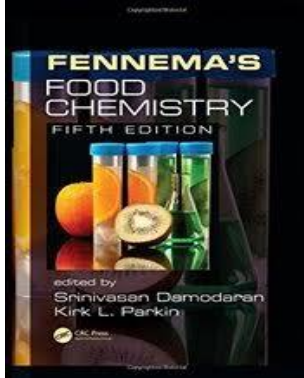


Food Chemistry I

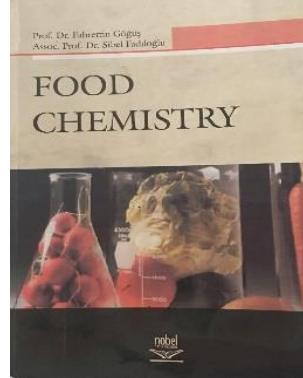


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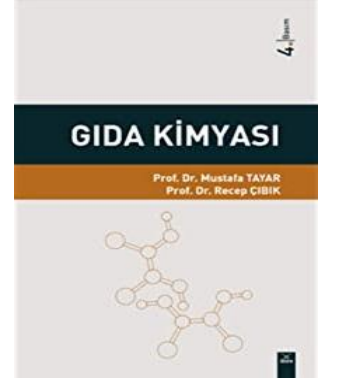
1.



2.



3.



1. Fennema O.R., Ed: Damodaran S. and Parkin K.L. 2017. *Fennema's Food Chemistry*, CRC Press Taylor & Francis Group Boca Raton, FL, USA.
2. Göğüş F. and Fadiloğlu S. 2006. *Food Chemistry*, Nobel Akademik Yayıncılık, Ankara.
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VITAMINS

Vitamin is one important group of nutrients that determines the nutritional value of foods. These compounds play extremely important role in many metabolisms in organism as cofactors of various enzymes and long-term vitamin deficiency can cause various diseases and even death.

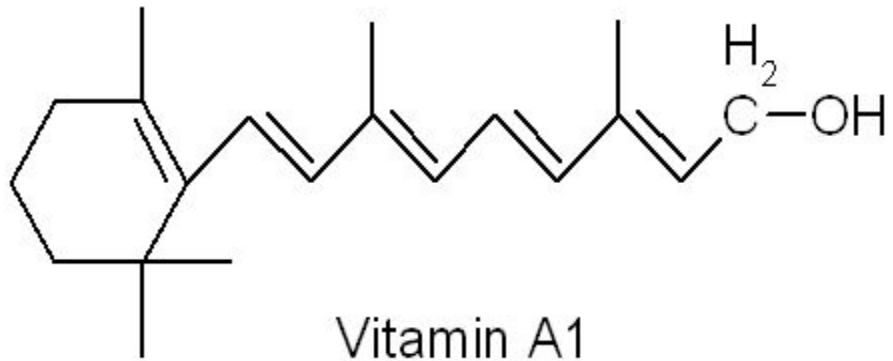
Classification of vitamins and their functions

Category	Name	Synonyms	Physiological functions
Water-soluble	V _{B1}	Thiamine, Antineuritic factor	Antineuritic Prevent beriberi
	V _{B2}	Riboflavin	Prevent inflammation of lip and tongue, Facilitate growth
	V _{B3} , V _{PP}	Nicotinic acid, Niacin, Nicotinamide Antipellagra factor	Prevent pellagra Form Coenzyme I or II
	V _{B6}	Pyridoxine, pyridoxal, pridoxal	Play a role in amino acid <i>metabolism</i>
	V _{B9}	Folic acid, folinic acid	Prevent pernicious anemia
	V _{B12}	Cyanocobalamin, hydroxycobalamin, methylcobalamin	Prevent pernicious anemia
	V _{B7} , V _H	Biotin	Prevent skin disease Facilitate lipid metabolism
	V _{B5}	Pantothenic acid	Prevent Paresthesia
	V _C	Ascorbic acid	Prevent or cure scurvy Facilitate the growth of intercellular substance
Fat-soluble	V _{A1,2}	Antixerophthalmic vitamin, carotenoids, retinol, retinal	Work as a light-sensitive substance in a visual cell, prevent epidermal cell keratinization, facilitate growth, prevent and cure xerophthalmia
	V _{D1,3}	Cholecalciferol, Lexacalcitol, Resistant rickets	Regulate metabolism of calcium and phosphate, prevent rachitis and gibbosity
	V _E	Tocopherol, A antisterility vitamin	Prevent barrenness
	V _{K1,2,3}	Phytomenadione, phylloquinone	Accelerate blood coagulation

