

Chapter 5

The Nutrients in Dehydrated Cereal Grass

“It is one of those anomalies of nature and man that the countries with the highest rates of vitamin A deficient blindness are among the perennially greenest of the world, but the nutritious green leaves do not find their way into the mouth of the small child.”

—Devadas²⁸

Walk into any health food store or drug store and you might feel overwhelmed by the number of nutrient supplements displayed there. All of the vitamins, minerals, and amino acids are available individually and in creative combinations with other supplements. In those ubiquitous displays we can find combinations to build muscles, reduce stress, grow fuller hair and raise energy levels. The most popular supplements are the multiple vitamin/mineral combinations which supply at least the U.S. Recommended Daily Allowance (RDA) of all the known vitamins, plus a few of the minerals.

Surrounded by multitudes of “natural” supplements and remedies, it is easy to overlook the obvious. In nature, there is no such thing as 2000 mg. of calcium or vitamin C isolated into a single nugget. Furthermore, concentrated amounts of all of the identified nutrients are never found in individual foods.

Foods contain hundreds of compounds which interact with each other in the foods themselves and in our digestive tracts and bloodstreams. The combinations of nutrients and other factors found in foods bear little resemblance to those found in the supplement pills in the health food stores, and are many times more complex. Low-dose supplements may fill some nutrient gaps, and mega-dose supplements may have therapeutic value, but neither can come close to replacing our need for food nutrition.

The research described in Chapter 2 provides a good example. For over fifty years, the beneficial effects of adding cereal grasses to the rations of test animals could not be duplicated by adding any or all of the known isolated chemical components of those foods. The results of many studies which demonstrate the value of green vegetables in the prevention of human diseases cannot be explained in terms of the individual nutrients they are known to contain.

Figure 5.1 Typical Analysis of Dehydrated Cereal Grass

3.5 Grams / 7 tablets (500 mg. each) or 1 tsp. powder

VITAMINS

Vitamin A 1750 I/U
 Vitamin K 280 mcg.
 Vitamin C 11 mg.
 Vitamin E 1.1 mcg.
 Thiamin 10 mcg.
 Choline 1 mg.
 Riboflavin 71 mcg.
 Pyridoxine 45 mcg.
 Vitamin B-12 1 mcg.
 Niacin 263 mcg.
 Pantothenic 84 mcg.
 Biotin 4 mcg.
 Folic Acid 38 mcg.

MINERALS

Calcium 18 mg.
 Phosphorus 18 mg.
 Potassium 112 mg.
 Magnesium 3.6 mg.
 Iron 2 mg.
 Manganese .35 mg.
 Selenium 3.5 mcg.
 Sodium 1 mg.
 Zinc 17.5 mcg.
 Iodine 7 mcg.
 Copper .02 mg
 Cobalt 1.75 mcg.

PROTEIN 800 mg.

CRUDE FIBER 600 mg.

CALORIES 10

CHLOROPHYLL 19 mg.

CARBOHYDRATES 1.3 gm.

AMINO ACIDS

Lysine 29 mg.
 Histidine 16 mg.
 Arginine 39 mg.
 Aspartic Acid 78 mg.
 Threonine 37 mg.
 Glutamic Acid 85 mg.
 Proline 33 mg.
 Glycine 41 mg.
 Alanine 48 mg.
 Valine 44 mg.
 Isoleucine 31 mg.
 Leucine 57 mg.
 Tyrosine 18 mg.
 Phenylanlanine 38 mg.
 Methionine 15 mg.
 Cystine 8 mg.
 Tryptophan 4 mg.
 Amide 10 mg.
 Purines 2 mg.
 Serine 85 mg.

Sources: References 64 and 153.

Why Wheat and Barley Grasses?

The cereal grass promotional literature of the 1950s claimed that cereal grasses contain every nutrient known to be required by humans except vitamin D, which is made in the skin. Contemporary laboratory analyses show that a wide variety of nutrients are contained in dehydrated cereal grasses. Some of these nutrients are quite concentrated, others are present only in small amounts. These nutrients are combined by nature to provide a uniquely potent food.

The following table summarizes the levels of known nutrients contained in the cereal grasses. The nutrient concentrations depend on the growing conditions and the growth stage at which the cereal grasses are harvested, rather than on the type (barley, rye, or wheat) of cereal grass analyzed.

