

A NUTRITIONAL FOUNDATION

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Understanding proper nutrition during normal times can help you stay healthy but during a prolonged crisis that knowledge can be vital.

A crisis usually means increased work, worry and stress, which increases customary nutritional needs. If the total needs are not supplied by the current intake, the body draws on its stored reserves. If the reserves are inadequate, a nutritional deficiency is created. Deficiencies lower the resistance of the body, resulting in increased illness and susceptibility to infectious diseases. Productivity is also decreased. All at a time when they can least be afforded. Death can be the final result. Short of that, children can be permanently damaged. Severe malnutrition during pregnancy, infancy or early childhood can cause retarded physical and mental growth that can never be made up.

Clearly, prevention through nutritional knowledge and planning now is the key.

Food Keeps Us Going

Food is necessary to sustain life. It provides the body's heat and energy needs, the materials for growth and tissue repair and for the maintenance of health and reproduction through assisting with the regular bodily functions.

There are approximately forty essential nutrients, but not all will be covered here. Some are more critical to survival than others, and the overall order of presentation in this chapter reflects those priorities.

Water and Salt

Water is second only to oxygen in its importance to sustain life. Generally, a person can survive only one tenth as long without water as he can without food. Lack of water quickly results in exhaustion and weakness. Even a loss of 10% of total body water is very serious.

Salt is necessary for the body to retain water effectively. The sodium in salt helps regulate body fluids—including blood—and maintain the balance of fluids and pressure inside and outside the cells. It also plays a major role in nerve impulse transmission, heart action and the metabolism of carbohydrates and protein. Finally, it contributes to the palatability of food.

Energy

Energy is the fuel our bodies run on. It comes from the food our digestive systems oxidize, is measured in calories and is used for three purposes: (1) to maintain bodily functions, (2) for growth, and (3) for physical activity. Total energy needs are determined by age, body size, degree of activity, sex and individual metabolic characteristics. Women, due to additional body fat, require fewer calories per pound of body weight than men. Younger and smaller people require more per pound. Everyone needs more during cold weather, when they have a fever or when producing abnormal amounts of bone and tissue as is the case after surgery, during pregnancy and for nursing mothers.

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Energy not required immediately is stored by the body as fat. Whenever the energy demands can't be met by current intake the body starts to burn this reserve. After exhausting the fat, the body breaks down the proteins in vital tissues and muscles, sapping strength. The body attempts to conserve energy, the pulse rate and blood pressure fall and body temperature drops. Children stop growing, nursing mothers fail to produce milk, women stop menstruating and men become impotent. Finding food becomes an all-consuming obsession or the craving for food is lost entirely along with the will to live. Speech becomes slurred, hearing and smell fail and blindness inevitably precedes death.

Adequate calories are needed to provide enough energy and avert serious weight loss. A loss of 20-30% can be very dangerous and could result from a shortage of only 360 calories per day over a year's time for a 150 pound person.

The normal energy foods are the carbohydrates and fats.

Carbohydrates

Carbohydrates are of two types: (1) simple—such as sugars—that are easily digested, and (2) complex—such as starches which the body breaks down into simple sugars before digesting and fiber which is essentially indigestible.

Carbohydrates provide energy more quickly than any other form of nutrient, are required by the liver to break down fats and are needed to prevent ketosis—a problem caused by burning primarily fat for energy, resulting in excess ketone formation and increased urination, burdening the kidneys. Too little carbohydrate can also cause headaches, weakness, lethargy and dizziness. The dietary fiber—roughage—relieves constipation, promotes normal elimination of body wastes and prevents diverticular disease. (Fiber is also credited with preventing many other diseases for which current scientific evidence is inconclusive and excess fiber can impair absorption of calcium, copper and iron).

Carbohydrates are the chief energy source in the survival diet and should make up 55-65% of the total calorie intake. Foods high in carbohydrates are the cereal grains, legumes, seeds and nuts, fruits, vegetables and sugars. Fiber is found only in the seeds, skin and fibrous structure of plants, and raw foods contain more than processed.

Fat

Seldom are recommendations seen for fat because the average diet contains much more than needed. However, some fat is essential for a healthy body and must be considered for the survival diet.

Fat is the most concentrated source of energy and helps reduce bulk in the diet. This is especially important for children who have high energy needs for their size. They may not physically be able to eat enough food to supply their energy needs from a diet lacking in a concentrated energy source. Infants exclusively fed a formula made from nonfat dry milk must also have some added fat in their diet to give adequate energy without excessive protein.

Fat adds flavor and texture to the diet, contributing to the palatability of foods. It is slower digesting and remains in the stomach longer than carbohydrates and protein, giving a “full” feeling and delaying the onset of hunger. Fat is used in the blood to carry the fat-soluble vitamins to the cells. It also lubricates, cushions the body organs, conserves body heat and insulates the body from environmental temperature changes.