VITAMINS IN FOODS

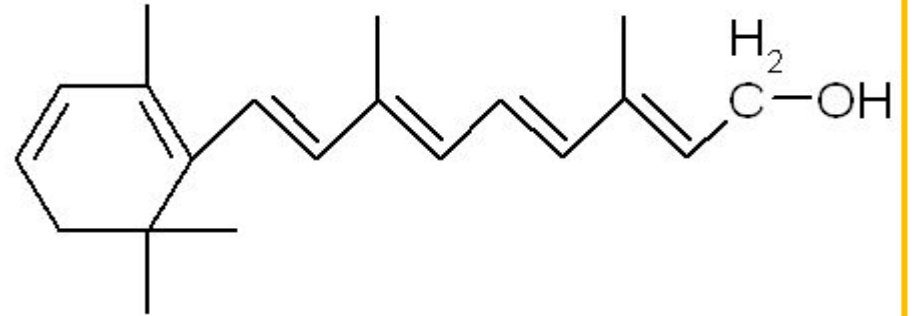
- * Vitamins are a class of natural organic compounds that maintains the normal physiological functions of human body.
- * They are essential for human health.
- * Vitamins have to be largely provided by foods.

Vitamin A



Vitamin A1

retinol



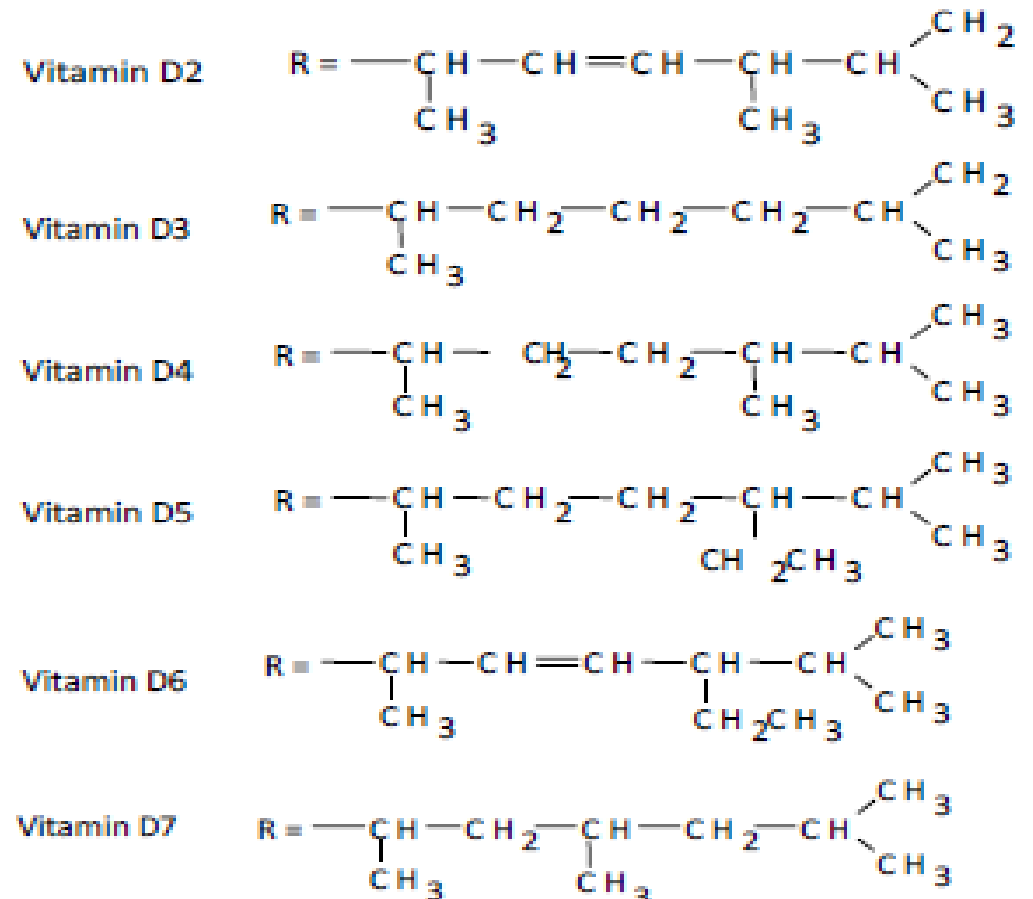
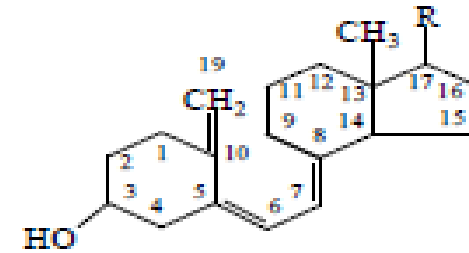
Vitamin A2