Many individuals have enjoyed the benefits of cereal grass for years. Research reports and consumer comments indicate that cereal grass is generally used for the following nutritionally related reasons:

- As a convenient and economical way to enjoy high quality, non-toxic green vegetables.
- As a concentrated food source of beta-carotene, calcium, chlorophyll, fiber, iron, and vitamin K.
- As a good food source of the following nutrients: Protein, Vitamin C, Vitamin B-12, Folic Acid, Vitamin B-6 (Pyridoxine), and other trace minerals

In addition, cereal grasses are used in laboratories around the world as a medium to support the growth of lactobacilli, the “healthy flora” bacteria which grow naturally in the human digestive tract.

Dehydrated cereal grasses have been used for over fifty years as a vitamin/mineral supplement. We won't attempt to provide a detailed account of everything these nutrients do in the body. There are many books which provide that information. Here, however, are the highlights of what is known about the nutrients which are found in abundance in the green leaves of wheat and barley.

Dietary Fiber

Many people who eat dehydrated cereal grass daily know only one thing about it—that cereal grass is one of the best available sources of fiber. It is one

of the few fiber-rich food supplements which also provides an array of vitamins, minerals, and protein. Figure 5.2 compares the fiber content of several well known fiber foods with dehydrated cereal grass.

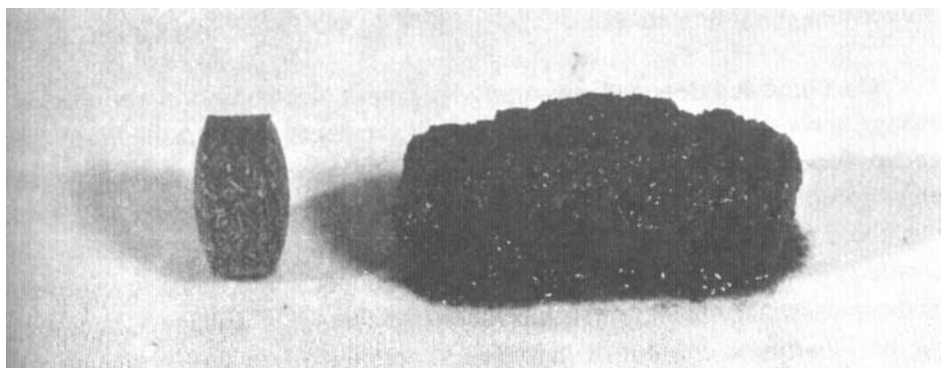
Fiber is the general term used for the structural parts of plants which are not readily broken down by our digestive systems. It includes quite a large number of substances, some of which can be digested by the organisms which reside in a healthy colon. Digested fiber can be a significant source of food energy.^{86,96}

The various terms used to describe fiber can be confusing. Many health claims made for “fiber” do not specify the type of fiber involved. But these distinctions are important. Different types of fiber have different effects in the body.

Crude Fiber includes the coarse fibers which are identified using older methods of chemical extraction. Those methods underestimate the total fiber content of a plant. Crude fiber consists primarily of cellulose and lignin, the least digestible fibers.

Total Dietary Fiber is the newer, more acceptable term. It includes all of the fibers contained in plants—hemicellulose, pectins, gums, pentosans, and the indigestible fibers cellulose and lignin. Total dietary fiber includes two types of fiber:

- **Soluble Fibers** are those which dissolve in water. They are found in foods such as oat bran, apple pectin, beans, and psyllium seeds. These fibers are currently receiving attention for their potential role in lowering serum cholesterol.



When placed in a teaspoon of water and allowed to sit for fifteen minutes, dehydrated cereal grass tablets expand dramatically, demonstrating why five to ten tablets are equivalent to a serving of other dark green leafy vegetables.

- **Insoluble Fibers** include hemicellulose, cellulose and lignin, and are found in whole grains and vegetables. Dehydrated cereal grasses are a very rich source of insoluble fibers. These fibers are best known for their ability to restore and maintain bowel regularity.

Dietary fiber has been extensively studied for the effects it may have on the serious chronic diseases that are called the “diseases of civilization.” Because low-fiber diets are almost invariably high in fat and animal protein, it is difficult to separate the negative effects of a low fiber diet from those associated with excessive consumption of animal foods and saturated fats.

Colon cancer is the third most common type of cancer in industrialized areas of the world, but is extremely rare in developing countries. Because people in the developing world have diets higher in fiber than those in the more affluent nations, fiber has been studied for its relationship to the development of tumors in the colon.

