



Vitamins and the Body

EXTENSION

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Vitamins are essential nutrients, which means that it is necessary to eat them to live and be healthy. In fact, the word vitamin comes from the Latin word for life, which is "vita." Vitamins are part of important processes throughout the body. For example, vitamins help release energy from food, help keep skin and nerves healthy and help make red blood cells.

The body needs more than a dozen different vitamins to remain healthy. Vitamins are all different from each other and one vitamin cannot substitute for another in the body. Some vitamins have several different closely related forms that occur naturally in food. Because vitamins can have various forms, there may see several different names for the same vitamin. This can be confusing when trying to choose a healthful diet. Look at the vitamin table at the end of this fact sheet to help recognize different names for vitamins. This table also will help explain the functions and good sources of each vitamin.

Types of Vitamins

The two major types of vitamins are **fat soluble** vitamins and **water soluble** vitamins.

Fat Soluble Vitamins

The fat soluble vitamins are A, D, E and K. They are usually found with fats in food and the body absorbs them best when people eat them with some fat. Do not worry about adding fat to the diet so that there will be enough fat soluble vitamins. Only a small amount of fat is needed to help absorb fat soluble vitamins. Some of the good sources of vitamin E are vegetable oils and nuts and good sources of vitamin D are egg yolk and fish oil. These are also high in fat. Whole grains and deep green leafy vegetables also are good sources of fat soluble vitamins. Even in these, there is enough fat to absorb the vitamins.

Fat soluble vitamins are not easily washed out of food into cooking water because they mix with fat, not water. As a result, these vitamins are not easily lost when one cooks food in water.

Water Soluble Vitamins

The water soluble vitamins are all of the B vitamins, or "B complex" and vitamin C. The B vitamins are thiamin (B₁), riboflavin (B₂), niacin (B₃), vitamin B₆, folate, vitamin B₁₂, biotin and pantothenic acid. All of the water soluble vitamins are easily lost in cooking water. Because they are water soluble, they are washed out into the water that food is being cooked

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in. The best way to preserve vitamins when cooking is to use as little water as possible and cook vegetables for as short a time as possible. Save the cooking water, to use in other foods like soup or low fat gravy.

People do not store extra water soluble vitamins in their bodies. When they eat more than is needed, the extra is washed out through the kidneys in urine. Because water soluble vitamins are not stored, eat foods that are good sources of them often.

Dietary Reference Intakes

The dietary reference intakes for vitamins were developed by nutrition experts and are constantly updated when new research on vitamins is completed. Based on the recommended intakes, most healthy people can meet their needs for vitamins if they follow the USDA MyPlate Plan. This includes eating the recommended amount of foods from each of the USDA MyPlate food groups every day.

What about Supplements?

Nutrition researchers constantly study the US food supply to determine if there is a risk of vitamin deficiencies. As more has been learned about vitamins, those that could be lacking in our diets have been added to foods. For example, in the early 1900s, many children suffered from rickets, a vitamin D deficiency disease. Today, vitamin D is added to milk to prevent rickets in children. A deficiency of thiamin causes the disease beri beri and a deficiency of niacin causes the disease pellagra. Even in the 1930s, many people in this country died of a niacin deficiency. Starting in 1941, these vitamins were required to be added to refined flour, corn meal and rice to prevent these diseases.

Most people gain no extra benefits by taking vitamin supplements to get more vitamins than the dietary reference intakes. Reasons people give for taking vitamin supplements, such as "vitamins will make me feel better" or "give me more energy," are not true unless they suffer from a vitamin deficiency. A vitamin deficiency could be caused by eating an imbalanced diet, for example, never eating food from one of the food groups, going on a very low calorie diet to lose weight, or having a greater need for certain vitamins. The first two reasons require improving the diet, while the third category,

having increased needs, may require supplementation. For example, pregnant and breastfeeding women are usually prescribed multiple vitamin and mineral supplements. Some people, particularly older adults may not eat an adequate diet for a variety of reasons. Arthritis and other disorders make it difficult to prepare foods. Lack of teeth or chewing problems may make it difficult to eat foods like fruits, vegetables, meats and high fiber foods. Some people have diseases that interfere with absorption of vitamins. Others take medicines that interfere with absorption of vitamins. Discuss this with a doctor or a registered dietitian.

Too Much of a Good Thing?

Bodies store fat soluble vitamins in fatty tissues and in the liver. Because they are stored, too much can build up and make people ill. This occurs only if a person takes extra supplements of these vitamins for a long time. The two fat soluble vitamins that are most toxic are vitamin A and vitamin D. Regular foods do not contain enough vitamins to cause a toxicity, people only need to worry if they take high dose supplements regularly.

The body protects people or individuals from absorbing too much vitamin A from many food sources. For example, one raw carrot contains over 2,000 mg of vitamin A. This is such a large dose that seems it would be harmful to eat carrots. But the vitamin A in vegetables is actually a form called beta carotene. Beta carotene has to be converted into vitamin A. The body will not make too much vitamin A from beta carotene no matter how much they eat.

Vitamin D also can be very toxic if consumed in large quantities. Vitamin D toxicity can cause hardening of body arteries and organs like the liver and kidneys. This happens because vitamin D helps absorb calcium from the diet. Too much vitamin D results in absorption of so much calcium that the body cannot store it where it should go, which is in the bones. Then the calcium is deposited in other tissues, where it prevents the tissues from functioning.

Even though individuals cannot store toxic amounts of water soluble vitamins, very high doses can cause annoying or harmful side effects. For example, a feeling of being hot, flushing of the face and a rash can occur only minutes after taking a very large dose of niacin. Taking large doses of vitamin C can cause diarrhea in some people and letting chewable vitamin C tablets dissolve in the mouth can cause tooth damage, because vitamin C is an acid. Taking large doses of vitamin B₆ for several months may cause nerve damage that can be permanent.

