الجمهوريـــة الجزائريـــة الديمقراطيـــة الشعبيـــة
People's Democratic Republic of Algeria
وزارة التعليـــــــم العالـــي و البحـــث العلـــمـي
Ministry of Higher Education and Scientific Research
جامعة عمار ثليجي- الأغواط

Faculty of Science
Department of Agronomic Sciences
Field: Natural and Life Sciences (NLS)
Program: Food Sciences
Specialty: Agri-Food Technology and Quality Control (AFTQC)

Handout of (Lectures and Tutorials)

Intended for students of: Agri-Food Technology and Quality Control (TACQ), Level: Bachelor's (L3)

Human Nutrition: 1.Course and 2.Directed work

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Academic Year : 2024/2025.

People's Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research

UNIVERSITY AMAR TELIDJI –LAGHOUAT

FACULTY: SCIENCES

DEPARTMENT: AGRONOMIC SCIENCES

Handout of material:

Human Nutrition: 1.Course

LEVEL: LICENSE (L3)

SECTOR: FOOD SCIENCES

VOLUME: 45 HOURS

OPTION: AGRI-FOOD TECHNOLOGY AND QUALITY CONTROL

Presented by: Dr. MENASRA Amina

Academic year : 2024-2025.

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Foreword:

Food plays a fundamental role in the development, health and well-being of individuals. Understanding the principles of human nutrition is essential not only to promote good eating habits, but also to respond to current challenges, such as malnutrition, obesity, or the emergence of diet-related chronic diseases.

This handout, intended for Bachelor 3 students in Agri-Food Technology and Quality Control, aims to provide them with a solid foundation on the fundamental concepts of human nutrition. By combining theory and practical aspects, it addresses various themes ranging from nutritional needs and dietary recommendations to the study of nutritional diseases and protective factors for health.

This document is also intended to be a support tool to prepare future professionals to integrate the notions of quality and nutritional safety in the agri-food sector, thus contributing to the production of products that are both healthy, balanced and adapted to the needs of consumers.

Introduction

Human nutrition plays a central role in the health and well-being of individuals. It is based on the study of nutritional needs, food intake, and their interactions with biological processes. This field also explores the role of food in preventing disease and maintaining a good quality of life.

As part of the License 3 in Agri-Food Technology and Quality Control, this Human Nutrition module allows students to understand the importance of nutritional components in the design and quality of food products. It offers them tools to analyze nutritional needs, evaluate the nutritional quality of foods and identify factors influencing eating habits. This knowledge is essential to meet growing public health requirements and to meet the expectations of consumers looking for food products that are both healthy and balanced.

By integrating notions of biochemistry, physiology and public health, this module also aims to raise students' awareness of global nutrition issues, such as the fight against non-communicable diseases, obesity, and even malnutrition. It constitutes a key step in preparing them for a career in the food industry, where the quality and safety of products are inseparable from their nutritional value.

Module objectives:

- Understand human nutritional needs and their impact on health;
- Study the role of nutrients and their metabolic effects;
- Identify the links between diet, diseases and public health;
- Integrate nutritional quality into food production;
- Promote practices and products that promote healthy eating.

Chapter 01: Introduction to Human Nutrition

Introduction

Human nutrition is the study of how food affects the health and functioning of the human body. It explores the essential nutrients needed for growth, energy, and maintenance of bodily functions. Proper nutrition is crucial for preventing disease and promoting overall well-being.

This chapter introduces the basic concepts of nutrients, dietary needs, and metabolism. Understanding human nutrition lays the foundation for healthier lifestyle choices.

1. From foods to nutrients

1.1. Foods and nutrients

Foods are composed of large, complex molecules formed by the assembly of nutrients (elementary building blocks).

Carbohydrates, lipids and proteins are complex molecules contained in food. Simple sugars, fatty acids and amino acids are nutrients.

Digestion consists of breaking down food: the nutrients are then in simple form and absorbable in the intestine. These nutrients, once absorbed, can be used to build new complex molecules involved in the proper functioning of the body or to produce energy.

1.2. Digestion of food

Certain organs in the digestive tract release substances called digestive juices:

- The mouth produces saliva;
- The liver produces bile;
- The stomach produces gastric juice;
- The pancreas produces pancreatic juice;
- The large intestine produces intestinal juice

These digestive juices contain molecules called enzymes that break down food into nutrients. Each enzyme can break down only one type of food

Example: amylase breaks down starch which is a carbohydrate.

1.3. Nutrient absorption

Only nutrients are absorbed. The majority of absorption takes place in the small intestine. The wall of the small intestine is not capable of absorbing large molecules from food, it only absorbs nutrients: digestion by enzymes is therefore essential.

1.4. The absorption surface of the small intestine

The small intestine is a tube 6 to 7 m long and approximately 4 cm in diameter, folded on itself. The intestinal wall is an exchange surface through which nutrients pass easily thanks to the numerous blood capillaries.

1.5. The role of the microbiota in digestion

Microorganisms living in our digestive tract (microbiota) also release enzymes. The enzymes released by the microbiota are much more numerous and varied than those released by the organs of our digestive tract. The microbiota therefore participates greatly in the chemical digestion of foods into nutrients and facilitates intestinal absorption of nutrients.

2. Dietary balance

Meals taken daily must be varied and contain all categories of foods. Additionally, quantity and quality must be combined.

A good diet is a factor of good health**.** Many common diseases are closely linked to poor diet, such as cardiovascular disease, diabetes, anemia, obesity and cancer.

2.1. Balanced diet

Set of measures concerning the quantity of food, their distribution throughout the day, the type of food and the way of eating with the aim of respecting a balanced diet.