Animal research indicates that insoluble fibers, such as those in the cereal grasses and whole grains, may reduce colon cancer.³⁰ The mechanism for this protection is the subject of much debate, but it is thought that the increased stool bulk and quicker colon emptying associated with the insoluble fibers may reduce the exposure of the bowel to carcinogens and other harmful substances.⁸⁶

Dietary fiber has been shown to reduce blood glucose concentrations and the need for insulin by diabetics.¹ High fiber diets have also been studied and used for reducing blood pressure² and for weight loss. Insoluble fiber is

Figure 5.2 Total Dietary Fiber Content of High Fiber Foods

Fiber Food	(serving size)	TOTAL DIETARY FIBER	
		Grams per serving	Grams per 100 grams
Dehydrated Cereal Grass	5 grams	1.9	37.5
Wheat Bran	5 grams	2.2	44.4
Oat Bran	5 grams	0.9	17.9
Whole Wheat Cereal (cooked)	1/3 cup	1.0	2.0
Prunes	1/2 cup	2.5	2.9
Brown Rice	1/2 cup	2.0	2.0

Sources: References 52 and 153.

often used to alleviate constipation, and is thought by some to be linked to the lower incidence of many gastrointestinal diseases (hemorrhoids, irritable colon, etc.) in developing countries.

The Food and Nutrition Board of the National Academy of Sciences, the National Cancer Institute, the American Cancer Society, and the U.S. Department of Health and Human Services recommend the generous intake of fiber for all Americans.¹

Beta-carotene

Beta-carotene is one of the most popular nutrients being discussed these days. It is one of those rare substances which has received abundant attention from both the medical profession and the alternative health community. Beta-carotene has always been valued as a non-toxic source of vitamin A. It has more recently been studied and generally accepted for its role in the prevention of some cancers.

Carotene is a deep yellow-orange pigment. It is found in abundance in orange and yellow colored vegetables such as carrots and squash. Many dark green foods are even richer sources of beta-carotene, with the green

Figure 5.3 Beta-Carotene Content of Selected Vegetables

Vegetable	Serving	BETA CAROTENE CONTENT	
		IU per Serving	IU per 100 grams
Cereal Grass (dehydrated)	5 Grams	1,156	23,136
Carrots (raw)	1/2 cup	6,050	11,000
Kale (raw, finely chopped)	1/2 cup	4,565	8,300
Spinach (raw, finely chopped)	1/2 cup	2,230	7,964
Summer Squash	1/2 cup	410	390
Broccoli (raw, finely chopped)	1/2 cup	680	877
Cabbage (raw, finely chopped)	1/2 cup	60	133

Sources: References 52 and 153.

chlorophyll pigments masking the orange carotene color. Generally speaking, the darker green the vegetable, the more beta-carotene it contains. The carotene in leafy greens is converted to vitamin A about twice as efficiently as the carotene in carrots and other root vegetables.^{50,126} Figure 5.3 compares the beta-carotene content of dehydrated cereal grasses with those of other commonly consumed vegetables.

One of the primary reasons that physicians have traditionally warned against vitamin megadosing is that some people have overdosed themselves with vitamin A. The resulting disease is serious, and may even be life threatening. Preformed vitamin A is called retinol, and is found only in animal foods, where it is stored in the fatty tissues. Cod liver oil is loaded with it. It can be concentrated in our livers, too, and so is toxic in large amounts. The carotenes, especially beta-carotene, are converted by the body to vitamin A. But carotenes have never been known to be toxic in any amounts, although eating extremely large amounts can give an orange color to the skin.

The known functions of vitamin A are summarized below:

- Aids in the growth and maintenance of epithelial tissues and mucous membranes. This includes the skin and tissues which line our lungs, mouth and nose, digestive tract, and genital and urinary tracts.
- Essential for normal bone development.
- Required for normal function of four of our five senses (sight, smell, hearing, and taste).
- Required for the synthesis of DNA and RNA.⁵⁰
- Supports normal fertility in both males and females.
- Involved in the synthesis of adrenal hormones.¹²⁶
- Provides resistance to chemical carcinogens.¹²⁶

Beta-carotene is an anti-oxidant.¹⁶ Like vitamins E and C, it can bind and reduce free radicals, which are thought to cause cell aging and, in some cases, cancer.