3-dehydroretinol

- * night-blindness
- * hyperkeratosis
- * keratomalacia

Vitamin D

- * Anti-rickets or anti-rachitis vitamin
- * The content of Vitamin D in fish oil from seafood is much high, followed by egg yolks, milk, and butter
- * Sunlight can promote the synthesis of vitamin D in animals





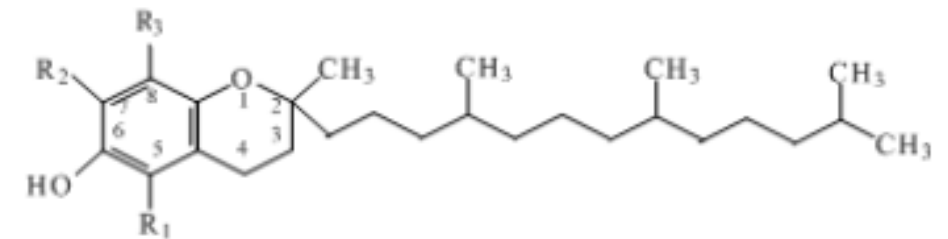
Chemical structures of vitamin D members

Vitamin E

- * α -, β -, γ -, δ -tocopherols
- * Vitamin E is derivatives of benzo-3 H-pyran

Members of the vitamin E family

Side chain	Name	R ₁	R ₂	R ₃	Occurrence
	α - tocopherol	-CH ₃	-CH ₃	-CH ₃	Wheat embryo
	β - tocopherol	-CH ₃	-H	-CH ₃	Wheat embryo
	γ - tocopherol	-H	-CH ₃	-CH ₃	Corn
	δ - tocopherol	-H	-H	-CH ₃	Bean
	Σ - tocopherol	-CH ₃	-CH ₃	-H	Rice
	η - tocopherol	-H	-CH ₃	-H	Rice
	ϵ - tocopherol	-CH ₃	-H	-CH ₃	Corn
	Σ_1 - tocopherol	-CH ₃	-CH ₃	-CH ₃	Rice

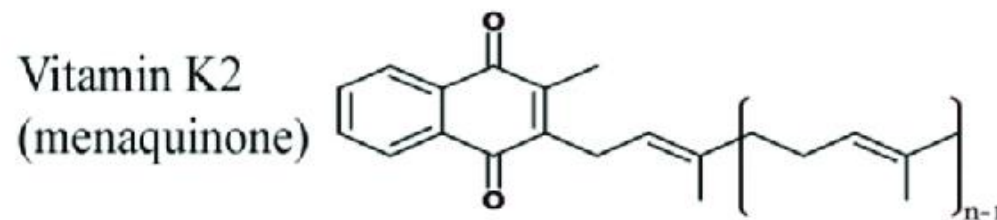
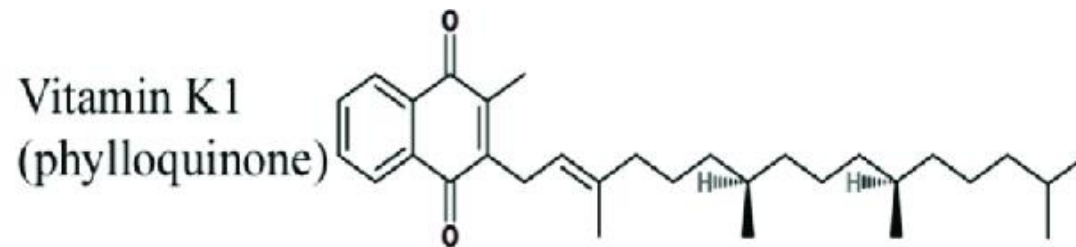


