Vitamins

by Dr. Jane Moore

Vitamins are the most common supplement taken by the general population and by athletes. Many people are concerned that their diet will not provide adequate amounts of vitamins, so they use vitamin supplements. Athletes may feel that extra vitamins will improve performance or speed recovery or they may fear that inadequate amounts prevent optimum performance. Some authorities feel that vitamin supplementation may help prevent or improve certain diseases while others disagree.

Vitamins are organic substances that are required in very small amounts to prevent deficiency disorders. They do not supply energy or add to body mass, but do serve crucial functions in almost all body processes. The human body is not able to produce vitamins, except for vitamin D. They must be obtained from foods or from dietary supplements. A substance that can be produced by the human body is not a vitamin. Substances that are not required to prevent deficiency disorders are also not vitamins. Vitamins are involved in energy metabolism, function of the central nervous system, production of hemoglobin, immune function, antioxidant function, and bone metabolism.

Vitamins are commonly classified as water-soluble or fat-soluble. Vitamin C and the B complex vitamins are water-soluble. Vitamins A, D, E, and K are fat-soluble. Water-soluble vitamins are not stored in the body and must be taken in regularly. Excess amounts are washed out of the body in urine or sweat. Fat-soluble vitamins can be stored in body fat so excessive intake may result in toxicity.

Vitamin deficiency diseases are uncommon in the general population in industrialized countries. Athletes may have an increased requirement for vitamins due to higher energy metabolism. Research on this topic is limited and data conflicting. There is also a lack of evidence that large intakes of vitamins improve performance or recovery.

The Vitamin B complex includes thiamine, riboflavin, niacin, pyridoxine, cobalamin, pantothenic acid, biotin, and folic acid.

Vitamin B1 or thiamine is required for aerobic metabolism. It helps release energy from carbohydrates. Deficiency may result in excess lactate production with early fatigue and poor performance. Thiamine is also required for production of hemoglobin so deficiency may reduce the oxygen carrying capacity of red blood cells. The daily requirement of thiamine increases with increased energy expenditure and with increased carbohydrate intake. Good food sources are pork, organ meats, whole grains, and legumes. Thiamine deficiency, known as beriberi, causes damage to peripheral nerves, edema, confusion, and heart failure. Thiamine is destroyed by alcohol, so those who drink alcohol may need supplementation.

Riboflavin (Vitamin B2) is involved in aerobic and anaerobic metabolism. It is found in a
wide variety of foods. Deficiency causes reddened lips, cracks at the corners of the mouth, and sensitivity of eyes to light. Riboflavin is also good for migraine prevention.

Niacin (B3, nicotinic acid) is also required for both anaerobic and aerobic performance. However, excessive niacin may reduce breakdown of fatty tissue and decrease the availability of fat as an energy source for prolonged exercise. Niacin is found in liver, lean meats, grains, and legumes. The body can convert tryptophan in protein to niacin. Deficiency known as pellagra leads to skin and digestive tract disorders as well as nervous and mental problems. High doses of niacin may lower cholesterol levels but may also cause liver damage.

Vitamin B6 (pyridoxine) is involved in many different metabolic processes involving proteins and glycogen. There is no evidence that extra vitamin B6 improves athletic performance. Good sources include meats, poultry, fish, nuts, avocados, vegetables, and whole grain cereals. Deficiencies result in irritability, convulsions, muscle twitching, dermatitis, and kidney stones. High protein diets increase the need for vitamin B6. Pyridoxine may be helpful in treating carpal tunnel syndrome and PMS (premenstrual syndrome).

Cobalamin or Vitamin B12 is essential to the formation and function of red blood cells. It also affects function of the nervous system. Because B12 is available only from animal products, strict vegetarians may have deficiencies. It does not appear to improve performance except in persons with a deficiency. Deficiency may cause pernicious anemia or neurologic disorders.

Pantothenic acid is important in aerobic metabolism. Deficiencies are rare as it is found in many different foods but can result in fatigue, sleep disorders, and impaired coordination.

Folic acid or folacin is required for red blood cell formation and amino acid metabolism. It can be found in legumes, green vegetables, and whole-wheat products. A deficiency may cause anemia or diarrhea and impair aerobic endurance performance. Deficiency during pregnancy can cause fetal abnormalities. Women who take oral contraceptives may need extra folic acid. Folic acid, along with vitamins B6 and B12, regulates levels of homocysteine. High levels of homocysteine increase the risk of heart attack, arterial disease, and cancer.