A balanced diet is made up of all the substances necessary for the proper functioning of the body. It must provide sufficient macro and micronutrients.

2.2.Principle of nutritional balance

Food is intended to cover human nutritional needs which change over the course of life.

To stay healthy, the body needs a certain ratio of carbohydrates, fats and proteins as well as vitamins and minerals. No single food contains all the nutrients we need.

For a balanced diet, foods from each family must be consumed daily at the recommended intakes.

Each individual has nutritional needs that depend on their gender, state of health, lifestyle, physical activity, age, etc.

The diet must be balanced, that is to say, provide all the elements necessary for our body in order to: ensure good growth during childhood and adolescence, ensure the daily energy needs, to prevent certain diseases (cardiovascular, obesity, etc.), to fight against deficiencies responsible for nutritional diseases, to feel in shape thanks to the good functioning of the body.

The food pyramid helps us visualize the share that each food family should represent in the daily intake.

3. The different categories (groups) of foods

Foods are classified into 7 groups or categories:

Table 01: The 7 food groups (categories).

Band	Main contributions	Example	Main role
Dairy product	Calcium, Animal proteins, Lipids, Carbohydrates, B vitamins…	Milk, cheese, yogurt…	Builder
Meat, fish, eggs (animal proteins)	Animal proteins, Animal lipids (+/- depending on the product), Carbohydrates, Vitamins A, B, D, iron…	Red or white meats, cold meats, offal, fish, shellfish, eggs, etc.	Builder
Fruits and vegetables (fiber)	Simple sugars, Vitamins C and A, Fiber, Mineral salts, water..	Watermelon, pear, cherry, melon, banana, apple...	Functional (+ Energetic)
Starchy foods (carbohydrates)	Complex carbohydrates (starch), Fiber, B vitamins, Calcium, phosphorus…	Bread, flour, pasta, rice, cereals, dried vegetables, potatoes…	Energetic (+ functional)
Fats (lipids)	Plant lipids, Vitamins A/D….	Butter, oil, fatty fruits, cold meats….	Energetic (+ functional)
Sugars and sugar products	Simple, quick carbohydrates Pastries….	Candy….	Energy
Water	Water, mineral salts…	Water, mineral water…	Functional

4. Conditions for maintaining the body in good health

There are many conditions to keep the body healthy, such as:

- Balanced diet (pay attention to excesses and deficiencies, eat variedly);
- Have sufficient sleep time;
- Do not consume alcohol, tobacco, etc. (dangers of drugs);
- Have regular physical activity (e.g. 30 minutes of walking/day...).

5. Food pyramid

The importance of the food pyramid is that it represents a model of healthy eating. Allows you to view different food groups and display the relative proportions of each:

- The foods which appear at the base are the most represented quantitatively, and the quantities decrease as we go up;
- To obtain a correct distribution of nutrients, you must eat a variety of foods, because no food is balanced in itself;
- Each major food family must be represented at least once a day.

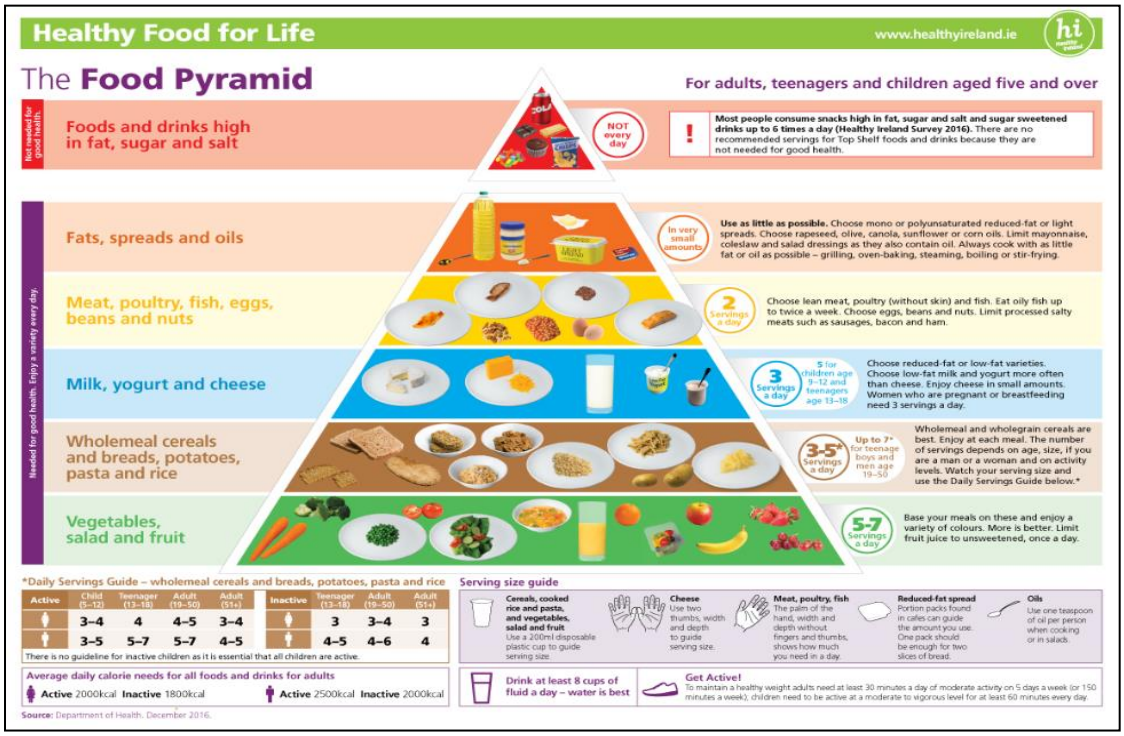


Figure 01: Food pyramid.

