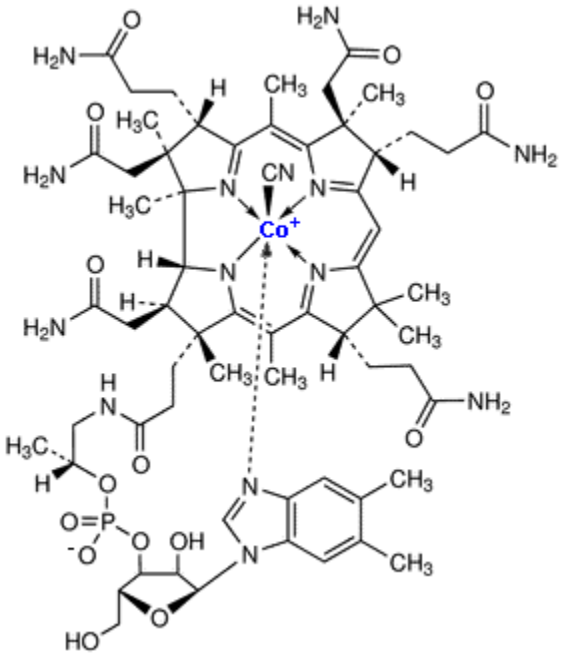
VITAMINS

WATER SOLUBLE VITAMINS: B AND C, BIOMEDICAL IMPORTANCE IN MAN AND ANIMALS.

VITAMIN B12;- CYANOCOBALAMINE

It is a hemopoeitic vitamin required for maturation o RBCs, and also involved in nucleic acid metabolism, methyl transfer, and myelin synthesis and repair. It serves as a carrier of one carbon group in metabolic reactions. The compound is composed of physiologically active substances classified as cobalamines or corronoids which is made up of tetrapyrole rings surrounding a central cobalt atom and nucleotide side chains. It has a molecular weight of about 1355.

Sources include clams, oysters, turkey, chicken, beef, and pork. Absorption is under the influence of an intrinsic factor, which takes place in the terminal ileum, it is then released from the factor and transported into blood. it is stored in liver and released to meet plasma needs. Excess vit. B12 is excreted by the kidneys.



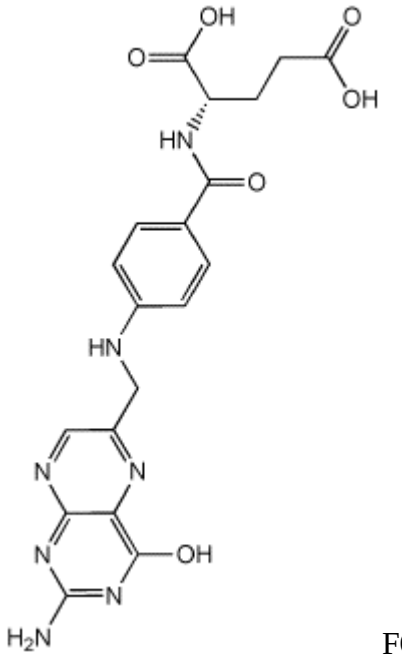
CYANOCOBALAMINE (VITAMIN B12)

FOLIC ACID

This consists of one molecule of P-aminobenzoic acid and glutamate to which a base, pteridine, has been attached sometimes (rarely) referred to as vitamin B-9, it is also is involved in maturation of red blood cells and the synthesis of purines and pyrimidines which are required for development of the fetal nervous system.

Sources include dried peas, dried beans, yeast, and leafy green vegetables such as spinach, endive, lettuce, and mustard greens.

It is absorbed in the duodenum and upper jejunum.



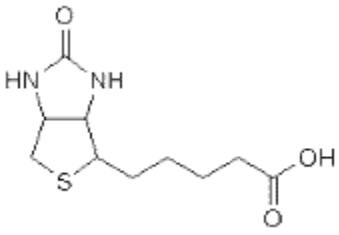
FOLIC ACID

BIOTIN

This is an imidazole derivative, chemical name – Cis-tetrahydro-2-oxothienol [3,4-d]-imidazole-4- valeic acid.

Liver, egg yolks, green vegetables, and whole grains are rich sources of biotin. It acts as a coenzyme for carboxylation reactions essential to fat and carbohydrate metabolism e.g. pyruvate carboxylase, acetyl co A carboxylase, serving as a carrier on the enzyme.

Avidin found in egg white binds biotin and makes it unavailable for absorbtion into the body. Biocytin a form of biotin is readily absorbed and in the plasma is hydrolyzed to biotin and taken up by tissues for use attached to an apoenzyme. By products of biotin in form of biotin sulfoxides and bisnorbiotin (trace amounts) is excreted along with free vitamins.



BIOTIN

VITAMIN B6 (PYRIDOXINE)

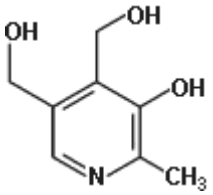
Derivatives of pyridines and their phosphates including pyridoxine, pyridoxal and pyridoxamine.

