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Water-soluble vitamins

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Quick Facts

B-complex vitamins and vitamin C are water-soluble vitamins that are not stored in the body and must be replaced each day. These vitamins are easily destroyed or washed out during food storage and preparation. The B-complex group is found in a variety of foods--cereal grains, meat, poultry, eggs, fish, milk, legumes and fresh vegetables. Citrus fruits are good sources of vitamin C. Use of megadoses of vitamins is not recommended.

supply of them in the diet. The water-soluble vitamins are the B-complex group and vitamin C.

Water-soluble vitamins are easily destroyed or washed out during food storage or preparation. Proper storage and preparation of food can minimize vitamin loss. To reduce vitamin loss, refrigerate fresh produce, keep milk and grains away from strong light, and use the cooking water from vegetables to prepare soups. (Refer to Table 2.)

Vitamin B-Complex

Eight of the water-soluble vitamins are known as the B-complex group: thiamin (vitamin B₁), riboflavin (vitamin B₂), niacin, vitamin B₆, folacin, vitamin B₁₂, biotin and pantothenic acid. These vitamins

Vitamins are essential nutrients found in foods. The requirements are small but they perform specific and vital functions essential for maintaining health. The two types of vitamins are classified by the materials in which they will dissolve. The fat-soluble vitamins--vitamins A, D, E and K--dissolve in fat before they are absorbed in the blood stream to carry out their functions. Excesses of these vitamins are stored in the liver. Since the fat-soluble vitamins are stored, they are not needed every day in the diet. By contrast, the water-soluble vitamins dissolve in water and are not stored in the body. They are eliminated in urine. There is a need for a continuous

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can be found widely distributed in foods. (Refer to Table 2.) Their influence is felt in many parts of the body. They function as coenzymes that assist in helping the body obtain energy from food. They also are important in promoting normal appetite, good vision, healthy skin, healthy nervous system and red blood cell formation.

Beriberi, pellagra and pernicious anemia are a few of the more well-known B-vitamin deficiencies. These diseases are not a problem in the United States, but occasionally they occur when people omit certain foods or overeat certain foods at the expense of others. Alcoholics are especially prone to thiamin deficiency since alcohol replaces food.

Due to the increase in the refinement of many grains and grain products, essential nutrients that are lost during the processing are put back into the foods. The replacement of nutrients is called enrichment. Three of these nutrients are members of the B vitamins--thiamin, niacin and riboflavin; the other nutrient is iron. Some examples of enriched grain products are white rice, many breakfast cereals, white flour, breads and pasta.

Certain populations of the world eat a diet containing rice as the main staple. When the practice of "polishing" the rice (removing the outer layers of rice) became popular, the diagnosis of the thiamin deficiency disease, beriberi, increased significantly. In the early 1900s the most widespread vitamin deficiency disease in the United States was pellagra, the niacin deficiency disease. At that time pellagra caused thousands of deaths and many cases of mental and physical illness among the poor in the Southeast. The enrichment of flour, rice and wheat products helped to eliminate the deficiency problems found in people who depended on these food items for most of their daily calories.

Table 1 summarizes the Recommended Dietary Allowances (RDA), established by the Food and Nutrition Board of the National Academy of Sciences-National Research Council (NASNRC). The recommendations meet the average daily nutritional needs of all healthy people. To ensure the needs of all in the population, the RDA usually exceeds the requirements of most people. Requirements for illness and special health disorders are not covered by the RDA.

Vitamin C

Why do we need vitamin C? Like the other vitamins, the body needs vitamin C to keep it in good working order. Also known as ascorbic acid, vitamin C helps hold body cells together, aids in wound healing, assists in bone and tooth formation, strengthens the blood vessel walls, and improves absorption and utilization of iron. It also helps prevent nutritional ailments such as scurvy, the disease that did the most to bring public attention to vitamin deficiency diseases.

Vitamin C cannot be made in the body; therefore, foods containing this vitamin must be eaten every day. Although the body has a constant need for vitamin C, it has a limited storage capacity. A regular and adequate intake is essential.

Eating vitamin C-rich foods is a good method of getting enough of this vitamin. Many common foods contain vitamin C but the best food sources are citrus fruits. A one-half cup of unsweetened orange or grapefruit juice provides about 50 milligrams of vitamin C, which is enough for a day.

Some conditions have been shown to increase vitamin C requirements. They are:

1. emotional and environmental stress
2. use of certain drugs (such as oral contraceptives)
3. tissue healing of wounds
4. growth (children and pregnant women)
5. fever and infection
6. smoking

Refer to Table 1 for RDA requirements for vitamin C.

The controversy of megadoses to prevent and cure the common cold and other disorders has not been resolved. Vitamin supplements will not necessarily provide extra energy, clear up skin problems, or prevent and cure the common cold, heart disease and cancer. Unlike pellagra, beriberi or Scurvy, these problems are not the result of a vitamin deficiency. What is known is that the only disease a vitamin will cure is the one caused by a deficiency of that vitamin.

Table 1: Recommended Dietary Allowances (RDA).