Vitamin A and beta-carotene are required for several components of a healthy immune system. Epithelial tissues line all of the body surfaces which are exposed to outside elements. The mucous-producing cells on these surfaces provide resistance to infections and environmental toxins. They depend on vitamin A to remain healthy and functional. Vitamin A has also

been shown to support the production of antibodies⁴² and to enhance the immune response of polymorphonuclear leukocytes and other white blood cells.⁸

Moreover, both vitamin A and carotene have been demonstrated to reduce our risk of certain cancers, particularly those of epithelial tissues—skin cancer, lung cancer and cervical cancer.^{70,78,100,112,139,152} The American Cancer Society strongly recommends a diet rich in foods containing beta-carotene.

Vitamin K

Vitamin K was discovered in 1935 by a Danish scientist who named it the “Koagulation” vitamin. It is one of the fat-soluble vitamins, one which we normally don’t hear much about. This may be because vitamin K is synthesized by the healthy flora in the large intestine. Vitamin K deficiencies are rare in humans, except in connection with the use of some medications and certain disease conditions. Dark green vegetables are the best dietary source of vitamin K, which is usually found associated with chlorophyll in the chloroplasts of green plants.⁵⁰

Vitamin K is best known for its role in blood clotting. Clotting is an essential function of the blood, and a rather complex process. The normal clotting of blood involves a combination of several chemical reactions, with each step dependent on the preceding steps. Vitamin K is required for at least three of these reactions. The ability of blood to clot is crucial for the prevention of hemorrhage and excessive blood loss.

Vitamin K is also required for the synthesis of several important proteins which are not associated with blood clotting. Among these are osteocalcin, the sixth most common protein in the body, which is involved in bone metabolism.^{50,126}

There was a time when patients undergoing liver or gallbladder surgery routinely suffered from excessive blood loss due to the clotting deficiency associated with a reduction in bile. That was before the discovery of vitamin K. In the 1930s and 1940s, before vitamin K could be easily synthesized, dehydrated cereal grass was given before liver or gallbladder surgery because it was the richest source of vitamin K available. Numerous medical studies reported excellent recoveries from this type of surgery when dehydrated cereal grass was administered.¹¹⁵

In addition, vitamin K has been successfully used for reducing excessive menstrual flow and cramps.⁹⁸ The vitamin is often given to newborn infants

to prevent the hemorrhagic disease that is sometimes associated with the first weeks of life.¹²⁶

Vitamin K deficiencies can result in spontaneous bleeding, failure to stop bleeding in response to slight injury, or excessive bruising. Deficiency of this nutrient can accompany liver diseases such as jaundice, as well as bile obstructions and pancreatic insufficiency. It can also accompany diseases which inhibit intestinal absorption such as prolonged diarrhea and cystic fibrosis.¹²⁶

Medical therapies which can induce vitamin K deficiency include prolonged use of antibiotics, prolonged use of anticoagulants or aspirin,⁵⁰ and the internal use of mineral oil.

Normally, our need for vitamin K is met by the action of our intestinal bacteria, which synthesize it. However, any of the conditions mentioned above, as well as prolonged stress or the consumption of a diet very low in fat can increase our dietary needs for this vitamin. Research has linked excessive bruising and delayed clotting time, seen in over 50% of elderly people studied, to vitamin K deficiency.⁵⁰ Green vegetables, particularly the cereal grasses, are our best sources of vitamin K. Although synthetic forms of this vitamin have been shown to be toxic when taken in excessive amounts, natural vitamin K is completely nontoxic, even in extremely high doses.¹²⁶

Vitamin C

Humans are one of the few species which cannot make adequate amounts of vitamin C internally, and so must obtain it from the diet. This vitamin is probably the most purchased and consumed isolated nutrient in the United States and Europe. It is said to prevent and reduce the severity of many viral infections, including the common cold. It has also been researched as a possible cancer cure or preventive agent when taken in large amounts.¹¹⁶

Scurvy, the disease which results from vitamin C deficiency, was once one of the most dreaded diseases in the world. Vitamin C is found almost exclusively in plant foods. The richest sources are the acerola cherry, citrus fruits and some green vegetables. Dehydrated wheat and barley grasses contain about the same amount of vitamin C as oranges on a per weight basis (about 60 mg. per 100 grams), and may certainly be considered a good source of vitamin C on a per serving basis.

