Chapter 01: Foods and Food Groups

1. **Food**

   Food is a substance consumed to nourish the body, allowing it to grow, maintain good health, and produce the energy required for its vital functions. For the body to function properly, it must be supplied with substances that are essential to its balance and development. These substances, called nutrients, play a fundamental role in metabolism and ensure the proper functioning of cells.

2. **Nutrient**

   Nutrients are substances that can be directly absorbed by the body without the need for complex digestion. They are divided into macronutrients and micronutrients. Macronutrients include carbohydrates, fats, and proteins, which are necessary for energy production and tissue formation. Micronutrients, on the other hand, include vitamins and minerals, which are involved in many metabolic reactions and contribute to maintaining health.

2.1 **Proteins**

Proteins, also known as protides, are organic molecules made up of amino acids, which are the basic building blocks of these structures. Out of the twenty existing amino acids, eight are considered essential because they cannot be synthesized by the body and must be obtained through the diet. Proteins are found in both animal-based foods, such as meat, fish, eggs, and dairy products, and plant-based foods, such as legumes and cereals. Animal-based proteins contain all the essential amino acids, while plant-based proteins must be combined to ensure a complete intake.

Proteins play several essential biological roles. They are involved in the structure of cells and tissues, contributing to growth and repair of the body. They also participate in the production of enzymes, hormones, and antibodies, thus ensuring enzymatic, hormonal, and immune functions. Although their primary role is not energy-related, they can be used as an energy source in the event of a deficit in carbohydrates and fats. The recommended daily intake of protein is approximately 1 gram per kilogram of body weight, with this need varying depending on age, physical activity, and physiological state.

2.2 Carbohydrates

Carbohydrates are organic compounds composed of carbon, hydrogen, and oxygen. They are

the primary source of energy for the body and are mainly of plant origin. Several types of carbohydrates are distinguished based on the length of their molecular chain. Simple carbohydrates, such as glucose and fructose, are quickly absorbed and cause a rapid increase in blood sugar levels. Double carbohydrates, like sucrose and lactose, require digestion before they can be absorbed. Complex carbohydrates, such as starch, are made up of long chains of molecules and release energy gradually during digestion.

Carbohydrates play a fundamental energetic role. Each gram of carbohydrates provides approximately 4 kcal (17 kJ). Once digested, they release glucose, which is immediately used by the cells or stored as glycogen in the liver and muscles. Adequate carbohydrate consumption prevents the body from using proteins as an energy source, thus preserving muscle mass. Blood glucose levels, known as blood sugar, are maintained around 1 g/L when fasting through hormonal regulation mechanisms.

The glycemic index is an indicator that measures the ability of a food to raise blood sugar levels after ingestion. The higher the glycemic index, the faster glucose is released into the blood. This index depends on several factors, such as the composition of the food, its cooking method, and the industrial treatments it has undergone. It is also influenced by the presence of other nutrients, such as fats and proteins, which slow down glucose absorption. To maintain good glycemic balance, it is recommended to favor foods with a low or moderate glycemic index, such as whole grains, legumes, and dried fruits, while limiting the intake of fast sugars found in processed products.

Carbohydrates do more than provide energy. They are often accompanied by B vitamins, which are necessary for their metabolism, as well as minerals and dietary fibers, which support the proper functioning of the digestive system. To ensure sufficient carbohydrate intake, it is recommended to consume starchy foods such as bread, pasta, rice, and potatoes during meals, while integrating fruits and vegetables, which also provide antioxidants and fibers essential for digestive health.

2.3 Lipids

Lipids, also known as fats or fatty substances, are organic molecules made up of carbon, hydrogen, and oxygen. Their structure is based on fatty acids, which can be classified into three categories according to the nature of their chemical bonds: saturated, monounsaturated, and polyunsaturated. Among these, polyunsaturated fatty acids, such as omega-3 and omega-

6, are considered essential because the body cannot synthesize them and must therefore obtain them from the diet.

Lipids serve several vital functions. Their main role is energetic: one gram of lipid provides approximately 38 kJ, making it a more concentrated energy source than carbohydrates and proteins. They also contribute to thermoregulation by helping to maintain body temperature. Structurally, lipids are involved in the formation of cell membranes and facilitate the absorption of fat-soluble vitamins (A, D, E, K). When not immediately used, lipids are stored in adipose tissue, serving as an energy reserve that can be mobilized when needed.

