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Coenzymes are any of a number of freely diffusing organic compounds that function as cofactors with enzymes in promoting a variety of metabolic reactions. Coenzymes participate in enzyme-mediated catalysis in stoichiometric (mole-for-mole) amounts, are modified during the reaction, and may require another enzyme-catalyzed reaction to restore them to their original state. Examples include nicotinamide adenine dinucleotide (NAD), which accepts hydrogen (and gives it up in another reaction), and ATP, which gives up phosphate groups while transferring chemical energy (and reacquires phosphate in another reaction). Most of the B vitamins (see vitamin B complex) are coenzymes and are essential in facilitating the transfer of atoms or groups of atoms between molecules in the formation of carbohydrates, fats, and proteins.

2.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.

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.

Vitamin B12 (cobalamin) aids in the production of normal red blood cells as well as the maintenance of the nervous system.

Biotin helps release energy from carbohydrates and aids in the metabolism of fats, proteins, and carbohydrates from food.

Pantothenic acid aids in metabolism and the formation of hormones.

Vitamin C (ascorbic acid) is central to iron absorption and collagen synthesis. It aids in wound healing and bone formation while improving overall immune function.

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.

Vitamin K is central to blood clotting and also keeps bones healthy.

3)

***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 **Biochemical function**

Niacin (or vitamin B3) is a water-soluble [B vitamin](https://www.sciencedirect.com/topics/neuroscience/b-vitamins) that has multiple necessary biologic effects, particularly energy metabolism. Niacin is defined collectively as nicotinamide and [nicotinic acid](https://www.sciencedirect.com/topics/medicine-and-dentistry/niacin), both of which fulfill the vitamin functions of niacin carried out by the bioactive forms NAD(P). Niacin is converted to NAD, [NADH](https://www.sciencedirect.com/topics/medicine-and-dentistry/reduced-nicotinamide-adenine-dinucleotide), which serve necessary roles in oxidative respiration as electron carriers. [NADP](https://www.sciencedirect.com/topics/medicine-and-dentistry/nicotinamide-adenine-dinucleotide-phosphate) and [NADPH](https://www.sciencedirect.com/topics/medicine-and-dentistry/reduced-nicotinamide-adenine-dinucleotide-phosphate) are also niacin-dependant biomolecules which are important in synthesis of [nucleic acids](https://www.sciencedirect.com/topics/medicine-and-dentistry/nucleic-acid), [fatty acids](https://www.sciencedirect.com/topics/medicine-and-dentistry/fatty-acid), and cholesterol. Therefore, it plays an important role in [DNA repair](https://www.sciencedirect.com/topics/neuroscience/dna-repair) and production of [steroid hormones](https://www.sciencedirect.com/topics/medicine-and-dentistry/steroid-hormone). Niacin could also have a major impact on decreasing the risk for cardiovascular disease as well as treatment of cancer.