6. Eating rhythm and daily consumption

Nutritionists often emphasize the importance of meal timing for a healthy and balanced diet. For example, they recommend eating three meals a day: a full breakfast after fasting for at least eight hours overnight, a lunch in the middle of the day and a dinner in the evening. This rhythm gives the body the necessary benchmarks to better regulate food intake.

6.1. Where does this rhythm come from?

Eating rhythms, regulated by the circadian clock influenced by the environment and social factors, require regular food intake. The brain, dependent on glucose, draws on glycogen reserves, limited to 24 hours. Meal frequency and distribution are crucial for available energy and weight management. Skipping a meal causes the body to store it in the form of fat, while spreading it over several meals reduces the risk of weight gain.

6.2. Understanding satiety

Food intake depends more on the volume of food than on its energy intake. A large amount of low-calorie food fills you up better than a small portion high in energy. Satiety, which inhibits hunger, varies depending on the nutrients: proteins are more satiating than carbohydrates, and the latter more than lipids.

6.3. As we get older, the rhythm of meals changes (but not that much)

With age, respecting three meals becomes essential due to increased energy expenditure and reduced metabolic output. A sufficient intake of nutrients, supplemented by a snack, is crucial, especially for active or sporty seniors. Monitoring by a nutritionist can help balance energy expenditure and intake.

7. The food ration

A balanced food ration requires three meals per day with an ideal energy distribution: 20 to 25% at breakfast, 40 to 45% at lunch, and 25 to 30% at dinner.

The food ration must provide sufficient quantity (quantity), of all food groups (quality).

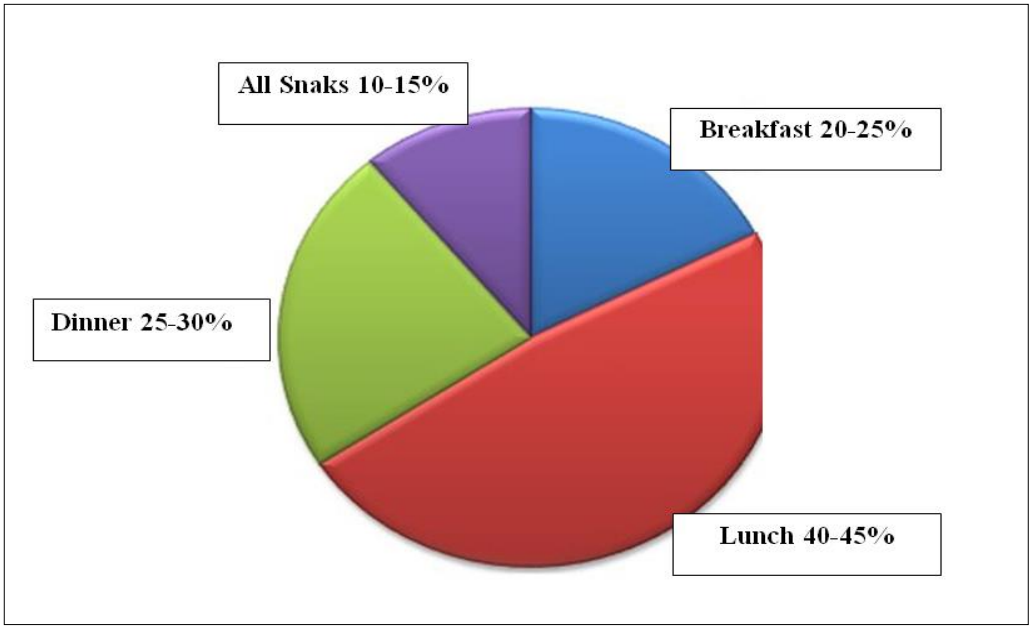


Figure 02: Distribution of daily meals.

The average food intake of an adult man with low physical activity is approximately 2400 Kcal/day (≈ 10,000 Kjoules)

8. Recommended energy to provide through nutrients

Regardless of the quantity of calories recommended, we recommend bringing:

- 50 to 55% of energy in the form of carbohydrates (1 g of carbohydrates = 4 kcal), or approximately 250 to 300g per day for an adult, of which 1/5 in the form of fast sugars (sugar) and the rest in the form complex sugars (starch);
- 30 to 35% in the form of lipids (1 g of lipids = 9 kcal) or approximately 70 to 100g per day for an adult, with a distribution between saturated fatty acids (25%), monounsaturated (50%) and polyunsaturated (25%);
- 10 to 15% in the form of protein (1 g of protein = 4 kcal), or approximately 60 to 80g per day for an adult.

Table 02: Daily intake of nutrients.

	Nutrients	Daily intake
Macronutrient	Carbohydrates	250 to 300 g
	Lipids	70 to 100 g
	Proteins	60 to 80 g
Micronutrients	Na^+	1g
	K^+	2g
	Ca^{2+}	1g
	Fe	2 to 20 mg
Vitamins	B_1	1 to 1.2 mg
	C	30 mg
Energy		2400 Kcal= 10000Kj

9. Current food trends

Consumption habits have evolved after Covid, with an emphasis on healthier eating (local, seasonal, organic products, less sugar and salt). Consumers are seeking more transparency, particularly on the origin of products, favoring "Made in Algeria". Demand for labeled products (Organic, AOC, Label Rouge) has increased. There is also a return to local products, a desire to reduce food waste, and a growing interest in plant-based products, associated with ecological and health concerns.

10. Food and health

There are several dietary factors that influence the appearance of many diseases, particularly cancers.