Although vitamin C has been available and studied for many years, most of its biochemical roles have still not been identified. The major established function of vitamin C is in the formation of a protein called collagen. Collagen gives structural stability to connective tissues—those which surround and support our bones and ligaments, our skin and other epithelial tissues. Vitamin C deficiency results in the inability to form collagen and the structural breakdown of tissues, including gums, bones, and blood cells.

Injured and infected tissues cannot repair themselves if the body is low in vitamin C, making this nutrient essential for resistance to disease (immunity), the healing of wounds, and the formation of scar tissue.⁵⁰

Vitamin C is perhaps the best water-soluble antioxidant found in nature.¹²⁶ It acts with the other antioxidants, vitamin E, beta-carotene and selenium, to reduce free radicals, chemical substances which damage cells and cellular membranes. Free radicals are thought to contribute to carcinogenesis and the aging process.

Vitamin C can also act as a chelating agent, or a “grabber” of mineral ions. In this way it enhances absorption of iron and calcium. Inadequate vitamin C intake can result in iron deficiency anemia.

Several conditions have been shown to increase our need for vitamin C. It is stored in large amounts in the adrenal glands. Stress stimulates the release of adrenal hormones and neurotransmitters, and thus leads to the depletion of vitamin C.¹²⁶ For this reason, vitamin C (along with many of the B complex vitamins) is considered an “anti-stress” nutrient.

Higher than normal requirements for vitamin C have also been reported for smokers, elderly people, pregnant and nursing mothers, and for women taking birth control pills.

Folic Acid

One of the nutrients which is most often deficient in the American diet is folic acid or folacin.^{50,135} Its name comes from the word foliage because one of the best sources of folic acid is dark green leafy vegetables.

Folic acid acts as an intermediary in all biochemical reactions in the body which involve the transfer of a single carbon atom between two substances.⁵⁰ It is particularly important in cells which are rapidly replaced, such as red blood cells and the cells involved in immune processes.

Several reactions involved in normal blood formation require folic acid. Deficiency of this nutrient is characterized by an anemia in which the red

blood cells are abnormally large and improperly formed. Folic acid stimulates the regeneration of both hemoglobin and red blood cells.

Folic acid is involved directly in the synthesis of specific proteins such as hemoglobin and those containing the amino acid tyrosine. Folic acid coenzymes are also required for the synthesis of DNA and RNA, the “blueprints” of living tissues required for all protein synthesis. Vitamin B-12 is required for the activation of folic acid. Both nutrients may be stored in the liver.

Although many of us do not get enough folic acid in our diet, there are certain conditions in which even adequate levels of folic acid cannot be absorbed. Seventy-five percent of alcoholics have folic acid deficiencies.⁵⁰ Individuals who take birth control pills or anti-convulsive drugs may also be deficient in folic acid. Folic acid requirements are higher during pregnancy.

Although no toxic effects have been observed with high doses of folic acid, the U.S. Food and Drug Administration limits the amount that may be included in vitamin supplements because large doses of folic acid can mask a vitamin B-12 deficiency.⁵⁰

Symptoms of folic acid deficiency include an anemia (megaloblastic) which cannot be treated with iron, disturbances in the gastro-intestinal tract, lesions in the corners of the mouth, and irritability.

Vitamin B-12

Vitamin B-12 is one of the more recently discovered nutrients; it was not isolated and identified until 1948, and was known for many years as the “anti-pernicious-anemia factor.”

The primary source of Vitamin B-12 in nature is its synthesis by many types of bacteria. There is little evidence that Vitamin B-12 is made in the tissues of plants or animals. Healthy animals which are host to a large number of microbes are able to absorb and store this nutrient. Vitamin B-12 is contained, then, in a wide variety of foods of animal origin—meats and dairy foods. Plant foods are generally considered to be devoid of Vitamin B-12. For this reason, vegetarians who consume no animal products are often advised to take Vitamin B-12 supplements.

Surprisingly, laboratory analyses from the past forty years consistently show that dehydrated cereal grass does contain appreciable amounts of vitamin B-12. Laboratory tests show that a day's supply (ten grams) of dehydrated cereal grass contains between .24 and .44 micrograms of vitamin B-12,⁶⁴ or four to eight percent of the Recommended Daily Allowance for

this nutrient. The B-12 found in wheat and barley grasses may be there in connection with microbes found in the soils in which the grasses are grown, or the positive flora (lactobacilli) which are known to thrive on cereal grasses.

