VITAMIN

OVERVIEW

Compiled by

Campbell M gold

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IMPORTANT

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Vitamins

Vit A - (Retinol, Carotenoids) maintenance 1-3 mg
Vit A - RDA 0.8-1 mg
Vit A - toxic 75,000 IU, (15 mg)

Vit A Unit Conversion		
IU - International Units mg - milligrams ug (mcg) - micrograms RE - Retinol Equivalents		
Vit A - retinol	1 mg	3333 IU
	1 mg	1 mg RE
	1 IU	0.3 ug (mcg)
	1 ug (mcg) RE	1 ug (mcg)
Vit A - retinyl acetate	1 mg	2907 IU
	1 mg	872 ug (mcg) RE
	1 IU	0.344 ug (mcg)
	1 ug (mcg) RE	1.147 ug (mcg)
Vit A- retinyl palmitate	1 mg	1818.18 IU
	1 mg	546 ug (mcg) RE
	1 IU	0.55 ug (mcg)
	1 ug (mcg) RE	1.832 ug (mcg)

Vit A - dairy products, dark greens, eggs, fish oils, and yellow fruits
Vit A - one carrot can deliver up to 15,000 IU of beta carotene
Vit A - is a powerful antioxidant that can slow the aging process
Vit A - helps to prevent disease, especially cancer and heart disease
Vit A - resistance to infection, especially of respiratory tract
Vit A - maintains a healthy condition of the other layer of organs and tissue
Vit A - promotes growth and vitality
Vit A - permits formation of visual purple in eye
Vit A - counteracts night blindness and weak eyesight
Vit A - essential for pregnancy and lactation
Vit A - lowers risk of heart and lung disease, stomach, and oral cancers
Vit A - aids in the proper functioning of the immune system
Vit A - shortens the duration of disease
Vit A - promotes strong bones, healthy hair, teeth, and gums
Vit A - adjunct in acne, superficial wrinkles, and impetigo
Vit A - adjunct in boils and open ulcers
Vit A - maintains mucus membrane in the mouth, bowel, eyes, and nose
Vit A - maintains the skin, night vision, bone growth, and reproduction
Vit A - needed for red blood cell and hormone formation
Vit A - causes ulcers of the mucous membranes
Vit A - increases susceptibility to infection

Vit B1 (Thiamine) - maintenance 2-25 mg
Vit B1 - RDA 1.0-1.5 mg
Vit B1 - toxic none

Vit B1 - whole grains, fish, meat, nuts, and poultry
Vit B1 - carbohydrate metabolism, and appetite control
Vit B1 - nervous system function
Vit B1 - is needed to convert glucose to energy or fat
Vit B1 - is needed for healthy nerves and muscles
Vit B1 - deficiency causes weakness, fatigue, and depression
Vit B1 - deficiency causes insomnia, and headaches
Vit B1 - deficiency causes aching, stiffness, and back pains
Vit B1 - deficiency causes indigestion and flatulence (wind)

Vit B1 - deficiency causes palpitations and shortness of breath

Vit B2 (Riboflavin) - maintenance 2-25 mg
Vit B2 - RDA 1.2-1.7 mg
Vit B2 - toxic none

Vit B2 - milk, eggs, whole grains, mushrooms, dried peas and beans
Vit B2 - energy metabolism
Vit B2 - is needed for metabolism of carbohydrates, fats, and proteins
Vit B2 - deficiency causes sensitivity to light, sore and bloodshot eyes
Vit B2 - deficiency causes cheeks with many small blister marks
Vit B2 - deficiency causes dry peeling lips
Vit B2 - many alcoholics have this deficiency

Vit B3 (Niacin, Niacinamide, Nicotinic Acid) - maintenance 20-100 mg
Vit B3 - RDA 13-19 mg
Vit B3 - toxic low, 3,000 mg. Diabetics and ulcer cases should consult their health professional
Vit B3 - toxic low, 3,000 mg. Flush and itching can occur

Vit B3 - poultry, peanuts, and whole grains
Vit B3 - body can convert the amino acid tryptophan into B3 (niacin)
Vit B3 - works with Vitamin B1 and Vitamin B2 in energy metabolism
Vit B3 - is needed for most body processes
Vit B3 - is needed for metabolism of carbohydrates, fat, and proteins
Vit B3 - deficiency produces dermatitis, diarrhoea, and dementia
Vit B3 - deficiency may cause depression, tension, and insomnia
Vit B3 - deficiency may cause impaired memory

Vit B5 (Pantothenic Acid) - maintenance 2-25 mg
Vit B5 - RDA none established
Vit B5 - toxic none

Vit B5 - all plants and animals. Poultry, fish, and whole grains
Vit B5 - is needed for energy metabolism, and the formation of hormones
Vit B5 - is needed for the metabolism of energy from fat and carbohydrates
Vit B5 - deficiency stops the adrenal from working properly
Vit B5 - deficiency causes low blood pressure and blood sugar
Vit B5 - deficiency causes fatigue
Vit B5 - deficiency causes weakened muscle and joints, aches, and palpitations
Vit B5 - deficiency causes and depression