These risk factors include alcohol, red meats, salt and beta-carotene supplements, which are recommended to be limited. Being overweight and physical inactivity also increase the risk of various cancers. On the other hand, **protective factors** presented by a diet rich in fruits, vegetables, fiber and dairy products can reduce the risk of certain cancers, notably colorectal, breast and stomach.

Conclusion

Human nutrition is a fundamental science that explains the role of nutrients in maintaining health. It highlights the importance of balanced eating habits for physical and mental well-being. Understanding these basics is essential for advancing into more specialized nutritional studies.

Chapter 02: Nutritional Needs

Introduction

Nutritional needs refer to the specific quantities of nutrients essential for maintaining health, growth, and physiological functions. These requirements vary with age, gender, health status, and levels of physical activity. Meeting nutritional needs ensures optimal energy balance, immune defense, and disease prevention. Understanding these needs is fundamental for developing personalized diets and effective public health strategies. This chapter explores the factors influencing nutritional demands and guidelines for achieving balanced nutrition.

1. Nutritional needs

Nutritional requirements are the quantity of nutrients, macronutrients, micronutrients and energy which makes it possible to cover the net requirements taking into account the quantity actually absorbed. They correspond to the quantity necessary to maintain normal physiological functions and a state of health and to cope with certain periods of life such as growth, pregnancy or gestation, lactation (breastfeeding).

1.1. Net nutritional requirements

Net nutritional requirements express a quantity of nutrient used at the tissue level, after intestinal absorption. They also include the constitution and maintenance of reserves. In fact, when food is ingested, nutrients are released which must be absorbed in the intestine. Only a fraction will be absorbed, under the influence of individual factors as well as other nutrients (bioavailability of nutrients). This absorption varies greatly depending on the individual, depending on the nutrients, and depending on the nature of the diet (iron from meat is better absorbed than that from spinach).

1.2. Reserve nutritional requirement for a nutrient

The reserve makes it possible to cope with irregular intake and a temporary increase in needs in certain physiological and pathological situations. The ideal reserve should be easily mobilized and not have any harmful consequences for the body.

The human body has a fairly large reserve of different nutrients. If there are deficiencies, adaptation mechanisms quickly begin. If reserves are high, the deficit will not be seen immediately. It is impossible to cover all daily needs; It is estimated that it takes 21 days to cover all of these nutritional needs if the diet is balanced and this is possible thanks to reserves.

Exception: infants < 6 months whose breast milk is sufficient to meet their needs.

2. Recommended nutritional intakes (advised)

The recommended nutritional intakes (ANC) represent all the nutrients, essential or not necessary to cover all physiological needs. They correspond to the average nutritional need, and are estimated from scientific data and are calculated in such a way that they cover the needs of the majority of the population, i.e. 97.5% of individuals.

Table 03: Energy needs according to age and sex.

Age	**20-40 years old**	**41-60 years old**
Man	2400-2700 Kcal	2500 Kcal
Women	2200 Kcal	2000 Kcal

The recommendations give values for the main categories of individuals, defined taking into account age, sex, level of physical activity (PAL), etc.

These recommendations should not be taken as standards to be imposed individually. Rather, they are references for achieving a good state of nutrition which would limit deficiencies, imbalances or overloads within a given population.

Table 04: Average recommended energy intakes/day in relation to the level of physical activity.

Physical activity level	Man (Kcal/Day)	Female (Kcal/Day)
Sedentary	2200	1800-2000
Physical activity level AVERAGE	2500	2200
High level of physical activity	3000-3500	2700
Proteins	10-15%	
Lipids	30-35%	
Carbohydrates	50-55%	
1 Kcal=4.18 Kjoul		
Women during pregnancy		+350 Kcal
Breastfeeding women		+ 500 Kcal

3. Energy needs

Energy requirements are the amount of energy needed to compensate for energy expenditure and maintain healthy body size and composition. They must also allow physical activity adapted to the social and economic context. These needs vary throughout the day depending on activity and from day to day, depending on intrinsic and environmental factors.

3.1. The energy balance

The body is divided into two compartments: the metabolically active compartment (lean mass) and the energy reserve compartment (fat mass). The energy balance reflects the balance between energy intake and expenditure. In the case of contributions equal to expenses, the balance is maintained. If intakes are lower, the body draws on its mass reservesfat, leading to weight loss. Conversely, excess intake leads to weight gain through storage in the form of adipose tissue.

3.2. What is energy?

Energy represents the capacity to perform work, expressed in joules (1 Kcal = 4.184 KJ). This reflects a force applied over a distance. In the biological context, energy is essential to ensure all vital functions and physical activity.

3.3. Components of energy expenditure

Energy expenditure is made up of several elements: basic metabolism, thermoregulation, dietary thermogenesis (specific dynamic action), and muscular work (physical activity). Each of these elements helps determine daily energy needs.

Energy expenditure = Basic metabolism + thermoregulation + dietary thermogenesis (or specific dynamic action) + muscular work (or physical activity)

4. Basic metabolism

Basal metabolism (MB) corresponds to the minimum energy expended to maintain vital functions at rest, fasting for 12 hours and in conditions of thermoneutrality. It depends on height, weight, age and gender.

The basal metabolism represents approximately **60% of daily energy expenditure** and is linked to lean mass, decreasing with age, malnutrition or in women compared to men.

It varies depending on the conditions: it increases by **10% per degree of fever** and under the influence of smoking, pregnancy or physical activity. A slight variation (5%) exists between awake and asleep.

