

Vitamins

Vitamin A is fat soluble, and primarily active in the cells that cover the outer and inner surfaces of the body: skin, membranes lining the mouth, respiratory passages, digestive/urinary tract, etc. Primary sources of Vitamin A include dark, leafy green vegetables like spinach, broccoli, lettuce and plants that have a rich yellow-orange color like carrots, squash, and peaches. Vitamin A is highly concentrated in organ meats, especially liver, and in some seafood. If a high potency Vitamin A supplement (or multi vitamin) is taken daily along with regular servings of liver and/or fish, then Vitamin A can become toxic. However, toxicity is nearly impossible from vegetable sources.

Vitamin B The B-complex vitamins are essential for the utilization of energy, thus are of major importance for the endurance athlete. The "burning" or food for energy is a highly complex process. In order for the energy to be usable, the "fire" is regulated through a series of reactions which happen quickly, but must be in sequence. The B vitamins control many of these steps and the need for B vitamins increases as energy output increases. These vitamins are especially important in the breakdown of carbohydrates. There are a number of different substances included as B vitamins but all are necessary for energy metabolism. Fatigue will occur if the diet is deficient in even one of these vitamins. Ingesting just one B vitamin (as a supplement) can upset the general balance and make a deficiency in others more severe; therefore, supplementation should be balanced to include the entire family of B's (as in a B-complex supplement.)

The following are the individual B vitamins and their functions and sources:

Thiamin (B1) is required for release of energy from carbohydrates, protein and fats. Mild deficiencies of thiamin reduce stamina, causing depression, irritability, inability to concentrate, and chronic fatigue. The need for thiamin increases with energy output (i.e. when increasing quantity or quality of training) It is water soluble and not easily stored in the body. Sources of thiamin (in order of potency) include brewer's yeast, oat bran, rice bran, wheat bran, beans, oats, whole wheat flour/bread, seed and nuts, spinach and oranges.

Riboflavin (B2) is necessary for energy release and protein synthesis (building and rebuilding tissue). Symptoms of riboflavin deficiency include soreness, cracking at corners of mouth, swollen membranes in mouth and throat, and itchy eyes. Sources of this vitamin include cottage cheese, milk, milk products, yeast, asparagus, spinach, mushrooms, and broccoli.

Niacin (B3) is essential in metabolism of carbohydrate, protein and fat for energy. Niacin deficiency shows up in skin rashes, nervous irritability, headaches, and digestive disorders. Sources of this vitamin include soybeans, tofu, beans, cottage cheese, whole wheat, peanuts, potato, sesame, and sunflower seeds.

Pantothenic Acid (B5) is found in every cell of living tissue. It is necessary for the breakdown of food into energy and synthesis of tissue. Sources of the B5 vitamin include whole grains, legumes (beans, peas), and yeast.

Pyridoxine (B6) is essential in the synthesis of non-essential amino acids and protein metabolism. Also, it is vital for conversion of glucose to glycogen to provide energy to muscle tissues. Vitamin B6 is required for production of red blood cells. Symptoms of Vitamin B6 deficiency include fatigue, lack of energy, and poor stamina. Vitamin sources include various beans (soy, pinto, kidney, lentils, etc.), whole grains (oats, wheat, rice, etc...), spinach, bananas, and potatoes.

Cobalamin (B12) is essential for the functioning of most body cells and the production of red blood cells. Sources of Vitamin B 12 include milk products and meat.

Folacin, a group of important compounds necessary for the formation of RNA and DNA, works with Vitamin B12 to aid in the production of new cells. Folacin sources include dark green leafy vegetables, beans, nuts, fresh oranges, and whole wheat products.

Biotin works with amino acids to transport carbon dioxide and to release energy from glucose. Sources of biotin include whole grains, vegetables, and legumes.

Vitamin C is one of the most reactive vitamins and also one of the most versatile in the body. It is necessary for the formation of collagen which is the substance that binds the body together and forms connective tissue. Infections decrease the amount of Vitamin C stores; thus, it is apparently used to combat infections. It also has an important role in aiding the absorption of other vitamins and minerals. Symptoms of Vitamin C deficiency include bleeding gums listlessness, joint pains, and poor endurance. Vitamin C sources are fresh fruits, especially citrus fruits, and many vegetables. Vitamin C is easily destroyed by cooking, alkalinity, and oxygen.

