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WHAT MOLECULES HIDE BEHIND FOOD?

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To stay in good health, human need to eat to cover their **nutritional requirements**. All flavors, textures and odours of each food are associated with **nutrients**, which are food substances assimilated by the body and essential to its proper functioning. The aim of this newsletter is to inform you about the molecules constituting food, from macronutrients (**lipids**, **proteins**, **carbohydrates**) to micronutrients (**vitamins**, **minerals**).

Macronutrients

Macronutrients correspond to **carbohydrates**, **proteins** and **lipids**, and provide the energy required for our bodies. These 3 macronutrients are essential to the body.



Lipids

Dietary lipids are mainly **triglycerides**, being made up of 3 **fatty acids*** (FA). Fatty acids are distinguished by their structure : saturated fatty acids have no double bonds, while unsaturated fatty acids have one or more double bonds.

Saturated (SFA)	Monounsaturated (MUFA)	Polyunsaturated (PUFA)
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Excessive consumption of saturated fats, which mainly come from ultra-processed products, is associated with an **increased cardiovascular risk**. As a result, it is recommended to limit saturated fatty acids intake and favour unsaturated fats, especially **Omega 3** (oily fish, oleaginous fruits such as rapeseed, linseed, walnuts, etc.) and **Omega 6** (vegetable oils, chia, walnuts, etc.).

*Organic molecules with a long carbon chain (C) which enter into the composition of animal and vegetable fats.

Cholesterol is also sometimes pointed out, even though it is a vital lipid for the body (cell composition, vitamin production...). Its negative impact on health is not linked to cholesterol itself, but to its 2 transporters : LDL (low density lipoprotein) and HDL (high density lipoprotein).





*A substance produced by the liver that helps the body to digest fats.

In fact, LDL transporters **promote the accumulation** of cholesterol in the arteries, thus increasing the risk of cardiovascular diseases, and are described as "bad". Conversely, HDL transporters **promote the elimination** of cholesterol present in the arteries and its **transformation into bile***, and are thus commonly referred to as "good".

Carbohydrates

Carbohydrates are the body's **main source of energy (50%)**. They are divided into two categories: **simple** and **complex** carbohydrates. Complex carbohydrates are distinguished by their **large number of molecules (>2)** and by **their lack of sweetness** compared to simple carbohydrates.



**sucrose : extract of sugar cane or beet.

Simple carbohydrates can be naturally present in fruits and, conversely, can be "added" in ultraprocessed products such as cookies and sweets. The purpose of this addition is to improve taste, texture and shelf life of the product. Regarding added sugars, WHO recommends a consumption of less than 10% of total energy intake (ex: 50 g for an energy intake of 2000 kcal per day). Excessive sugar consumption can lead to overweight, obesity and related diseases, such as type 2 diabetes.

Carbohydrates can also be defined as **fast** or **slow**, **depending on digestion time**. Logically, complex carbohydrates, with a longer-chain, should be slower to digest. However, there are exceptions that make the use of these terms **highly controversial in the scientific literature**. Foods, such as boiled potatoes, made up of 80% starch, undergo rapid digestion. Although starch is a complex carbohydrate, it is rapidly broken down into glucose (a simple carbohydrate), leading to a rapid digestion, a sharp **rise in blood sugar concentration** and a **high glycemic index***** (>70). In the case of wheat, the starch is protected by a protein network that makes it difficult to digest and so leading to a slower digestion.



Note : whole wheat still contains the bran (the husk that protects the grain), which slows down digestion and absorption, resulting in a lower GI than refined wheat (flour).

The complexity of carbohydrates (simple or complex) in no way predicts their speed of digestion and therefore whether they are slow or fast; the **overall composition of the food** can modify the digestion capacity of carbohydrates.

Proteins

Proteins are macromolecules made up of a sequence of **amino acids** (AA). There are 20 AA which are present in dietary proteins, classified into 2 categories :



AA make up both plant and animal proteins. However, the AA composition of these two sources differs : animal proteins **provide all the essential AA**, while vegetable proteins do not.





micronutrients (vitamins and minerals) and fibers.

Note : Food products of animal origin have a higher protein content : 100g of beef steak provide 27g of protein, compared with 6g for wheat and 10g for kidney beans.

Micronutriments

Micronutrients do not provide energy, but are essential for the **body's proper functioning**. Micronutrients are minerals (e.g. calcium, potassium, magnesium, copper...) and vitamins (vitamins A, C, D, E...). Some of these have antioxidant properties that can prevent cellular aging.

Note : The shift from whole foods to processed and refined foods reduces the quantity of micronutrients in the modern Western diet, leading to deficiencies in the world's population and increasing the risk of some pathologies (obesity, cancer...).

	Minerals	Vitamins
Definition	Essential inorganic compounds that cannot be synthesized by the body. The main minerals present in the body are : calcium, sodium, phosphorus, potassium, magnesium.	Essential organic compounds. Some can be synthesized by the body, while others cannot.
Sources	 Calcium: Dairy products, sardines, green leafy vegetables, eggs, seeds Magnesium: Spinach, legumes, seeds, whole grains, nuts, avocado Phosphorus: Red meat, dairy products, bread, rice, oatmeal, fish, poultry Potassium: Sweet potatoes, tomatoes, potatoes, beans, seafood, bananas 	 Vitamin C: Citrus fruits, parsley, red peppers Vitamin A: Made from beta-carotene found in carrots, sweet potatoes, green leafy vegetables Vitamin K: Produced by intestinal microbiota or in cabbage, spinach, soybean oil, rapeseed oil Vitamin D: Synthesized by skin cells in sunlight, or in oily fish, cod liver oil, egg yolk
Fonctions	 Calcium: Necessary for a healthy heart, muscles and digestive system, strengthens bones Magnesium: Contributes to energy and is necessary for bones formation Phosphorus: Energy processing, component of bones and cells Potassium: Regulation of ionic exchange , energy regulation 	 Vitamin A: Involved in immune system function, differentiation of ocular epithelium Vitamin K: Involved in blood coagulation and bones regulation Vitamin D: Maintains calcium and phosphorus homeostasis, and mineralization of bones, cartilage and teeth during and after growth Vitamin C: Helps the functioning of enzymes (coenzymes), promotes iron absorption and is an antioxidant

Conclusion

By now, you're familiar with the major families of molecules that hide behind foods. By reading this Newsletter, it's now clear that each nutrient has a **specific and indispensable role** to play in the body, making it easier to understand what we eat and why it's essential to eat a **balanced and varied diet**.

In view of the complexity and density of the subject, we've only given you a brief introduction to micronutrients. A forthcoming newsletter **will present micronutrients**, their functions and recommended consumption **in more detail**.







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