Vit B6 (Pyridoxine, Pyridoxal, Pyridoxamine) - maintenance 2-25 mg
Vit B6 - RDA 2.0-2.2 mg
Vit B6 - toxic none, but typically supplement less than 300 mg/day

Vit B6 - whole grains, fish, walnuts, and wheat germ
Vit B6 - acts as a coenzyme involved with metabolism
Vit B6 - is needed to process magnesium, zinc, and manganese
Vit B6 - is needed to process Essential Fatty Acids (EFAs)
Vit B6 - is needed to process many amino acids
Vit B6 - deficiency causes headache, irritability, and nervousness
Vit B6 - deficiency causes inability to concentrate, lethargy, and anorexia
Vit B6 - deficiency causes memory funk
Vit B6 - deficiency causes abdomen pains, nausea, and vomiting
Vit B6 - deficiency causes diarrhoea, and haemorrhoids (piles)
Vit B6 - deficiency causes cracked skin

Vit B7 Biotin - maintenance 2-5 mg
Vit B7 Biotin - RDA none established
Vit B7 Biotin - toxic none

Vit B7 - Biotin soybeans, brown rice, and dark green vegetables
Vit B7 - Biotin is made in the intestinal tract by microorganisms
Vit B7 - Biotin absorption is prevented by raw egg
Vit B7 - Biotin necessary for fat, carbohydrate, and protein metabolism
Vit B7 - Biotin deficiency causes depression, fatigue, and muscular pain
Vit B7 - Biotin deficiency causes panic attacks, and dry peeling skin
Vit B7 - Biotin deficiency causes hair loss

Vit B9 Folic Acid (Folacin) - maintenance 400 ug (mcg)
Vit B9 Folic Acid - toxic unknown (1,000 ug (mcg))

Vit B9 Folic Acid - is needed for cell division, metabolism of sugar and amino acids
Vit B9 Folic Acid - is needed for formation of blood and antibodies
Vit B9 Folic Acid - deficiency can cause pernicious anaemia, depression, and fatigue
Vit B9 Folic Acid - deficiency can cause a susceptibility to infection

Vit B12 (Cyanocobalamin, Cobalamins) - maintenance 5-25 ug (mcg)
Vit B12 - RDA 1-3 ug (mcg)
Vit B12 - toxic none

Vit B12 - milk, clams, oysters, fish, and meat
Vit B12 - fat and protein metabolism, production of red blood cells
Vit B12 - is needed to make and maintain cell membranes
Vit B12 - deficiency causes pernicious anaemia, and damage to nerves
Vit B12 - deficiency causes a sore mouth and tongue

Vit B-Complex contains:

- Vit B1 (Thiamine)
- Vit B2 (Riboflavin)
- Vit B3 (Niacin, Niacinamide, Nicotinic Acid)
- Vit B5 (Pantothenic Acid),
- Vit B6 (Pyridoxine, Pyridoxal, Pyridoxamine)
- Vit B7 (Biotin)
- Vit B9 (Folic Acid)
- Vit B12 (Cyanocobalamin, Cobalamins)
- Choline
- Inositol

PABA (Para-aminobenzoicacid) - is part of the vitamin B complex, also called Vit Bx
PABA (Para-aminobenzoicacid) - maintenance 25-50 mg
PABA (Para-aminobenzoicacid) - RDA none established
PABA (Para-aminobenzoicacid) - toxic none

PABA (Para-aminobenzoicacid) - whole grains, and wheat germ
PABA (Para-aminobenzoicacid) - function not fully established, but is a co-factor of B Vitamins
PABA (Para-aminobenzoicacid) - important in skin and hair growth. On skin as an effective sun-screen
PABA (Para-aminobenzoicacid) - is required for the formation of folic acids, and is widely used in sunscreens to absorb ultraviolet light

Choline - nutrient in the Vitamin B family
Choline - maintenance 100-200 mg

Choline - RDA none established
Choline - toxic none (3500 mg)

Choline - lecithin, and eggs
Choline - co-factor of the B Vitamins
Choline - metabolism of fats and cholesterol
Choline - probable brain functions and memory
Choline - is needed for formation of DNA and RNA
Choline - is needed for muscle function, nerve function, and memory
Choline - is needed for manganese metabolism
Choline - deficiency may cause headaches, dizziness, and high blood pressure
Choline - co-factor of the B complex

Inositol - nutrient in the Vitamin B family
Inositol - maintenance 100-200 mg
Inositol - RDA none established
Inositol - toxic none

Inositol - wheat germ, and lecithin
Inositol - co-factor of the B complex. Total function unknown

Vit C (Ascorbic Acid) - maintenance 500-2,000 mg
Vit C - RDA 60 mg
Vit C - toxic none - diarrhoea can occur at high doses (above 10 grams)

