interactions

What medications affect beta-carotene?

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The cholesterol-lowering medications referred to as bile acid sequestrants (Cholestyramine, Colestipol, and Colestid) lower blood levels of carotenoids. In addition, margarines enriched with plant sterols such as Benecol and Take Control, may decrease the absorption of carotenoids. Olestra, a fat substitute added to snack foods, may also decrease the absorption of carotenoids.

Nutrient Interactions

How do other nutrients interact with beta-carotene?

Beta-carotene supplements reduce blood levels of lutein while they may also increase blood levels of beta-cryptoxanthin.

Supplementing your diet with pectin may decrease the absorption of carotenoids.

Health Conditions

Carotenoids may play a role in the prevention of the following health conditions:

- Acquired Immunodeficiency Syndrome (AIDS)
- Age-related macular degeneration
- Angina pectoris
- Asthma
- Cataracts
- Cervical cancer
- Cervical dysplasia
- Chlamydial infection
- Heart disease

- Laryngeal cancer (cancer of the larynx)
- Lung cancer
- Male and female infertility
- Osteoarthritis
- Photosensitivity
- Pneumonia
- Prostate cancer
- Rheumatoid arthritis
- Skin cancer
- Vaginal candidiasis

Form in Dietary Supplements

What forms of beta-carotene are found in dietary supplements?

In dietary supplements, beta-carotene is available as synthetic all-trans beta-carotene, beta- and alpha-carotene from the algae *Dunaliella*, and mixed carotenes from palm oil.

It is important to note, however, that, due to the inconsistent results from research studies aimed at evaluating the health benefits of beta-carotene supplements, the National Academy of Sciences cautions against taking high dose carotenoid supplements, except as a method for preventing vitamin A deficiency.

Food Sources

What foods provide beta-carotene?

Beta-carotene can be found in concentrated amounts in a variety of foods including sweet potatoes, carrots, kale, spinach, turnip greens, winter squash, collard greens, cilantro, fresh thyme, cantaloupe, romaine lettuce and broccoli.

Food Source Analysis not Available for this Nutrient

Public Health Recommendations

What are current public health recommendations for beta-carotene and carotenoids?

To date, no recommended dietary intake levels have been established for carotenoids. In an effort to set such recommendations, the Institute of Medicine at the National Academy of Sciences reviewed the existing scientific research on carotenoids in 2000.

Despite the large body of population-based research that links high consumption of foods containing beta-carotene and other carotenoids with a reduced risk of several chronic diseases, the Institute of Medicine concluded that this evidence was not strong enough to support a required carotenoid intake level because it is not yet known if the health benefits associated with carotenoid-containing foods are due to the carotenoids or to some other substance in the food.

However, the National Academy of Sciences supports the recommendations of various health agencies, which encourage individuals to consume five or more servings of fruits and vegetable every day. This level of intake of fruits

and vegetables provides approximately three to six milligrams of beta-carotene.