

The bile acids, likewise derivatives of cholesterol, are formed in the liver and excreted by way of the bile into the intestine, from which some may be reabsorbed and used over again, others being excreted in the feces.

5.1.4.6. RELATION OF FATTY ACIDS AND CHOLESTEROL TO CORONARY HEART DISEASE

High blood cholesterol may be a causative factor in coronary heart disease and may be associated with a particular type of hardening of the arteries known as atherosclerosis.

This is a degenerative condition in which there is a tendency for cholesterol scales or mushy deposits of large lipoprotein molecules to form on the interior wall of arteries.

There is ample evidence to show that ingestion of considerable amounts of saturated fatty acids, or of animal fats which carry a preponderance of saturated fatty acids, tends to increase levels of total lipids and of cholesterol in the blood.

Conversely, the inclusion in the diet of a higher proportion of vegetable fats, rich in polyunsaturated content of lipids tend to diminish level of total lipids and cholesterol in the blood.

At present the consensus of competent medical opinion is that a good many people would do well to reduce their fat intake and at the same time substitute moderate amounts of polyunsaturated fats (vegetable oils, margarines) for animal fats, which are high in saturated fatty acids.

Such changes are recommended especially for over weight persons, those who have already had a heart attack or stroke, and those whose family histories suggest that they may be coronary prone.

5.1.4.7. PLACE OF FAT-RICH FOODS IN THE DIET

Only about 10 percent of the energy in the average diets of Asiatic peoples is furnished by fats, because over population requires that land be used for production of carbohydrate-rich foods, which furnish energy at the least cost, instead of for the production of more expensive meat and dairy products.

Among people of moderate means in most European countries fat intake may account for 10 to 25 percent of their total caloric intake.

5.1.5. THE BODY NEEDS MINERAL ELEMENTS AND VITAMINS

Carbon, oxygen and hydrogen (in varying proportions) are the chief constituents of practically all organic compounds found in the body, especially fats, carbohydrates, and proteins. Nitrogen is an essential constituent of proteins.

These four elements make up 96 percent of the body weight and are supplied by carbohydrates, fats, and proteins in the foods we eat and in part by the water and beverages we drink and the oxygen in the air we breath.

Naturally occurring, inorganic substances are essential for human life, and provide a role in metabolic processes.

Bioavailability is the ease at which nutrients can be absorbed.

Electrolytes are made from minerals; these charged particles in a solution are capable of conducting electricity.

Soluble organic compounds aid certain metallic ions into the molecular structure. They are often used to increase absorption of minerals into the body.

5.1.5.1. MINERAL ELEMENTS AS BUILDING MATERIALS

Sherman groups the mineral elements in tissues into three classes:

1. as constituents of hard tissues-bones and teeth;
2. as essential elements of soft tissues, chiefly in organic compounds;
3. as constituents of body fluids-chiefly as soluble inorganic salts.

1. About 99 percent of the calcium and 90 percent of the phosphorus in the body are found in the bones and teeth.

2. Phosphorus is a constituent of the biologically important organic compound nucleoprotein, found in every cell nucleus.

In the vitally important nucleus are granules of chromatin, a complex protein that contains iron and is essential to the life of the cell. Iron, which is essential to the oxidative processes of the tissues by means of which their life is sustained, is also present in cytochrome in the protoplasm.

Sulfur is a constituent of cystine and methionine (amino acids built into tissue proteins) as well as of substances (vitamin B₁ or thiamine, glutathione) that function in oxidation-reduction processes, which in turn set free energy for life processes of cells.

Keratin, an insoluble protein found in skin, hair, and nails, is high in sulfur content.

Inorganic salts that contain sodium, potassium, calcium, magnesium, sulfur, phosphorus, and chlorine are also constant and important constituents of protoplasm of cells in the blood and soft tissues. Potassium salts are especially abundant in soft tissues, whereas sodium salts predominate in the body fluids.

The red corpuscles of the blood are special cells developed to carry oxygen to the tissues and remove the carbon dioxide that results from combustion of body fuel. Over 60 percent of the body's total iron content is concentrated in the hemoglobin in red cell of the blood.

3. The fluid tissues of the body are the blood plasma, lymph, and the interstitial fluids surrounding the cells.

Sodium chloride is by far the most abundant of the mineral constituents of the blood, but salts of practically all the more common mineral elements are also found in the body fluids.

