

1. Coenzyme: A substance that enhances the action of an enzyme. (An enzyme is a protein that functions as a catalyst to mediate and speed a chemical reaction).

Coenzymes are small molecules. They cannot by themselves catalyze a reaction but they can help enzymes to do so. In technical terms, coenzymes are organic nonprotein molecules that bind with the protein molecule (apoenzyme) to form the active enzyme (holoenzyme).

A number of the water-soluble vitamins such as vitamins B1, B2 and B6 serve as coenzymes.

1b. Differences between fat soluble and water soluble vitamins.

Water-Soluble Vitamins

Water-soluble vitamins are those that are dissolved in water and readily absorbed into tissues for immediate use. Because they are not stored in the body, they need to be replenished regularly in our diet. Any excess of water-soluble vitamins is quickly excreted in urine and will rarely accumulate to toxic levels. With that being said, certain types of water-soluble vitamin, such as vitamin C, can cause diarrhea if taken in excess.

The water-soluble vitamins include the B-complex group and vitamin C, each of which offers the following health benefits:

Vitamin B1 (thiamine) helps to release energy from foods and is important in maintaining nervous system function.

Vitamin B2 (riboflavin) helps promotes good vision and healthy skin and is also important in converting the amino acid tryptophan into niacin.

Vitamin B3 (niacin) aids in digestion, metabolism, and normal enzyme function as well as promoting healthy skin and nerves.

Vitamin B6 (pyridoxine) aids in protein metabolism and the production of red blood cell, insulin, and hemoglobin.

Folate (folic acid) also aids in protein metabolism and red blood cell formation and may reduce the risk of neural tube birth defects.

Fat-Soluble Vitamins

Fat-soluble vitamins are dissolved in fats. They are absorbed by fat globules that travel through the small intestines and distributed through the body in the bloodstream. Unlike water-soluble vitamins, excess fat-soluble vitamins are stored in the liver and fatty (adipose) tissues for future use. They are found most abundantly in high-fat foods and are better absorbed if eaten with

fat. Because fat-soluble vitamins are not readily excreted, they can accumulate to toxic levels if taken in excess. Where a well-balanced diet can't cause toxicity, overdosing on fat-soluble vitamin supplements can.

There are four types of fat-soluble vitamin, each of which offers different benefits:

Vitamin A is integral to bone formation, tooth formation, and vision. It contributes to immune and cellular function while keeping the intestines working properly.

Vitamin D aids in the development of teeth and bone by encouraging the absorption and metabolism of phosphorous and calcium.

Vitamin E is an antioxidant that helps fight infection and keeps red blood cells healthy.

C. Niacin

Niacin is a coenzyme, like thiamine and riboflavin, that is responsible for energy release from carbohydrates. A niacin deficiency can lead to pellagra, a disabling disease with symptoms that may be characterized by four "Ds": depression, diarrhea, delirium and dementia.

Niacin is found in fortified breads and cereals. Protein foods, such as eggs, fish, meat, dairy milk and poultry, are naturally rich in niacin. They are also plentiful in the amino acid tryptophan, which can be synthesized into niacin by the liver. Chicken breast, ground beef, halibut, tuna and turkey are particularly good sources of tryptophan. In the vegetable kingdom, asparagus, baked potatoes and cantaloupe have significant amounts of tryptophan.

Niacin has been used to lower LDL cholesterol and raise HDL cholesterol when administered as a drug under medical guidance. In heavy doses, niacin has been known to cause a "niacin flush" due to the capillaries increasing in size. This condition can lead to fatigue and even liver damage. Caution should be used if one is taking niacin or B-complex supplements.

Sources of niacin: eggs, fish, legumes, meats nuts, peanuts, poultry, pork

Roles in body: coenzyme, digestive and nervous system functions, healthy skin

Deficiency: appetite loss, confusion, fatigue, flaky skin, indigestion, pellagra

Toxicity: cramping, flushing, headaches, irregular heartbeat, irritated ulcers, liver dysfunction

Cooking Foods with Niacin

Niacin is one of the more stable water-soluble vitamins and is minimally at risk for destruction by air, heat or light.

The adult RDA for niacin is 14 to 16 milligrams of niacin equivalents (NE) daily.