Macronutrients

**Calories** are a unit of energy widely used in nutrition. They are measured in kilocalorie (kcal) which represents the amount of heat required to raise the temperature of 1 kilogram of water by 1°C. Fat in food contains 9 kilocalories per gram (kcal/g) while carbohydrates and proteins in food contain 4 kcal/g. Alcohol in food contains 7 kcal/g.

**Proteins** serve as the major structural component of all cells of the body, and functions as enzymes, in membranes, as transport carriers, and as some hormones. Protein is found in meat, dairy, legumes, nuts, seafood, and eggs.

**Carbohydrates** provide energy, spare protein consumption, and support the central nervous system. Carbohydrates are found in pasta, rice, cereals, breads, potatoes, milk, fruit, and sugar.

**Fat** is an important energy source and can be a source of Omega-6 and Omega-6 polyunsaturated fatty acids. Fats are categorized according to the number and bonding of the carbon atoms in their aliphatic chains. Saturated fats have no double bonds between the carbons in the chain. Unsaturated fats have one (mono) or more (poly) double bonded carbons in the chain.

**Saturated fatty acids** are fatty acids without double bonds in their backbones. A diet low in saturated fatty acids is thought to lower the risk of cardiovascular disease, diabetes, and death. Most animal fats are saturated whereas the fats of plants and fish are generally unsaturated.

**Monounsaturated fatty acids** are fatty acids that have only one double bond in their backbone. They can improve insulin sensitivity and promote healthier serum lipid profiles in children. Monounsaturated fats are found in animal flesh such as red meat, whole milk products, nuts, high fat fruits such as olives and avocados, and vegetable oils.

**Polyunsaturated fatty acids** are fatty acids that contain more than one double bond in their backbone. **Omega-6 polyunsaturated fatty acids (linoleic acid)** are an essential component of structural membrane lipids, involved with cell signaling, and precursor of eicosanoids. They are also required for normal skin function. **Omega-3 polyunsaturated fatty acids (α-linoleic acid)** are involved with neurological development and growth. They are also a precursor of eicosanoids.

**Dietary fiber (roughage)** is the portion of plant-derived food that cannot be completely broken down by human digestive enzymes. It normalizes bowel movements, maintains bowel health, lowers cholesterol levels, and helps control blood sugar levels. Dietary fiber is found in whole grains, nuts and seeds, and fruit and vegetables.

Minerals

**Calcium** is a macromineral that is important for healthy bones and teeth, muscle relaxation and contraction, nerve functioning, blood clotting, blood pressure regulation, and immune system health. Calcium is found in milk and milk products, canned fish, fortified tofu and fortified soy milk, greens (especially broccoli and mustard greens), and legumes.

**Copper** is a trace mineral that is part of many enzymes and is needed for iron metabolism. Copper is found in legumes, nuts and seeds, whole grains, organ meats, and drinking water.

**Iron** is a trace mineral that is critical in hemoglobin and is needed for energy metabolism. Iron is found in organ meats, red meats, fish, poultry, shellfish (especially clams), egg yolks, legumes, dried fruits, dark, leafy greens, iron-enriched breads and cereals, and fortified cereals.

**Magnesium** is a macromineral that is important for healthy bones and teeth, making protein, muscle contraction, nerve transmission, and immune system health. Magnesium is found in nuts and seeds, legumes, leafy, green vegetables, seafood, chocolate, artichokes, and “hard” drinking water.

**Phosphorus** is a macromineral that is important for healthy bones and teeth. It is found in every cell and is part of the system that maintains acid-base balance. Phosphorus is found in meat, fish, poultry, eggs, milk, and processed foods.

**Potassium** is a macromineral needed for proper fluid balance, nerve transmission, and muscle contraction. Potassium is found in meats, milk, fresh fruits and vegetables, whole grains, and legumes.

**Sodium** is a macromineral that is needed for proper fluid balance, nerve transmission, and muscle contraction. It is found in large amounts in table salt, soy sauce, and processed foods. It is found in small amounts in milk, breads, vegetables, and unprocessed meats.

**Zinc** is a trace mineral that is part of many enzymes, needed for making protein and genetic material, has a function in taste perception, wound healing, normal fetal development, production of sperm, normal growth and sexual maturation, and immune system health. Zinc is found in meats, fish, poultry, leavened whole grains, and vegetables.

Vitamins

**Cobalamin (vitamin B12)** is a water soluble vitamin that is part of an enzyme needed for making new cells and is important to nerve function. Cobalamin is found in meat, poultry, fish, seafood, eggs, and milk and milk products. It is not found in plant foods.

**Folate (folic acid)** is part of an enzyme needed for making DNA and new cells, especially red blood cells. Folate is found in leafy green vegetables and legumes, seeds, orange juice, and liver. It is also now added to most refined grains.

**Niacin (vitamin B3)** is a water soluble vitamin that is part of an enzyme needed for energy metabolism and is important for the nervous system, digestive system, and skin health. Niacin is found in meat, poultry, fish, whole-grain or enriched breads and cereals, vegetables (especially mushrooms, asparagus, and leafy green vegetables), and peanut butter.

**Riboflavin (vitamin B2)** is a water soluble vitamin that is part of an enzyme needed for energy metabolism and is important for normal vision and skin health. Riboflavin is found in milk and milk products, leafy green vegetables, whole-grain, and enriched breads and cereals.

**Thiamine (vitamin B1)** is a water soluble vitamin that is part of an enzyme needed for energy metabolism and is important to nerve function. Thiamine is found in all nutritious foods in moderate amounts, pork, whole-grain or enriched breads and cereals, legumes, and nuts and seeds.

**Vitamin A** is a fat soluble vitamin that is needed for vision, healthy skin and mucous membranes, bone and tooth growth, and immune system health. Vitamin A is found in animal sources (retinol): fortified milk, cheese, cream, butter, fortified margarine, eggs, and liver.

**Vitamin B6 (Pyridoxine)** is a water soluble vitamin that is part of an enzyme needed for protein metabolism and it helps make red blood cells. Vitamin B6 is found in meat, fish, poultry, vegetables, and fruits.

**Vitamin C (ascorbic acid)** is a water soluble vitamin that is an antioxidant, part of an enzyme needed for protein metabolism, important for immune system health, and aids in iron absorption. Vitamin C is found only in fruits and vegetables, especially citrus fruits, vegetables in the cabbage family, cantaloupe, strawberries, peppers, tomatoes, potatoes, lettuce, papayas, mangoes, and kiwifruit.

**Vitamin D** is a fat soluble vitamin needed for proper absorption of calcium and is stored in bones. Vitamin D is found in egg yolks, liver, fatty fish, fortified milk, and fortified margarine. When exposed to sunlight, the skin can also make vitamin D.

References

Smith MR, Micha R, Golden CD, Mozaffarian D, Myers SS (2016) Global Expanded Nutrient Supply (GENuS) model: a new method for estimating the global dietary supply of nutrients. *PLoS One* 11(1): e0146976. <https://doi.org/10.1371/journal.pone.0146976>

[National Academy. 2000. Dietary Reference Intakes: Applications in Dietary Assessment. Page 9956. National Academies Press, Washington, D.C. Available from http://www.nap.edu/catalog/9956 (accessed May 29, 2020).](https://www.zotero.org/google-docs/?KpMtkS)