Structure of vitamin E

Vitamin K

Vitamin K occurs mainly in plant tissues. Green leafy vegetables, such as alfalfa, cabbage, cauliflower, spinach and cabbage, contain more vitamin K1 than vitamin K2, with the latter derived mainly from the metabolism of intestinal bacteria.

Vitamin K1 and K2 are the derivatives of 2-methyl-1, 4-naphthoquinone and the two compounds differ in their side chains.

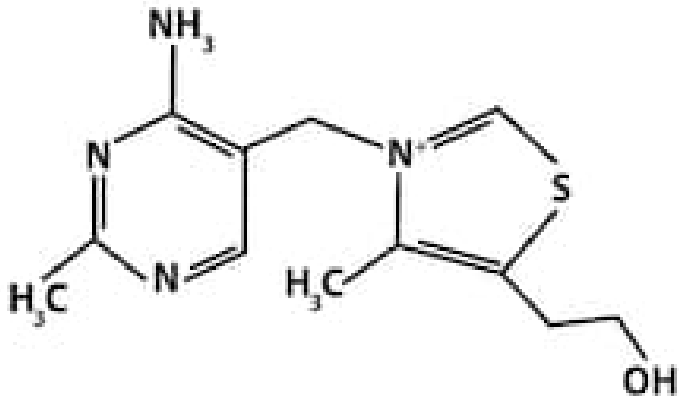


Vitamin B1

- * Vitamin B1 is also known as thiamin.
- * Yeast is reported to have the highest content of vitamin B1, followed by muscle, drupe, and eggs. Vitamin B1 in cereals occurs mainly in cortex and embryo.

Vitamin B1

Thiamine

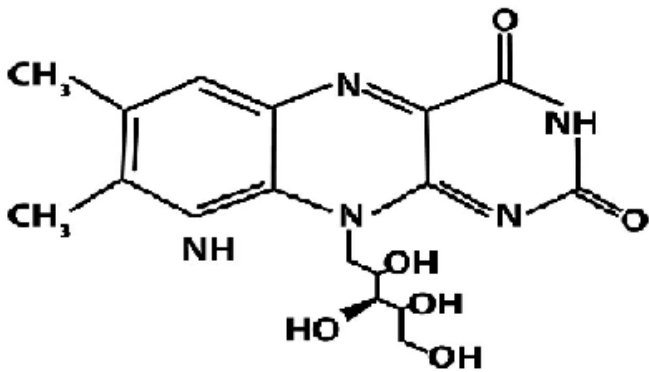


- * Vitamin B1 contains a pyrimidine ring that contains an amino group and a thiazole ring that contains a sulfur residue.

Vitamin B2

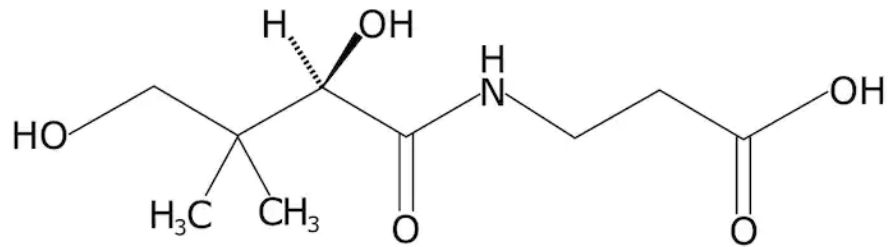
- * Vitamin B2 is also known as riboflavin and is found mainly in yeast, liver, milk, muscle and yolk. In addition, Greenery vegetables, grain and germinated seed also contain vitamin B2.

Vitamin B2
Riboflavin



- * Riboflavin is the condensation product of D-ribose and 7, 8-dimethyl-isoalloxazine.