Sources include brewer's yeast, liver, mackerel, avocado,, bananas, meat, vegetables and eggs. Vitamin B6 is readily absorbed by intestinal mucosa cells that contain cytoplasmic pyridoxal kinase that catalyse the phosphorylation of the vitamin form, which is then absorbed to other cells by diffusion (the active form of the vit is the phosphate form especially pyridoxamine-5-phosphate).

B6 serves as a coenzyme in the catalysis of transamination, decarboxylation and threonine aldolase reactions. Vitamin B6 is important in the biosynthesis of heme and nucleic acid, as well as in lipid, carbohydrate, and amino acid metabolism. As a coenzyme in the breakdown of

glycogen-phophorylase and in condensation of L-serine with palmitoyl Co A to form sphingomyelins.

The main by product of vit B6 metabolism is excreted in urine as 4-pyrodoxic acid formed by oxidation of the aldehyde and aldehyde dehydrogenation.

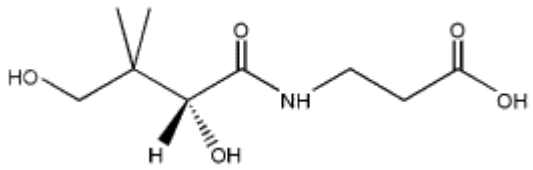


PYRIDOXINE(VITAMIN B6)

PANTOTHENIC ACID

This is a combination of pantoic acid and β-alanine. Also called vit B5. It is richly distributed in foods- whole grain cereals, legumes, eggs, and meat. It is critical in the metabolism and synthesis of carbohydrates, proteins, and fats.

It is readily absorbed in the intestine and goes into the cell for the formation of coenzymes. It is absorbed as pantetheine and pantothenate into circulation and it is within the cells that coenzyme forms are synthesized. The β-mecarptoethylamine derivative is excreted in urine and smaller fractions excreted in milk and colostrums.



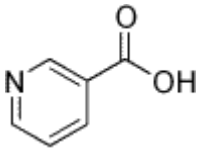
PANTOTHENIC ACID

NIACIN

This comprises nicotinic acid and nicotinamide. It can be synthesized from tryptophan in man but cats lack the metabolizing enzymes. Derivatives include nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP), which are coenzymes in oxidation-reduction reactions vital in cell metabolism.

Sources include most plants and animal products, mushrooms and fish are good sources of niacin.

Both the acid and amide forms are readily absorbed in the GIT into circulation from where it diffuses into the cerebrospinal fluid. They are converted to the coenzyme forms in the liver, kidney blood and brain cells. Metabolites of this vitamin are excreted in urine.



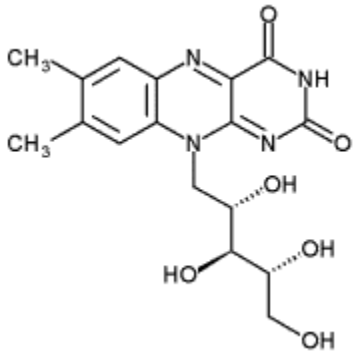
NIACIN

RIBOFLAVIN

Riboflavin – 7,8 dimethyl[1′-D-ribityl] isoalaxazine; a heterocyclic isoalloxazine ring attached to a sugar alcohol, ribitol. The coenzyme forms are flavin mononucleotide (FMN) and flavin adenine dinucleotide (FAD). It is involved in carbohydrate metabolism as an essential coenzyme in many oxidation-reduction reactions.

Sources are yeast, liver, kidney, heart and vegetables. It is synthesized in plants and microorganisms. Coenzyme forms of the vitamin release riboflavin during digestion in the intestine upon acidification in the stomach, it is absorbed in the proximal small intestine aided by bile salts and hen absorbed into cells the flavins are converted to the coenzymes.

Excess riboflavin is excreted in urine and to a lesser extent in feces.



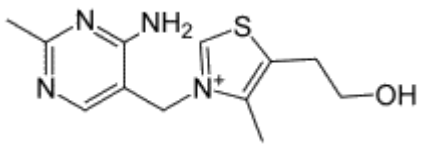
RIBOFLAVIN

THIAMIN(B1)

Thiamin is 3-[4-amino-2-methyl-pyrimidyl-5- methyl]-4-methyl-5-[β-hydroxyethyl] thiazole. The active coenzyme form is thiamin pyrophosphate (TPP) or the diphosphate. It is widely available in the diet. Small amounts are present in animal and plant tissues but are more abundant in unrefined cereals grains, liver ,heart, kidney and pork.

Thiamin is involved in carbohydrate, fat, amino acid, glucose, and alcohol metabolism, coenzyme in transketolase reactions etc.

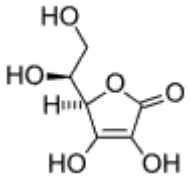
It is readily absorbed by the small intestine by active transport process and phosphorylated to TPP in the jejuna mucosa, then to portal blood. The diphosphate or triphosphate forms maybe stored in minute quantities in skeletal muscles, liver, heart and nervous tissue. Excess and metabolites of thiamin are excreted in urine.