Certain polyunsaturated fats that the body can not manufacture from other fats are necessary for the proper growth and functioning of the cells and skin. They are called “essential fatty acids” (EFA), and give permeability to the cell membranes, allowing the cell to receive needed nutrients and excrete wastes. A deficiency retards this exchange, the cell becomes malnourished and toxins accumulate. Skin becomes dry, hair brittle and mucous membranes more subject to infection. Nerves and endocrine glands fail to function efficiently, affecting growth and body regulation. The metabolism of cholesterol is also affected.

A minimum of 3% of the total caloric intake should be from EFA. This will most likely be supplied from a diet with at least 15% fat where much of the fat comes from wheat, rice, corn and vegetable oils. Liquid oils have about twice as much EFA as solid oils do, and the highest amounts are found in safflower, sunflower, corn, soybean and cottonseed oils in that order. Peanut and olive oils contain much less.

Before leaving fats, cholesterol must be discussed. Current scientific opinion is greatly divided on the role of cholesterol and saturated fats in the diet. Some studies show that an abundance of cholesterol and saturated fats leads to hardening of the arteries and increased risk of heart disease. Other studies show no such correlation. Whatever the case, it should be understood that cholesterol is a normal part of the blood and body tissue that is essential for the synthesis of certain important hormones. Only a portion of blood cholesterol comes from the food we eat and, if we don't get enough, the liver will produce it. Certain research also shows that polyunsaturated fats may have carcinogenic properties. The only sure thing is that too much fat isn't good for you. However, in a survival diet, the problem will most likely be to get enough rather than having too much.

Protein

Next to water, protein is the most important substance in the body and vital for its growth, maintenance and repair. It is found in every part of the body, and performs an almost endless list of functions. It accounts for the tough, fibrous nature of hair, nails and ligaments, as well as for the structure of muscles and connective tissue. It is part of the red blood cells that transport oxygen to the cells and carry off the carbon dioxide. It is part of the DNA molecule that controls the genetic code and, thus, all hereditary characteristics. As collagen, it makes up about half of the bones and is the glue that holds them together. It helps regulate the body's water and acid-base balance, and is required for the production of hormones and enzymes.

Various combinations of amino acids make up all proteins. The body can synthesis all but nine of the roughly twenty-two common amino acids, and these nine, including histidine, are called the essential amino acids. Five are relatively abundant, but lysine, methionine, isoleucine and tryptophan are scarcer.

A food protein is broken down by digestion into its amino acids and absorbed into the blood. The body then uses these amino acids in a particular ration—different for growth than for maintenance—to build its protein. If the amino acids are not available in that ratio at the same time, then the body can only use them in proportion to the presence of the least abundant one and is “limited by it. The nutritive value of the food protein is determined by this limiting amino acid.

An analogy to limiting amino acids would be building automobiles from a selection of various parts. Assume an automobile requires one motor, two headlights and four tires. If you have an unlimited supply of tires but only three motors, you could only make three automobiles. But if you had only eight tires you would be limited to making two automobiles.

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The body has little protein reserve. If it does not regularly get enough usable protein—based on the availability of the limiting amino acid—it will be unable to produce the protein required. It will stop making the less vital protein and concentrate on more vital functions. Lacking enough balanced protein to even do that, it will begin to break down the least vital protein tissues to obtain the necessary amino acids. The collagen in connective tissue of bones and cartilage is the first to victim. This is followed by the muscle tissue, then by vital organs and nerve tissue.

Bones become brittle and distorted in shape. Strength diminished. Abnormal, ineffective antibodies are produced, and resistance to infection and disease drops. The pancreas can no longer produce insulin—the hormone that regulates the blood sugar level—and either diabetes or hypoglycemia may develop, with attendant mental and emotional disorders. Enzymes, necessary for digestion and chemical functions of the cells, are no longer manufactured. Weight is lost, the body sickens and eventually dies. The only prevention is making sure there is enough of the essential amino acids in each meal.

Based on their amino acid profiles, protein foods can be divided into three categories:

1. Complete proteins. These are high quality proteins having all nine essential amino acids in sufficient quantity. They are animal proteins and include eggs, milk, meat, fish and poultry. Soybeans are often included with this group, but their protein quality is lower.
2. Partial proteins. These proteins have all nine essential amino acids, but are low in one or more. The vegetable proteins—including the grains, legumes, seeds and nuts—are in this group.
3. Incomplete proteins. These proteins lack one or more of the nine essential amino acids, and are unable to support growth or maintenance by themselves. Gelatin is an example.

Within each category there are different grades of protein quality. For example, egg has a better quality protein than meat, while rice has a better quality protein than corn.