5.1.5.1.1. MINERALS AND THEIR HEALTH EFFECTS

The minerals and their particular effects are:

- **CALCIUM** 800 - 1000 mg.
 - **Deficiency:** Heart arrhythmia, muscle cramping, and bone/ tooth weakening.
 - **Benefits:** Nerve transmissions, muscle contraction, bone and tooth density.
 - **Sources:** Milk, cheese, and green vegetables.
 - **Works with:** Vitamin A, C, D, and phosphorus.
 - **Interactions:** Excess saturated fat.
- **CHROMIUM** 50 - 200 mcg
 - **Deficiency:** Poor glucose tolerance.
 - **Benefits:** Energy from carbohydrate/glucose metabolism.

- **Sources:** Vegetable oils, yeast, whole grains.
 - **Works with:** Unknown.
 - **Interactions:** Excess iron.
-
- **COPPER** 2 - 3 mg
 - **Deficiency:** Anemia, weakness, and fatigue, bone fragility.
 - **Benefits:** Hemoglobin production, enzyme function.
 - **Sources:** Raisins, nuts, seeds, and organ meats.
 - **Works with:** Iron, zinc, and cobalt.
 - **Interactions:** Cadmium, exhaust fumes.
-
- **IODINE** 150 mcg
 - **Deficiency:** Enlarge neck/ thyroid gland.
 - **Benefits:** Production of thyroid hormone/ regulates metabolism.
 - **Sources:** Seafood, kelp, iodized salt.
 - **Works with:** Unknown.
 - **Interactions:** Unknown.
-
- **IRON** 10 - 18 mg
 - **Deficiency:** Anemia, fatigue, weakness, and brittle fingernails.
 - **Benefits:** Transport of oxygen/ enzyme function.
 - **Sources:** Nuts, green vegetables, whole grains.
 - **Works with:** Vitamin B6, B12, C, and folic acid. Fiber increases absorption.
 - **Interactions:** Excess saturated fat and protein.
-
- **MAGNESIUM** 300 - 400mg
 - **Deficiency:** Leg cramps, growth failure, nervousness, easily angered.
 - **Benefits:** Protein metabolism, nerve function, enzyme activity, and Artery health.
 - **Sources:** Whole grains, green vegetables, seafood.
 - **Works with:** Vitamin B6, C, calcium, and phosphorus.
 - **Interactions:** Excess Iron.
-
- **MANGANESE** 2.5 - 5.0 mg
 - **Deficiency:** Coordination and reproductive abnormalities.
 - **Benefits:** Fat metabolism, enzyme activity in reproduction, growth.
 - **Sources:** Eggs, nuts, green vegetables, whole grains.
 - **Works with:** Unknown.
 - **Interactions:** Excess sugar/ carbohydrates, cortisone, diuretics, coffee, and alcohol.
-
- **PHOSPHORUS** 800 - 1200 mg
 - **Deficiency:** Continuous thirst, dry skin, weak reflexes, general weakness.
 - **Benefits:** Nerve and muscle activity, kidney function, and bone/ tooth formation.
 - **Sources:** Eggs, meat, fish, poultry, cheese, grains.
 - **Works with:** Calcium, iron magnesium, manganese, vitamins A, and D.
 - **Interactions:** Oral contraceptives, phytic acid, and alcohol.

- **POTASSIUM** 99 mg
 - **Deficiency:** Irregular heartbeat, muscular weakness, and rapid build-up of lactic acid.
 - **Benefits:** Nerve and muscle function, pH balance of blood, body-water balance.
 - **Sources:** Sunflower seeds, dates, raisins, figs, peaches.
 - **Works with:** Sodium.
 - **Interactions:** Mercury, cadmium.
- **SELENIUM** 50 - 200 mcg
 - **Deficiency:** Irregular heart beat, heart muscle enlargement, and anemia.
 - **Benefits:** Antioxidant activity with vitamin E, protects cells and cell membrane.
 - **Sources:** Seafood, eggs, meat, whole grain, brown rice.
 - **Works with:** Vitamin E.
 - **Interactions:** Excess zinc and copper, coffee.
- **ZINC** 15 mg
 - **Deficiency:** Poor growth and wound healing, loss of sense of taste.
 - **Benefits:** Male hormone production and reproduction, wound healing.
 - **Sources:** Yeast, liver, whole grains, and sunflower seeds.
 - **Works with:** Absorption of Vitamin A, C, D, calcium, and phosphorus.
 - **Interactions:** Unknown.

5.1.5.1.2. MINERAL DEFICIENCIES

Deficiency of any mineral element may occur whenever assimilation from food is unusually poor, or whenever extra large amounts are lost from the body.

Considerable mineral losses may occur through vomiting, bleeding, excessive perspiration, diarrhea, or in the urine under certain conditions.