Vitamin B5 (Pantothenic Acid)

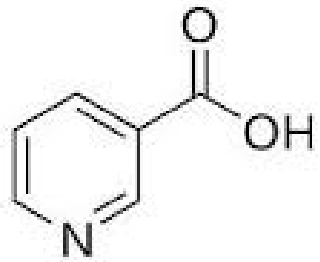


VITAMIN B₅ (PANTOTHENIC ACID)

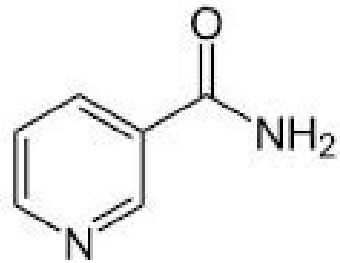
- * Pantothenic acid (Vitamin B5) is a water soluble vitamin and occurs widely in foods, including yeast, liver, kidney, egg, muscle, skimmed milk, pea, peanut and sweet potato.
- * Intestinal bacteria and some plants can synthesize pantothenic acid.
- * The chemical name of pantothenic acid is N-(α , γ -dihydroxy- β , β -dimethyl-buteryl)- β -alanine.

Vitamin B3

Vitamin B3 is known as vitamin PP and is famous for its anti-pellagra capability. Two members of the family have been identified, including nicotinic acid and nicotinamide. Both the two compounds occur widely in yeasts, liver, muscle, milk, peanut, and soybean. The cortex and embryo of cereal grains also contain high levels of the two compounds.

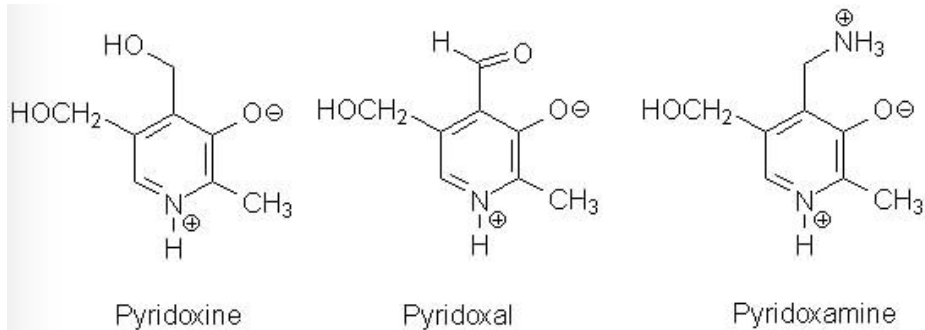


Niacin



Nicotinamide

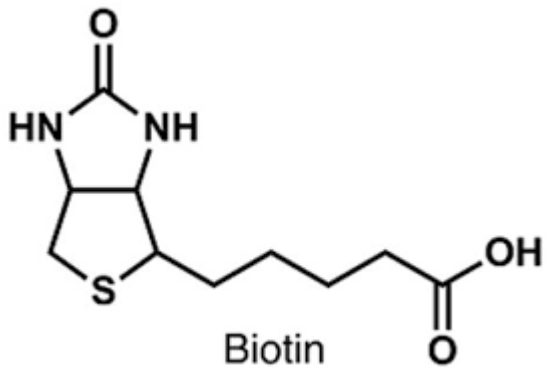
Vitamin B6



* Vitamin B6 is also called adermine and includes pyridoxine, pyridoxal, and pyridoxamine. Pyridoxine, pyridoxal and pyridoxamine are the derivatives of pyridine.

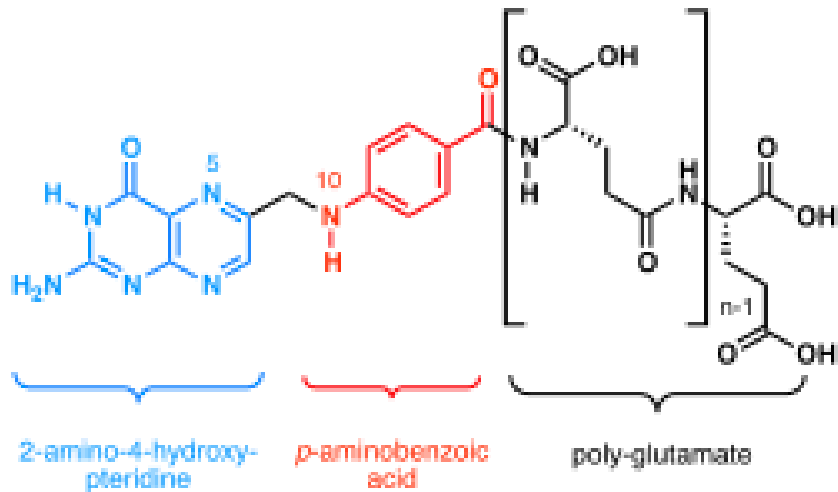
* Vitamin B6 widely distributes in animals and plants. Wheat germ, rice bran, soybean, peanut, yeast, liver, fish and meat are the major storage pool of this vitamin.