Vit C - citrus fruits, tomatoes, peppers, and melon
Vit C - formation of collagen, detoxifies poisons, and resists infection
Vit C - prevents oxidation of other vitamins
Vit C - blocks formation of cancer-causing nitrosamines
Vit C - detoxifies pollutants
Vit C - is needed to remove the free-radicals caused by neotoxins
Vit C - keeps the skin, bones, and muscles healthy
Vit C - promotes healing after infection, injury, and surgery
Vit C - deficiency causes fatigue, irritability, depression, weakness
Vit C - deficiency causes muscle pains, joint pains, gum and skin damage

Vit D3 - maintenance 5-20 ug (mcg) (200-800 IU
Vit D3 - RDA 5-10 ug (mcg) (200-400 IU) of Cholecalciferol activity
Vit D3 - toxic 5,000 IU (125 ug (mcg))

Vit D Unit Conversion		
IU - International Units ug (mcg) - micrograms		
Vit D2 - ergocalciferol	1 ug (mcg)	40 IU
	1 IU	0.025 ug (mcg)
Vit D3 - cholecalciferol	1 ug (mcg)	40 IU
	1 IU	0.025 ug (mcg)

Vit D3 - fortified milk, tuna, and salmon
Vit D3 - made by the sun's action in deep skin layers
Vit D3 - bone formation, and phosphorus metabolism
Vit D3 - is needed for calcium metabolism, and growth
Vit D3 - is needed for the maintenance of bones and teeth
Vit D3 - deficiency can cause symptoms similar to the female menopause
Vit D3 - deficiency can cause sweats, depression, irritability, and nervousness
Vit D3 - deficiency can cause cramp, and soft bones

Vit E - maintenance 400 IU
Vit E - RDA 100 IU

Vit E - toxic unknown (1,000 IU ?)

Vit E (Synthetic/Natural) Unit Conversion		
IU - International Units mg - milligrams		
Synthetic Vit E and Esters	**IU to mg**	**mg to IU**
Vit E - d-alpha-Tocopherol acetate	1.00	1.00
Vit E - d-alpha-Tocopherol succinate	0.89	1.12
Vit E - d-alpha-Tocopherol	1.10	0.91
Natural Vit E and Esters	**IU to mg**	**mg to IU**
Vit E - d-alpha-Tocopherol acetate	1.36	0.74
Vit E - d-alpha-Tocopherol succinate	1.21	0.83
Vit E - d-alpha-Tocopherol	1.49	0.67

Vit E Unit Conversion		
IU - International Units mg - milligrams ug (mcg) - micrograms		
Vit E - d-alpha-Tocopherol	1 mg	1.49 IU
	1 IU	671 ug (mcg)
Vit E - dl-alpha-Tocopherol	1 mg	1.1 IU
	1 IU	909 ug (mcg)
Vit E - d-alpha-Tocopheryl acetate	1 mg	1.36 IU
	1 IU	735 ug (mcg)
Vit E - dl-alpha-Tocopheryl acetate	1 mg	1 IU
Vit E - d-alpha-Tocopheryl acid succinate	1 mg	1.21 IU
	1 IU	826.4 ug (mcg)
Vit E - dl-alpha-Tocopheryl acid succinate	1 mg	0.89 IU
	1 IU	1.12 mg

Vit E - Therapeutic Dosages: the optimal therapeutic dosage of Vitamin E has not been established. Studies have used between 50 and 800 IU daily, and some have used even higher doses. This would correspond to about 50 to 800 mg of synthetic Vitamin E (dl-alpha-tocopherol), or 25 to 400 mg of natural Vitamin E (d-alpha - or mixed tocopherols)

Vit E - alternate names: Alpha Tocopherol, D-Tocopherol, DL-Tocopherol, DL-Alpha-Tocopherol
Vit E - alternate names: Tocopheryl Succinate, Tocopheryl Acetate, D-Alpha-Tocopherol
Vit E - alternate names: D-Delta- Tocopherol, D-Beta-Tocopherol,
Vit E - alternate names: D-Gamma-Tocopherol, Mixed Tocopherols

Vit E - dark green vegetables, wheat germ, and whole grain cereals
Vit E - cold pressed vegetable oils
Vit E - protects EFAs, and acts as an antioxidant
Vit E - aids in formation of red blood cells
Vit E - removes dangerous "free radicals" that may cause allergies
Vit E - prevents destruction of Vitamin A
Vit E - deficiency causes anorexia, premature ageing, and infertility

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Minerals

Boron - is a trace element with a lack of strong evidence for any specific use
Boron - RDA 70 ug (mcg)
Boron - toxic 20 mg

Boron - possibly useful in bone maintenance

Calcium - maintenance 800-1,200 mg
Calcium - RDA 800-1,200 mg
Calcium - toxic none. Avoid mega-doses (>15,000) which can cause overload