4.1. Variability of basal metabolism

Metabolic activity varies depending on the tissue: the liver, kidneys and heart are 20 times more active than resting muscle and 50 times more than adipose tissue. With age, metabolism decreases by 2-4% per decade, reaching an 80% reduction at age 60-70, particularly in obese or elderly people, where fat mass dominates.

4.2. Additional factors of energy expenditure

In addition to basic metabolism, needs related to growth (30% before 5 years), pregnancy and healing (5 kcal/g of tissue formed) must be integrated. These elements require constant adaptation of nutritional intake to each individual.

4.3. Human body maintenance expenses

The maintenance costs of the human body correspond to the energy necessary to maintain the proper functioning of the body and preserve its state of health. They include common biological processes, such as tissue repair, cell renewal and maintenance of vital functions, without altering the body's basic structure or functions. These mechanisms can also include specific actions to restore essential elements in the event of damage or imbalance.

4.4. Thermoregulation expenses

Thermoregulation, essential for maintaining body temperature at 37°C, is regulated hormonally. An increase of 1°C leads to an increase in metabolism of 10%, due to the acceleration of the enzyme reaction speed.

4.5. Thermogenesis expenses

Diet-related thermogenesis represents the energy spent to digest, absorb, and transform nutrients. It varies depending on the composition and quantity of foods, corresponding to approximately 8-10% of daily energy expenditure. Proteins induce the highest expenditure (20-30%), followed by carbohydrates (5-10%) and lipids (0-2%).

4.6. Muscular work expenditure

Muscular work or physical activity is produced by skeletal muscles and significantly increases energy expenditure beyond rest. It includes professional, daily, and leisure activities, while a sedentary lifestyle corresponds to an expenditure close to the basic metabolism.

4.7. Emotion-related spending

Emotional spending results from impulsive behaviors, often amplified by psychological states like sadness, anger or frustration. This phenomenon was particularly accentuated during the confinements linked to the pandemic.

5. Protein requirements

Proteins are macromolecules composed of amino acids, constantly renewed in the body. The balance between proteolysis and proteosynthesis is approximately 250 to 300 g per day in adults. Eight essential amino acids must be provided through food.

The eight essential amino acids for the human body, which must be obtained through food, are: **Leucine (Leu)**, **Isoleucine (Ile)**, **Lysine (Lys)**, **Methionine (Met)**, **Phenylalanine (Phe)**, **Threonine (Thr)**, **Tryptophan (Trp)** And **Valine (Val)**

Sometimes **histidine (His)** is also considered essential, especially in infants. These amino acids are crucial for growth, tissue repair and the proper functioning of various bodily functions.

5.1. Food sources of protein

Proteins are present at varying levels in foods, particularly in animal proteins (meat, fish, milk) and plant proteins (cereals, legumes, wheat germ). The minimum recommended intake for a healthy adult is 0.8 to 1 g/kg/day.

5.2. Recommended protein intakes

According to the World Health Organization 'WHO', the average protein requirement for an adult is 0.6 g/kg/day, with a recommendation of 0.8 g/kg/day for quality protein. Protein should represent 9 to 12% of daily energy intake, but the average consumption is 14 to 17%. A slight excess is not serious, but a high-protein diet can lead to calcium loss and a risk of obesity in children.

Among vegans, it is essential to combine different plant sources to balance essential amino acids, while vegetarians can consume eggs, milk and fish. Pregnant and lactating women have increased needs, as do the elderly, who require approximately 1 g/kg/day due to chronic inflammation.

5.3. Protein metabolism

Protein metabolism involves a constant exchange between body proteins and free amino acids, with a turnover of 250-300 g per day. This includes protein anabolism and catabolism.

5.3.1. Anabolism

Anabolism is the synthesis of new proteins (proteosynthesis) from amino acids, requiring high energy consumption to build body tissues.

5.3.2. Catabolism

Catabolism, on the other hand, breaks down existing proteins (proteolysis), releasing amino acids used for the synthesis of new proteins or to provide energy. This includes dietary and endogenous proteolysis.

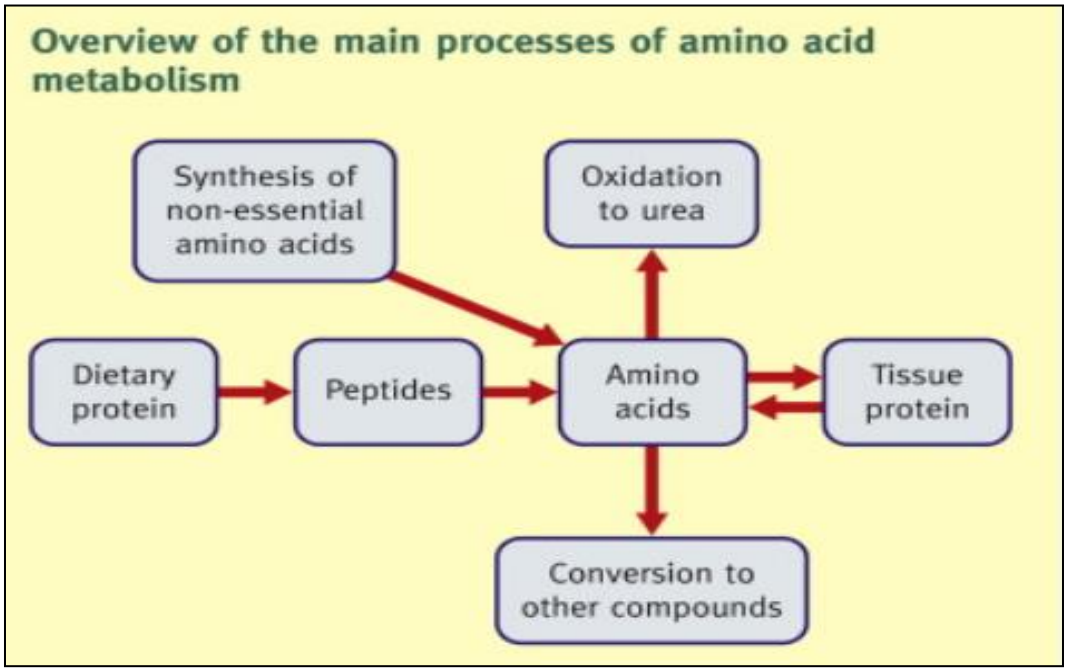


Figure 03: General diagram of protein metabolism in a healthy adult.

