BODYBIO Bulletin

Vitamins? Why?

By Dr. Tom Wnorowski

Do you take vitamins? Yes? Why? No? Why not? Confusing, isn't it? Can we ever get to the bottom of the yes-no controversy?

First of all, let's find out what we're talking about.

The word "vitamins" describes organic substances that are quite diverse in function and structure. It was initially felt that these compounds could be obtained through a normal diet, and that they were capable of promoting growth and development, and of maintaining life. The word itself was coined by a Polish biochemist named Casimir Funk, in 1911. He deemed these substances to be chemical amines, thinking that all contained a nitrogen atom. Since they were considered to be vital to existence ("vita" means "life" in Latin), they were called "vitamines." After it was discovered that they all did not have a nitrogen atom, and, therefore, were not amines, the terminal "e" was dropped. Funk was working in London at the time, at the Lister Institute, where he isolated a substance without which chickens would suffer neurological inflammation.

Casimir Funk

The lettered names of the vitamins were ascribed to them in the order of their discovery. Vitamin K, however, is the exception. Its label was given by the Danish researcher Henrik Dam, from the word "koagulation."

If a vitamin is improperly absorbed, or is absent from the diet, a deficiency exists and a specific disease may surface, such as Beriberi, which was noted by William Fletcher in 1905 when symptoms appeared in populations whose diet consisted mostly of polished rice, lacking the thiamine-rich husk. Lack of thiamine, or vitamin B1, causes emotional disturbances, physical weakness, heart failure, impaired sensory perception, and, in severe circumstances, eventual death.

Scurvy, a deficiency of vitamin C, was once a common ailment of sailors and others who were out to sea for a longer time than their fruits and vegetables could remain edible. The Latin name of this condition that caused bleeding from the mucus membranes and spongy gums is "scorbutus," from which we get "ascorbic acid." James Lind, a surgeon in the Royal Navy, learned in the 1750s that scurvy could be treated with citrus fruits, and he wrote about his experiments in his 1753 book, "A Treatise of the Scurvy."

If vitamins are so "vital," what, exactly, are their roles in human health and well-being? Vitamin A was first synthesized in 1947, though discovered around 1912 by researchers Elmer McCollum and M. Davis, and later isolated from butter by Yale scientists Thomas Osborne and Lafayette Mendel. This nutrient contains carotene compounds that are responsible for transmitting light signals to the retina of the eye. McCollum also uncovered the B vitamins, but later researchers isolated each of the individual factors.

We already know that a lack of B1 causes Beriberi, while a deficiency of B2 may lead to inflammation of the lining of the mouth. Also called riboflavin, B2 is responsible for the reactions of enzymes, as is its partner, B3 (niacin). In general, the gamut of B vitamins is involved in the same metabolic processes. It was decided that a B vitamin must meet specific criteria: it must be water-soluble, must be essential for all cells, and must function as a coenzyme. B12 and folate have the added responsibility of being involved in the synthesis of nucleic acid. Folate is the form of the nutrient naturally found in food, while folic acid is synthetic. Great excesses of one B vitamin can cause deficiencies of the others. Therefore, if taken as supplements, it is recommended that they be taken together.

Besides preventing scurvy, as mentioned, vitamin C helps the body to make collagen, the protein that acts as the framework for the body. Collagen is a major component of ligaments and cartilage, it strengthens blood vessels, and it is responsible for skin strength and elasticity. Vitamin C was the first to be artificially made, in 1935.

Vitamin D is not actually a vitamin, but a prohormone, meaning that it is a precursor to a hormone, called 1,25-D, which helps the body to make its own steroids, such as cholesterol, a substance absolutely necessary to the integrity of each of our trillions of cells. Vitamin D is needed to maintain correct calcium and phosphorus levels, to assure proper bone mineralization, and to support the immune system. A severe deficiency leads to rickets, a softening of the bones—usually in children—that was studied in 1922 by Edward Mellanby.

