Vitamin B6 (Pyridoxine)

Vitamin B6 is a water soluble vitamin that is converted in the body to its active form, pyridoxal phosphate. It is an important cofactor in many metabolic reactions. In amino acid metabolism, pyridoxal phosphate facilitates transamination and decarboxylation reactions. Pyridoxal phosphate is a necessary cofactor for the enzymes glycogen phosphorylase and cystathionine synthase. Additionally, it facilitates heme synthesis and the conversion of tryptophan to niacin. Several neurotransmitters are also dependent on vitamin B6 as a cofactor in their synthesis pathways. Vitamin B6 deficiency can cause decreased activity of these enzymes and reactions leading to a range of clinical manifestations including hyperirritability, seizures, peripheral neuropathy, sideroblastic anemia, and niacin deficiency.



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Pyridoxal Phosphate
Pirate-duck with Phosphate-Ps
Vitamin B6 is a water soluble vitamin that is activated to the form pyridoxal phosphate, a cofactor in many reactions in body.

Mechanism

Transamination
Trans-am-car
Transamination refers to a reaction between an amino acid, which contains an amine (NH2) group and a keto acid, which contains a keto (=O) group. In this reaction, the NH2 group on one molecule is exchanged with the keto group on the other. Pyridoxal phosphate is an important cofactor in transamination reactions, which play an essential role in providing amino acids as substrates for gluconeogenesis.

Decarboxylation
(D) Dog in Cardboard-box with Lace
Decarboxylation reactions refer to reactions in which a carbon is removed from a carbon chain, typically released as carbon dioxide. Vitamin B6 is an important cofactor in decarboxylation reactions.

Glycogen Phosphorylase
Glider with Phosphate-P-lace
Vitamin B6 is a required coenzyme for glycogen phosphorylase, which catalyzes the rate limiting step in glycogenolysis. This reaction releases glucose-1-phosphate molecules from glycogen, mobilizing the body’s glucose stores.

Cystathionine Synthase
Sisters-with-thimbles
This enzyme catalyzes the conversion of homocysteine to cystathionine, and requires pyridoxal phosphate as a cofactor. Deficiency of vitamin B6 can lead to accumulation of homocysteine and cause homocystinuria.

Functions

Heme Synthesis
Heme-man
Pyridoxal phosphate is a cofactor for the enzyme ALA synthase in the heme synthesis pathway. In this way vitamin B6 is crucial for the formation of heme which is incorporated into hemoglobin. Vitamin B6 deficiency can therefore lead to an anemia called sideroblastic anemia.

Niacin Synthesis
Nice-sun
Vitamin B6 is required for the metabolic conversion of tryptophan to niacin. A vitamin B6 deficiency can impair this conversion and lead to niacin deficiency in the body.

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Neurotransmitter Synthesis

Nerve-transmitter

Vitamin B6 plays an important role in several neurochemical pathways. These include the synthesis of neurotransmitters such as serotonin, dopamine, epinephrine, norepinephrine, and GABA. Histamine synthesis also depends on vitamin B6.

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