Vitamins

Introduction

A **vitamin** is an organic compound and an essential nutrient that an organism requires in limited amounts. An organic chemical compound is called a vitamin when the organism cannot make the compound in sufficient quantities, and it must be obtained through the diet; thus, the term *vitamin* is conditional upon the circumstances and the particular organism. For example, vitamin C is a vitamin for humans, but not most other animals which make enough internally. Vitamin D is essential only for people who do not have adequate skin exposure to sunlight, because the ultraviolet light in sunlight normally promotes synthesis of vitamin D. While vitamin supplements are important for the treatment of certain health problems, otherwise healthy people generally receive no benefit from using vitamin supplements.

By convention the word *vitamin* does not include other essential nutrients, such as dietary minerals, essential fatty acids and essential amino acids. Thirteen vitamins are universally recognized at present. Vitamins are classified by both biological and chemical activity, and not their structure. Each vitamin name (the word *vitamin* followed by a letter of the alphabet) refers to a number of vitamer compounds that all show the same biological activity. For example, *vitamin A* refers to the compounds retinal, retinol, and four known carotenoids. Vitamers by definition are convertible to the active form of the vitamin in the body, and are sometimes inter-convertible to one another as well.

Vitamins have diverse biochemical functions. Some, such as vitamin D, have hormone-like functions as regulators of mineral metabolism, or regulators of cell and tissue growth and differentiation (such as some forms of vitamin A). Others function as antioxidants (e.g., vitamin E and sometimes vitamin C). The largest number of vitamins, the B complex vitamins, function as enzyme cofactors (coenzymes) or the precursors for them; coenzymes help enzymes in their work as catalysts in metabolism. In this role, vitamins may be tightly bound to enzymes as part of prosthetic groups: For example, biotin is part of enzymes involved in making fatty acids. They may also be less tightly bound to enzyme catalysts as coenzymes, detachable molecules that function to carry chemical groups or electrons between molecules. For example, folic acid may carry methyl, formyl, and methylene groups in the cell. Although these roles in assisting enzyme-substrate reactions are vitamins' best-known function, the other vitamin functions are equally important.

Until the mid-1930s, when the first commercial yeast-extract vitamin B complex and semi-synthetic vitamin C supplement tablets were sold, vitamins were obtained solely through food intake, and changes in diet (which, for example, could occur during a particular growing season) usually greatly altered the types and amounts of vitamins ingested. However, vitamins have been produced as commodity chemicals and made widely available as inexpensive semisynthetic and synthetic-source multivitamin dietary and food supplements and additives, since the middle of the 20th century. Study of structural activity, function and their role in maintaining health is called vitaminology.

Vitamins Defined

If you are like most people, you've probably heard at least one of these sayings: 'Don't forget to take your vitamins!' or 'Eat your veggies -- they are packed with vitamins!' or maybe 'Need more energy? Take your vitamins!' But what exactly are vitamins?

Vitamins are nutrients your body needs to function and fight off disease. Your body cannot produce vitamins itself, so you must get them through food you eat or in some cases supplements. There are 13 vitamins that are essential to your body working well. Knowledge of the different types and understanding the purpose of these vitamins are important for good health.

Types and Examples of Foods

There are two types of vitamins: fat-soluble and water-soluble. **Fat-soluble vitamins** are stored in your fat cells, consequently requiring fat in order to be absorbed. **Water-soluble vitamins** are not stored in your body; therefore, they need to be replenished daily. Your body takes what it needs from the food you eat and then excretes what is not needed as waste. Here is a list of some vitamin types and common food sources:

Fat-Soluble Vitamins

- Vitamin A - comes from orange colored fruits and vegetables; dark leafy greens, like kale
- Vitamin D - can be found in fortified milk and dairy products; cereals; (and of course, sunshine!)
- Vitamin E - is found in fortified cereals; leafy green vegetables; seeds; nuts
- Vitamin K - can be found in dark green leafy vegetables; turnip/beet greens