THIAMIN (VIT.B1)

VITAMIN C

Vitamin C (ascorbic acid) plays a role in collagen, carnation, hormone, and amino acid formation. It is essential for wound healing and facilitates recovery from burns. Vitamin C is also an antioxidant, supports immune function, and facilitates the absorption of iron. Higher amounts can cause stomach upset and diarrhea. Vitamin C is found in fresh fruits and vegetables. Citrus fruits like oranges and lemons are good sources of vitamin C.

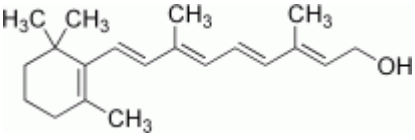


VITAMIN C

FAT SOLUBLE VITAMINS A,D,E,K THEIR BIOCHEMICAL FUNCTIONS IN MAN AND ANIMALS

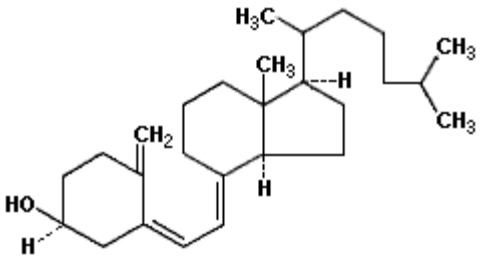
VITAMIN A

Vitamin A (retinol) is required for the formation of rhodopsin, a photoreceptor pigment in the retina. Vitamin A helps maintain epithelial tissues. Normally, the liver stores 90% of the body's Vitamin A. To use Vitamin A, the body releases it into the circulation bound to prealbumin (transthyretin) and retinol-binding protein. β-carotene and other provitamin carotenoids, contained in green leafy and yellow vegetables and deep- or bright-colored fruits, are converted to Vitamin A. Carotenoids are absorbed better from vegetables when they are cooked or homogenized and served with some fats or oils. Deficiency impairs immunity and causes skin rashes and typical ocular effects such as dry eyes and night blindness.



VTAMIN D

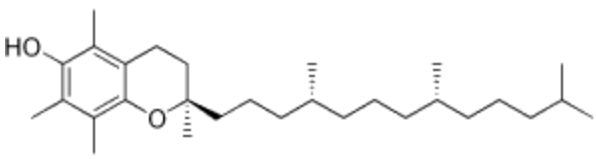
Vitamin D has two main forms: D2 (ergocalciferol) and D3 (cholecalciferol). Vitamin D3 is synthesized in skin by exposure to sunlight (ultraviolet radiation) and obtained in the diet chiefly in fish liver oils and egg yolks. Vitamin D is a prohormone with several active metabolites that act as hormones. Vitamin D3 is metabolized by the liver to 25(OH)D, which is then converted by the kidneys to 1,25(OH)2D (1,25-dihydroxycholecalciferol, calcitriol, or active vitamin D hormone). 25(OH)D, the major circulating form, has some metabolic activity, but 1,25(OH)2D is the most metabolically active. Inadequate exposure to sunlight may cause vitamin D deficiency. Deficiency impairs bone mineralization and may contribute to osteoporosis.



CHOLECALCIFEROL
(VITAMIN D_3)

VITAMIN E

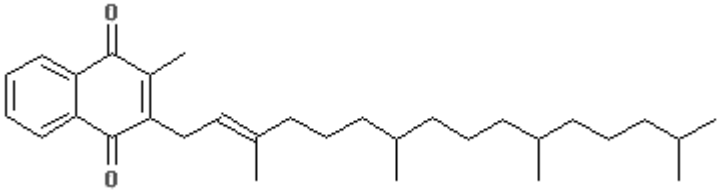
Vitamin E is a group of compounds (including tocopherols and tocotrienols) that have similar biologic activities. The most biologically active is α-tocopherol, but β-, γ-, and δ-tocopherols also have important biologic activity. These compounds act as antioxidants, which prevent lipid peroxidation of polyunsaturated fatty acids in cellular membranes. Plasma tocopherol levels vary with the total plasma lipid levels. Vitamin E deficiency causes degeneration of the axons of neurons (nerve cells) resulting in neurologic deficits, and fragility of red blood cells which is generally diagnosed as hemolytic anemia. Vitamin E is found in spinach, watercress, mustard greens, and many green leafy vegetables. Good sources of Vitamin E are oily plant seeds such as peanuts and sunflower kernels.



ALPHA-TOCOPHEROL (VITAMIN E)

VITAMIN K

Vitamin K1 (phylloquinone) is dietary vitamin K. Dietary fat enhances its absorption. Vitamin K2 refers to a group of compounds (menaquinones) synthesized by bacteria in the intestinal tract; the amount synthesized does not satisfy the vitamin K requirement. Vitamin K controls the formation of coagulation factors II (prothrombin), VII, IX, and X in the liver. Vitamin K is widely distributed in green vegetables such as kale, spinach, and mustard greens. The bacteria of the normal gut also synthesize menaquinones.



VITAMIN K_1 (PHYLLOQUINONE)