Nutrient

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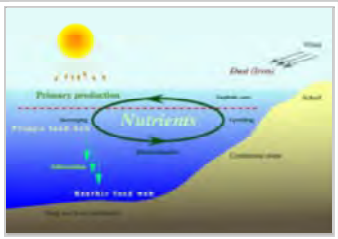

Nutrient cycle in the oceans

A **nutrient** is a component in foods that an organism uses to survive and grow. Macronutrients provide the bulk energy an organism's metabolic system needs to function while micronutrients provide the necessary cofactors for metabolism to be carried out. Both types of nutrients can be acquired from the environment.[1] Micronutrients are used to build and repair tissues and to regulate body processes while macronutrients are converted to, and used for, energy. Methods of nutrient intake are different for plants and animals. Plants take in nutrients directly from the soil through their roots and from the atmosphere through their leaves. Animals and protists have specialized digestive systems that work to break down macronutrients for energy and utilize micronutrients for both metabolism and anabolism (constructive synthesis) in the body.

Organic nutrients consist of carbohydrates, fats, proteins (or their building blocks, amino acids), and vitamins. Inorganic chemical compounds such as dietary minerals, water (H2O), and oxygen may also be considered nutrients.[2] A nutrient is considered essential if it must be obtained from an external source either because the organism cannot synthesize it or because insufficient quantities are produced. Nutrients needed in very small amounts are called micronutrients while those needed in large quantities are called macronutrients. The effects of nutrients are dose-dependent; shortages are called deficiencies.[3]

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Types of nutrient

Macronutrients are defined in several different ways.[4]

- The chemical elements humans consume in the largest quantities are carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulphur, or CHNOPS.

- The classes of chemical compounds humans consume in the largest quantities and which provide bulk energy are carbohydrates, proteins, and fats. Water and atmospheric oxygen also must be consumed in large quantities, but are not always considered "food" or "nutrients".
- Calcium, salt (sodium and chloride), magnesium, and potassium (along with phosphorus and sulfur) are sometimes added to the list of macronutrients because they are required in large quantities compared to other vitamins and minerals. They are sometimes referred to as the macrominerals.

Good sources of magnesium: bran muffins, pumpkin seeds, barley, buckwheat flour, low-fat vanilla yogurt, trail mix, halibut steaks, garbanzo beans, lima beans, soybeans, and spinach

Substances that provide energy

- Carbohydrates are compounds made up of types of sugars. Carbohydrates are classified by their number of sugar units: monosaccharides (such as glucose and fructose), disaccharides (such as sucrose and lactose), oligosaccharides, and polysaccharides (such as starch, glycogen, and cellulose).
- Proteins are organic compounds that consist of amino acids joined by peptide bonds. The body cannot manufacture some of the amino acids (termed essential amino acids); the diet must supply them. Proteins, in nutrition, are broken down through digestion by proteases back into free amino acids.
- Fats consist of a glycerin molecule with three fatty acids attached. Fatty acids are unbranched hydrocarbon chains,1 connected by single bonds alone (saturated fatty acids) or by both double and single bonds (unsaturated fatty acids). Fats are needed to keep cell membranes functioning properly, to insulate body organs against shock, to keep body temperature stable, and to maintain healthy skin and hair. The body does not manufacture certain fatty acids (termed essential fatty acids) and the diet must supply them.

Although alcohol provides energy, and can thus be compared to macronutrients, it is not a substance that is essential for normal function. The acetic acid in vinegar also provides a similar amount of energy per gram, but again, it is not a nutrient because it is not essential for normal function.

Fat has an energy content of 9 kcal/g (~37.7 kJ/g); proteins and carbohydrates 4 kcal/g (~16.7 kJ/g). Ethanol (grain alcohol) has an energy content of 7 kcal/g (~29.3 kJ/g).[5]

Substances that support metabolism

- Dietary minerals are generally trace elements, salts, or ions such as copper and iron. Some of these minerals are essential to human metabolism.
- Vitamins are organic compounds essential to the body. They usually act as coenzymes or cofactors for various proteins in the body.
- Water is an essential nutrient and is the solvent in which all the chemical reactions of life take place.