Vitamin H / Vitamin B7 / Biotin



Vitamin H is also called biotin and includes α - and β -biotin, of which, the former exists in yolk and the later in liver. Biotin widely distributes in plant and animal tissues. Most of vitamin H is bound with proteins and only a little portion occurs in the unbound state. Many organisms can synthesize biotin on their own. In human body, part of this vitamin is synthesized by intestinal bacteria.

Folic acid (Vitamin B9)



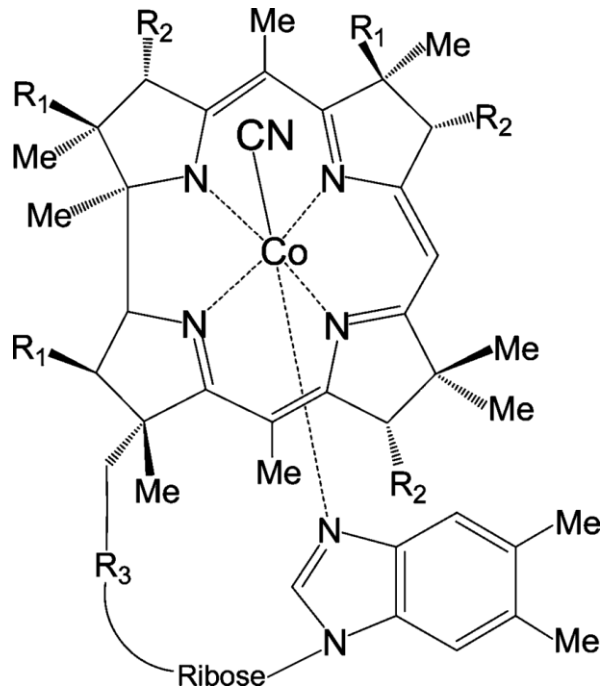
- * Folic acid occurs widely in nature.
- * Green leaves, liver, kidney, cauliflower, yeast, beef and kernels are found to have high contents.
- * Vitamin B9 is composed of pteridine, p-aminobenzoic acid and L-glutamate.

Vitamin B12

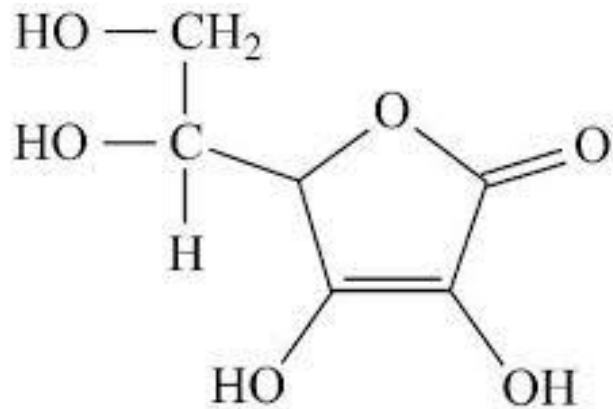
* Vitamin B12 contains cobalt and is therefore also called cobalamine.

* Liver has the highest vitamin B12 content, followed by milk, meat, egg, and fish. Vitamin B12 is not found in plants.

* Vitamins of the B12 family are polycyclic compounds and contain one trivalent cobalt ion.



Vitamin C (Ascorbic Acid)



Ascorbic acid
(Vitamin C)

Vitamin C, or ascorbic acid, is an acid derivative of hexose. Vc occurs widely in fresh fruits and vegetables. Only L-ascorbic acid is bioactive.