Summary of Vitamins

Vitamin	*Best food source*	*RDA (1989)**	*ODA***	*Principal functions*	*Major deficiency symptoms*
A (retinol; retinal = aldehyde form; precursors = carotenes)	Green and yellow vegetables, yellow fruits, butter, whole milk	1000 mcg RE	10,000–35,000 IU	Maintenance of epithelial tissues; constituent of visual pigments	Nyctalopia, xerophthalmia, hyperkeratosis; faulty tooth formation
D (cholecalciferol = D3; ergocalciferol = D2)	Fish liver oils; fortified or irradiated milk	10 mcg	200–400 IU	Transport of Ca; intestinal and renal absorption of phosphate	Rickets (children); osteomalacia (adults)
E (d-alpha tocopherol)	Vegetable oils; dark green leafy vegetables	10 mg (alpha-TE)	50–400 IU	Protects cell membranes against lipid peroxidation and destruction	Hemolytic anemia; degenerative changes in muscle.
K (phylloquinone = K1; menaquinones = K2)	Green leafy vegetables, liver, egg yolk, meat, dairy products	70 mcg		Required for proper blood clotting	Hemorrhagic disease in newborn and in biliary disease; anemia

*For American men, 19 to 22 years of age, of average activity
**Optimal Daily Allowance is a theoretical range based upon the author's literature research. If no range is listed, the authors felt that there was insufficient evidence to make a recommendation at this time.

Adapted from Orten, J. and Neuhaus, O. Human Biochemistry. St. Louis: C. V. Mosby Co., 1982

Vitamin	*Best food source*	*RDA (1989)**	*ODA***	*Principal functions*	*Major deficiency symptoms*
C (l-ascorbic acid)	Citrus fruits, tomatoes	60 mg	250–2000 mg	Collagen formation; capillary walls; metabolism of Tyr, Phe, folic acid; iron absorption	Scurvy, petechial hemorrhages, anemia, delayed wound healing, bone fragility
B1 (thiamin)	Pork, liver, yeast, whole or enriched grains, legumes	1.5 mg	5–10 mg	Decarboxylation and transketolation	Beriberi (polyneuritis), cardiovascular problems; anorexia, nausea; fatigue, paralysis
B2 (riboflavin)	Milk, organ meats, animal protein, enriched grains, brewer's yeast	1.7 mg	6–15 mg	Coenzyme of electron transfer system; cell respiration; metabolism of carbohydrates, fat, protein	Cracks and sores at corner of mouth (cheilosis), dermatitis, conjunctivitis, photophobia, glossitis
B3 (niacin, nicotinic acid, niacinamide)	Meat, enriched or whole grains, poultry, fish, peanuts, milk products	19 mg equiv (1 mg equiv per 60 mg Trp)	25–100 mg	Coenzyme of electron transfer system; dehydrogenase reactions; oxidation to produce ATP (NAD+); biosynthesis of fatty acids, steroids, etc. (NADP+)	Pellagra, diarrhea, scaly dermatitis, dementia, stomatitis
B6 (pyridoxine)	Meat, whole grains, poultry, fish	2.0 mg	10–20 mg	Coenzyme in amino acid metabolism; transamination, decarboxylation, transsulfuration, tryptophan synthetase, amino acid transport	Cheilosis, glossitis, stomatitis, seborrheic dermatitis, convulsions, anemia
Folacin (folic acid, peteroyl-glutamic acid)	Liver, greens, mushrooms, whole grains, legumes	200 mcg	2000–4000 mcg	Transfer of 1-carbon fragments (formyl); biosynthesis of purines, choline, methionine, etc.	Macrocytic and megaloblastic anemias, sprue, malabsorption, leukopenia, thrombocytopenia
B12 (cobalamin)	Animal protein, meats, milk, egg	2 mcg	10–100 mcg	Transfer of 1-carbon fragments (methyl); biosyntheis of purines, choline, methionine, etc.; mutase reactions	Pernicious anemia, neurological lesions, sprue
Biotin	Egg yolk, organ meats, yeast, whole grains, nuts; widely distributed	30–100 mcg***		Carboxylation and transcarboxylation	Dermatitis, alopecia, anemia; experimentally only in humans
Pantothenic acid	Liver, meat, cereal, milk, legumes; widely distributed	4–7 mg***	10–50 mg	Acylation reactions (acetyl group transfers)	Anemia, achromotrichia; human deficiency most unlikely

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***Estimated safe and adequate range.

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