

Vitamins B6 and B12

Water-Soluble Vitamins	<p>B vitamins Thiamin (B1), riboflavin (B2), niacin (B3), pantothenic acid (B5), pyridoxine (B6), biotin (B7), cobalamin (B12), folate</p> <p>Characteristics: 1-Not significantly stored in the body 2-Must be supplied regularly in the diet 3-Excess excreted</p>
Vitamin B Complex	<p>1-Present in small quantities in different types of food 2-Important for growth and good health 3-Help in various biochemical processes in cell 4-Function as coenzymes</p>

Vitamin B₆

Has three forms :
1-Pyridoxine, 2-Pyridoxal, 3-Pyridoxamine
All 3 are converted to **** active form**** : pyridoxal phosphate (PLP)
Functions of Vitamin B₆ :
1-Transamination
2-Deamination
3-Decarboxylation
4-Condensation reactions

Transamination



Convert alanine to pyruvate by : Alanine Aminotransferase (ALT) enzyme and converting **alpha-KG** to **glutamate** by pyridoxal phosphate (PLP)

Decarboxylation

- 1-Formation of Chatecholamines: Dopamine, norepinephrine and epinephrine
- 2- Formation of histamine
- 3- Formation of Serotonin

Condensation reactions

Formation of **ALA** by **ALA synthase**, **The regulatory step in hemoglobin synthesis**
(ALA) = Aminolevulinic acid

Disorders of Vitamin B6 Deficiency	<p>A-Dietary deficiency : (rare) 1-Newborn infants fed on formulas low in B6, 2-Women on oral contraceptives, 3-Alcoholics. * Isoniazid treatment for tuberculosis can lead to vitamin B₆ deficiency by forming inactive derivative with PLP</p> <p>B- Deficiency leads to poor activity of PLP-dependent enzymes causing: 1-Deficient amino acid metabolism,</p>
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	<p>2-Deficient lipid metabolism, 3-Deficient neurotransmitter synthesis: Serotonin, epinephrine, norepinephrine and gamma amino butyric acid (GABA) C- PLP is involved in the synthesis of sphingolipids so its deficiency leads to demyelination of nerves and consequent peripheral neuritis.</p>
Symptoms of deficiency	<p>A-Mild deficiency leads to: 1-Irritability 2-Nervousness 3-Depression B-Severe deficiency leads to: 1-Peripheral neuropathy 2-Convulsions</p>
Vitamin B₁₂	
<p>Forms of Vitamin B₁₂ : 1-Cyanocobalamin 2-Hydroxycobalamin 3-Adenosylcobalamin (major storage form in the liver) 4-Methylcobalamin (mostly found in blood circulation) Coenzyme forms of B₁₂ : Adenosylcobalamin and Methylcobalamin -Coenzymes for metabolic reactions * Body can convert other cobalamins into active coenzymes</p> <p>Vitamin B₁₂ (cobalamin):</p> <ul style="list-style-type: none"> ■ Mainly found in animal liver ■ Bound to protein as Methylcobalamin or 5'-deoxyadenosylcobalamin <p>Characteristics :</p> <ul style="list-style-type: none"> ■ Essential for normal nervous system function and red blood cell maturation ■ Not synthesized in the body and must be supplied in the diet ■ Binds to intrinsic factor and absorbed by the ileum ■ Intrinsic factor is a protein secreted by cells in the stomach 	
Vitamin B₁₂ Storage	
<p>- Liver stores vitamin B₁₂ (4-5 mg) - Other B vitamins are not stored in the body - Vitamin B₁₂ deficiency is observed in patients with IF deficiency due to autoimmunity or by partial or total gastrectomy * Clinical deficiency symptoms develop in several years</p>	
Functions of Vitamin B₁₂	<p>Two reactions require B₁₂ : 1. Conversion of methylmalonyl-CoA to succinyl-CoA. The enzyme in this pathway, methyl-malonyl-CoA mutase, requires B₁₂ 2. Conversion of homocysteine to methionine. Methionine synthase requires B₁₂ in converting homocysteine to methionine</p>
B₁₂ Deficiency and Folate Trap	<ul style="list-style-type: none"> ■ Homocysteine re-methylation reaction is the only pathway where N⁵-methyl TH₄ can be returned back to tetrahydrofolate pool ■ Hence folate is trapped as N⁵-methyltetrahydrofolate (folate trap) ■ This leads to folate deficiency and deficiency of other TH₄ derivatives (N⁵-N¹⁰ methylene TH₄ and N¹⁰ formyl TH₄) required for purine and pyrimidine syntheses <p>TH₄: Tetrahydrofolate</p>
Disorders of Vitamin	Pernicious anemia

<p><i>B₁₂ Deficiency</i></p>	<p>1-Megaloblastic anemia 2-Vitamin B₁₂ deficiency is mainly due to the deficiency of intrinsic factor</p> <p>Demyelination</p> <ul style="list-style-type: none"> ■ Myelin sheath of neurons is chemically unstable and damaged <p>Neuropathy</p> <ul style="list-style-type: none"> ■ Peripheral nerve damage
<p>Causes of neuropathy</p> <ul style="list-style-type: none"> ■ Deficiency of vitamin B₁₂ leads to accumulation of methylmalonyl CoA ■ High levels of methylmalonyl CoA are used instead of malonyl CoA for fatty acid synthesis ■ Myelin synthesized with these abnormal fatty acids is unstable and degraded causing neuropathy 	
<p><i>Neuropsychiatric symptoms of Vitamin B₁₂ Deficiency</i></p>	<p>Neurological symptoms</p> <ul style="list-style-type: none"> ■ Paraesthesia (abnormal sensation) of hands and feet ■ Reduced perception of vibration and position ■ Absence of reflexes ■ Unsteady gait and balance (ataxia) <p>Psychiatric symptoms:</p> <ul style="list-style-type: none"> ■ Confusion and memory loss ■ Depression ■ Unstable mood