



The Weston A. Price Foundation

Vitamin Primer

JANUARY 1, 2000 BY SALLY FALLON AND MARY G. ENIG, PHD
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The discovery of the first vitamins, in the early 1900s, began the era of modern interest in diet and nutrition. Pioneering chemists found that certain “unknown substances” in food were essential to life. They discovered that fat-soluble vitamin D and water-soluble B vitamins were necessary to prevent diseases like rickets, beriberi and pellagra; and that vitamin C, a factor present in many fresh foods, prevented scurvy. By the 1930s, scientists had discovered many more vitamins and had catalogued their effects. Public interest in the subject was intense, and articles on vitamins often appeared in magazines and newspapers.

The study of vitamins has not waned since the early days of research, and the subject of food science has proved to be far more complex than scientists at first imagined. The early discoveries led some researchers to conclude that all vitamins necessary to life could be supplied in their isolated factory-produced form as vitamin pills. We now know that vitamins do not exist as single components but as parts of a complex of compounds, each part contributing to the whole. For example, vitamin C used to treat scurvy and other deficiency conditions is more effective when given as a natural food concentrate, which includes minerals, rutin and other analogs.¹

As many as seventeen water-soluble vitamins labeled B have been discovered, present in different proportions in different foods, but all working together synergistically; vitamin D may have as many as twelve components of which several are active;² vitamin P has at least five components. Most vitamins produce optimum results in the presence of certain naturally occurring "cofactors," such as trace minerals, enzymes and coenzymes, as well as other vitamins.

The bewildering array of factors in foods now known to be essential has led well-informed nutritionists to recognize the futility of providing all factors necessary to life in pill form. While supplementing the diet with certain isolated vitamins has proven temporarily beneficial for many disease conditions, the best source of vitamins for most of us in the long term is properly prepared whole foods. For this reason, the importance of eating nutrient-dense meals, rich in vitamins and their cofactors, cannot be underestimated.

Vitamin and mineral content of food varies enormously with farming methods.³ Nitrogen fertilizers produce initial high yields, in part by pulling minerals from the soil. In time, commercially fertilized soils become depleted, and the foods grown on them suffer accordingly. Overall, vitamin and mineral content of American fruits and vegetables has declined significantly during the last fifty years.⁴ The revival of interest in compost and natural fertilizers, rich in minerals including trace minerals, is due in part to the realization that healthy soil is the basis of health for all life forms. Scientific assays have shown large differences in vitamin and mineral content between foods grown with nitrogen fertilizers and food grown organically. For example, cabbage can vary in its iron content from 94 parts per million to 0 parts per million; tomatoes can vary in iron content from 1,938 parts per million to 1 part per million. Vitamin A content of butterfat varies with the season as well as the soil; even the protein portion of grains and legumes will vary with soil fertility. Some commercially raised oranges have been found to contain no vitamin C!

Food processing affects vitamin content to varying extents. Some vitamins are heat-sensitive while others survive heating fairly well. Steaming and waterless methods of cooking preserve vitamins better than rapid boiling, and vegetables cooked in an acidic liquid preserve vitamins better than those cooked in an alkaline medium. Oxidation is a prime cause of vitamin loss.

Long periods of high heat used in canning are destructive to some vitamins but not all. On the other hand, cold temperatures and freezing have little effect on vitamin content, and air or sun drying preserves or even enhances nutrient content. Some methods of food preservation and processing actually make nutrients more available—these include simmering bones in acidic liquid to make broth, culturing of dairy products, sprouting and traditional methods of pickling, fermenting and leavening.

The Diet Dictocrats have set minimum daily requirements for a few key vitamins and minerals, but many investigators feel that these standards are far too low. These critics contend that minimum daily requirements are sufficient to prevent acute deficiencies but not enough to support optimum health, especially as individual requirements for specific vitamins and minerals vary widely. In fact, a typical profile of nutrient requirements is one in which the individual has average needs with respect to most vitamins and minerals but requirements far in excess of average for a few specific nutrients.⁵ Consumption of sugar, refined flour and hydrogenated fats, and of alcohol, tobacco and many drugs, depletes the body of nutrients, resulting in higher vitamin and mineral requirements for users. Stress of any sort causes the body to use up available nutrients at a faster-than-normal rate.