5.3.3. Protein synthesis and degradation

Protein synthesis uses a small pool of free amino acids, mainly intracellular. An insufficient intake of essential amino acids limits anabolism. Protein metabolism depends on a balance between synthesis and degradation.

5.3.4. Regulation of metabolism

Hormones like insulin promote anabolism, while glucagon and thyroid hormones stimulate catabolism. Amino acids are either used for protein synthesis or catabolized for energy production.

5.4. Quantitative protein requirements

Protein requirements are the minimum intake necessary to compensate for nitrogen losses in an adult with moderate physical activity and energy balance.

5.5. Qualitative protein requirements (amino acids)

Essential amino acids cannot be produced by the body. Some become conditionally essential, such as glutamine in cases of inflammation or injury, when internal synthesis is insufficient.

Example : The eight essential amino acids.

5.6. Protein quality

The quality of a protein is measured by the proportion of essential amino acids.

Quality of a protein = quantity of essential amino acid / total quantity of amino acid.

Examples of protein quality in some foods: egg protein: 50%; beef protein: 45%; soy protein: 40% and white flour protein: 32%.

Egg proteins have a quality of 50% thanks to their high content of essential amino acids. These proteins contain the 8 essential amino acids. They are considered a high-quality source of protein due to their complete profile of essential amino acids, which makes them a reference protein, particularly for adults. This is why egg proteins are often used to evaluate the quality of other dietary proteins.

6. Carbohydrate needs

It is recommended that carbohydrates represent 50 to 55% of energy intake, with 1/5 in the form of simple sugars, for a balanced diet. They are essential to cover daily energy needs.

6.1. Slow and fast sugars

Slow sugars (complex carbohydrates) are released slowly, while fast sugars (glucose, fructose, sucrose) are quickly assimilated by the body.

The **fast sugars (simple carbohydrates)** are mainly found in **fruits**, in the form of fructose, glucose and sucrose. These sugars are quickly assimilated by the body.

On the other hand, the **slow sugars** (**complex carbohydrates)**, are present in foods such as **legumes**, such as **chickpeas**, as well as in other foods such as lentils, brown rice and vegetables. These sugars are slowly released into the body, providing a more stable and sustainable source of energy.

6.2. The glycemic index

The glycemic index classifies foods according to their effect on blood sugar (blood glucose level), compared to a reference food such as glucose (which is assigned an index of 100). A lower index means slower absorption.

Table 05: Classification of foods according to the glycemic index.

Low glycemic index < 55	Vegetables, cereal seeds, milk and dairy products, meat, oilseeds….
Average glycemic index between 55 and 70	Products based on whole grains, whole grain bread, rice, banana, raisins, potatoes with skin, dried figs…..
High glycemic index > 70	White sugar, white bread, dates, fries, chocolate, sweets, cakes….

6.3. Dietary fiber:

It is recommended to significantly increase fiber consumption in the diet. The World Health Organization ‘WHO’ advises increasing fiber intake by 50%. It is therefore recommended to consume between 25 and 30 g of fiber per day as an adult. As for soluble fiber, the effective amounts are 10 to 15 g per day.

Table 06: Fiber levels in foods.

	Total fibers (g/100g)	Soluble fiber (g/100g)
Wheat bran	40-45	2
Oat bran	17-25	8
Oat flakes	8-10	4
Dried figs	10	2
Dates	9	2
Oilseeds	6-13	1
Artichokes	6	2

7. Lipid requirements

Lipids represent 30 to 35% of daily energy intake. The National Agency for Food, Environmental and Occupational Health Safety 'ANSES' (formerly the French Food Safety Agency 'AFSSA') recommends approximately 100 g of lipids per day (≈ 35%) for an adult. The omega-6 to omega-3 ratio should be 5:1 for best health.

7.1. Types of fatty acids

- **Saturated fatty acids (SFA)** : Provided by food and produced by the body, to be limited.
- **Monounsaturated fatty acids (MUFA)** : Provided by food and endogenous synthesis (e.g.: oleic acid).
- **Polyunsaturated fatty acids (PUFA)** : Essential, provided by plant foods and fatty fish.

7.2. Role of lipids

Lipids provide 9 kcal/g and play a key role in cellular structure, the transport of vitamins A, D, E, K, and hormone production. They are essential for the proper functioning of the brain and cells.

7.3. Fat quality

It is crucial to favor unsaturated fats and limit saturated fats, for a lipid balance favorable to health, in particular by reducing the risk of type 2 diabetes and cardiovascular diseases.

7.4. Body Mass Index (BMI)

It is recommended to reduce the consumption of lipids harmful to health and to carefully control the Body Mass Index (BMI). This is calculated by dividing the person's weight in kg by their height in meters squared.

Obesity is strongly linked to type 2 diabetes, which in turn is associated with other health problems such as stroke, high blood pressure, etc.

Table 07: WHO international standards for Body Mass Index (BMI).