The important fact to remember is that these vitamins are essential in small amounts but can be harmful in very large amounts.

Vitamins and the USDA MyPlate Plan

Most foods contain a variety of vitamins. But, no one food has enough of all of the vitamins to meet the total requirement. An eating plan made up of a variety of foods should meet vitamin needs. Eating foods from each of the USDA MyPlate food groups in the recommended amounts is the best way to get the vitamins you need.

Vitamins Provided by Each USDA My-Plate Plan Food Group

Each USDA MyPlate food group provides important vitamins. The grain group provides folate, niacin, riboflavin and thiamin. The vegetable group provides folate, vitamin A, vitamin C and vitamin E. The fruit group provides folate, vitamin A and vitamin C. The dairy group provides riboflavin, vitamin B12 and when fortified vitamins A and D. The protein foods group provide niacin, thiamin, vitamin B6 and vitamin B12. Bean, peas and lentils are also sources of folate, thiamin and vitamin E. Lastly, oils provide vitamin E.

Necessary vitamins can be provided in a low fat diet. Steamed broccoli is a good source of vitamins A and C. Broccoli with cheese sauce is high in fat and saturated fat. A slice of whole wheat bread is low fat, but a croissant is very high in fat. When choosing foods from the protein foods group, be sure to choose lean, trimmed products and don't add extra fat in preparation. For example, round steak is a low fat red meat choice, while spare ribs are much higher in fat. In the dairy group, skim milk is fat free, but whole milk has 50 percent of its calories from fat.

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References

Whitney, E.N. & Rolfes, S.R. (2015). *Understanding Nutrition*, 14th ed., Wadsworth, Cengage Learning, Belmont, CA. United States Department of Agriculture. ChooseMyPlate.gov. Accessed www.choosemyplate.gov

Table 1. Vitamins: Functions and Foods Sources

<i>Vitamin</i>	<i>Function</i>	<i>Food Sources</i>
Fat-Soluble Vitamins		
Vitamin A (retinol)	Maintains healthy skin and eyes. butter.	Liver, whole or fortified milk, fortified margarine,
Beta-carotene (Provitamin A)	Functions like vitamin A and may have important functions as an antioxidant.	Leafy green (spinach, broccoli, brussels spouts) and deep yellow orange fruits and vegetables (sweet potatoes, cantaloupe, squash).
D (cholecalciferol)	Helps the body absorb calcium and phosphorus.	Fish oils, egg yolk, liver, fortified milk, fortified cereals.
E (alpha-tocopherol)	Antioxidant protects body tissues and membranes.	Vegetable oils, whole grains, nuts (almonds).
K	Necessary for normal blood clotting.	Green leafy vegetables; liver; egg yolk; soybean oil; beans, peas and lentils.
Water Soluble Vitamins		
Thiamin (B ₁)	Helps the body use carbohydrates.	Pork, beef, liver, whole or enriched grains, meat.
Riboflavin (B ₂)	Helps the body break down nutrients for energy.	Milk, egg whites, leafy vegetables, whole or enriched grains, meat.
Nicin(B ₃) (nicotinamide) (nicotinic acid) (niacinamide)	Like riboflavin and thiamin, helps the body break down nutrients for energy.	Meat, peanuts, whole or enriched grains (except whole corn).
B ₆ (pyridoxine) (pyridoxal) (pyridoxamine)	Functions in use of amino acids (components of protein).	Whole grains, corn, meat, egg yolk, green leafy vegetables.
Folate (folic acid) (folacin) (pteroylglutamic acid)	Needed for rapidly growing body tissue.	Green leafy vegetables; liver; asparagus; lima beans; and beans, peas and lentils.
B ₁₂ (cobalamin) (cyanocobabamin)	Like folate, needed for rapidly growing body tissue. Necessary for normal nerve maintenance.	Meats, milk, eggs, cheese.
Vitamin C (Ascorbic acid)	Helps the body make collagen, a connective protein found all over the body. Aids wound healing, bone formation, capillary wall health. Helps absorb iron, acts as an antioxidant vitamin.	Citrus fruits, tomatoes, cabbage, potatoes, chili peppers, strawberries, broccoli, spinach and other greens, cantaloupe.

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The Cooperative Extension Service is the largest, most successful informal educational organization in the world. It is a nationwide system funded and guided by a partnership of federal, state and local governments that delivers information to help people help themselves through the land-grant university system.

Extension carries out programs in the broad categories of agriculture, natural resources and environment; family and consumer sciences; 4-H and other youth; and community resource development. Extension staff members live and work among the people they serve to help stimulate and educate Americans to plan ahead and cope with their problems.

Some characteristics of the Cooperative Extension system are:

- The federal, state and local governments cooperatively share in its financial support and program direction.
- It is administered by the land-grant university as designated by the state legislature through an Extension director.
- Extension programs are nonpolitical, objective and research-based information.
- It provides practical, problem-oriented education for people of all ages. It is designated to take the knowledge of the university to those persons who do not or cannot participate in the formal classroom instruction of the university.
- It utilizes research from university, government and other sources to help people make their own decisions.
- More than a million volunteers help multiply the impact of the Extension professional staff.
- It dispenses no funds to the public.
- It is not a regulatory agency, but it does inform people of regulations and of their options in meeting them.
- Local programs are developed and carried out in full recognition of national problems and goals.
- The Extension staff educates people through personal contacts, meetings, demonstrations and the mass media.
- Extension has the built-in flexibility to adjust its programs and subject matter to meet new needs. Activities shift from year to year as citizen groups and Extension workers close to the problems advise changes.

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