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## **COENZYMES**

Some enzymes require an additional nonprotein component for its optimum activity. This additional component is called cofactor which may be either loosely or tightly bound to the protein portion of the enzyme, the cofactor which is an organic compounds is called **coenzyme**

## **DIFFERENCE BETWEEN FAT SOLUBLE AND WATER SOLUBLE VITAMINS**

- Water soluble vitamins function as precursor for coenzymes and antioxidants while fat soluble vitamins function as coenzymes, hormones and antioxidants.
- Water soluble vitamins are usually non-toxic since excess amounts of these vitamins are excreted in the urine, while fat soluble vitamins are toxic and even lethal when taken in excessive quantities.
- Water soluble vitamins are not stored extensively except vitamin B12, and so their intake has to be more frequent than that of other fat soluble vitamins which are stored.

## **Niacin (Vitamin B3)**

### **Structure**

Niacin is a general name for the nicotinic acid and nicotinamide, either of

which may act as a source of the vitamin in the diet. Niacin is a simple derivative of pyridine.

### **Active form**

Active forms of niacin are:

- Nicotinamide adenine dinucleotide (NAD<sup>+</sup>)
- Nicotinamide adenine dinucleotide phosphate

(NADP<sup>+</sup>)

### **Sources**

- Yeast, liver, legumes and meats are major sources of niacin.
- Limited quantities of niacin can also be obtained from the metabolism of tryptophan. For every 60 mg of tryptophan, 1 mg equivalent of niacin can be generated.

### **FUNCTIONS**

- 1). Niacin is a precursor of coenzymes, nicotinamide adenine dinucleotide (NAD<sup>+</sup>) and nicotinamide adenine dinucleotide phosphate (NADP<sup>+</sup>).
- 2). NAD<sup>+</sup> and NADP<sup>+</sup> are involved in various oxidation and reduction reactions catalyzed by dehydrogenases in metabolism.
- 3). They are, therefore involved in many metabolic pathways of carbohydrate, lipid and protein.

Generally, NAD<sup>+</sup> linked dehydrogenases catalyze oxidation-reduction reactions in oxidative pathways, e.g. citric acid cycle and glycolysis.

- 4). Whereas NADP<sup>+</sup> linked dehydrogenases or reductases are often

found in pathways concerned with reductive synthesis, e.g. synthesis of cholesterol, fatty acid and pentose phosphate pathways.

5). Selected examples of enzymes and the reactions they catalyze are given in

### **Nutritional Requirement**

- The RDA for niacin is 15 to 20 mg.
- Tryptophan can only provide about 10% of the total niacin requirement.

### **Deficiency Manifestation**

Pellagra

- Deficiency of niacin in human causes pellagra, a disease involving the:  
Skin
- Gastrointestinal tract
- Central nervous system.
- The symptoms of pellagra are characterized by three 'Ds':

1. Dermatitis
2. Diarrhea
3. Dementia and if not treated death.

Dermatitis: Skin inflammation is seen in any area exposed to direct sunlight.

Diarrhea: Frequent diarrhea nausea, vomiting, anorexia are the disorders of GI tract.

Dementia: Dementia (loss of memory) is associated with degeneration of

nervous tissues.

- To produce niacin deficiency, diet must be poor in both available niacin and tryptophan. Niacin

deficiency occurs in:

- Population dependent on maize (corn) or sorghum (jowar) as the staple food.
- Deficiency of vitamin B6 (pyridoxal phosphate) leads to niacin deficiency as it is involved as a coenzyme in the pathway of synthesis of niacin from tryptophan.
- Malignant carcinoid syndrome in which tryptophan metabolism is diverted to formation of serotonin.
- In Hartnup disease, a genetic disorder in which tryptophan absorption and transportation is impaired.

### **Therapeutic Uses of Niacin**

Nicotinic acid (not nicotinamide), used at high doses (1–2 gm/day), has been shown to lower total cholesterol, LDL cholesterol and VLDL triglyceride in patients with hyperlipoproteinemias.

### **Toxicity**

High intake of the vitamin has undesirable side effects, mainly vasodilation and flushing and also liver damage.