Classification	**BMI (kg/m^2)**	**Risk of health problems**
Underweight	< 18.5	Important
Normal weight	18.5 to 24.9	Minimum
Overweight	25 to 29.9	Important
Obese Category 1	30 to 34.9	High
Obese Category 2	35 to 39.9	Very high
Obese Category 3	40	Extremely high

8. Vitamin requirements

Vitamins are essential substances for the body, but they do not provide energy. With the exception of vitamins K and D, the body cannot produce them, so their intake through food is necessary. They play a key role in various biological functions such as growth, macronutrient transformation, vision, and the proper functioning of the nervous, muscular and immune systems. There are two types of vitamins:

8.1. **Fat Soluble Vitamins** (A, D, E, K): they are soluble in fat and can be stored in the body. They are found in fatty foods.

8.2. **Water Soluble Vitamins** (B, C): They are soluble in water and cannot be stored. Their daily intake is therefore necessary, coming from fruits, vegetables, meat, fish, and dairy products.

- **Food sources of some vitamins** :
  - Vitamin A: cod liver oil, liver, carrots;
  - Vitamin D: fatty fish, cod liver oil, dairy products;
  - Vitamin B9: leafy vegetables, beans, liver;
  - Vitamin C: citrus fruits, kiwi, pepper, cabbage.

Table 08: Body requirements for certain vitamins.

	A	D	E	C	B6	B9	B12
Man	800 mg	5 microg	12 mg	110 mg	1.8 mg	330 microg	3.4 microg
Women	600 mg	5 microg	12 mg	110 mg	1.5 mg	300 microg	2.4 microg
Pregnant woman	700 mg	10 microg	12 mg	120 mg	2 mg	400 microg	2.6 microg
Elderly person	700 mg	15 microg	50 mg	120 mg	2.2 mg	350 microg	3 microg

9. Water and mineral salt requirements

9.1. Water needs

For an adult in a temperate climate and with moderate physical activity, the recommended water intake is 2 to 2.5 L per day. Needs vary depending on age, physical activity and environment. Normal losses are approximately 2500 ml per day, including diuresis (1000-1500 ml), sweating (500-1000 ml), and digestive losses (100 ml). In the event of pathologies, these losses can be increased. Water intake comes from drinks (1200 ml), food (1000 ml) and metabolic water (300 ml).

9.2. Mineral salt requirements

Minerals essential to the body are classified into two groups:

- **Macroelements** (calcium, potassium, sodium, etc.), needed in large quantities;
- **Trace elements** (iron, iodine, zinc, etc.), needed in small quantities.

Table 09: Nutritional requirements for mineral elements.

	Ca	P	Mg	Fe	Zn	I
Man	1 g	750 mg	420 mg	9 mg	12 mg	15 microg
Women	1 g	750 mg	360 mg	16 mg	10 mg	150 microg
Women pregnant	1.1 g	800 mg	400 mg	30 mg	14 mg	200 microg
Elderly person	1.2 g	800 mg	400 mg	10 mg	12 mg	150 microg

Mineral elements play a key role in bone strengthening, fluid balance, muscle and nerve function, as well as hormonal and enzymatic synthesis. A balanced diet helps ensure sufficient intake because these minerals are water soluble and can be lost during food preparation.

10. Special needs

10.1. Pregnant woman

Energy requirements increase gradually during pregnancy, with intakes slightly higher at the beginning of pregnancy and higher at the end. Weight gain should be monitored closely, with approximately 1 kg/month in the first half and 500 g/month in the second. Protein needs vary from 1 g/day in the 1st trimester to 10 g/day in the 3rd trimester. Caloric intake does not change significantly during the first trimesters, but should be increased by 100 to 200 kcal/day in the 3rd trimester. Calcium and vitamin D requirements are also important.

10.2. Infants and young children

Energy requirements increase significantly during the first 12 months of life, reaching 380 kJ/kg/day at 12 months. However, energy stored in proteins and lipids decreases as growth slows.

10.3. Adolescents

The nutritional needs of adolescents increase with pubertal development. Girls have increased needs between the ages of 10 and 13, while those of boys increase from 13 to 18, linked to rapid bodily changes.

10.4. Sportsmen

Endurance athletes have protein requirements of 1.2 to 1.4 g/kg/day, while those of strength athletes are estimated between 1.3 and 1.5 g/kg/day. If the objective is to develop muscle mass, the intake can go up to 2.5 g/kg/day, but for a limited period.

10.5. Elderly subjects

The needs of older people increase for water, calcium, vitamin D and folate. Their energy requirement is lower than that of young adults, around 30 kcal/kg/day, due to reduced physical activity and a reduction in muscle mass.

Conclusion

Nutritional needs vary according to age, sex, physiological status, and activity level. Meeting these needs ensures proper development, immune function, and disease prevention. A tailored approach is necessary to achieve optimal health outcomes.

Chapter 03: Dietetics

Introduction

Dietetics focuses on the study and application of nutrition to maintain health and treat disease through appropriate dietary choices.It combines scientific knowledge with clinical skills to design, implement, and monitor nutritional care plans.By addressing individual and community needs, dietetics plays a vital role in disease prevention and recovery.

This chapter explores the principles, methods, and ethical considerations that guide modern dietetic practice.

1. How to prescribe a diet

A diet is a modification, more or less important depending on the case, of an individual's diet with the aim of eliminating its harmful effects temporarily or permanently.

Dietetic medical prescription is a therapeutic medical act which involves the medico-legal responsibility of the prescriber.