The daily lipid intake accounts for about 35% of the total energy intake. Excessive consumption of lipids, particularly saturated fatty acids found in animal products, can lead to an increase in cholesterol levels and promote the development of cardiovascular diseases. Furthermore, an excess of dietary fats can lead to weight gain and, over time, obesity, especially if combined with a sedentary lifestyle and other risk factors. On the other hand, unsaturated fatty acids, found in vegetable oils and fatty fish, have a protective effect on cardiovascular health.

Foods containing lipids vary in their content. Oily fruits like walnuts and almonds contain about 45% lipids, while fermented cheeses have between 15% and 35%. The fat content in meats ranges from 3% to 25%, and in fish, it is between 1% and 20%. Pure fats, such as oil, are made up of 100% lipids, while butter and margarine contain about 83%. Creams, depending on their fat content, range from 12% to 30%. In a low-calorie diet, it is recommended to favor light creams over butter to limit fat intake.

2.4 Vitamins

Vitamins are essential micronutrients required by the body in very small quantities, typically in milligrams (mg) or micrograms (µg) per day. Unlike macronutrients, they do not provide energy but play a crucial role in regulating biological reactions and maintaining health. The body cannot synthesize most vitamins, with the exception of vitamin D, which can be produced under the effect of sunlight.

Vitamins are divided into two main categories based on their solubility. Fat-soluble vitamins (A, D, E, K) dissolve in lipids and are primarily found in fatty foods, such as vegetable oils, butter, and fatty fish. They can be stored in adipose tissue, allowing for some reserve in case of insufficient intake. On the other hand, water-soluble vitamins (B1, B2, B3 to B12, C, and

P) dissolve in water and are mainly found in fruits, vegetables, and whole grains. Unlike fat-soluble vitamins, they are not stored in large amounts in the body, necessitating regular intake to prevent deficiencies.

Each vitamin has a specific role in metabolism. Some facilitate the use of nutrients by the body, such as the B vitamins, which are involved in the conversion of carbohydrates, fats, and proteins into energy. Others have antioxidant properties, such as vitamins C and E, which protect cells from damage caused by free radicals. Vitamin D, on the other hand, is essential for bone health as it promotes calcium absorption.

To ensure optimal vitamin intake, it is recommended to consume a varied and balanced diet. A deficiency in vitamins can lead to various physiological disorders, while an excess, particularly of fat-soluble vitamins, can be toxic. Therefore, a diverse diet including fruits, vegetables, cereals, dairy products, and protein sources is essential to meet the daily needs of the body.

2.5 Mineral Elements

Mineral elements, inorganic substances, make up about 4% of body mass. Two types of mineral elements are distinguished: macrominerals and trace minerals.

Macrominerals, which are needed in relatively large amounts (grams or fractions of a gram), include minerals such as calcium, phosphorus, potassium, magnesium, and sodium. Among these, calcium is the most abundant in the human body. Trace minerals, found in very small amounts (hundredths of a gram or micrograms), include elements such as iron, fluoride, copper, zinc, iodine, and sulfur.

Mineral elements play essential roles in the body, both structural and functional. They are involved in the formation and renewal of tissues such as bones, teeth, and blood cells. They also participate in the metabolism of nutrients, the regulation of fluid balance and blood pressure, and muscle excitability. Furthermore, some minerals are required for hormone production and for strengthening the immune system.

The needs for mineral elements vary depending on a person's physiological state. For example, calcium needs are increased during pregnancy and breastfeeding, as these periods require more support for bone and tooth formation.

2.6 Water and Fibers

Water

Water makes up approximately 70% of the human body weight. It is primarily present inside cells, with one-third of this water found in extracellular fluids such as blood, lymph, and interstitial fluid. Water serves several vital functions, including transporting nutrients to cells and eliminating metabolic waste. It also plays a crucial role in thermoregulation, helping the body maintain a stable temperature of 37°C.

Hydration balance must be maintained, meaning that water intake must match the body's water losses, which occur through urine (1.5 liters), feces (0.1 liter), as well as respiration and perspiration (0.9 liter). Thirst is a signal sent by the brain to indicate dehydration. Drinking water, whether from sources, minerals, or the tap, also contributes to the intake of mineral elements.

Fibers

Fibers are complex carbohydrates that the body cannot digest. They do not provide energy, as they are not assimilable by digestive enzymes. However, they play an important functional role in the digestive system. Fibers help regulate intestinal transit by increasing stool volume, and they are partially broken down by the gut flora. Some fibers can also reduce blood cholesterol levels, thereby contributing to the prevention of cardiovascular diseases.