Calcium - milk products, salmon, dark green vegetables
Calcium - is necessary for nerve and muscle function
Calcium - is necessary for blood clotting, bones, and teeth
Calcium - deficiency causes irritability, insomnia, and palpitations
Calcium - deficiency causes constipation
Calcium - deficiency causes PMT
Calcium - long-term deficiency causes rickets, osteoporosis, and fractures

Chromium maintenance - 50-200 ug (mcg)
Chromium - RDA 25 ug (mcg). 50-200 ug (mcg) is a safe level
Chromium - toxic unknown

Chromium - shellfish, whole grains, mushrooms, and brewers yeast
Chromium - levels decline with age
Chromium - is needed for sugar and protein metabolism
Chromium - deficiency may cause high blood pressure
Chromium - deficiency may encourage the onset of diabetes

Copper - maintenance 0.5-2.0 mg
Copper - RDA 2 mg
Copper - toxic up to 10 mg is considered safe, but less is desirable

Copper - is necessary for the use of Vitamin C, Iron, and Amino Acids
Copper - necessary for Iron and Vitamin C utilization
Copper - enzyme reactions and the healing process
Copper - available in oysters and other shellfish, whole grains, beans, nuts, potatoes
Copper - available in organ meats (kidneys, liver)
Copper - available in dark leafy greens, dried fruits such as prunes, cocoa, black pepper, and yeast
Copper - deficiency causes anaemia, and oedema (water retention)

Fluoride - toxic 10 mg

Fluoride - usage of fluoride outside of biochemic tissue salts should be absolutely avoided

Iodine - maintenance 100-200 ug (mcg)
Iodine - RDA 150 ug (mcg)
Iodine - toxic possibly 1,100 ug (mcg)

Iodine - seafood, seaweed, kelp, and iodized salt
Iodine - function of thyroid gland

Iron - maintenance 15-25 mg
Iron - RDA 10-18 mg
Iron - Toxic 100 mg (45 mg)

Iron - meats, green leafy vegetables, dried fruits, and whole grain cereals
Iron - is needed to make haemoglobin (oxygen carrying pigment in blood cells)
Iron - oxygen transportation
Iron - deficiency causes anaemia which causes weakness, and shortness of breath
Iron - deficiency causes anaemia which causes palpitations
Iron - deficiency causes fatigue, depression, mental confusion, and poor memory
Iron - deficiency is much more common in women than in men

Magnesium - maintenance 300-1,000 mg

Magnesium - RDA 300-500 mg
Magnesium - toxic 10,000 mg magnesium sulphate. Lesser of other forms (> 420 mg ?)

Magnesium - green vegetables, lemons, grapefruit, apples, and whole grains
Magnesium - transmission of nerve impulses, pH balance, and metabolism
Magnesium - bone structure
Magnesium - is needed for energy production, function of nerves and muscles
Magnesium - is needed for many enzymes, and protein synthesis
Magnesium - deficiency causes tics, tremors, and twitching
Magnesium - deficiency causes palpitations, and cramps
Magnesium - deficiency causes depression, and poor memory
Magnesium - deficiency causes increased sensitivity to noise
Magnesium - deficiency causes hyper-sensitivity in children

Manganese - maintenance 5-10 mg
Manganese - RDA 40 mg
Manganese - toxic none established (<11 mg ?)

Manganese - fruits, whole grains, and green leafy vegetables
Manganese - systems involved with protein and energy metabolism
Manganese - activates many enzymes including those used for digestion
Manganese - activates utilization of food, bone growth, and reproduction
Manganese - deficiency causes fatigue, irritability, and memory loss

Molybdenum - maintenance 10-100 ug (mcg)
Molybdenum - RDA non established, 150-500 ug (mcg) recommended
Molybdenum - toxic possible in excess of 2,000 ug (mcg)

Molybdenum - legumes, whole grains, widespread in diet
Molybdenum - participates in essential enzyme systems

Nickel - maintenance unknown
Nickel - RDA unknown
Nickel - toxic unknown (1 mg ?)

Nickel - is an activator of several enzymes
Nickel - is needed for hormone production, and cell membrane metabolism
Nickel - deficiency aggravates iron deficiency anaemia

Phosphorous - maintenance 500-800 mg
Phosphorous - RDA 800-1,200 mg
Phosphorous - toxic none. Excess depletes calcium (4,000 mg)

Phosphorous - fish, poultry, meat, and eggs
Phosphorous - contributes to supportive structure of body (bones and teeth)
Phosphorous - contributes to energy production
Phosphorous - is needed for most intracellular reactions
Phosphorous - is needed for growth, repair, and production of energy
Phosphorous - deficiency is rare because most foods contain phosphorus

Potassium - maintenance 500-1,000 mg
Potassium - RDA none established
Potassium - toxic none

Potassium - bananas, citrus fruits, and green vegetables
Potassium - fluid and electrolyte balance
Potassium - transmission of nerve impulses
Potassium - is needed for nerve and muscle functions
Potassium - deficiency causes weakness, irritability, diarrhoea, and constipation
Potassium - deficiency causes cramp

Selenium - maintenance 50-200 ug (mcg)
Selenium - RDA none established. 50-200 ug (mcg) considered safe
Selenium - toxic no more that 300-400 ug (mcg)

Selenium - wheat germ, seafood, and chicken
Selenium - neutralizes free radicals, which cause tissue damage and disease
Selenium - interacts with Vitamin E to assist in utilization
Selenium - slows ageing
Selenium - deficiency causes muscular weakness, and infertility
Selenium - raises blood pressure in cases of hypotension (low blood pressure)

Zinc - maintenance 15-25 mg
Zinc - RDA 15 mg
Zinc - toxic unknown (40 mg ?)

