B.Sc second year Zoology (Honours)

Paper- 4

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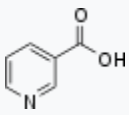
Vitamin B-complex

The vitamin B-complex refers to all of the known essential water-soluble vitamins except for vitamin C. These include thiamine (vitamin B1), riboflavin (vitamin B2), niacin (vitamin B3), pantothenic acid (vitamin B5), pyridoxine (vitamin B6), biotin, folic acid and the cobalamins (vitamin B12).

Most multivitamin-mineral products contain the B-complex along with the rest of the essential vitamins and minerals. Since they are more complete than B-complex vitamins alone, multiple vitamin-mineral supplements are recommended to improve overall micronutrient intake and prevent deficiencies.

Vitamin	Name	Structure	Molecular Function
Vitamin B_1	Thiamine		Thiamine plays a central role in the release of energy from carbohydrates. It is involved in RNA and DNA production, as well as nerve function. Its active form is a coenzyme called thiamine pyrophosphate (TPP), which takes part in the conversion of pyruvate to acetyl coenzyme A in metabolism.
Vitamin B_2	Riboflavin		Riboflavin is involved in release of energy in the electron transport chain, the citric acid cycle, as well as the catabolism of fatty acids (beta oxidation).
Vitamin B_3	Niacin		Niacin is composed of two structures: nicotinic acid and nicotinamide. There are two co-enzyme forms of niacin: nicotinamide adenine dinucleotide (NAD)

			and nicotinamide adenine dinucleotide phosphate (NADP). Both play an important role in energy transfer reactions in the metabolism of glucose, fat and alcohol. NAD carries hydrogens and their electrons during metabolic reactions, including the pathway from the citric acid cycle to the electron transport chain. NADP is a coenzyme in lipid and nucleic acid synthesis.
Vitamin B_5	Pantothenic acid		Pantothenic acid is involved in the oxidation of fatty acids and carbohydrates. Coenzyme A, which can be synthesised from pantothenic acid, is involved in the synthesis of amino acids, fatty acids, ketone bodies, cholesterol, phospholipids, steroid hormones, neurotransmitters (such as acetylcholine), and antibodies.
Vitamin B_6	Pyridoxine, pyridoxal, pyridoxamine		The active form pyridoxal 5'-phosphate (PLP) (depicted) serves as a cofactor in many enzyme reactions mainly in amino acid metabolism including biosynthesis of neurotransmitters.
Vitamin B_7	biotin		Biotin plays a key role in the metabolism of lipids, proteins and carbohydrates. It is a critical co-enzyme of four carboxylases: acetyl CoA carboxylase, which is involved in the synthesis of fatty acids from acetate; pyruvate CoA carboxylase, involved in gluconeogenesis; β-methylcrotonyl CoA carboxylase, involved in the metabolism of leucine; and propionyl CoA carboxylase, which is involved in the metabolism of energy, amino acids and cholesterol.
Vitamin B_9	Folate		Folate acts as a co-enzyme in the form

			of tetrahydrofolate (THF), which is involved in the transfer of single-carbon units in the metabolism of nucleic acids and amino acids. THF is involved in purine and pyrimidine nucleotide synthesis, so is needed for normal cell division, especially during pregnancy and infancy, which are times of rapid growth. Folate also aids in erythropoiesis, the production of red blood cells.
Vitamin B_{12}	Cobalamin		Vitamin B_{12} is involved in the cellular metabolism of carbohydrates, proteins and lipids. It is essential in the production of blood cells in bone marrow, and for nerve sheaths and proteins. Vitamin B_{12} functions as a co-enzyme in intermediary metabolism for the methionine synthase reaction with methylcobalamin, and the methylmalonyl CoA mutase reaction with adenosylcobalamin

Deficiencies

Vitamin	Name	Deficiency effects
B1	Thiamine	Deficiency causes beriberi. Symptoms of this disease of the nervous system include weight loss, emotional disturbances, Wernicke encephalopathy (impaired sensory perception), weakness and pain in the limbs, periods of irregular heartbeat, and edema (swelling of bodily tissues). Heart failure and death may occur in advanced cases. Chronic thiamin deficiency can also cause alcoholic Korsakoff syndrome, an irreversible dementia characterized by amnesia.
B2	Riboflavin	Riboflavin deficiency can cause ariboflavinosis, which may result in cheilosis (cracks in the lips), high sensitivity to sunlight, angular

		cheilitis, glossitis (inflammation of the tongue), seborrheic dermatitis or pseudo-syphilis (particularly affecting the scrotum or labia majora and the mouth), pharyngitis (sore throat), hyperemia, and edema of the pharyngeal and oral mucosa.
B3	Niacin	Deficiency, along with a deficiency of tryptophan, causes pellagra. Symptoms include aggression, dermatitis, insomnia, weakness, mental confusion, and diarrhea. In advanced cases, pellagra may lead to dementia and death (the 3(+1) D's: dermatitis, diarrhea, dementia, and death).
B5	Pantothenic acid	Deficiency can result in acne and paresthesia, although it is uncommon.
B6	Pyridoxine, pyridoxal, pyridoxamine	Vitamin B_6 deficiency causes seborrhoeic dermatitis-like eruptions, pink eye and neurological symptoms (e.g. epilepsy).
B7	Biotin	Deficiency does not typically cause symptoms in adults, other than cosmetic issues such as decreased hair and nail growth, but may lead to impaired growth and neurological disorders in infants. Multiple carboxylase deficiency, an inborn error of metabolism, can lead to biotin deficiency even when dietary biotin intake is normal.
B9	Folic acid	Deficiency results in a macrocytic anemia, and elevated levels of homocysteine. Deficiency in pregnant women can lead to birth defects.
B12	Cobalamins	Deficiency results in a macrocytic anemia, elevated methylmalonic acid and homocysteine, peripheral neuropathy, memory loss and other cognitive deficits. It is most likely to occur among elderly people, as absorption through the gut declines with age; the autoimmune disease pernicious anemia is another common cause. It can also cause symptoms of mania and psychosis. In rare extreme cases, paralysis can result.

For women and men, the recommended daily intake (RDI) for B vitamins are as follows:

	Women	Men
B1 (Thiamine)	1.1 mg	1.2 mg
B2 (Riboflavin)	1.1 mg	1.3 mg
B3 (Niacin)	14 mg	16 mg
B5 (Pantothenic acid)	5 mg (RDI not established; Adequate Intake, or AI, provided)	5 mg (AI)
B6 (Pyridoxine)	1.3 mg	1.3 mg
B7 (Biotin)	30 mcg (AI)	30 mcg (AI)
B9 (Folate)	400 mcg	400 mcg
B12 (Cobalamin)	2.4 mcg	2.4 mcg