Plants absorb nutrients from the soil or the atmosphere, or from water (mainly aquatic plants). An exception are the carnivorous plants, which externally digest nutrients from animals before ingesting them.[6]

The chemical elements consumed in the greatest quantities by plants are carbon, hydrogen, and oxygen. These are present in the environment in the form of water and carbon dioxide; energy is provided by sunlight.[7] Nitrogen, phosphorus, and sulfur are also needed in relatively large quantities. Together, the "Big Six" are the elemental **macronutrients** for all organisms,[8] often represented by the acronym CHNOPS.[9] Usually they are sourced from inorganic (e.g. carbon dioxide, water, nitrate, phosphate, sulfate) or organic (e.g. carbohydrates, lipids, proteins) compounds, although elemental diatomic molecules of nitrogen and (especially) oxygen are often used.

The strip of a green alga (*Enteromorpha*) along this shore indicates that there is a nearby source of nutrients (probably nitrates or ammonia from a small estuary).

Other chemical elements are also necessary to carry out various life processes and build structures; see fertilizer and micronutrient for more information.

Some of these are considered micronutrients in certain organisms. The mnemonic C. HOPKN'S CaFe Mg (to be used as C. Hopkins coffee mug) is used by some students to remember the list as: carbon, hydrogen, oxygen, phosphorus, potassium, nitrogen, sulfur, calcium, iron, and magnesium. Silicon, chloride, sodium, copper, zinc, and molybdenum are sometimes also included, but are in other cases considered micronutrients.[10]

Rich sources of copper: oysters, beef or lamb liver, Brazil nuts, blackstrap molasses, cocoa, and black pepper. Good sources: lobster, nuts and sunflower seeds, green olives, and wheat bran.

Essential and non-essential nutrients

Nutrients are frequently categorized as essential and nonessential.

Essential nutrients

Essential nutrients are unable to be synthesized internally (either at all, or in sufficient quantities), and so must be consumed by an organism from its environment.[11]

For humans, these include essential fatty acids, essential amino acids, vitamins, and certain dietary minerals. Oxygen and water are also essential for human survival, but are generally not considered "food" when consumed in isolation. There are no "essential carbohydrates", animals can synthesize all the types of carbohydrates needed for growth.

Humans can derive energy from a wide variety of fats, carbohydrates, proteins, and simple chemicals such as ethanol and acetic acid.

Non-essential nutrients

Non-essential nutrients are substances within foods can still have a significant impact on health, whether beneficial or toxic. For example, most dietary fiber is not absorbed by the human digestive tract, but is important in maintaining the bulk of a bowel movement to avoid constipation.

Nonessential nutrients are those nutrients that can be made by the body; they may often also be absorbed from consumed food.[11] The majority of animals ultimately derive their essential nutrients from plants,[11] though some animals may consume mineral-based soils to supplement their diet.

Interest has recently increased in phytochemicals, which include many non-essential substances which may or may not have health benefits.[1]

Deficiencies and toxicity

An inadequate amount of a nutrient is a deficiency. Deficiencies can be due to a number of causes including inadequacy in nutrient intake called dietary deficiency, or conditions that interfere with the utilization of a nutrient within an organism.[3] Some of the conditions that can interfere with nutrient utilization include problems with nutrient absorption, substances that cause a greater than normal need for a nutrient, conditions that cause nutrient destruction, and conditions that cause greater nutrient excretion.[3]

Nutrient toxicity occurs when an excess of a nutrient does harm to an organism.

See also

- Agricultural Research Service
- Ecological sanitation
- Essential nutrient
- Food composition
- Nutrient density
- Nutrients (journal)
- Nutrition
- Nutritionism
- Underweight
- List of macronutrients
- List of micronutrients
- List of phytochemicals in food

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External links

- USDA. Dietary Reference Intakes (https://fnic.nal.usda.gov/sites/fnic.nal.usda.gov/files/uploads/recommended_intakes_individuals.pdf)