Mineral deficiencies are more serious and show up more quickly during the growth period or during pregnancy and lactation, when the quantities needed are larger.

Even in normal adults, small amounts of mineral elements are constantly excreted from the body, chiefly as salts in the urine, and these losses must be made up by the mineral elements taken in food if the body is not to become depleted.

Tissues that have a special need for certain elements naturally are the first to show the effects of an insufficient supply of the particular elements—for example, bones and teeth suffer first from a lack of calcium or phosphorus, the red blood corpuscles (hemoglobin) from a lack of iron, and the thyroid gland from a lack of iodine.

5.1.5.2. VITAMINS

5.1.5.2.1. DEFINITION

Vitamins may be defined as organic compounds, different from any of the previously described essential nutrients, which are needed in the diet only in small amounts but which are necessary for normal growth and the maintenance of health.

Vitamins differ from the mineral elements in that they are organic substances (some of them complex compounds), while they differ from hormones

in that (at least for the most part) they are not formed within the body but must be supplied in food.

5.1.5.2.2. DISTRIBUTION IN FOODS

The green leaves of the plant are its chemical laboratories in which vitamins are made along with many other substances.

Hence, green leafy vegetables have high content of most vitamins, as have also the green, growing shoots of plants. Seeds, such as legumes, nuts, and wholegrain cereals, also have a good content of certain vitamins.

Root vegetables and fruits and vegetables of high water content usually have a lower content of most vitamins, although there are notable exceptions in the case of certain vitamins or of special fruits and vegetables. It should be remembered that the different vitamins are often unevenly distributed in food, and the vitamin content of fruits and vegetables may vary, depending on the soil on which they are grown, their stage of ripeness when picked, conditions of storage, and other factors.

The lean flesh of animals (muscle meats) provides certain vitamins (especially vitamin B₁₂) but organs such as liver and kidneys are much richer in their vitamin content.

The content of certain vitamins in eggs and milk may vary according to the relative amount of vitamins in the animals' feed.

Fish store certain vitamins (A and D) in their body fat, especially in their livers. This accounts for the fact that fish liver oils are the richest source of these particular vitamins.

Naturally, the fat-soluble vitamins are found chiefly in fatty foods—liver, butter, egg, etc.

Water-soluble vitamins are more abundant in fruits and vegetables, whole grains and legumes, and lean meats.

Milk carries both water-soluble and fat-soluble vitamins—the latter in the fat globules.

• FAT-SOLUBLE VITAMINS

The fat-soluble vitamins are: A, D, E, K.

➤ VITAMIN A

Vitamin A is a family of compounds that includes retinol, retinal, and carotenoids. Retinol and retinal are found in foods of animal origin, such as liver and eggs. These forms of the vitamin are ready to be used by the body directly from the food source and are called preformed vitamin A. The carotenoids are a group of fat-soluble pigments found in orange, dark yellow, and dark green vegetables and fruits. Some carotenoids like beta-carotene can be converted to vitamin A once ingested and are called a provitamin form of vitamin A.

- Sources:

Vitamin A can be found in animal livers, fish, liver oil, egg, butter and green and yellow fruits and vegetables. Foods that contain significant amounts include apricots, asparagus, beet greens, broccoli, cantaloupe, carrots, collards, dandelion greens, dulse, fish liver and fish liver oil, garlic, kale, mustard greens, papayas, peaches, pumpkin, red peppers, spirulina, spinach, sweet potatoes, Swiss chard, turnip greens, watercress, and yellow squash. It is also present in the following herbs: alfalfa, borage leaves, burdock root, cayenne (capsicum), chickweed, eyebright, fennel seed, hops, horsetail, kelp, lemongrass, mullein, nettle, oat

straw, paprika, pepper mint, plantain, raspberry leaf, red clover, rose hips, sage, uva ursi, violet leaves, watercress, and yellow dock.

- **Dose:** minimum 5000 ui/day;
- **Benefits:** growth, vision, healthy tissue - skin hair, resistance to infection. Beta-carotene has a protective effect against cigarette-smoking cancers: lung, pancreas, larynx, esophagus, bladder, and stomach.
- **Deficiency:** night blindness, itching, dry skin, loss of sense of taste.
- **Overdose:**

Acute overdose: Bleeding gums, sore mouth, confusion or unusual excitement, diarrhea, drowsiness or dizziness, double vision, severe headache, irritability, peeling skin especially on lips and palms, and severe vomiting.