Vitamin E is actually a group of isomers (like-structured molecules) that function as antioxidants. Study of this fat-soluble nutrient has focused on its purported benefits to the cardiovascular system. University of California researchers discovered vitamin E while studying green, leafy vegetables, in the 1920s.

Another fat-soluble substance, vitamin K is used by the body to assist in the manufacture of bone, and in the manufacture of blood clotting proteins, without which serious bleeding episodes may occur. This nutrient has been available from green leafy vegetables and from the brassica family, such as broccoli, cauliflower, and kale.

Now the question is, "**Can** we get all these nutrients from our food, or is supplementation necessary?"

Working at the University of Texas Biochemical Institute, Dr. Donald Davis led a crop-nutrient study in 2004. He and his team found that the nutrient value of forty-three garden crops has declined considerably over the past fifty years. As reported in the "Journal of the American College of Nutrition" in December of that year, the forty-three crops showed "statistically reliable declines" in protein, calcium, iron, phosphorus, riboflavin (vitamin B2), and ascorbic acid (vitamin C). Some nutrients could not be compared because their values were not reported in the 1950s. They include magnesium, zinc, vitamin B6, vitamin E, dietary fiber, and phytochemicals.

After accounting for possible confounders, the study concluded that the change in nutrient value could be ascribed to changes in cultivated varieties, in which there could have been a trade-off between crop yield and nutrient value. Dr. Davis added that farmers are paid by the weight of a crop, not by its food value.

Some innovative farming techniques have given rise to faster-growing crops, which, by virtue of their seed-to-market time, do not have sufficient time to develop their nutrients. They do not have the chance to absorb everything they need from the soil.

Crop rotation has fallen into disfavor by some farms because it requires more planning and management skills than are at hand, thus increasing the complexity of farming. Rotation of crops helps to reduce insect and disease problems, improves soil fertility, reduces soil erosion, and limits biocide carryover. If, however, a single crop is a big moneymaker for the farm, why should it bother even to try to grow something else? Why bother to rotate crops when chemical fertilizers, herbicides, fungicides, and insecticides can help to guarantee a bumper crop? Could nutrient value be affected by using these artificial chemicals? Do these materials come into our bodies? Do we have the proper kinds and amounts of nutrients to detoxify them? Maybe we do; maybe not.

Nitrogen-fixing bacteria convert atmospheric nitrogen to organic nitrogen, thus contributing to the food value of the crop. Certain crops, like the legumes, are better than others at replacing nitrogen lost from the soil. Nitrogen is part of a protein molecule. Without nitrogen there is no protein. While it is beneficial to the food and the soil to plant a legume following the harvest of a more lucrative planting, it is not often done.

Therefore, the same plant in place continues to withdraw the same minerals repeatedly, year after year, with little chance for replenishment except by chemical means, if at all. How many of us would prefer to get our dietary needs from unnatural sources, like iron from rusted nails, or zinc from galvanized wire?

In a study of peaches and pears published in the "Journal of Agriculture and Food Chemistry" in 2002, Marina Carbonaro, of the National Institute for Nutrition Studies, in Rome, reported a difference in the nutrition content of organic versus traditionally raised fruits. Amounts of polyphenols, citric and ascorbic acids, and alpha-tocopherol were increased in the organically grown crops. She and her colleagues concluded that the improved antioxidant defense of the plants developed as a result of organic cultivation methods. Which do you think has more vitamin C?

Here is a sampling of how the nutrient content of broccoli and potatoes sold in Canada has changed from 1951 to 1999. This information was compiled by Jeffrey Christian.