Water-Soluble Vitamins

- Vitamin B1, or Thiamin - come from whole grains; enriched grains; liver; nuts; seeds
- Vitamin B2, or Riboflavin - comes from whole grains; enriched grains; dairy products
- Vitamin B3, or Niacin - comes from meat; fish; poultry; whole grains
- Vitamin B5, or Pantothenic Acid - comes from meat; poultry; whole grains
- Vitamin B6, or Pyridoxine - comes from fortified cereals; soy products
- Vitamin B7, or Biotin - is found in fruits; meats
- Vitamin B9, or Folic Acid (Folate) - comes from leafy vegetables
- Vitamin B12 - comes from fish; poultry; meat; dairy products
- Vitamin C - comes from citrus fruits and juices, such as oranges and grapefruits; red, yellow, and green peppers

1. **Vitamin A:** One of vitamin A's main roles is within the production of retinal. Your body uses retinal within the rods and cones of your eyes to sense light-weight and facilitate

stop vision defect. Vitamin A is additionally necessary for your teeth, bones, skin, replica, and a healthy system.

2. **B complex vitamins:** The water-soluble vitamin vitamins include B vitamin, riboflavin, niacin, acid, pyridoxine, biotin, folic acid, and B12. They serve several functions in your body, as well as aiding in energy production, creating red blood cells, and creating new DNA, therefore, cells will multiply. They're additionally needed for healthy nerve and brain performance, internal organ health, and cardiovascular health.
3. **Vitamin E:** Vitamin E is an antioxidant which protects cells from damage and keeps the blood clean. It also aids our body in using vitamin K.
4. **Vitamin C:** Vitamin C, an inhibitor, might facilitate forestalling cell harm and scale back risk sure cancers, heart condition, and alternative diseases. Ascorbic acid is important for the formation of collagen that keeps your blood vessels sturdy and holds your teeth in their sockets. Additionally, ascorbic acid is very important to wound healing and serving your body absorbs iron.
5. **Vitamin D:** Vitamin D aids our body in absorbing phosphorous and calcium from the food we eat. It deposits phosphorous and calcium in teeth and bones and makes them healthier and stronger. It also protects us from other infections by keeping our immune system healthy.
6. **Vitamin K:** Vitamin K conjointly plays a job in alternative aspects of your health. Osteoblasts, the cells that deposit new bone tissue, think about fat-soluble vitamin to operate properly, and fat-soluble vitamin helps activate proteins that you simply have to be compelled to build healthy bones. fat-soluble vitamin conjointly activates a macromolecule, referred to as Gas6, that is needed for brand new cell growth. Since Gas6 conjointly plays a job in system development, the fat-soluble vitamin may additionally contribute to healthy nerves.

Health Effects

Vitamins are essential for the normal growth and development of a multicellular organism. Using the genetic blueprint inherited from its parents, a fetus begins to develop from the nutrients it absorbs. It requires certain vitamins and minerals to be present at certain times. These nutrients facilitate the chemical reactions that produce among other things, skin, bone, and muscle. If there is serious deficiency in one or more of these nutrients, a child may develop a deficiency disease. Even minor deficiencies may cause permanent damage.

For the most part, vitamins are obtained with food, but a few are obtained by other means. For example, microorganisms in the intestine — commonly known as "gut flora" — produce vitamin K and biotin, while one form of vitamin D is synthesized in the skin with the help of the natural ultraviolet wavelength of sunlight. Humans can produce some vitamins from precursors they consume. Examples include vitamin A, produced from beta carotene, and niacin, from the amino acid tryptophan.

Once growth and development are completed, vitamins remain essential nutrients for the healthy maintenance of the cells, tissues, and organs that make up a multicellular organism; they also enable a multicellular life form to efficiently use chemical energy provided by food it eats, and to help process the proteins, carbohydrates, and fats required for cellular respiration.

Supplements

500 mg calcium supplement tablets, with vitamin D, made from calcium carbonate, maltodextrin, mineral oil, hypromellose, glycerin, cholecalciferol, polyethylene glycol, and carnauba wax.

In those who are otherwise healthy, there is little evidence that supplements have any benefits with respect to cancer or heart disease. Vitamin A and E supplements not only provide no health benefits for generally healthy individuals, but they may increase mortality, though the two large studies that support this conclusion included smokers for whom it was already known that beta-carotene supplements can be harmful. Other findings suggest that vitamin E toxicity is limited to only a specific form when taken in excess.