Chronic overdose: Drying or cracking of skin or lips, bone or joint pain, fever, general feeling of discomfort, increased sensitivity of skin to sunlight, increased urination, loss of appetite, hair loss, stomach pain, unusual fatigue, yellow-orange patches on soles of feet, palms and hands, or around the nose and lips.

Beta-carotene on the other hand is non-toxic. Large amounts of dark green, yellow, or orange fruits and vegetables can be consumed over long periods without any significant adverse effects. There may only be a harmless yellowing of skin, which disappears when fruit and vegetable intake is reduced.

- **Works with:** vitamins C,D,E,Niacin, Pantothenic acid, and zinc.
- **Interactions:** Alcohol, coffee, cortisone, mineral oil, nitrates.

➤ VITAMIN D (CHOLECALCIFEROL)

Vitamin D can be produced in the body through sunlight but it can also be acquired through food. In old age the ability to produce the vitamin decreases, therefore, the need for longer exposure to sunlight increases and there is greater dependency on dietary sources for its intake. Vitamin D aids in the formation and maintenance of normal bones and teeth.

- Sources

The most reliable dietary source of vitamin D is vitamin D-fortified milk. Some forms of dried or evaporated milk also contain this vitamin although it is not found in goat's milk. Other sources include cod liver oil and other fish oils, salmon, saltwater fish, herring, mackerel, sardines and a few processed cereals. Sunlight is another significant source of the vitamin. Dietary sources, which have varying amounts of the vitamin, include liver, egg yolk, butter, and cream. Vegetables are poor sources of this vitamin.

- **Dose:** minimum 400 ui/day;
- **Benefits:** bones, teeth, optimum calcium-phosphorus metabolism.
- **Deficiency:** soft bones and teeth, spontaneous fractures, bone curvature;
- **Overdose**

Acute overdose: none

Chronic overdose: Premature heart attack, diarrhea, dermatitis, headache, nausea, general weakness, loss of appetite, irreversible kidney and heart damages, retarded growth, mental retardation, and atherosclerosis.

- **Work with:** vitamin A, C, calcium, and phosphorus.
- **Interactions:** mineral oil.

> VITAMIN E (TOCOPHEROL)

Vitamin E belongs to a family of fat-soluble compounds. It is available in different forms, the most common and potent being alpha tocopherol. Its main function is as an antioxidant. It prevents destruction of fats and vitamin A in the body by oxygen fragments. The vitamin also helps in the production of hormone-like substances that regulate blood pressure, reproduction, and muscle contraction.

- Sources

The richest dietary sources of vitamin E are brown rice, commeal, dulse, eggs, kelp, milk, nuts, vegetable oil, seeds, and wheat germ. Among plants, the vitamin is found in asparagus, avocados, broccoli, dried prunes, peaches, spinach, and whole grain breads and cereals. Foods of animal origin are usually poor sources of the vitamin.

Herbs that contain the vitamin include bladder wrack, dandelion, dong qual, flaxseed, nettle, oat straw, raspberry leaf, and rose hips.

- **Dose:** minimum 30 ui/day;

- **Benefits:** antioxidant, protects cell membrane and tissue; helps maintain the circulatory system.

- **Deficiency:** poor muscular and circulatory performance;

- **Overdose**

Acute overdose: Large dose of vitamin E interfere with vitamin K activity and may result in prolonged bleeding.

Chronic overdose: None.

- **Interactions:** birth control pills, mineral oil, air pollution.

> VITAMIN K (MENADIONE)

There are three natural and one synthetic forms of vitamin K. However, for purposes of absorption, all these forms require a small amount of dietary fat in the intestine. Vitamin K is an essential nutrient for bone formation and repair.

- Sources

Half of the daily intake of vitamin K comes from bacterial synthesis in the intestine. Significant dietary sources of the vitamin are green or leafy vegetables, such as broccoli, cabbage, cauliflower, romaine lettuce, and turnip greens. Some of the other less significant sources of the vitamin include cheese, egg yolk, and liver.

Herbs that contain the vitamin are green tea, kelp, nattle, oat straw, and shepherd's purse.

- **Dose:** is not establish.

- **Overdose**

Acute overdose: Jaundice among infants leading to the degeneration of the brain, and flushing and sweating among adults.

Chronic overdose: None.

- **Interactions:** aspirin, antibiotics, mineral oil, x-ray therapy, and rancid fat.

• WATER-SOLUBLE VITAMINS

The water-soluble vitamins are: B₁, B₂, B₆, B₁₂, C, pantothenic acid, biotin, folic acid.