Broccoli, Raw, 3 spears, 93g. 100/93=1.08

	Calcium (mg)	Iron (mg)	Vitamin A (I.U.)	Vitamin C (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)
1951	130.00	1.30	3500	104.0	0.10	0.21	1.10
1972	87.78	0.78	2500	90.0	0.09	0.20	0.78
1999	48.30	0.86	1542	93.5	0.06	0.12	1.07
% Change	-62.85	-33.85	-55.94	-10.10	-40.00	-42.86	-2.73

Potatoes, one potato, peeled before boiling, 136g. 100/136=.74

	Calcium (mg)	Iron (mg)	Vitamin A (I.U.)	Vitamin C (mg)	Thiamine (mg)	Riboflavin (mg)	Niacin (mg)
1951	11.00	0.70	20.00	17.00	0.11	0.04	1.20
1972	5.74	0.49	0.00	16.39	0.09	0.03	1.15
1999	7.97	0.30	0.00	7.25	0.09	0.02	1.74

The USDA, in its statistical bulletin # 978, made public in June, 2002, titled "The Changing Landscape of U.S. Milk Production," admitted that milk production has increased because of "advances in animal nutrition and health, improved artificial breeding techniques, and the recent addition of biotechnology, such as… rbST…"

rbST is a hormone that is administered to cows to increase milk production. Take a look at how milk production has changed, and then decide if there might be implications that could involve humans.

In 1950, a single cow (I mean one cow, not an unmarried cow.) produced 5,314 pounds of milk. By 1975, she increased her output to 10,360 pounds. In 2000, that amount increased to 18,204 pounds. The USDA admits that "…a 76-percent increase in milk per cow since 1975 is substantial." Substantial? How about phenomenal, even miraculous? Could a factory have increased its output by seventy-five percent in twenty-five years? Could a weight lifter elevate that much of a weight increase in a military press as he did twenty-five years ago? Could recombinant bovine somatotropin enter the milk supply and affect human growth and development, or even contribute to human misery?

Not only do modern agricultural techniques affect the quality of food, but also do the processes by which food is processed and packaged. To prevent the growth of pathogenic bacteria, some canned foods are exposed to temperatures that compromise their nutritional value. Acidic foods, like tomatoes, are excused from excessive heat because their nature does not support the growth of food poisoning bacteria. Others are heated to temperatures high enough to destroy bacteria, yeasts, and molds that could cause foods to spoil. Heating to 250 degrees Fahrenheit for three minutes not only kills pathogens, but also denigrates the potency of water-soluble vitamins. If these foods are consumed without also consuming the water in which they are prepared, nutrition is sacrificed.

The USDA has a table of nutrient retention factors that compare the nutritional value of processed foods. This table includes most nutrients from alpha-tocopherol to zinc. It is noted that folate, for example, a nutrient easily lost in food preservation and preparation, is diminished by almost 50% in canned fruits as compared to fresh and frozen. Additionally, canned foods are higher in sodium, and their texture is softer than either fresh or frozen. The mineral and protein values of canned foods are usually

undisturbed. In rare instances, as with tomatoes and pumpkin, nutrient value is retained, or even increased, by canning. We should note that canned fruits and vegetables are better than none at all.

Frozen foods, on the other hand, retain much of the nutrition they are destined to have. The folate retention factor for frozen fruits is ninety-five, contrasted to fifty for canned. There are some compromises, though, because frozen foods need to be blanched prior to being frozen. Blanching, however, is no worse than what happens to foods during normal cooking activity. This means that frozen vegetables provide levels of nutrition similar to fresh, provided they are stored and handled properly. The "International Journal of Food Science and Technology," reported in June of 2007 that the freezing process alone does not affect vitamin levels, but that the initial processing and later storage do. About 25% of vitamin C and a higher percentage of folate are lost through the blanching process. These numbers will vary according to the processing techniques.