However, excessive fiber intake can accelerate intestinal transit, potentially leading to the loss of essential minerals that don't have enough time to be absorbed. The daily requirement for fiber is approximately 30 grams. Fruits, vegetables, and whole grains are excellent sources of fiber. A balanced and varied diet is generally sufficient to meet the recommended fiber intake.

4. Food Classification

Food classification allows foods to be grouped rationally and simply, making it easier to manage the thousands of different foods. Classification criteria can be partial, based on elements such as technological origin or dominant nutrients, or multiple. Below are the main classifications used to categorize foods.

4.1. By Origin

Foods can be classified based on their origin, which can be plant-based, animal-based, or mineral-based.

4.1.1. Plant-Based Foods

Plant-based foods can be categorized according to the systematics and anatomy of plants. For

example, grasses, legumes, algae, and mushrooms can be distinguished based on systematics. Anatomically, plant-based foods can be classified into leaves, fruits, seeds, and tubers.

4.1.2. Animal-Based Foods

Animal-based foods are also classified according to systematics and tissue. Systematically, animals can be grouped into mammals, birds, and fish. From a tissue perspective, they can be divided into muscle, liver, and milk.

4.1.3. Mineral or Synthetic Foods

Some foods come from mineral origins or are produced synthetically. This includes water, chlorides, amino acid mixtures, and synthetic triglycerides.

4.2. By Technology

Foods can also be classified based on their technological treatment.

4.2.1. Fresh Foods

Fresh foods can be standardized or sourced from specific regions, representing a category of non-processed products.

4.2.2. Canned Foods

Foods can be preserved in various ways, such as by smoking, salting, irradiation, dehydration, freezing, sterilization, or pasteurization. These methods help extend the shelf life of foods.

4.2.3. Level of Preparation

Foods can also be classified based on their level of preparation, such as ready-to-eat, peeled, precooked, or composite, depending on the extent of processing they have undergone.

4.3. By Role

Foods can be organized according to the main role they play in the human body.

4.3.1. Functional Foods

Functional foods provide fibers, minerals, and vitamins. They play a protective role and are necessary for the proper functioning of the body. These foods are primarily represented by fruits and vegetables.

4.3.2. Builder Foods

Builder foods are essential for forming bone structure and developing muscle mass. These foods include starches as well as meats, fish, and eggs.

4.3.3. Energy Foods

Energy foods provide the energy necessary for the body's cells and serve as reserves. This category includes cereal products, sweet foods, and fats.

Vital Food

Water, although not strictly considered a food, is essential for life. It belongs to the beverage category and plays a fundamental role in hydration and metabolism within the human body

4.4. By Nutrient Content

Foods can also be classified based on their content of various nutrients. This classification primarily focuses on proteins, lipids, carbohydrates, minerals (such as iron, calcium, magnesium), and vitamins (both fat-soluble like A, D, E, K and water-soluble like B, C).

Fruits and Vegetables

This food group plays a functional role while being low in energy. Fruits, and to a lesser extent vegetables, primarily provide fructose, a simple sugar responsible for the sweet taste of these foods, which is energetically equivalent to glucose. However, fruits and vegetables are mainly composed of water (up to 80-95% of their weight) and are rich in elements that the body cannot produce on its own.

Fibers

The fibers found in fruits and vegetables accelerate intestinal transit, provide a feeling of fullness, and promote the development of gut flora. They protect against harmful agents, reduce fat absorption, and limit the increase in blood sugar levels. Fibers are also the only dietary element that is not digested.

Minerals

Fruits and vegetables are an important source of essential minerals for the body:

- **Potassium and sodium**: They regulate water distribution in the body.
- **Magnesium**: It balances the nervous system and regulates the heart rhythm.
- **Calcium**: Although present in smaller amounts compared to dairy products, calcium is necessary for bone construction and maintenance. However, calcium absorption from fruits and vegetables is less efficient (5% compared to 30% in dairy products).

Vitamins

Fruits and vegetables are also an excellent source of vitamins, notably:

- **Vitamin C**: It stimulates the immune system, aids in iron absorption, and has antioxidant effects.
- **Vitamin B9 (folic acid)**: It plays a crucial role in protein metabolism and the formation of genetic material.
- **Beta-carotene**: Acting as an antioxidant, it protects tissues and converts to vitamin A in the body, which is necessary for growth and vision.

A varied and regular consumption of fruits and vegetables is essential to meet the needs for fiber, vitamins, and minerals. It is also recommended to respect the seasonality of fruits and vegetables to optimize their nutritional quality.