Vitamin B-12 has many important functions, which are often related to the functions of other B-complex vitamins. It is required for the conversion of folic acid from the inactive form to the active form. It is essential for the proper formation and maturing of red blood cells and the synthesis of DNA and RNA. It is needed for normal growth and for the maintenance of healthy nerve tissues. It is also involved in fat and protein metabolism.⁵⁰

The human liver can store up to a 6-year supply of vitamin B-12. Large doses of this vitamin are sometimes injected for a number of therapeutic reasons ranging from menopausal problems to a general lack of energy. The effectiveness of these uses of the vitamin has not been firmly established, nor have toxic effects been seen from high doses.

Absorption of vitamin B-12 requires the presence of a protein called intrinsic factor, which requires pyridoxine for its synthesis.

Pyridoxine

Pyridoxine is also known as vitamin B6. It is required for processes involved in the synthesis of a number of proteins. For example, pyridoxine is directly involved in the formation of the protein heme, which is the iron-containing portion of the hemoglobin molecule. It is necessary for the production of nucleic acids (DNA and RNA) as well as for RNA's use of amino acids to make proteins. Pyridoxine functions as a coenzyme, needed for the function of enzymes, in the body's use of carbohydrates and lipids.

Pyridoxine is essential for the formation of the neurotransmitters which send impulses through the brain and nervous system. It is also needed for the formation of antibodies—crucial elements in immune defenses against disease.⁵⁰

Pyridoxine is water soluble, and cannot be stored in the body. The 1978 Food Consumption Survey showed that almost half of those people evaluated got less than 70% of the RDA of this nutrient in their normal diet.⁵⁰ Pregnant women and those who take oral contraceptives have a special need for this vitamin. Deficiency of pyridoxine is associated with a type of anemia in which the body has large amounts of iron. Insufficient levels of pyridoxine may also be associated with irritability, insomnia, and the formation of kidney stones.⁵⁰

Cereal grasses are somewhat richer sources of pyridoxine than most green vegetables. Its presence in these green foods is important because it complements the presence of folic acid, vitamin B12, vitamin C and iron as a support nutrient for the maintenance of blood hemoglobin levels and a healthy immune system.

Iron

Most of the body's iron is contained in the hemoglobin molecule, the blood protein which carries oxygen to body tissues. But iron is also present throughout the body, and is known to be essential to a wide variety of enzymatic reactions. The major physiological uses for iron are these:⁵⁰

- Central element in heme protein, essential for transport of oxygen and carbon dioxide throughout the body.
- Needed for the conversion of beta-carotene to the active form of vitamin A.
- Essential for antibody production.
- Required for the synthesis of DNA and RNA
- Involved in the detoxification of drugs by the liver.

Our absorption of the non-heme iron in plant foods is facilitated by the presence of an acid such as vitamin C. Absorption of dietary iron is increased when hemoglobin levels are low, and reduced when our iron stores are adequate. Although iron deficiencies are rare in men, the majority of American women have been shown to have diets which provide less than 60% of the RDA for iron.⁵⁰

Iron deficiency results in anemia, a condition characterized by a low concentration of hemoglobin in the blood and by paleness and abnormal fatigue. Insufficient iron is also associated with increased susceptibility to infections, inability to concentrate, apathy and irritability.⁵²

Calcium

Calcium is the most abundant mineral in the body. The hard tissues—bones and teeth—contain 99% of the body's calcium. The remaining one percent is distributed throughout the cells and fluids of the body. This

relatively small amount of calcium is of huge importance in vital functions. Processes for which calcium is required by the body are summarized below:

- Combines with phosphorous to form the hard substance of bones and teeth.
- Aids in the absorption of vitamin B-12.
- Involved in the transmission of nerve impulses.
- Required at each step in the cascade of reactions necessary for blood clotting.
- Essential for muscle contraction including the maintenance of heart contractions.
- Needed for fat metabolism and the secretion of insulin.