The European Union and other countries of Europe have regulations that define limits of vitamin (and mineral) dosages for their safe use as dietary supplements. Most vitamins that are sold as dietary supplements are not supposed to exceed a maximum daily dosage referred to as the tolerable upper intake level (UL). Vitamin products above these regulatory limits are not considered supplements and should be registered as prescription or non-prescription (over-the-counter drugs) due to their potential side effects. The European Union, United States, Japan and some other countries each set ULs.

Dietary supplements often contain vitamins, but may also include other ingredients, such as minerals, herbs, and botanicals. Scientific evidence supports the benefits of dietary supplements for persons with certain health conditions. In some cases, vitamin supplements may have unwanted effects, especially if taken before surgery, with other dietary supplements or medicines, or if the person taking them has certain health conditions. They may also contain levels of vitamins many times higher, and in different forms, than one may ingest through food.

Effect of Cooking

The USDA has conducted extensive studies on the percentage losses of various nutrients from different food types and cooking methods.

Some vitamins may become more "bio-available" – that is, usable by the body – when foods are cooked.

The table below shows whether various vitamins are susceptible to loss from heat—such as heat from boiling, steaming, frying, etc. The effect of cutting vegetables can be seen from exposure to air and light. Water-soluble vitamins such as B and C dissolve into the water when a vegetable is boiled, and are then lost when the water is discarded.

Vitamin	Soluble in Water	Stable to Air Exposure	Stable to Light Exposure	Stable to Heat Exposure
Vitamin A	no	partially	partially	relatively stable
Vitamin C	very unstable	yes	yes	yes
Vitamin D	no	no	no	no
Vitamin E	no	yes	yes	no
Vitamin K	no	no	yes	no
Thiamine (B_1)	highly	no	?	> 100 °C
Riboflavin (B_2)	slightly	no	in solution	no
Niacin (B_3)	yes	no	no	no
Pantothenic Acid (B_5)	quite stable	?	no	yes
Vitamin B_6	yes	?	yes	?
Biotin (B_7)	somewhat	?	?	no
Folic Acid (B_9)	yes	?	when dry	at high temp
Vitamin B_{12}	yes	?	yes	no

Deficiencies

Humans must consume vitamins periodically but with differing schedules, to avoid deficiency. The body's stores for different vitamins vary widely; vitamins A, D, and B_{12} are stored in significant amounts, mainly in the liver, and an adult's diet may be deficient in vitamins A and D for many months and B_{12} in some cases for years, before developing a deficiency condition. However, vitamin B_3 (niacin and niacinamide) is not stored in significant amounts, so stores may last only a couple of weeks. For vitamin C, the first symptoms of scurvy in experimental studies of complete vitamin C deprivation in humans have varied widely, from a month to more than six months, depending on previous dietary history that determined body stores.

Deficiencies of vitamins are classified as either primary or secondary. A primary deficiency occurs when an organism does not get enough of the vitamin in its food. A secondary deficiency may be due to an underlying disorder that prevents or limits the absorption or use of the vitamin, due to a "lifestyle factor", such as smoking, excessive alcohol consumption, or the use of medications that interfere with the absorption or use of the vitamin. People who eat a varied diet are unlikely to develop a severe primary vitamin deficiency. In contrast, restrictive diets have the potential to cause prolonged vitamin deficits, which may result in often painful and potentially deadly diseases.

Well-known human vitamin deficiencies involve thiamine (beriberi), niacin (pellagra), vitamin C (scurvy), and vitamin D (rickets). In much of the developed world, such deficiencies are rare; this is due to (1) an adequate supply of food and (2) the addition of vitamins and minerals to common foods (fortification). In addition to these classical vitamin deficiency diseases, some evidence has also suggested links between vitamin deficiency and a number of different disorders.

Hypervitaminosis

Some vitamins have documented side effects that tend to be more severe with a larger dosage. The likelihood of consuming too much of any vitamin from food is remote, but overdosing (vitamin poisoning) from vitamin supplementation does occur. Acute symptoms can include nausea, vomiting and diarrhea. In the United States, the Institute of Medicine of the National Academies has established Tolerable upper intake levels (ULs) for those vitamins which have documented side effects at high intakes. In the European Union the European Food Safety Authority has also set ULs. ULs from the two organizations do not always match.

In 2014, overdose exposure to all formulations of vitamins and multi-vitamin/mineral formulations was reported by 68,058 individuals to the American Association of Poison Control Centers with 73% of these exposures in children under the age of five.

References

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