Meat/Fish/Eggs

These foods are primarily recommended for their high protein content, which is essential for tissue building and renewal, especially for muscles. However, their content of lipids, vitamins, and minerals varies depending on the animal and the cooked cuts. This is why it is advised to diversify the sources of these foods.

Nutrients:

- **Proteins**: Composed of amino acids, proteins are essential for building vital organs and tissues, including muscles.
- **Lipids (fats)**: They provide energy, but their quantity and quality vary depending on the animal origin.
- **Minerals**:
    - **Iron**: Necessary for the production of hemoglobin and myoglobin, which transport and store oxygen. Iron from animal sources is better absorbed than from plant sources.
    - **Zinc**: Strengthens the immune system and acts as an antioxidant, protecting against aging.

  - **Selenium**: An antioxidant, it also protects against aging.

- **Vitamins**:
  - **B vitamins**: Various types, their richness depends on the fat content.
  - **Vitamin E**: An antioxidant, it protects tissues
  - **Vitamin K**: It participates in blood clotting.

Dairy Products

Dairy products are "building foods" and play a crucial role during adolescence, particularly in the development of bone mass. They provide a wide variety of nutrients.

Nutrients:

- **Proteins**: Essential for the construction and renewal of tissues, especially muscles.
- **Lipids**: Provide energy and are composed of saturated, monounsaturated, and polyunsaturated fatty acids, balanced among them.
- **Minerals**:
  - **Calcium**: Necessary for the formation of bones and teeth, and for muscle contraction. Dairy products are the best sources of calcium.
  - **Phosphorus**: Associated with calcium, it is a component of cells and participates in energy storage.
- **Vitamins**:
  - **Vitamin A**: Essential for growth, vision, and skin renewal.
  - **Vitamin D**: Allows the utilization of calcium in the body.
  - **B vitamins**: Their richness depends on the fat content.

Starches (Féculents)

This large family includes potatoes, cereals, bread, and legumes and represents the main source of energy. Starches should make up about half of our daily food intake.

Nutrients:

- **Fibers**: Mainly found in whole cereals and unrefined products, they help regulate intestinal transit and provide a feeling of fullness.
- **Complex Carbohydrates**: In the form of starch, they provide glucose, which is the primary source of energy for the body. Glucose is released gradually, helping to maintain satiety and support physical and mental activities over the long term.
- **Proteins**: Plant-based proteins contain amino acids, but one of them is often in insufficient quantity. Therefore, combining certain foods is necessary to obtain a high-quality protein (e.g., milk + cereals or cereals + legumes).
- **Minerals**:
    - **Magnesium**: Contributes to the balance of the nervous system and regulates heart rhythm.
- **Vitamins**:
    - **Vitamin E**: An antioxidant that protects tissues.
    - **B vitamins**: They are involved in the utilization of nutrients.

The levels of vitamins and minerals vary depending on the cereals and their refining level.

Fats (Matières grasses)

Fats include foods like butter, cream, oils, and margarines. They play a fundamental role in energy supply, cell formation, digestion regulation, and transport of fat-soluble vitamins. Fats break down into three types of fatty acids: saturated, monounsaturated, and polyunsaturated. It is important to vary the sources of fats, as their complementarity is essential for proper functioning of the body, especially for the cardiovascular system.

Sugary Products

Sugary products include foods that have a marked sweet taste, such as chocolate, honey, jam, pastries, and spreads. While they provide simple carbohydrates, these foods also contain "hidden" fats. Their consumption should be moderate, as excessive intake can lead to dietary imbalances. However, these foods can be beneficial for athletes, particularly during prolonged physical efforts.

Nutrients:

- **Simple Carbohydrates**: Simple carbohydrates are a quick source of energy, providing glucose, which is the fuel for all cells in the human body. Glucose is particularly essential for the brain, which can only use this energy source. These carbohydrates are quickly digested, leading to a rapid increase in blood sugar levels. These products are primarily associated with taste pleasure.

Beverages

Water is vital and constitutes about 60-70% of the human body. Dehydration, caused by excessive water loss, can lead to rapid functional disturbances in the body. It is important not to wait until you are thirsty to drink, as the sensation of thirst often comes only after the body has already begun to dehydrate.

Role: Water compensates for daily water losses from the body through urine (1,500 ml/day), feces (100-150 g/day), skin (via sweat, depending on thermoregulatory needs), and respiration (800 ml/day).

Needs: Water requirements range from 1.2 L to 2.5 L per day, depending on physical activity and climatic conditions. It is recommended to vary the water sources, whether from tap water or bottled water (mineral or spring), as their mineral content varies.

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