Zinc - oysters, eggs, whole grains, and seafood
Zinc - wound healing, metabolism, and carbohydrate digestion
Zinc - is needed for the formation of many enzymes
Zinc - is needed to control protein synthesis
Zinc - is needed for the contraction of muscles
Zinc - is needed for the formation of insulin, and fertility
Zinc - deficiency causes white spots on fingernails, and stretch marks on skin
Zinc - deficiency causes poor hair growth, acne, period problems, and infertility
Zinc - deficiency causes arthritis, and cold extremities

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Essential Fatty Acids (EFA)

Omega-3 (EFA) - fish oil
Omega-3 (EFA) - is part of a healthy diet that helps to lower the risk of heart disease
Omega-3 (EFA) - cell membrane maintenance, and fat metabolism
Omega-3 (EFA) - reducing inflammation
Omega-3 (EFA) - adjunct in arthritis, asthma, and arterial disease

Eicosapentaenoic acid (EPA) - one of several omega-3 fatty acids used by the body
Eicosapentaenoic acid (EPA) - is found in cold water fatty fish, and in fish oil supplements

Omega-6 (EFA) - starflower oil, oil of Evening Primrose
Omega-6 (EFA) - produce and maintain all cell membranes, nerves, and brain
Omega-6 (EFA) - produce and maintain hormones and prostaglandins
Omega-6 (EFA) - needed for absorption of fat soluble Vitamins (A, D, and E)
Omega-6 (EFA) - promotes growth of essential bacteria in the bowel
Omega-6 (EFA) - reduces inflammation, and helps the immune system
Omega-6 (EFA) - deficiency causes immune system problems, dry hair and skin
Omega-6 (EFA) - deficiency causes arthritis, and infertility
Omega-6 (EFA) - adjunct in eczema, arthritis, and hyperactivity in children
Omega-6 (EFA) - adjunct in PMT, and alcoholism

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Other Supplements of Interest

Bromelain - is an enzyme obtained from pineapple
Bromelain - is effective in treating inflammation and oedema of soft tissues associated with trauma

Coenzyme Q10 - maintenance 30-300 mg daily
Coenzyme Q10 - toxic unknown

Coenzyme Q10 - is produced by the human body and is necessary for the basic functioning of cells
Coenzyme Q10 - dietary sources include oily fish (salmon and tuna), organ meats (liver), and whole grains
Coenzyme Q10 - used in heart disease, and Parkinson's disease
Coenzyme Q10 - used in muscular dystrophies, cancer, diabetes, and HIV/AIDS
Coenzyme Q10 - improves immunity, and lowers blood sugar
Coenzyme Q10 - can dramatically slow tumour growth
Coenzyme Q10 - helps to improve athletic endurance
Coenzyme Q10 - increases energy levels in the elderly
Coenzyme Q10 - increases energy levels in those suffering from chronic illness

Octacosanol (wheat germ oil) - maintenance 1,000 mg daily
Octacosanol (wheat germ oil) - toxic unknown

Octacosanol (wheat germ oil) - is an excellent source of Vitamin E
Octacosanol (wheat germ oil) - cholesterol reduction and heart disease

Superoxide Dismutase (SOD) - maintenance - 250-1,000 mg daily

Superoxide Dismutase (SOD) - a systemic enzyme that helps repair cells and reduces damage by superoxide, the most common free radical in the body
Superoxide Dismutase (SOD) - barley grass, broccoli, Brussels sprouts, cabbage, wheatgrass
Superoxide Dismutase (SOD) - helps to protect joints, and immune system
Superoxide Dismutase (SOD) - reduces oxidative damage to the cells of the respiratory system
Superoxide Dismutase (SOD) - helps the body to use zinc, manganese, and copper
Superoxide Dismutase (SOD) - may prevent the growth of cancerous tumours
Superoxide Dismutase (SOD) - helps to ward off wrinkles, and heals scar tissues
Superoxide Dismutase (SOD) - may help in the treatment of arthritis
Superoxide Dismutase (SOD) - may help in the treatment of prostate problems

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Amino Acids

Amino Acids - are building blocks that make up proteins
Amino Acid - deficiency causes depression, fatigue, poor weight gain
Amino Acid - deficiency causes weakness of immune system
Amino Acid - sources - alfalfa, meat, fish, fowl, eggs, and dairy products