Vitamin D functions to regulate the metabolism of calcium and phosphorous, building and maintaining strong bones and joints. Sources of Vitamin D include milk and eggs. This vitamin is seldom deficient in athletes since it is also produced by the body from sunlight reacting on skin oils.

Vitamin E aids in healthy skin and hair and seems to delay or reduce the aging process by reducing the oxidation of fats in body tissue. Some studies have claimed that Vitamin E increases endurance, but these results have not been duplicated when the studies are repeated. Vitamin E is naturally in unsaturated oils where it prevents rancid decomposition (oxidation). Sources of this vitamin include vegetable oils, nuts, seeds, whole grains, and some vegetables.

Minerals

Minerals have many functions in the body. Similar to vitamins, their quantity is small, but their significance in maintaining health is very important. Minerals are found as components of enzymes and hormones, as well as in the structure of tissues, especially hard tissues like bones and teeth.

The six most common minerals in the body are discussed below, along with some of the "trace" minerals which are of special importance to endurance athletes.

Calcium & Phosphorus are the most abundant minerals in the body. Their main function is to keep bones and teeth hard and strong. Adequate calcium levels are also required for efficient muscular contraction, including that of the heart and for efficient blood clotting and nerve function. Phosphorus is involved in cell growth and repair, kidney function, the utilization of vitamins, as well as heart, nerve, and muscular activity. These minerals require Vitamin D to be present for absorption. Sources of calcium and phosphorus include milk, whole grains, beans, and vegetables.

Sodium, Potassium, and Chloride are the major electrolytes in the body. When dissolved in water, these minerals separate into ions which can conduct electrical charges. These electrolyte-rich body fluids either surround cells (extra cellular fluids) or are contained within cell walls (intracellular fluids). Without sufficient amounts of electrolytes in these fluids, normal nerve and muscular cell function cannot take place. Electrolytes are also important in maintaining the fluid balance in the body and in the maintenance of normal pH (acid-alkalinity balance).

Since these minerals are water soluble, they are easily washed out of the body through urination and sweat (especially during heavy exercise). The average diet contains adequate amounts of these minerals and many Americans consume too much sodium chloride (table salt), which can cause elevated blood pressure; thus, many doctors advocate salt-reduced diets. However, the serious endurance athlete can lose very large amounts of these minerals, especially during warm weather, and concern should be focus on balancing the intake of sodium chloride intake with potassium, rather than cutting out salt. Potassium is much less prevalent in common foods. Symptoms of electrolyte deficiency include muscle cramps, fatigue, dizziness leading to impaired performance, and possible heat prostration. Sodium chloride sources are readily available in salt or salted foods. Potassium is found in fruits, especially cantaloupe, papaya, bananas, raisins, prunes, beans, molasses, potatoes, and milk. "Light salt" is a product that tastes and measure like regular salt but contains 50% potassium chloride and 50% sodium chloride and provides a convenient way to help balance potassium intake. **Magnesium** is present throughout the body and is an important activator of enzymes, especially those involved in the transfer of energy. It is required for protein synthesis (building tissue), contraction of muscles, and the conduction of nerve impulses. Magnesium sources are beans, whole grains (oats, wheat, corn, rye etc.), vegetables and fruits.

Iron is essential to the enzyme systems which carry oxygen and is required for the production of hemoglobin, a protein in red blood cells which carries oxygen to the muscles. It is also found in myoglobin, the muscle protein that stores and transfers oxygen for muscle metabolism. Therefore, iron is extremely important to endurance event performance. Though iron is a trace mineral, it is the most commonly deficient nutrient in the American population. Symptoms of deficiency are pale skin, shortness of breath, general fatigue, weakness of muscles, lack of appetite, and a slowing down of body processes. Iron sources include prunes, beans, spinach, peaches, raisins, molasses, tomatoes, strawberries, potatoes, oat bran, and wheat bran. Vitamin C greatly increases the absorption

o globin, and red blood cell formation. Copper source include legumes, nuts, organ meats, seafood, raisins, and
f molasses.

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o **Chromium** is important in glucose metabolism and immune response. Sources of chromium are yeast, meats,
n cheeses, and whole grains.

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Zinc is important in the growth and repair of tissues, digestion of carbohydrates, and metabolism of other
C vitamins and minerals. Zinc is water soluble, and thus can be lost in heavy sweating. Sources of zinc include
o yeast, seafood, spinach, sunflower seeds, mushrooms, and meats.

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