Space permits only a most cursory summary of the major nutrients in our food.

Vitamin A: This all-important vitamin is a catalyst on which innumerable biochemical processes depend. According to Dr. Price, neither protein, minerals nor water-soluble vitamins can be utilized by the body without vitamin A from animal sources.⁶ Vitamin A also acts as an antioxidant, protecting the body against pollutants and free radicals, hence against cancer. Vitamin A stimulates the secretion of gastric juices needed for protein digestion, plays a vital role in building strong bones and rich blood, contributes to the production of RNA and is needed for the formation of visual purple. Sources of preformed vitamin A (called retinol) include butterfat, egg yolks, liver and other organ meats, seafood and fish liver oils. Provitamin A or carotene is also a powerful antioxidant. It is found in all yellow, red, orange or dark green fruits and vegetables. Carotenes are converted to vitamin A in the upper intestine.

Vegetarians claim that the body's requirements for vitamin A can be met with carotenes from vegetable sources, but many people—particularly infants, children, diabetics and individuals with poor thyroid function—cannot make this conversion.⁷ Furthermore, studies have shown that our bodies cannot convert carotenes into vitamin A without the presence of fat in the

diet.⁸ Dr. Price discovered that the diets of healthy isolated peoples contained at least ten times more vitamin A from animal sources than found in the American diet of his day. The high vitamin A content of their diets insured them excellent bone structure, wide handsome faces with plenty of room for the teeth and ample protection against stress of all types. It is best to obtain vitamin A from natural sources like yellow butter, egg yolks, organ meats, fish, shellfish and cod liver oil as high amounts of synthetic vitamin A from supplements can be toxic, especially to those with impaired liver function and to those whose diets are otherwise poor. High levels of natural vitamin A have no toxic effects, in spite of the medical establishment's dire warnings to the contrary. Antibiotics, laxatives, fat substitutes and cholesterol-lowering drugs interfere with vitamin-A absorption.

Vitamin B Complex: All the water-soluble B vitamins work as a team to promote healthy nerves, skin, eyes, hair, liver, muscle tone and cardiovascular function; they protect us from mental disorders, depression and anxiety. Deficiency of the B vitamin complex can result in the enlargement and malfunction of almost every organ and gland in the body. The best source of B vitamins is whole grains—refinement thus wastes this essential source. They are also found in fresh fruits, vegetables, nuts, legumes, seafood and organ meats; they can also be produced by intestinal bacteria. B₁ (thiamine) was the first water-soluble vitamin to be discovered. Deficiency leads to the disease beriberi. Recent evidence indicates that B₁ deficiency is the root cause of anorexia and other eating disorders.⁹ It is essential for the manufacture of hydrochloric acid and has been used to treat constipation, fatigue, herpes and multiple sclerosis. Sugar consumption rapidly depletes vitamin B₁. B₂ or riboflavin is found in a variety of whole foods. Frequent cracks in the lips and corners of the mouth is a sign of deficiency. Deficiency of B₃ or niacin results in the disease pellagra, characterized by dermatitis, dementia, tremors and diarrhea. The amino acid tryptophan can be converted to niacin and has been used to treat a variety of symptoms indicative of niacin deficiency. Pantothenic acid, vitamin B₅, found in organ meats, egg yolks and whole grains, is essential for the proper function of the adrenal glands. It plays a vital role in cell metabolism and cholesterol production. Pantothenic acid can improve the body's ability to withstand stress. Recent studies have revealed that vitamin B₆ or pyridoxine, found mostly in animal products, contributes to the proper functioning of over one hundred enzymes. Deficiencies in B₆ have been linked to diabetes, nervous disorders and coronary heart disease. They are widespread in the US because excess B₁ and B₂, added to white flour, interferes with B₆ function and because Americans no longer have access to one of the best sources of this heat-sensitive