Essential Amino Acids

Amino Acid Histidine - removes heavy metals from the body
Amino Acid Histidine - helps protect nerves by maintaining the myelin sheath
Amino Acid Histidine - helps protect against radiation damage
Amino Acid Histidine - promotes the manufacture of both red and white blood cells
Amino Acid Histidine - has been used in the treatment of rheumatoid arthritis, poor sexual arousal
Amino Acid Histidine - has been used in the treatment of ulcers in the digestive tract
Amino Acid Histidine - has been used in the treatment of nausea during pregnancy
Amino Acid Histidine - is converted by the body into the neurotransmitter, histamine, which plays a role in smooth muscle function and the dilation and contraction of blood vessels

Amino Acid Isoleucine - helps to increase endurance
Amino Acid Isoleucine - helps to heal and repair muscle tissue
Amino Acid Isoleucine - helps clotting at the site of an injury

Amino Acid Leucine - works with the amino acids isoleucine and valine to repair muscles
Amino Acid Leucine - increases production of growth hormones
Amino Acid Leucine - works with the amino acids isoleucine and valine to regulate blood sugar, and provide the body with energy

Amino Acid Leucine - helps burn visceral fat, which is located in the deepest layers of the body and the least responsive to dieting and exercise

Amino Acid Lysine - has antiviral properties
Amino Acid Lysine - helps prevent outbreaks of herpes and cold sores
Amino Acid Lysine - is needed for hormone production
Amino Acid Lysine - helps with the maintenance of bones in both children and adults
Amino Acid Lysine - Lysine helps in the production of antibodies for a strong, healthy immune system

Amino Acid Methionine - helps the body process and eliminate fat
Amino Acid Methionine - contains sulphur, which is required for the production of the body's natural antioxidant, glutathione
Amino Acid Methionine - is needed to produce two other sulphur-containing amino acids, Cysteine (semi-essential) and Taurine (non-essential), which help the body eliminate toxins, build strong, healthy tissues, and promote cardiovascular health

Amino Acid Phenylalanine - is needed for normal functioning of the central nervous system
Amino Acid Phenylalanine - has been used to help control symptoms of depression and chronic pain
Amino Acid Phenylalanine - has been used to treat diseases linked to a malfunctioning central nervous system
Amino Acid Phenylalanine - is effective in treating brain disorders, because it is able to penetrate the blood-brain barrier

Amino Acid Threonine - helps normal growth by maintaining the proper protein balance
Amino Acid Threonine - supports cardiovascular, and liver functions
Amino Acid Threonine - supports central nervous, and immune system functions

Amino Acid Tryptophan - is needed for the manufacture of the neurotransmitter serotonin, which regulates mood and sleep patterns
Amino Acid Tryptophan - helps in the treatment of jet lag, depression, and binge eating
Amino Acid Tryptophan - helps in the treatment of obsessive-compulsive disorder
Amino Acid Tryptophan - helps in the treatment of some forms of vascular migraines, panic attacks (when taken with vitamin B-6), and chronic pain
Amino Acid Tryptophan - may help in cases of rheumatoid arthritis, and tardive dyskinesia (Involuntary writhing movements of the facial muscles and tongue caused by high doses of antipsychotic drugs over long periods of time)

Amino Acid Valine - helps with normal growth, tissue repair
Amino Acid Valine - helps to regulate blood sugar, and provide the body with energy

Semi-Essential Amino Acids

Amino Acid Cysteine - is found in beta-keratin, the main protein in nails, skin and hair
Amino Acid Cysteine - helps maintain a healthy, youthful appearance, by encouraging collagen production and skin elasticity

Amino Acid Tyrosine - helps regulate mood and stimulates the nervous system
Amino Acid Tyrosine - helps to speed up the metabolism
Amino Acid Tyrosine - helps in the treatment of conditions characterised by chronic fatigue

Non-Essential Amino Acids

Amino Acid Alanine - helps to convert the simple sugar glucose into energy
Amino Acid Alanine - helps to eliminate excess toxins from the liver
Amino Acid Alanine - helps protect cells from being damaged during intense aerobic activity, when the body cannibalises muscle protein to help produce energy

Amino Acid Arginine (L-arginine) - is needed to keep the liver healthy
Amino Acid Arginine (L-arginine) - is needed to keep skin, joints, and muscles healthy
Amino Acid Arginine (L-arginine) - helps strengthen the body's immune system

Amino Acid Arginine (L-arginine) - regulates hormones, and blood sugar
Amino Acid Arginine (L-arginine) - promotes male fertility
Amino Acid Arginine (L-arginine) - may improve circulation, and heart disease
Amino Acid Arginine (L-arginine) - may help in cases of impotence

Amino Acid Asparagine - is required for normal functioning

Amino Acid Aspartic Acid (L-aspartate) - help promote a robust metabolism
Amino Acid Aspartic Acid (L-aspartate) - is used to treat fatigue and depression