Foods low in a particular amino acid can be combined with another food high in that same amino acid to improve the quality of the protein. This is called complementation. Cereal grains—low in lysine but high in methionine—can be combined in the same meal with beans—high in lysine but low in methionine—to make a much more complete protein. Beans can be combined with seeds and nuts, but peanuts, low in both lysine and methionine, should be combined with both grains and legumes. The use of even small amounts of complete proteins with partial proteins—like milk on cereal or rice with fish—will substantially improve the quality of the protein.

The amount of protein needed in the daily diet depends on the quality. A diet where the total protein quality is about 80% of the quality of protein from eggs and milk is assigned a protein quality rating of eighty, and is characteristic of most developed countries. A score of seventy is given when the diet contains substantially less animal protein, and is normal for less-developed countries. If nearly all protein is from poor quality sources, and there is essentially no animal protein, a score of sixty is used. The average survival diet, with powdered milk and some other animal protein, would rate about seventy. Total requirements also reflect the fact that healthy populations obtain about 10-15% of caloric intake from protein.

Protein needs are increased when the body is building tissue rapidly—in infancy, growing children and teenagers, pregnant women and nursing mothers—or repairing tissue due to hemorrhaging, burns, surgery, injury or infections. Stress increases the need for protein to

produce additional hormones, enzymes and antibodies, while needs also increase with fevers or cold temperatures.

Excess protein is not desirable, either. While its versatility allows it to be burned by the body for energy, it will only be so used if the fats and carbohydrates are exhausted or unavailable. Calories from protein sources are many times more expensive than those from fats and carbohydrates. Using protein for energy is not only wasteful but may be dangerous. Too much protein requires large quantities of water, may aggravate some types of liver and kidney diseases, promotes bone loss with resulting fractures and can affect the body's ability to retain calcium.

Good protein sources have fewer than thirty-five calories per gram of protein, while marginal sources are in the thirty-five to seventy range. Generally, high quality protein costs more than lower quality, depending on the mode. Freeze dried tuna, for example, costs three to four times as much for the same amount of protein as does similarly packed powdered milk and eggs, considered better proteins.

Vitamins and Minerals

Vitamins and minerals are the protective factors in food. They are required by the body to maintain life and, as with all nutrients, their actions are often dependent on each other. Some reactions need a combination of vitamins and minerals in order to take place.

Vitamins

Vitamins are the biochemical spark plugs of the body. They are unrelated, complex organic compounds, each with a unique function in some vital body process. They are essential in small amounts in every cell of the body to maintain life. They do not provide energy nor components of body structure, but act as important links or catalysts in the chemical reactions through which the body turns food into energy, removes waste products and builds tissue for normal growth, repair and maintenance. They form components of enzymes, aid in the regulation of metabolism and help nerves, muscles and organs work properly.

Although the body can synthesize some vitamins, the majority come from food. When a particular vitamin is unavailable to the body in sufficient amounts, a specific "deficiency" disease will develop, and can be reversed only by consuming a suitable amount of the vitamin. Prolonged deficiencies can lead to permanent dependencies. Excess vitamins can sometimes cause problems. Too much of some vitamins can interfere with the absorption or utilization of other vitamins and minerals and cause fatigue and other problems. Bodies will also adjust to high intakes of some vitamins and, when the large doses are suddenly stopped, react as if there is a deficiency of that vitamin with similar temporary reactions.

Vitamins are of two types, fat-soluble and water-soluble. The fat-soluble dissolve in fats or oils, and are stored by the body in fatty tissue as a reserve supply. Water-soluble vitamins dissolve in water and must be continually replaced because any excess is normally eliminated in the urine.

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Fat-Soluble Vitamins:

Vitamin A - Retinol

Functions: Affects skin, mucous membranes, eye tissue, bones. Helps resist infection, particularly of respiratory and genitourinary tracts.

Deficiency Symptoms: Inability of eye to see in dim light or to adjust to changing light conditions. Severe deficiency damages cornea, can result in permanent blindness. Dry and rough skin, easily broken fingernails, pimples, blackheads, boils, body more susceptible to infection. Membranes degenerate, stunted growth in children. Infants and children prone due to low reserves.

Toxicity Symptoms: Dry, cracked skin, loss of appetite, severe headaches, irritability, pains in bones and joints. Menstrual difficulties, liver and spleen enlarge, pressure can develop inside skull giving the appearance of brain tumor.

Works with: Vitamin C helps prevent toxic effects and fights infection. Fat necessary for efficient digestion and absorption.

Needs Increased by: Excessive iron, strenuous physical activity, cold weather, stress, alcohol, coffee.

Sources: Whole milk, egg yolk, liver, fish liver oils, butter, cream and cheese. Vegetable sources are not as efficient, but include carrots, sweet potatoes, "greens" such as spinach, dandelion, and water cress, winter squash, pumpkin, broccoli, tomatoes, apricots, cantaloups, prunes, peaches, cherries, elderberries and grapes. Smaller amounts in yellow corn, dried peas, wheat and alfalfa sprouts.