Biotin aids in the formation of fatty acids and helps release energy from carbohydrates. It is found in egg yolk, liver, dark-green vegetables, and green beans. Deficiency problems are not seen in most circumstances. Large amounts of raw egg whites destroy biotin and cause loss of appetite, nausea, vomiting, depression, fatigue, and muscle pain.

The B vitamins are all closely related. Severe deficiencies of the B complex vitamins could create a decrease in endurance capacity. However, it is very unlikely that athletes on a well balanced diet will develop such a deficiency. Results of studies on the effects
of vitamin B complex supplementation on exercise performance are contradictory and unclear. Excess amounts of individual B vitamins may adversely affect levels and function of the other B vitamins.

Vitamin C is a powerful antioxidant and helps with iron absorption. It also maintains the intercellular structure of cartilage and bone. Supplements may improve immune function and resistance to infection. It is found in citrus fruits, tomatoes, green peppers, and salad greens. Deficiencies result in scurvy with degeneration of skin, teeth, and blood vessels, loss of appetite, irritability, and weight loss. Excess amounts may contribute to formation of kidney stones.

Vitamin A is important for proper vision, development of bones and teeth, healthy skin and mucous membranes, and immune responses. Because Vitamin A is fat-soluble, large amounts may be stored in the body. Excess accumulation can result in anorexia, hair loss, high calcium levels, fatigue, joint pain, and liver and kidney damage. Deficiencies result in night blindness or permanent blindness, dry skin and mucous membranes, impaired bone growth, and poor tooth enamel. It is found in yellow, orange, and dark green vegetables, milk, eggs, butter, and cheese. Beta-carotene is a water-soluble, non-toxic precursor of vitamin A. The body converts beta-carotene to vitamin A. Those who eat large amounts of beta-carotene may notice that their skin turns orange. This change is reversible.

The skin can produce Vitamin D when exposed to sunlight. It is also found in cod-liver oil, eggs, liver, tuna, and dairy products. It is an important regulator of calcium metabolism and bone development and maintenance. Deficiencies result in softening of bones causing rickets in children or osteomalacia in adults. Excess amounts may result in calcium deposits throughout the body, deafness, high blood pressure, high cholesterol, and kidney stones. Taking Vitamin D with calcium supplements is very important for prevention of osteoporosis. Taking Vitamin D with calcium supplements is very important for prevention of osteoporosis.

Vitamin E is another antioxidant that prevents damage to cell membranes. It helps in the formation of red blood cells and muscle tissue. Supplements have been shown to improve maximum oxygen uptake at high altitude. Vitamin E may also reduce muscle damage and oxidative stress from exercise. It is found in seeds, wheat germ, whole-grain cereals and bread, liver, dried beans, and green leafy vegetables. Deficiency problems and toxic effects are rarely seen.

Vitamin K is important for proper blood clotting. Deficiencies can result in severe bleeding. It is found mostly in green tea, green leafy vegetables, peas, potatoes, and liver. Bacteria that normally live in the intestines also produce vitamin K. Excessive amounts may cause jaundice or anemia. People taking blood thinners such as coumadin must avoid foods with large amounts of vitamin K as it counteracts the blood thinning effect of the medication.

The Food and Drug Administration has developed the United States Recommended
Daily Allowances (USRDAs). They are based on Recommended Dietary Allowances (RDAs) developed by the Food and Nutrition Board of the National Academy of Sciences. These amounts are felt to be adequate to meet the known nutritional needs of practically all healthy persons. These are estimates that exceed the requirements of most people. The RDAs vary based on age and gender. Other countries have different recommendations. Those who believe vitamins can prevent or treat disease also recommend different daily amounts.

Further information on USRDAs (now referred to as Dietary Reference Intakes) for vitamins can be found at http://www.iom.edu/Object.File/Master/7/296/0.pdf

Information on use of vitamins to prevent or treat disease can be found from the National Center for Complementary and Alternative Medicine at http://nccam.nih.gov/, and from Andrew Weil, M.D, at www.askdrweil.com.