In America and Western Europe, dairy foods are the primary dietary sources of calcium. In many areas of the developing world, however, only mother's milk is consumed. Studies in African populations show that the calcium supplied by a number of green leafy plants can be absorbed in quantities comparable to the calcium absorbed from dairy products.³⁶ Osteoporosis is uncommon in many areas of the world where dairy products are rarely consumed.⁸⁸

Calcium absorption can be inhibited by natural plant substances such as oxalates and phytates. Oxalic acid is highly concentrated in rhubarb, cocoa and in some leafy greens such as spinach and Swiss chard. Dehydrated cereal grass contains only small amounts of oxalic acid.¹⁰ Phytates are contained in the outer husk of whole grains. High protein diets are also thought to reduce calcium absorption.^{50,88} Calcium absorption requires vitamin D and is enhanced by estrogen.

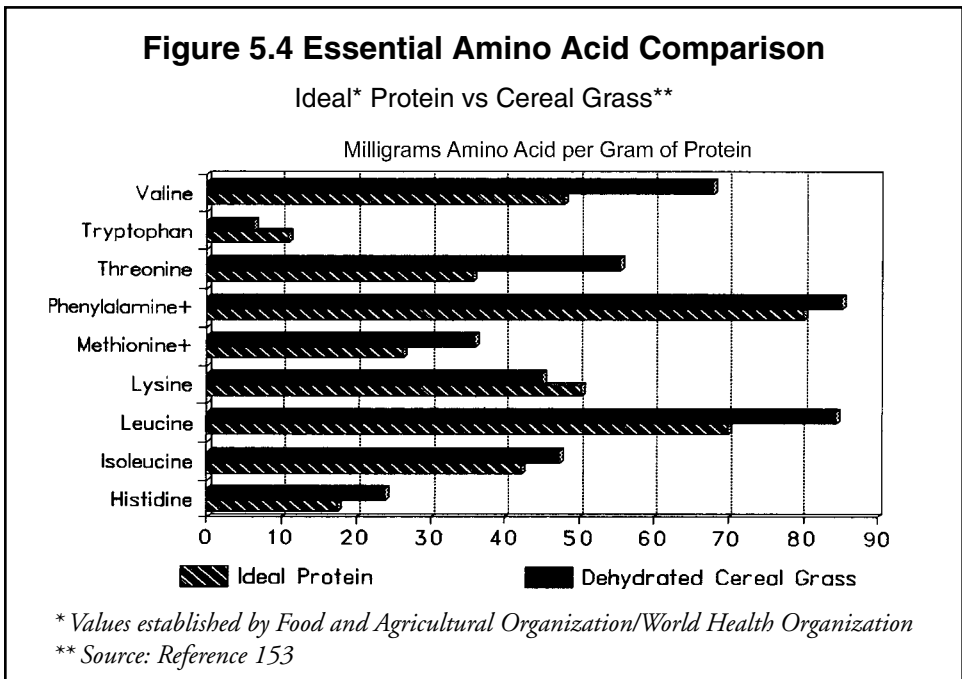
Osteoporosis ("porous bones") is a major problem for the elderly. It is thought to be a result of a prolonged imbalance between calcium absorption and calcium needs, resulting in brittle bones which are easily fractured. People of all ages, particularly middle-aged and elderly women, need to maintain an adequate level of calcium in their diets to avoid bone loss. Regular exercise can also help to minimize bone loss. Smoking and alcohol consumption contribute to the risk of osteoporosis.⁵²

Protein

Protein is a part of every living cell. It accounts for over half of the dry weight of the human body. The protein contained in cereal grasses and other green leaves is a nutrition resource that has barely been tapped. Dehydrated cereal grass is twenty to twenty-five percent protein, making it higher than milk (3%), eggs (12%), and sirloin steak (16%)! Of course, as nutritionists know, all proteins are not created equal. But the protein in cereal grass is superior to that of any other plant source, and is even superior to that of some animal foods.¹⁰⁹

Proteins are built from chemical building blocks called amino acids. There are 20 different amino acids which make up proteins. Healthy adult humans can make all but 9 of these in adequate quantities.^{50,52} The remaining 9 amino acids must be obtained from the foods we eat, and are called essential amino acids.

In order for food proteins to be optimally used by the body, all of the essential amino acids must be present in suitable proportions. Proteins which meet this requirement are called complete proteins. Those which are deficient in one or more amino acids are called incomplete proteins.



Most animal-food proteins are considered complete proteins; plant proteins are usually considered incomplete. Vegetarians often combine protein foods to balance the different amino acids which are low in each. Grain foods tend to be low in the essential amino acid lysine, while beans often lack methionine. Eggs are believed to contain the most usable combination of amino acids.