Vitamin D

Functions: Necessary for absorption and utilization of calcium and phosphorus required for bone and teeth formation and maintenance.

Deficiency Symptoms: Defective bone mineralization resulting in skeleton deformation in children (rickets), appearing as bowed legs, deformed spine, buckteeth, "potbelly", flat feet, stunted growth. In adults, results in softening of bones (osteomalacia) where bones lose calcium and deteriorate, weaken, prone to multiple fracture. Infants, children, pregnant women, nursing mothers most likely to have deficiency.

Toxicity Symptoms: As little as four to five times the RDA can cause excessive urination, loss of appetite, weight loss, diarrhea, nausea, weakness, hypertension, headaches, calcium deposits in soft tissues, kidney failure, possible death. Many symptoms remarkably similar to those caused by deficiency, such as bone deformation and multiple fractures.

Sources: About half normal intake comes from sunlight's action on the cholesterol layer just beneath surface of skin. Amount produced dependent on amount of skin exposed, time of day, intensity of sun. About thirty minutes per day would be minimum, but could be adequate in northern latitudes in winter or for persons with heavily pigmented skin. Other sources are oily fish, fish liver oils, butter and whole and fortified milk. Smaller amounts found in egg yolks, liver, sunflower seeds, sprouts, peas, carrots and green leafy vegetables.

Vitamin E - Tocopherol

Functions: Acts as antioxidant preventing oxygen from destroying other compounds such as vitamin A, and prevents damage to cell membranes from the oxidation of polyunsaturated fatty acids. Claims made that it helps heal burns and other wounds more rapidly with less scar tissue, protects lungs from pollution, aids in blood circulation and prevents hemorrhaging by strengthening blood vessels and heart muscles, slows aging, treats threatened abortion. Current scientific research gives no proof for increased sexuality.

Deficiency Symptoms: Appear only in persons unable to absorb fats and result in enhanced fragility of red blood cells and muscle loss. Infants fed formulas low in fat or made with polyunsaturated fats with low vitamin E content can suffer anemia and accumulation of body fluids. Deficiencies in sheep,

rabbits and rats have caused sterility, muscular dystrophy. Other possible effects are glandular disorders, leg cramps, muscle pains and round, wrinkly skin.

Toxicity Symptoms: Inconclusive research suggests possible low blood sugar, increased tendency to bleed, headaches, blurred vision, nausea, fatigue, giddiness, chapped lips, mouth inflammation and reduced sexual function.

Needs Increased By: Diet high in polyunsaturated fats, oral contraceptives, chlorine, rancid fats and oils.

Sources: Vegetable oils, shortening, margarine, whole cereal grains, nuts, legumes, seeds, liver, egg yolk, lettuce, watercress.

Vitamin K

Functions: Required for synthesis of prothrombin by liver for normal blood clotting.

Deficiency Symptoms: Rare, resulting in hemorrhaging and diseases of the liver, gall bladder, intestinal tract.

Needs Increased By: Antibiotics, aspirin, rancid fats and oils.

Sources: About half formed in intestinal tract by bacteria. Other sources are spinach, lettuce, cabbage, kale, cauliflower, vegetable oils, fruits, grains, liver, egg yolk, pork and dairy products.

Water-Soluble Vitamins

Vitamin C - Ascorbic Acid

Functions: Metabolism of tyrosine amino acid and folacin, synthesis of anti-inflammatory steroids and epinephrine, which stimulates the heart and increases muscular strength and endurance. Vital constituent of collagen, the basic cement-like protein “glue” that holds the cells together, is necessary for growth and promotes healing of wounds, burns, cuts, broken bones, aids in tooth and bone formation, strengthens blood vessel walls and prevents heart disease. Very important to immune system because enhances production of white blood cells, cortisone hormone, interferon, prostaglandins, T-lymphocytes and immunoglobulins. Increases body's supply of oxygen and opens stuffy breathing passages, giving antihistamine effect. Aids in absorption of iron, protects vitamins from oxidation, enhances effects of aspirin and antibiotics (this magnifying effect can be harmful with diabetics because normal intake of oral insulin may produce shock in the presence of vitamin C).

Deficiency Symptoms: Weakening of collagenase structure (scurvy or “blackleg”). Soft, swollen, bleeding gums, loose teeth, easy bruising and hemorrhaging. Nosebleeds, slow-healing wounds, tooth decay, decreased resistance to infection, increased allergies. Poor digestion, muscular weakness, loss of appetite and weight, shortness of breath, lethargy, irritability. Sudden death from severe hemorrhaging and heart failure.