nutrient—raw milk. The B vitamin folic acid counteracts cancer by strengthening the chromosomes; folic acid deficiency can result in babies born with neural tube deformities like spinal bifida. B₁₂ is needed to prevent anemia and nervous disorders as well as to maintain fertility and promote normal growth and development. Usable B₁₂ is found only in animal foods. An early symptom of B₁₂ deficiency is a tendency to irrational anger. B₁₅ (pangamic acid) and B₁₇ (nitrilosides) protect against cancer; the former is found in grains and seeds; the latter in grasses, sprouts, buckwheat, legumes and many fruit seeds. Traditional diets were much richer in nitrilosides than our own.

Vitamin C: A water-soluble vitamin best known for its use in treatment of the common cold, it is also needed for a host of processes including tissue growth and repair, strength of capillary walls, lactation and adrenal gland function. It is vital for the formation of collagen, the body's structural substance. It promotes healing of wounds and is a powerful antioxidant. Dr. Linus Pauling and others have promoted megadoses of Vitamin C for cancer while others have used large doses to treat schizophrenia and drug addiction. But megadoses of isolated ascorbic acid may lead to imbalances and deficiencies in vitamin P. New evidence suggests that vitamin C works synergistically with vitamin E. Hypoglycemics and individuals on a high-protein diet require more vitamin C as these conditions interfere with the metabolism of ascorbic acid. It is found in many fruits and vegetables and in certain animal organs. Vitamin C is destroyed by heat. Alcohol and many common drugs including aspirin and oral contraceptives may reduce vitamin C levels in the body.

Vitamin D: Like vitamin A, vitamin D is needed for calcium and phosphorus absorption and thus is essential for strong bones, healthy teeth and normal growth. It seems to protect against cancer and multiple sclerosis. Deficiency can cause rickets and myopia. The body manufactures vitamin D₃ out of cholesterol in the presence of sunlight. Although some claim that we can obtain all the vitamin D we need by spending a short amount of time each day in the sun, Price found that healthy primitive diets were rich in vitamin D-containing foods like butterfat, eggs, liver, organ meats, marine oils and seafood, particularly shrimp and crab.

Synthetic D₂ has been linked to hyperactivity, coronary heart disease and other allergic reactions. New research indicates that optimal intake should be ten times higher than the US Recommended Daily Allowance, thus confirming the findings of Dr. Price.

Vitamin E: This fat-soluble vitamin is needed for circulation, tissue repair and healing. It seems to help in the treatment of fibrocystic conditions, sterility, PMS and muscular dystrophy. It seems to retard the aging process. A vital role of vitamin E is the deactivation of free radicals. This powerful antioxidant works in concert with certain trace elements, notably selenium and zinc, to prevent cancer and cardiovascular disease. Increased ingestion of polyunsaturated oils requires greater amounts of vitamin E in the diet. It is found in unrefined vegetable oils, butter, organ meats, grains, nuts, seeds, legumes and dark green leafy vegetables.

Vitamin K: This fat-soluble compound is needed for blood clotting and plays an important role in bone formation. Vitamin K given to postmenopausal women helps prevent bone loss. It is found in liver, egg yolks, butter, grains, dark leafy vegetables, vegetables of the cabbage family and fermented soy foods like miso. (Update: Price's "Activator X"—see below—is now believed to be vitamin K₂ (<http://www.westonaprice.org/health-topics/abcs-of-nutrition/on-the-trail-of-the-elusive-x-factor-a-sixty-two-year-old-mystery-finally-solved/>).)

Vitamin P: Also called the bioflavonoids, these water-soluble compounds enhance the absorption of vitamin C to promote healing and protect the structure of blood capillaries. Bioflavonoids stimulate bile production, regulate menstrual flow, help prevent cataracts and have antibacterial effects. One of the bioflavonoids, rutin, has been shown to have a sedative-stimulant effect on the brain. Sources include peppers, grapes, buckwheat and the white peel of citrus fruits.