Cereal grasses contain all of the essential amino acids in amounts which make the protein very usable. Unlike most plant proteins, these grasses contain high levels of both methionine and lysine.

The value of the protein found in green leafy plants is relatively consistent throughout nature.¹⁰⁹ Because the world has such an abundant supply of green plants—both cultivated and wild—scientists have investigated ways of using green plants as a source of protein in areas where diets lack adequate levels of protein.

The importance of adequate protein in the diet cannot be overemphasized. The amino acids in dietary proteins are used to build all of the proteins which our bodies need. Among the most crucial functions of proteins are:

- Formation of essential compounds including antibodies, hormones, neurotransmitters and enzymes.
- The growth of all tissues and the replacement of damaged tissues, including blood cells.
- An important source of food energy
- Maintenance of electrolyte/water balance and acid/base balance.

The first item alone reminds us that it would be impossible to stay healthy or even to function without adequate protein. In many parts of the world there is an alarming rate of protein-energy malnutrition, especially among children.

In areas of the world where food availability is less of a problem, it is very difficult for anyone eating a reasonably balanced diet not to meet minimum protein needs, even when the diet contains little or no animal foods.⁵² Some nutritionists now say that some people in the developed areas of the world eat too much protein. Dr. John McDougall, noted physician, author, and nutrition authority, warns that high protein diets may be the major cause of osteoporosis.⁸⁸ Excessive intake of animal proteins has been linked in several studies to an increased risk of colon cancer⁷⁶ and coronary heart disease.⁵³

Nutrient Synergism in the Cereal Grasses

Dehydrated cereal grass tablets are not multi-vitamin pills. They are a concentrated combination of the nutrients found in all the higher quality dark green vegetables. As we have seen, the nutrients found in these foods work together to benefit the body as a whole. It may also have become apparent that the cereal grasses contain nutrients which support inter-related functions of our vital systems and physiological processes.

It is interesting, and rather amazing, to see how the variety of nutrients in the cereal grasses support the functions of other nutrients which are found there. A closer look at this phenomenon makes a good case for relying on foods rather than vitamin pills as sources of vitamins and minerals.

For example, vitamin C aids in the absorption of calcium and iron. Iron is required to convert beta-carotene to vitamin A. Calcium and pyridoxine help absorb vitamin B12, which is essential for the activation of folic acid. All of these nutrients are found together in the cereal grasses, along with others which support complimentary functions.

Healthy Blood and Circulation

Green food nutrients support healthy blood and circulation. Iron, folic acid, vitamin C, vitamin B12, pyridoxine, and protein are all vital for the formation and maintenance of adequate levels of hemoglobin and red blood cells. Chlorophyll may also be beneficial in these processes. In addition, chlorophyll, vitamin K, and calcium are all involved in blood clot formation and breakdown.

Detoxification

Dehydrated cereal grasses are perhaps most often consumed as fiber foods, and for their maintenance of bowel regularity. Their combination of insoluble fiber and chlorophyll make them excellent foods for this purpose. In addition, beta-carotene supports the growth and maintenance of the lining of the intestinal tract.

The mechanisms by which green foods provide protection from chemical carcinogens and radiation are not entirely clear. It has been shown that chlorophyll, beta-carotene, and vitamin C may contribute to this protection. The latter two nutrients are anti-oxidants, and chlorophyll may provide protection against DNA mutations in ways which are not yet known.

Immune System Support

Our bodies are constantly making and using immune cells. These cells are said, therefore, to have a high turnover rate. Cells and tissues with a high turnover rate are particularly sensitive to inadequate nutrition. The specific nutrients needed for the synthesis of immune cells and products include protein, vitamin A, vitamin C, iron, folic acid, and pyridoxine. Green vegetables are excellent sources of these nutrients. On a larger scale, it is thought that fiber foods provide some immune protection to the intestinal tract by reducing the amount of toxic material which contacts and penetrates the colon.

The Nutrients in Dehydrated Cereal Grass: A Summary

Wheat grass, barley grass, and all the dark green vegetables contain a wide variety of essential vitamins and minerals. These nutrients are combined by nature with high quality vegetable protein and fibers, to provide naturally potent foods. Green foods have been an essential part of the human diet for thousands, perhaps millions of years. Today, we are able to identify many of the specific nutrients found in green foods, and the reasons why we can't do without them. Even with all of this information, we may only be beginning to understand why green foods are so good for us.