Toxicity Symptoms: Acts more like chemical at levels above ten times the RDA, causes gastrointestinal problems and impairing ability of white blood cells to fight infection. Huge doses may leach calcium and other needed minerals from body, increase urine flow, act as laxative. Adverse effects on growing bones, precipitate formation of kidney stones, bring on menstrual bleeding in pregnant women, various problems in newborn infants. Destroys vitamin B₁₂, interferes with absorption of copper and certain drugs, contributes to possible iron poisoning and falsifies readings for blood tests, preventing proper diagnosis of colon cancer and for sugar in urine of diabetic.

Works With: Calcium and magnesium essential for proper functioning.

Needs Increased By: Acute mental or physical stress, excess sugar, aspirin, oral contraceptives, antibiotics, cortisone, hormone or radiation therapy, tobacco, alcohol, heat, oxidation, light.

Sources: The human body normally stores a reserve of about 1500 mg—higher in females—that will last approximately three to six weeks under normal conditions before psychological changes occur and scurvy symptoms appear. Normal sources are citrus fruits, acerola cherries, strawberries, tomatoes, berries, melons, “greens”, broccoli, cauliflower, peppers, rutabagas, turnips, green onions and

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summer squash. Good survival sources are cabbage, sweet and white potatoes and sprouts. Emergency sources include rose hips, currants, horseradish, ginger leaves and spruce or pine needles.

Vitamin B Complex

The B vitamins are unrelated compounds that function similarly and work in unison. They should all be present at the same time in a balanced ratio because an excess of some can cause a deficiency of others in the group. Together they promote appetite, aid in digestion and assimilation of food and help maintain proper functioning of the blood, heart, liver, muscles, membrane and nerve tissue. Mental or physical stress can increase needs substantially. Good general sources are a large variety of meats—particularly liver and kidney—and fish, eggs, cheese, milk, whole grains, legumes, nuts, seeds and leafy green vegetables. Concentrated sources are wheat germ, desiccated liver and brewer's yeast.

Vitamin B₁ - Thiamin

Functions: Essential in metabolism of carbohydrates and protein, for normal functioning of brain, nervous system, muscles and heart. Important for lactation and in fertility.

Deficiency Symptoms: A disease of the nervous system (beriberi) causing numbness, nausea, loss of appetite, insomnia, abnormal heart action, paralysis, mental confusion, irritability and depression.

Body may swell from abnormal accumulation of fluids, develop constipation, show muscle convulsions. Heart enlarges and death often results from heart failure. Deficiency may appear suddenly in children, impairing growth, and is especially likely on diet high in unenriched white rice or flour.

Works With: Sufficient amounts of fat and manganese.

Needs Increased By: Excessive B₁₂, stress, surgery, feverish infections, antacid preparations, sugar, raw fish, alcohol, coffee, tea, tobacco.

Sources: Lean pork and ham, heart, kidney, liver, milk, egg yolk, whole grains, legumes, nuts, turnip greens, okra, Jerusalem artichoke, collards, asparagus and avocado.

Vitamin B₂ - Riboflavin

Functions: Essential for enzymes that breakdown sugars and starches. Aids vitamin A in controlling skin disorders, improving health of eyes and mouth.

Deficiency Symptoms: Disorders of membranes. Skin blotches and cracks, lips sore and chapped, mouth inflamed, tongue swells, may be purplish and is painful. Eyes become red and bloodshot, vision dims.

Hair lost, itching and burning occur and growth stunted. Hard to meet requirements if diet almost all grains and legumes, but sprouting can help.

Works With: Phosphorus, needs equal amounts of vitamin B₆ to work effectively.

Needs Increased By: Physical activity, stress, oral contraceptives.

Sources: Lean meats, liver, heart, kidney, milk, cheese, eggs, soy beans, peas, peanuts and peanut butter, whole grains, almonds, seeds, turnip greens, collard greens, garden cress, beet greens, asparagus and spinach. Yeast is a concentrated source.

B₃ - Niacin or Nicotinic Acid

Functions: Skin, mucous membranes, central nervous system, gastrointestinal tract, tissue respiration.

Provides coenzyme vital for metabolism of sugar and tryptophan, synthesis of fat.

Deficiency Symptoms: Pellagra, characterized by dementia, dermatitis, diarrhea and death. Headache, insomnia, lack of concentration, irritability, depression, inflamed and rough skin, sores in mouth and on tongue. People subjected to starvation diet for prolonged period suffer physical and mental

illnesses largely relieved by daily doses of three grams niacin with B₆. Niacin deficiency may develop in five to six months if dried corn is principal staple of diet with few animal proteins or legumes because niacin in corn in form of amino acid tryptophan and not readily available. In Mexico and other countries where corn is traditionally a staple, this disadvantage is overcome by pre-processing in alkali water. The dried corn is soaked for a few hours or overnight and then boiled twenty minutes to two hours in a lime-water solution made alkaline with about 1% by weight of lime—calcium oxide—or slaked lime—calcium hydroxide. Wood ashes may also be used. This treatment, in addition to making the niacin more available, also makes the corn easier to prepare.