Amino Acid Carnitine (L-carnitine) - helps carry fatty acids into the mitochondria in cells so that they can convert these acids to energy
Amino Acid Carnitine (L-carnitine) - supplementation can help heart function

Amino Acid Carnosine (L-carnosine) is thought to be a powerful anti-aging supplement

Amino Acid Citrulline - promotes healthier skin and immune functions
Amino Acid Citrulline - is part of the Urea Cycle, and assists in converting ammonia to urea in the liver, which offers protection against damage promotes healthy liver function

Amino Acid Cystine - is a sulphur-containing amino acid that helps form healthy skin, hair, bones, and connective tissue
Amino Acid Cystine - is needed to make glutathione, one of the natural antioxidants that fights free-radical damage (glutathione detoxifies the liver)

Amino Acid Gamma-aminobutyric acid (GABA) - helps promote normal brain function by helping to block stress-related messages from reaching receptor sites in the central nervous system
Amino Acid Gamma-aminobutyric acid (GABA) - helps reduce feelings of anxiousness, and may be helpful for treatment of disorders linked to emotional stress, including reduced sex drive, and hypertension

Amino Acid Glutamic Acid - is an excitatory neurotransmitter that increases the firing of neurons in the central nervous system
Amino Acid Glutamic Acid - is a major excitatory neurotransmitter in the brain, and spinal cord

Amino Acid Glutamine - helps build and maintain muscles
Amino Acid Glutamine - helps remove toxic ammonia from the liver
Amino Acid Glutamine - helps maintain a healthy central nervous system

Amino Acid Glutathione peroxidase - is the body’s most abundant natural antioxidant
Amino Acid Glutathione peroxidase - protects vision, and boosts immune system
Amino Acid Glutathione peroxidase - helps to turn carbohydrates into energy
Amino Acid Glutathione peroxidase - prevents the build-up of oxidized fats that may contribute to atherosclerosis

Amino Acid Glycine - helps create muscle tissue and convert glucose into energy
Amino Acid Glycine - essential to maintaining a healthy central nervous system
Amino Acid Glycine - essential to maintaining a healthy digestive system
Amino Acid Glycine - may provide protection via antioxidants from some types of cancer

Amino Acid Ornithine - helps build muscle and reduce body fat, especially when combined with the amino acids arginine and carnitine
Amino Acid Ornithine - is needed for the formation of citrulline, proline, and glutamic acid - three amino acids that help to supply energy to all the body's cells

Amino Acid Proline - is needed for the production of collagen and cartilage
Amino Acid Proline - keeps muscles and joints flexible
Amino Acid Proline - helps reduce sagging/wrinkling that accompany UV exposure, and skin aging

Amino Acid Serine - needed for overall good health - physical and mental
Amino Acid Serine - needed for the proper functioning of the brain and central nervous system

Amino Acid Taurine - helps regulate the nervous system and the muscles
Amino Acid Taurine - helps to keep the brain and heart healthy

Amino Acid Threonine - promotes normal growth by helping to maintain the proper protein balance in the body
Amino Acid Threonine - supports cardiovascular, and liver function
Amino Acid Threonine - supports central nervous, and immune system function

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Dosage

This is where it gets subjective - there is a wealth of divergent opinion regarding supplement dosage, especially for the treatment of disease. In the final analysis it is up to the individual, in consultation with their health professional, as to what dosage is recommended.

See the chapter, "*Example Applications of Supplements*", for some examples of application.

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Amino Acids - General Overview

Some practitioners recommend and prescribe Amino Acid supplementation. However, all the essential amino acids should be readily obtained from the individual's diet; and only if special circumstances require, should Amino Acid therapy be considered.

What are Amino Acids?

Amino acids are the "building blocks", or chemical units, that make up protein.
There are nine essential amino acids, namely: Histidine, Isoleucine, Leucine, Lysine, Methionine, Phenylalanine, Threonine, Tryptophan and Valine; and their best sources are meat, fish, fowl, eggs, and dairy products.

Alfalfa is also a good source for the nine essential amino acids.

In addition, Cysteine and Tyrosine, sometimes classified as Non-essential Amino Acids, are now considered "semi-essential", because if they are present in the diet (meat, milk, fish, poultry, and legumes are good sources), the body can use them in place of the two essential amino acids, Methionine and Phenylalanine, to make protein.

The nonessential amino acids are: Alanine, Arginine, Asparagine, Aspartic Acid, Carnitine, Carnosine, Citrulline, Cystine, Gamma-aminobutyric acid (GABA), Glutamic Acid, Glutamine, Glutathione, Glycine, Ornithine, Proline, Serine, Taurine, and Threonine.

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Net Protein Utilization

Foods that lack essential amino acids are poor sources of protein equivalents - this is because the body tends to *deaminate the amino acids obtained, and convert proteins into fats and carbohydrates. Consequently, a balance of essential amino acids is necessary for a high degree of net protein utilization, which is the mass ratio of amino acids converted to proteins, to amino acids supplied.