➤ VITAMIN B₁ (THIAMINE, ANEURINE)

Vitamin B₁ was the first vitamin identified in rice bran extracts. Lack of vitamin B₁ causes the deficiency disease Beriberi. Nowadays in the Western world the vitamin B₁ deficiency is mainly found as a consequence of extreme alcoholism.

- **Sources:** lean meat, pork, liver, and poultry, milk cereals.
- **Dose:** minimum 1.5 mg/day.
- **Benefits:** energy production, heart and cardiovascular system, growth digestion, nervous system.
- **Deficiency:** Depression, fatigue, poor appetite, pins and needles in legs.
- **Works with:** vitamins B₁₂ and C.
- **Interactions:** physical and mental stress, alcohol, coffee, tobacco, sugar.

➤ VITAMIN B₂ (RIBOFLAVIN)

- **Sources:** lean meat, yeast, milk, eggs, and cereal, green leafy vegetables.
- **Dose:** minimum 1.7 mg/day.
- **Benefits:** antibody and red cell formation, tissue and skin repair.
- **Deficiency:** light sensitivity to eyes, sore tongue, cracks at mouth.
- **Work with:** vitamin A, B₁ and niacin.
- **Interactions:** physical and mental stress, alcohol, coffee, tobacco.

➤ VITAMIN B₆ (PIRIDOXINE)

- **Sources:** meat, wheat germ, cereal, yeast, vegetables, bananas.
- **Dose:** minimum 2 mg HCl.
- **Benefits:** Healthy red blood cells, teeth, gums, blood vessels, nervous system.
- **Deficiency:** fatigue, anemia, nerve dysfunction, irritability.
- **Works with:** vitamin C, Biotin, Pantothenic acid, niacin, and magnesium.
- **Interactions:** birth control pills, alcohol, coffee, and tobacco.

➤ VITAMIN B₁₂ (CYANOCOBALAMIN)

- **Sources:** lean meat, fish, liver, milk.
- **Dose:** minimum 3 mcg/day.
- **Benefits:** development of red blood cells, growth, and nervous system maintenance.
- **Deficiency:** anemia, weakness, fatigue, and red-sore tongue, nerve degeneration.
- **Works with:** vitamin A, B₁, B₆, niacin, and biotin, pantothenic acid.
- **Interaction with:** calcium deficiency, alcohol, coffee, and tobacco.

➤ FOLIC ACID

- **Sources:** meat, yeast, and leafy green vegetables.

- **Deficiency:** anemia, pale tongue, and intestinal problems.
- **Works with:** vitamin C, B₆, B₁₂, and niacin.
- **Interactions:** sulfa drugs, oral contraceptives, alcohol, tobacco, stress.

➤ **VITAMIN C (ASCORBIC ACID)**

- **Sources:** citrus fruit, tomatoes, cabbage, and vegetables.
- **Dose:** 60 mg/day.
- **Benefits:**
- **Deficiency:** bruising, wound healing, tooth/gum defects, and aching joints.
- **Works with:** vitamin A, B₆, and pantothenic acid, zinc.
- **Interactions:** aspirin, cortisone, and antibiotics, stress.

➤ **VITAMIN P (BIOFLAVONOIDS)**

- **Sources:** skin and pulp of fruit.
- **Dose:** -
- **Benefits:** blood vessel wall maintenance, healthy capillaries and veins.
- **Deficiency:** eczema, colds, bleeding gums.
- **Works with:** vitamin C.
- **Interactions:** aspirin, antibiotics, cortisone, and tobacco.

5.1.5.2.3. GENERAL USES OF VITAMINS IN THE BODY

Although individual vitamins have special functions, as a group of body regulators they share in certain functions such as:

1. The promotion of growth;
2. The promotion of ability to produce healthy offspring;
3. The maintenance of health and vigor through promoting:
 - Normal functioning of the digestive tract;
 - Normal nutrition, especially utilization of mineral elements and metabolism of energy nutrients;
 - Nervous stability;
 - Health of tissues and resistance to bacterial infections.

5.2. THE FOODS

5.2.1. MILK AND MILK PRODUCTS

5.2.1.1. MILK AND CHEESE

Milk is the sole natural food for the human infant for the first few month of life. After about 3 to 6 month it is desirable to give supplementary foods and gradually wean the infant on to a good mixed diet.

In this process milk slowly loses its dominant place in the infant's diet, but for the first two years of life it is important that milk should remain the largest single item of food.

From the age of 2 years and until growth ceases, children grow rapidly and reach maturity sooner if given ample quantities of milk. Increased growth rates are generally associated with improved health and vitality and with relative freedom from disease. All nutritionists agree that a regular intake of milk is good for invalids, especially for patients with acute illnesses.