Toxicity Symptoms: Flushing and burning of the face, tingling of hands, may damage liver.

Needs Increased By: Alcohol, excess sugar.

Sources: Liver, other organ meats, pork, chicken, fish, wheat, rice, legumes—particularly peanuts and peanut butter, potatoes, asparagus, collard leaves, summer squash and zucchini. Dried yeast is a concentrated source.

Pantothenic Acid

Functions: A coenzyme needed to digest carbohydrates, fatty acids and protein. Supports variety of functions necessary for proper growth and maintenance, healthy skin and development of central nervous system. Helps build red blood cells, used in synthesis of antibodies, makes sterols and steroid hormones that stabilize adrenal gland.

Deficiency Symptoms: Increased fragility of red blood cells, tissue failure. Headaches, dizzy spells, digestive problems, nausea, cramps, skin abnormalities, poor muscle coordination, fatigue. Feet can become burning and painful, growth retarded. Severe cases cause infertility, spontaneous abortion, sudden death.

Toxicity Symptoms: Occasionally diarrhea and water retention. Needs Increased By: Stress, alcohol, coffee.

Sources: Widely found in foods and abundant in liver, poultry, fish, eggs, white and sweet potatoes, peas, beans, whole grains and peanuts. Yeast is a concentrated source.

Folacin or Folic Acid

Functions: Helps in formation and maturation of red blood cells, important to bone marrow and brain chemistry, acts as transporter between cells, is coenzyme in metabolism of protein.

Deficiency Symptoms: Impaired cell division, altered protein metabolism. Results in certain types of anemia, insomnia, nervousness, constipation, fatigue.

Works With: Vitamin C necessary for its utilization.

Needs Increased By: High cooking heats, oral contraceptives, barbiturates, anticonvulsant drugs.

Sources: Liver, kidney, fish, raw leafy dark green vegetables, legumes, whole grains, nuts, fresh oranges and dates. Dried yeast concentrated source.

Vitamin B₆

Functions: Metabolism of protein and fat, manufacture of red blood cells and hormones. nerve tissue, brain, skin, teeth and gums.

Deficiency Symptoms: Insomnia, irritability, confusion, depression, dizziness, nausea, vomiting, convulsions, loss of muscle control, abdominal pain, skin eruptions, anemia, weight loss.

Toxicity Symptoms: Dependency, liver damage.

Needs Increased By: High protein diet, stress, oral contraceptives, alcohol, high heats.

Sources: Liver, other organ meats, fish, chicken, whole grains, legumes, sunflower seeds, filberts, potatoes, bananas, oranges, broccoli.

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Vitamin B₁₂ - Cobalamin

Functions: Development of red blood cells, functioning of all cells, bone marrow, nervous system, intestines.

Deficiency Symptoms: Pernicious anemia, a fatal disease, and spinal cord degeneration. Weakness and fatigue.

Toxicity Symptoms: Excess may cause nerve damage.

Needs Increased By: Excessive vitamins B₁ and C.

Sources: The normal healthy human liver has a two to four year supply. Sources are almost exclusively animal: organ and lean meats, fish, milk, eggs, cheese. Brewer's yeast concentrated source.

Minerals

Without minerals the body couldn't use the vitamins. Inorganic substances, minerals make up 4-5% of the body, and have two general functions: building and regulating. They are constituents of the bones, teeth, muscle, blood, nerve cells and all soft body tissue. As regulators, they act as catalysts in the biochemical reactions affecting blood clotting and controlling the osmotic action maintaining the internal pressure and acid-base balance of body fluids. They help regulate the heartbeat and other nerve responses, and help transport oxygen from the lungs to the tissue.

They are needed in balanced amounts to properly perform their function without disturbing those of other minerals. Excess intakes, sometimes as little as twice the amount needed to maintain good health, can result in anemia, bone demineralization and breakage, neurological disease and fetal abnormalities. A process called chelation, where the inorganic mineral is combined with an organic substance, can be used to increase absorption.

Minerals are often divided into two groups. Macro minerals are those needed by the body in relatively large amounts, while micro minerals are only needed in minute or trace amounts.

Macro minerals

Calcium

Functions: Builds and maintains bones and teeth, helps in blood coagulation, important for normal functioning of nerves and muscle response.

Deficiency Symptoms: Body normally contains reserves for a year or more and can greatly increase proportion used if need be. Weakening of bone and teeth structures, muscle cramps, nervousness, irritability, headaches, insomnia, irregular heartbeat. Research shows deficiency of calcium may be major cause of high blood pressure. Lack of sufficient calcium during pregnancy results in decreased bone density in newborn.

Toxicity Symptoms: Interferes with absorption of iron, manganese and zinc. Contributes to calcification of soft tissue, leads to lack of appetite, gastrointestinal problems, constipation, drowsiness and weakness.