> *(**deaminate, deamination** - is the process by which amino acids are broken down when too much protein has been taken in.)

Complete proteins

Complete proteins contain a balanced set of essential amino acids for the human organism. With animal sources such as meat, poultry, eggs, fish, milk, and cheese providing all of the essential amino acids.

Complete proteins are also found in some plant sources such as quinoa, buckwheat, hempseed, and amaranth. Soybeans are considered by some authorities to be a source of complete protein; however, this is contested.

The net protein utilization is seriously affected by the *limiting amino acid* content (the essential amino acid found in the smallest quantity in the foodstuff), and also affected by the salvage of essential amino acids in the body.

Protein Source	Limiting Amino Acid
Wheat	Lysine
Rice	Lysine
Legumes	Tryptophan
Maize	Lysine and Tryptophan
Pulses	Methionine (or Cysteine)
Egg, Chicken	none; the reference for absorbable protein

It is therefore a good idea to mix foodstuffs that have different weaknesses in their essential amino acid distributions, and thus limit loss through deamination, and to increase overall net protein utilization.

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Essential Amino Acids (Nine)

- **Histidine** - promotes growth and the repairing of body tissues.
- **Isoleucine** - necessary for protein synthesis, and is found in all foods that contain complete protein (meat, poultry, fish, eggs, milk, and dairy products, etc). Deficiency of Isoleucine has produced loss of muscular coordination in lab rats, as well as a hypersensitivity to pain, heat, and cold.
- **Leucine** - found in milk, meat, and other high protein foods. It is needed for protein synthesis, and a well functioning immune system. Deficiency of leucine has produced loss of muscular coordination in lab rats, as well as a hypersensitivity to pain, heat, and cold.
- **Lysine** - found in cheese, fish, and legumes. It is necessary for protein synthesis, and is integral to the production of Carnitine, which in turn is essential to the oxidation of fatty acids in the body. Lysine is the limiting amino acid in wheat.
- **Methionine** - its primary function is to facilitate fat and protein metabolism; the body also uses it to manufacture Cysteine, another amino acid. Methionine is the limiting amino acid in legumes and other vegetables.
- **Phenylalanine** - the body uses phenylalanine to produce tyrosine, a nonessential amino acid, and three important hormones (Epinephrine, Norepinephrine and Thyroxine) as well as melanin (brown skin pigment). Phenylalanine uses the same active transport channel as tryptophan to cross the blood-brain barrier; and, in large quantities, it interferes with the production of the brain neurotransmitter, Serotonin.
- **Threonine** - plays a major role in the synthesis of purines, which in turn break down uric acid, which is a by-product of protein digestion. Threonine is also necessary to bodily processes requiring Glycine, a non essential amino acid.

- **Tryptophan** - Tryptophan is a precursor of Niacin (Vitamin B3), and of Serotonin, the brain neurotransmitter that regulates appetite, pain, mood, and sleep. Because of Tryptophan's mood-elevating, sleep-inducing capabilities, it is prescribed as both a sleeping agent and an antidepressant.
- **Valine** - necessary in the growth and maintenance of body tissues (found in fibrous animal proteins). Deficiency of Valine has produced loss of muscular coordination in lab rats, as well as a hypersensitivity to pain, heat, and cold.

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Semi-essential Amino Acids (Two)

- **Cysteine** - Once considered a non-essential amino acid, Cysteine has been re-classified as semi-essential. This is because if there is a deficiency of Methionine (an essential amino acid) in the diet, the body can use Cysteine in place of Methionine to synthesize protein.

  Good sources of Cysteine include meat, fish, fowl, soybeans, oats, and wheat. Food manufacturers use Cysteine as an antioxidant to protect the Vitamin C content of processed foods. Also, bakers mix Cysteine into dough to speed kneading. Cystine, on the other hand, is used as a dough strengthener as well as a dietary supplement.

  Additionally, two molecules of Cysteine can bond, forming Cystine, another amino acid
- **Tyrosine** - originally classified as a non essential amino acid, tyrosine is now considered semi-essential by most nutritionists, because if the body gets a sufficient amount, it can be used in place of phenylalanine to synthesize protein. Milk, meat, fish and legumes are good sources of tyrosine. The brain uses tyrosine to manufacture Norepinephrine, an "upper" that boosts mental alertness. (Norepinephrine, also known as noradrenaline, is both a hormone and a neurotransmitter.)

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Non-essential Amino Acids (Eighteen)

These amino acids are called "nonessential", or "dispensable", because the human organism can synthesize as much of them as it needs. There are many non-essential amino acids, including: Alanine, Arginine, Asparagine, Aspartic Acid, Carnitine, Carnosine, Citrulline, Cystine, Gamma-aminobutyric acid (GABA), Glutamic Acid, Glutamine, Glutathione, Glycine, Ornithine, Proline, Serine, Taurine, and Threonine.

End

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