An advantage to canned and frozen foods is that the foods themselves are harvested at their maximum stage of development, containing all the vitamins and minerals they could possibly extract from their environments. What we call "fresh" vegetables are usually anything but. They have been picked before their maximum ripeness so that they can be shipped across the country. If not harvested locally, "fresh" vegetables are more accurately labeled as "raw," or "unprocessed." Water-soluble vitamins, like the B complex and vitamin C, are affected by exposure to light and air. Vitamin A is jeopardized by exposure to light, as well. The amount of time that a raw vegetable spends in storage may take its toll on nutrient integrity, also.

Typical Maximum Nutrient Losses (as compared to raw food)

Vitamins	Freeze	Dry	Cook	Cook+Drain	Reheat
Vitamin A	5%	50%	25%	35%	10%
Retinol Activity Equivalent	5%	50%	25%	35%	10%
Alpha Carotene	5%	50%	25%	35%	10%
Beta Carotene	5%	50%	25%	35%	10%
Beta Cryptoxanthin	5%	50%	25%	35%	10%
Lycopene	5%	50%	25%	35%	10%
Lutein+Zeaxanthin	5%	50%	25%	35%	10%
Vitamin C	30%	80%	50%	75%	50%
Thiamin	5%	30%	55%	70%	40%
Riboflavin	0%	10%	25%	45%	5%
Niacin	0%	10%	40%	55%	5%
Vitamin B6	0%	10%	50%	65%	45%
Folate	5%	50%	70%	75%	30%
Food Folate	5%	50%	70%	75%	30%
Folic Acid	5%	50%	70%	75%	30%
Vitamin B12	0%	0%	45%	50%	45%
Minerals	**Freeze**	**Dry**	**Cook**	**Cook+Drain**	**Reheat**
Calcium	5%	0%	20%	25%	0%
Iron	0%	0%	35%	40%	0%
Magnesium	0%	0%	25%	40%	0%
Phosphorus	0%	0%	25%	35%	0%
Potassium	10%	0%	30%	70%	0%
Sodium	0%	0%	25%	55%	0%
Zinc	0%	0%	25%	25%	0%
Copper	10%	0%	40%	45%	0%

The chart above, extracted from Nutrition Data's website (www.nutritiondata.com/topics/processing), demonstrates nutrient losses for common processing methods.

Can we get all the vitamins and minerals we need from food? No.

The normal eating habits of Americans suggest that we are woefully inadequate in meeting dietary recommendations to achieve optimum well-being and health. Most of us do not eat the recommended number of daily servings of fruits and vegetables. For some nutrients, daily intake needs may be higher for some populations than for others, especially those in particularly vulnerable groups, such as those with gastrointestinal problems or poor absorption, those who are chronically ill, those who are alcohol or drug dependent, and the elderly.

The June 19, 2002 edition of the "Journal of the American Medical Association" recanted that august body's negative position on vitamin supplements when it advised all adults to take at least one multivitamin tablet a day. The article, "Vitamins for Chronic Disease Prevention in Adults," authored by Robert H. Fletcher, MD, MSc, and others, agreed that suboptimal levels of folic acid and vitamins B6 and B12 are a risk factor for cardiovascular disease, neural tube defects, and colon and breast cancers. It added that risks for other chronic diseases are increased by low levels of the antioxidant vitamins A, C, and E.

Because it is accepted that high homocysteine levels are associated with increased risk of heart disease, the AMA's recommendation for optimal levels of cardio-specific supplements are well founded.

Depending on a person's physiological state, he or she may need more of a particular nutrient than is available from a multivitamin alone. The bioavailability of a specific nutrient from a high quality supplement is close to one hundred percent, compared to a food whose life experiences might have been less than ideal. In a society that falls short of consuming the five to nine servings of fruits and vegetables that are recommended, it would be inane to ask them to eat more fruits and vegetables to get the nutrients they lack.

This does not mean that a person should take a little of this and a little of that because he read about it somewhere. On the contrary, supplementation with vitamins, minerals, and herbs is a scientific enterprise that entails one's medical history, both distant and recent past, one's current physiological state, and even one's blood chemistry.

Do you take vitamins?

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