Works With: Vitamin D needed for efficient absorption. The calcium-phosphorus ratio also affects the absorption rate. The ideal ratio seems to be two parts calcium to one part phosphorus for experimental animals, but is less well understood for man. Available evidence indicates man can tolerate a much wider ratio—from about two parts of either mineral to one part of the other—while some researchers believe the ratio has no effect on the absorption rate as long as the diet contains adequate calcium. The RDA is set using a 1:1 ratio, while the average diet in the United States is one calcium to 1.5-1.6 phosphorus.

Needs Increased By: Strenuous physical activity, stress, high protein intake. Children may need two to four times as much for their body weight, and rapidly growing youths—approximately ages ten to

eighteen—need more, as do pregnant women, nursing mothers and, perhaps, older people. Phytic acid—found in whole grains and legumes—and oxalic acid—found in spinach, rhubarb, chard, green beans, raspberries, Concord grapes, chocolate and cocoa—can unite with calcium, iron and zinc to form insoluble salts. This makes the mineral unavailable to the body. Whole wheat, for example, contains enough phytic acid to theoretically bind all of the calcium contained in it and prevent absorption entirely. However, a calcium deficiency is not often found in persons habitually consuming a diet high in whole wheat. Apparently their system adjusts. Whatever problem may be caused can be minimized by the use of yeast for leavening or a calcium supplement. The yeast apparently destroys the phytic acid, and a diet high in whole grains where a large portion is used in leavened bread products will probably have little problem.

Sources: Milk, cheese, sesame seeds, carob flour, egg yolk, nuts, soy beans, buckwheat, oats, figs, prunes, “greens”, broccoli, rhubarb, green beans. Emergency sources are lambsquarters, dandelion, water cress and horseradish. There is some question about the absorbability of powdered egg shell, but it should be as good as dolomite, which is finely pulverized limestone.

Potassium

Functions: Used, with sodium, to maintain normal acid-base balance in body fluids. Necessary for proper muscle contraction, nerve transmission, heart action and enzyme reactions.

Deficiency Symptoms: Occur only with diarrhea, diabetic acidosis and with laxatives or certain diuretics for high blood pressure and heart disease. Constipation, bloating, physical and mental weakness, impaired nervous system and heart problems.

Toxicity Symptoms: Taking as much as the RDA in a single dose can cause severe illness and may result in fatal cardiac arrest.

Sources: Widely distributed in both plant and animal sources. Best sources include milk, legumes, nuts, seeds, whole grains other than rice, bananas, cantaloupe, oranges, prunes, raisins, water melon, potatoes, tomatoes, winter squash, Swiss chard, spinach, parsnips, garden and water cress.

Sodium

Functions: A component of salt along with chloride, it is primarily involved in maintenance of osmotic equilibrium and fluid volume and balance.

Deficiency Symptoms: Inadequate replacement after prolonged or excessive sweating results in nausea, vomiting, fatigue, exhaustion, giddiness, fainting, heat stroke. Mortality may exceed 20%.

Toxicity Symptoms: Excess may lead to hypertension, but this is not proven beyond doubt, and many people seem to be unaffected by sodium intakes as high as thirty-two pounds per year.

Sources: Table salt, animal sources such as cheese, milk, meat, fish, poultry, eggs.

Other macro minerals—chloride, magnesium, phosphorus and sulfur—are not covered here because, although important to the body, they are easy to obtain from many foods, deficiencies are rare and excesses are usually harmless.

Micro minerals

Chromium

Functions: Cofactor with insulin in normal metabolism of glucose for blood sugar.

Deficiency Symptoms: Diabetics are low in. Deficiencies cause diabetic-like condition.

Needs Increased By: Malnutrition, pregnancy, old age.

Sources: Liver, other meats, cheese, whole grains—particularly rye, and green pepper. Brewer's yeast concentrated source.

12 A NUTRITIONAL FOUNDATION

Copper

Functions: Necessary for absorption, storage and utilization of iron in formation of red blood cells. Needed for normal functioning of nervous system, to form bone tissue and to make enzymes and protein.

Deficiency Symptoms: Particularly important in early months of life, sometimes encountered among malnourished children. Weakness, skeletal defects, degeneration of nervous system, impaired cell respiration, loss of hair color, reproductive failure, pronounced cardiovascular lesions, bone disease.

Needs Increased By: Excess vitamin C hinders absorption.

Sources: Shellfish, oysters, clams, nuts, liver, kidney, egg yolk, corn oil margarine, legumes, dried fruits, cocoa, whole grains. A large source in normal diet can be from hard water or water carried through copper pipes.

Fluorine

Functions: Found in bone and tooth enamel, it can often decrease the incidence of cavities 50% or more. Some evidence helps older persons retain bone calcium and prevent osteoporosis—brittle, easily broken bones.