	Age (years)	Vitamin C (mg)	Thiamin (mg)	Riboflavin (mg)	Niacin (mg)	Vitamin B ₂ (mg)	Folacin (mg)	Vitamin B ₁₂ (mg)
Infants	0.0-0.5	35	0.3	0.4	6	0.3	30	0.5
	0.5-1.0	35	0.5	0.6	8	0.6	45	1.5
Children	1-3	45	0.7	0.8	9	0.9	100	2.0
	4-6	45	0.9	1.0	11	1.3	200	2.5
	7-10	45	1.2	1.4	16	1.6	300	3.0
Males	11-14	50	1.4	1.6	18	1.8	400	3.0
	15-18	60	1.4	1.7	18	2.0	400	3.0
	19-22	60	1.5	1.7	19	2.2	400	3.0
	23-50	60	1.4	1.6	18	2.2	400	3.0
	51+	60	1.2	1.4	16	2.2	400	3.0
Females	11-14	50	1.1	1.3	15	1.8	400	3.0
	15-18	60	1.1	1.3	14	2.0	400	3.0
	19-22	60	1.1	1.3	14	2.0	400	3.0
	23-50	60	1.0	1.2	13	2.0	400	3.0
	51+	60	1.0	1.2	13	2.0	400	3.0
Pregnant		+20	+0.4	+0.3	+ 2	+0.6	+400	+1.0
Lactating		+40	+0.5	+0.5	+ 5	+0.5	+100	+1.0

Table 2: Water-soluble vitamins and their characteristics.

Vitamins	Common food sources	Major functions	Deficiency symptoms	Overconsumption symptoms	Stability in foods
Vitamin C (ascorbic acid)	Citrus fruits, broccoli, strawberries, melon, green pepper, tomatoes, dark green vegetables, potatoes	Formation of collagen--a component of tissues--helps hold them together; healing of wounds; maintenance of blood vessels, bones and teeth; aids in the use of iron.	Bleeding gums, wounds that won't heal, bruise easily, dry, rough skin; scurvy.	Nontoxic under normal conditions, possibly symptoms of scurvy when high doses are discontinued, diarrhea.	Most unstable under heat, drying and storage; very soluble in water and leaches out of some vegetables during cooking; alkalinity (baking soda) is destructive to vitamin C.
Thiamin (vitamin B ₁)	Pork, liver, whole grains, enriched grain products, peas, meat, legumes.	Helps release energy from foods; promotes normal appetite; important in function of nervous system.	Mental confusion, muscle weakness and wasting, edema, impaired growth, beriberi.	None known.	Losses are dependent on cooking method, length of cooking time and alkalinity of cooking medium; destroyed by sulfite used to treat dried fruits, such as apricots; dissolves into cooking water.
Riboflavin (vitamin B ₂)	Liver, milk, dark green vegetables, whole-grain and enriched grain products, eggs.	Helps release energy from foods; promotes good vision and healthy skin.	Cracks at corners of mouth, dermatitis around nose and lips, sensitivity of eyes to light.	None known.	Sensitive to light; unstable in alkaline solutions.

Vitamins	Common food sources	Major functions	Deficiency symptoms	Overconsumption symptoms	Stability in foods
Niacin (nicotinamide, nicotinic acid)	Liver, fish, poultry, meat, peanuts, whole grain and enriched grain products.	Energy production from foods; aids digestion and promotes normal appetite; promotes healthy skin and nerves.	Skin disorders, diarrhea, weakness, mental confusion, irritability.	Abnormal liver function, cramps, nausea, irritability	
Vitamin B ₆ (pyridoxine, pyridoxal, pyridoxamine)	Pork, meats, whole grains and cereals, legumes, green, leafy vegetables.	Acids in the metabolism and absorption of proteins, assists in red blood formation; helps the body use fats.	Skin disorders, dermatitis, cracks at corners of mouth, irritability, anemia, kidney stones, nausea, smooth tongue.	None known	Considerable losses during cooking.
Folacin (folic acid)	Liver, kidney, dark green leafy vegetables, meats, fish, whole grains, legumes.	Aids in the metabolism of proteins; promotes red blood cell formation.	Anemia, smoothness of tongue, diarrhea.	May mask vitamin B ₁₂ deficiency (pernicious anemia)	Easily destroyed by storing, cooking and other processing.
Vitamin B ₁₂	Only found in animal foods, meats, liver, kidney, fish, eggs, milk and milk products, oysters, shellfish.	Assists in the building of genetic material; aids in development of normal red blood cells; maintenance of nervous system.	Anemia, neurological disorders, degeneration of peripheral nerves that may cause numbness and tingling in fingers and toes.	None known.	
Pantothenic acid	Liver, kidney, meats, egg yolk, whole grains, legumes; also made by intestinal bacteria.	Involved in energy production; aids in formation of hormones.	Not common due to availability in most foods; fatigue, nausea, abdominal cramps, difficulty in sleeping.	None known.	About half of pantothenic acid is lost in the milling of grains and heavily refined foods.
Biotin	Liver, kidney, egg yolk, milk, most fresh vegetables, also made by intestinal bacteria.	Helps release energy from carbohydrates; aids in fat synthesis.	Uncommon under normal circumstances; fatigue, loss of appetite, nausea, vomiting, depression, muscle pains, anemia.	None known.	