

2.1.4. Micronutrients

Micronutrients are nutrients that are required in humans in small (micro) amounts. The micronutrients group consists of vitamins and minerals. Each of the vitamins has its own function. Almost every action in the body requires the assistance of vitamins (Table 2.1). Vitamins can function only if they are intact, but can break down easily because of heat, light or chemical agents. Cooking and processing can greatly reduce the vitamin content of food.

Fat soluble vitamins are: A, D, E and K. Water soluble vitamins can hardly be stored by the body, with exception of B12. All B vitamins and vitamin C are water soluble. An excess of water soluble vitamins leaves the body through the urine. Nevertheless, vitamin supplementation can cause toxicity symptoms even of water-soluble vitamins.

In addition to vitamins, the body also needs minerals to maintain its functions. Fourteen minerals are known to be essential in human nutrition. Minerals are indestructible and do not need to be handled with the special care that vitamins require. They can however, leach into water during cooking. Minerals can also be bound by substances that interfere with the body's ability to absorb them. For example, if you drink a coffee with your sandwich, the iron from your sandwich will not be absorbed properly because of certain substances in the coffee that bind to the iron (for more info §2.2 on bioavailability). Trace elements are those minerals of which the body only needs small amounts, with a magnitude of micrograms (1/1000 milligram) daily. An overview of the essential minerals and their sources is shown in Table 2.2.

Vitamin	Source
A	Vitamin A can be obtained in two forms: 1) preformed retinol (retinyl esters) found in animal derived foods 2) carotenoids which are mainly plant derived, some of which can be converted to retinol in the body; 6mg of beta-carotene is equivalent to 1mg of retinol. Liver, whole milk, cheese, butter and many low fat spreads are dietary sources of retinol. Carrots, dark-green leafy vegetables, tomatoes, and yellow/orange-coloured fruits, e.g. oranges, mangoes and apricots, are dietary sources of carotenoids.
C	Fresh fruits especially citrus fruits and berries; green vegetables, potatoes, peppers and tomatoes are all good sources of vitamin C.
D	Most vitamin D is obtained through the action of sunlight on skin during the summer months. Foods that contain significant amounts of vitamin D include oily fish, eggs, fortified cereals, meat and fat spreads.
E	Vegetable oils, nuts and seeds.
K	Green leafy vegetables, dairy products and meat.
B1 (Thiamin)	Whole grains, nuts, meat (especially pork), fruit and vegetables.
B2 (Riboflavin)	Milk, eggs, fortified breakfast cereals, liver, legumes, mushrooms and green vegetables are all sources of riboflavin.
B3 (Niacin)	Meat, wheat and maize flour, eggs, dairy products and yeast.
B5	Meat, eggs, whole grain cereals, legumes, milk and dairy, vegetables, fruits.
B6	Poultry, white fish, milk, eggs, whole grains, soya beans, peanuts and some vegetables.
B8 (Biotin)	Eggs, liver, milk, nuts, peanuts.
B11 (Folate)	Green leafy vegetables, brown rice, peas, oranges, bananas (supplements in pregnancy are advised).
B12	Meat, fish, milk, cheese, eggs, yeast extract and fortified breakfast cereals.

*Table 2.1: A list with essential vitamins and their main sources.
 (British Nutrition Foundation)

Mineral element	Food sources
Calcium	Milk, cheese and other dairy. Some green leafy vegetables such as broccoli and cabbage (but not spinach), fortified soya products and fish eaten with the bones such as sardines, tinned salmon and whitebait.
Chromium	Meat, nuts, cereal grains, brewer's yeast and molasses
Copper	Shellfish, liver, kidney, nuts and wholegrain cereals
Fluoride	Fluoride is found in fluoridated water, tea and fish. The diet provides only about 25% of total intake. The addition of fluoride to toothpaste is important in those areas where the water supply is low in fluoride.
Iodine	The amount of iodine in plant foods such as vegetables and cereal grains is determined by the amount of iodine in the growing plant's environment, and the amount in the soil or water can vary a lot. The only rich sources of iodine are seafoods (sea fish, shellfish and seaweed), although milk is also a source. In many countries salts, and thus processed foods containing salt (e.g. bread), are fortified with iodine.
Iron	Liver, red meat, pulses, nuts, eggs, dried fruits, poultry, fish, whole grains and dark green leafy vegetables are all sources of iron.
Magnesium	Present in both plant and animal cells and is the mineral in chlorophyll, the green pigment in plants, and so is widely available. Sources include green leafy vegetables, nuts, bread, fish, meat and dairy products.
Manganese	Present in plant foods such as vegetables, cereals and nuts. Tea is also a rich source
Molybdenum	Present in many foods. Whole grain cereals, legumes, nuts are good sources.
Phosphorus	Red meat, dairy products, fish, poultry, bread, rice and oats and is usually found in foods that also contain calcium.
Potassium	Present in almost all foods, but fruit (particularly bananas), vegetables, meat, fish, shellfish, nuts, seeds, pulses and milk are most useful sources. Processed foods typically contain less than raw foods.
Selenium	Found in a variety of foods, especially Brazil nuts, bread, fish, meat and eggs. The selenium content of cereals is directly proportional to the selenium content in the soil.
Sodium	Most raw foods contain very small amounts of sodium chloride (salt). But salt is often added during the processing, preparation, preservation and serving of foods.
Zinc	Zinc is present in many foods and is most readily absorbed from meat. It is also present in milk, cheese, eggs, shellfish, wholegrain cereals, nuts and pulses.

Table 2.2: Essential mineral elements and examples of food sources*
*(British Nutrition Foundation)

Chloride is not included in Table 2.2 as there are no intake targets determined for it. Sodium, potassium and chloride are also called electrolytes. Deficiency of these minerals hardly exist in humans, as they are present in many foods. Only through loss of fluid (diarrhea, sweating, kidney problems) needs can be higher (Voedingscentrum).

Arsenic, boron, cobalt, lithium, lead, nickel, silica, tin and vanadium are not considered essential trace elements; therefore, no recommendations are determined for these elements. If present in larger quantities than naturally present in foods, most of these elements are toxic (Voedingscentrum).

References

British Nutrition Foundation. (n.d.). Vitamins. Retrieved from <https://www.nutrition.org.uk/nutritionscience/nutrients-food-and-ingredients/vitamins.html?limitstart=0>

Voedingscentrum. (n.d.). Voedingscentrum. Retrieved from <https://www.voedingscentrum.nl/nl.aspx>

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