Toxicity Symptoms: Excess results in mottled children's teeth. Large amounts can be toxic (fluorosis).

Sources: Found in few sources outside of naturally fluoridated water.

Iodine

Functions: Integral part of hormone thyroxine necessary for proper functioning of thyroid gland and essential for energy metabolism and growth.

Deficiency Symptoms: Enlargement of thyroid (goiter), usually in females.

Toxicity Symptoms: Huge doses can result in death.

Sources: Iodized table salt usual source for majority. In emergency, one drop of 2% tincture of iodine in a cup of water will provide the adult requirement for two weeks. Use one-fourth to one-half that for children seven or younger.

Iron

Functions: Required in manufacture of red blood cells, helps carry oxygen and carbon dioxide in blood, used in production of number of enzymes that help body utilize oxygen.

Deficiency Symptoms: The number one nutritional problem in the United States. Occurs when significant amounts of blood loss—from surgery, childbirth or menstruation—or blood formation during rapid growth, pregnancy or lactation.

Toxicity Symptoms: Most common type of poisoning among children five and under. Diarrhea, blood in stools, vomiting, shock, coma and death. Always keep vitamins containing iron, vitamins A and D where children can't get to them.

Works With: Vitamin C helps absorption. Absorption rate automatically increases two to three times if diet deficient.

Needs Increased By: Excess calcium, phosphorus, fiber, antacids, hookworms, and certain substances found in some foods, such as phytic acid, oxalic acid and tannic acid found in tea. Amount absorbed depends on amount eaten, how much body has stored, which foods are eaten at same time and form of iron. Body absorbs 10% on average, but heme iron (found in animal sources) absorbed at three times the rate of nonheme iron (found in vegetable sources). Diets low in animal sources may need double the amount to absorb the equivalent.

Sources: Animal sources include liver, kidney, other meats, sardines, oysters, clams, egg yolk. Plant sources are legumes, seeds, nuts, whole grains, cocoa and chocolate, molasses, dried fruits, potatoes, green peas, green beans and the green leafy vegetables. One of the best non-food sources is from cooking acid foods in iron pots and pans. An iron solution can also be made by placing an iron nail in vinegar for two to four weeks until small flakes of iron float to the surface. A teaspoon of this

solution should contain about thirty to sixty milligrams of iron, and could be used as emergency supplement. Adding to a cup of water may make it more palatable.

Zinc

Functions: Constituent of many enzymes involved in major metabolic processes. Necessary for cell growth and tissue repair, aids in protein and carbohydrate metabolism, needed for proper muscle activity, maintains resistance to infections, promotes healing of wounds and skin diseases.

Deficiency Symptoms: Even milk deficiencies may appear suddenly. Poor appetite, failure to grow properly, changes in skin, impaired healing of wounds, sexual problems. Impaired taste and smell. Pregnant women may have fetus development malformations and behavioral disturbances in their children.

Toxicity Symptoms: Stomach irritation, diarrhea, vomiting. Excess destroys copper.

Needs Increased By: Pregnancy.

Sources: Main diet source is meat. May be largely unavailable in diets of mainly plant sources due to phytic acid (see calcium). Animal sources are liver, other meats, oysters, eggs and milk. Other sources are whole wheat, oatmeal, green peas, lentils, garbanzo beans and black eye peas.

Cobalt, manganese, molybdenum and selenium have not been covered because they are easily obtained, are rarely deficient, and have low toxicity. Other minerals, such as nickel, silicon, tin, and vanadium are essential for animals and may be essential for man. Some, like aluminum, arsenic, boron, bromine, cadmium, lithium, silver, and titanium, are found in most plant and animal food, but are currently considered non-essential.

Crisis Requirements

Estimates of average nutritional needs are published by the National Academy of Sciences as the Recommended Dietary Allowances (RDAs). Actual requirements for any particular individual may differ from those recommendations, because of variability in metabolism and body chemistry (although normal variations are taken into account in the RDAs). And obtaining the needed nutrients depends entirely on eating an adequate diet.

During normal times, with abundant nutritional foods, it might be expected that all would easily meet their needs. But that is not the case. A USDA study shows that one-third do not get enough calcium nor vitamin B₆, and women often get as much as 40% less magnesium and iron than they need. Iron deficiency is common among children, and many lack adequate vitamin C. The average diet also supplies less than 60% of the needed zinc. Survival diets, with the increased needs caused by crisis, may be even more deficient.

A balanced diet is best assured by eating moderate amounts of many different foods from each of the basic food groups each day. Variety and moderation are the key words. Keeping them in mind while following the steps outlined in the next chapter will provide you with a nutritionally balanced food storage plan. Any supplements for added insurance is up to you, but I would consider a good multi-vitamin (with A, B complex, zinc, and iron for women and children) along with additional vitamin C, a calcium-magnesium supplement, and fluoride for children.