Coenzyme Q₁₀: Coenzyme Q₁₀ (CoQ₁₀), or Vitamin Q, is a substance present in every cell of the body which is essential for the production of energy and which also functions as powerful anti-oxidant. While it is naturally present in a wide variety of foods, almost all of the needs of healthy individuals are met by the body's synthesis of CoQ₁₀. To put dietary intake in perspective, one pound of beef heart, three pounds of beef, or four pounds of peanuts provide 50 mg of CoQ₁₀, or about 10% of daily needs. The heart utilizes a lot of CoQ₁₀ because of its high energy requirements. Deficiency of CoQ₁₀ causes stiffening of the walls of the heart which results in incomplete filling of the heart, or diastolic dysfunction, and causes increased heart rate and blood pressure, and can lead to heart failure if not corrected. Synthesis of CoQ₁₀ decreases with age and its deficiency causes some degree of diastolic dysfunction in a large percentage of those over 65. CoQ₁₀ deficiency can result from deficiency of any of the

seven vitamins required for its synthesis, or by interference with its synthesis by cholesterol-lowering drugs or hormone replacement therapy (HRT). Deficiency can also result from increased utilization of CoQ₁₀ due to excessive stress on the heart or immune system. CoQ₁₀ deficiency is common in the elderly and vegetarians, and among those with heart disease, high blood pressure, asthma, diabetes, cancer, or HIV. In clinical studies, improvement in patients with heart failure supplemented with CoQ₁₀ has been nothing short of dramatic. In addition to protecting the heart, CoQ₁₀ supplementation has proven beneficial in treatment of diabetes, asthma, and high blood pressure. Bio-identical CoQ₁₀ supplements, which are widely available over the counter, are fat soluble and are better absorbed when taken with a high fat meal.

Activator X or the Price Factor: Discovered by Weston Price, this fat-soluble nutrient is a potent catalyst to mineral absorption. It is found in certain fatty parts of animals that feed on young green growing plants or microorganisms, such as organ meats, fish and shellfish, fish eggs and butter from cows eating rapidly growing green grass of spring and fall pasturage. Largely absent today, the Price Factor was present in all traditional diets. (Update: [Activator X is now believed to be vitamin K₂](http://www.westonaprice.org/health-topics/abcs-of-nutrition/on-the-trail-of-the-elusive-x-factor-a-sixty-two-year-old-mystery-finally-solved/) (<http://www.westonaprice.org/health-topics/abcs-of-nutrition/on-the-trail-of-the-elusive-x-factor-a-sixty-two-year-old-mystery-finally-solved/>.)

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About Sally Fallon and Mary G. Enig, PhD

Sally Fallon Morell is the founding president of the Weston A. Price Foundation and founder of A Campaign for Real Milk. She is the author of the best-selling cookbook, *Nourishing Traditions* (with Mary G. Enig, PhD) and the *Nourishing Traditions Book of Baby & Child Care* (with Thomas S. Cowan, MD). She is also the author of *Nourishing Broth* (with Kaayla T. Daniel, PhD, CCN).

Mary G. Enig, PhD, FACN, CNS, is an expert of international renown in the field of lipid chemistry. She has headed a number of studies on the content and effects of trans fatty acids in America and Israel and has successfully challenged government assertions that dietary animal fat causes cancer and heart disease. Recent scientific and media attention

on the possible adverse health effects of trans fatty acids has brought increased attention to her work. She is a licensed nutritionist, certified by the Certification Board for Nutrition Specialists; a qualified expert witness; nutrition consultant to individuals, industry and state and federal governments; contributing editor to a number of scientific publications; Fellow of the American College of Nutrition; and President of the Maryland Nutritionists Association. She is the author of over 60 technical papers and presentations, as well as a popular lecturer. She is the author of *Know Your Fats*, a primer on the biochemistry of dietary fats as well as of *Eat Fat Lose Fat* (Penguin, Hudson Street Press, 2004). She is the mother of three healthy children.

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