The approach is based on 3 steps:

- **Evaluate the patient's dietary profile and identify eating disorders** likely to obstruct the planned changes;
- **Establish a meal plan** with precise objectives defined by consensus with the patient;
- **Support the patient** to evaluate the difficulties caused, possibly readjust the objectives according to the difficulties, and support the persistence of the dietary modifications undertaken.

Note :

Physical activity is part of nutritional care, in addition to dietary care, regardless of the type of diet.

1.1. Dietary profile assessment

1.1.1. Food records

The subject notes the food and drinks consumed ± their quantities over a given period (e.g. the weekly log is a record over 7 days). Noting foods prospectively can influence the quality of the food collection.

1.1.2. The 24 hour reminder

Collection of food and drinks consumed during the previous 24 hours. This method is quick because it is retrospective, but it carries a risk of memorization bias and presents high intra-individual variability (need to use several reminders/subject).

1.1.3. Consumption frequency questionnaires

Collection of the usual frequency of consumption of each food from a pre-established list. They are interesting when we seek to assess whether there is a deficiency in the intake of a nutrient (example: Vitamin D, Iron, Calcium, etc.)

1.1.4. Food history

Dietary history consists of estimating usual intake over a given period. It is based on a detailed examination of the subject's usual diet, to which is sometimes added a 24-hour recall and a frequency questionnaire.

Noticed

In practice, the patient will be asked to indicate on a typical day what he consumed at the main meals and between meals (simplified 24-hour recall). The patient will also be able to fill out a 7-day food diary (weekly) which he will bring back at the next consultation.

1.2. Establish a meal plan

There must be evidence that the diet is effective in the condition concerned: reduction in the complications of anemia, obesity or diabetes.....

Diets can have side effects. In the elderly, a strict sodium diet can lead to accidents of dehydration and hyponatremia. In an intestinal malabsorption syndrome, a diet without residue that is too severe, little varied, monotonous, can lead to a reduction in intake and progressive malnutrition, or even certain selective deficiencies (vitamin C). Highly restrictive diets (for example with low or very low calorie levels) are contraindicated in cases of inflammatory conditions, in cases of serious psychiatric conditions or depression, etc.

1.3. Support the patient

Membership in the plan is all the better if the benefit of the plan has been understood and its terms have been personalized and well detailed: show the expected benefits
; explain the details of the diet, adapt the diet to the patient's habits; check adherence to the diet (understanding, factors favoring adherence, monitoring of maintenance of adherence to the diet, etc.).

Remark :

In most cases, nutritional advice does not only concern diet but is accompanied by recommendations for physical activity. It is therefore necessary to specify

- The nature of physical activity
  - Professional;
  - Daily;
  - Leisure.
- Level of sedentary lifestyle: time spent in front of a screen

- Barriers to physical activity
    - Disability, joint pain;
- Time problem;
- Financial barriers.

2. General principles of nutritional advice

The advice must be simple and practical, based on the patient's habits and his motivation for change. Rather than giving a very precise catalog, it is better to set objectives with the patient adapted to their abilities, therefore progressive and readjusted regularly according to their integration by the patient.

A supportive, empathetic relational approach allowing the patient to express their difficulties without fear of judgment, and support in implementing changes, as well as adapting them to different life situations, are the best guarantees of the persistence of behavioral changes in terms of diet and physical activity.

3. Rate of food intake

The patient's own rhythm of food intake must be respected. However, there are a few rules to keep in mind:

- Do not prolong the nocturnal fast too much, if the patient is not hungry when he gets up, suggest that he eat a little later in the morning;
- Avoid eating during other activities, particularly in front of the television.

Table 10: Food consumption benchmarks corresponding to the objectives of the National Nutrition and Health Program 'PNNS'.

Fruits and vegetables	At least 5 times a day	At each meal and in case of hunger, raw or cooked, plain or prepared fresh, frozen, or canned
Starchy foods (cereal products)	At each meal and according to appetite	Favor whole grain foods or whole grain bread and favor variety
Dairy products	3 times a day	Favor variety, preferably cheeses richest in calcium, The least fatty and the least salty
Meat, eggs and fish	1 to 2 times a day	Meat: favor the least fatty cuts Fish : at least 2 times a week
Fats	Limit consumption	Favor vegetable fats (oil olive, rapeseed, etc.), promote variety and limit fats of animal origin (butter, crème...)
Sweet products	Limit consumption	Be careful of sugary drinks, avoid fatty foods and sweet at the same time (pastries, dessert creams, chocolate, ice cream, etc.)
Drinks/juices	Unlimited water	During and outside meals and limit sugary drinks (favor natural juices)
Salt	Limit consumption	Prefer iodized salt, do not re-salt before tasting, reduce the addition of salt when cooking and limit the saltiest cheeses and cold meats

*For good health, incorporate at least 30 minutes of daily physical activity into your routines: walk, climb the stairs or ride a bike to stay active every day.

4. Special diets

There are several types of special diets used in certain common pathologies.

4.1. Dairy-free diet

People following this diet avoid eating foods that contain dairy products, for example cheese or milk products. You can use lactose-free dairy products in the diet of patients with lactose intolerance (but make sure that it is actually lactose intolerance and not a milk allergy).

4.2. Gluten and wheat free diet

A gluten-free diet excludes foods containing gluten, mainly found in wheat, rye, barley and their derivatives. This is an intolerance or reaction related to celiac disease, requiring careful attention to food labels. People with wheat protein allergies should avoid wheat but can consume gluten found elsewhere. Conversely, a gluten-free diet prohibits all wheat products.

Note :

Food allergies are reactions of the immune system to mostly harmless proteins. Major allergens include peanuts, tree nuts, eggs, milk, sesame, shellfish, fish, soy and wheat. Certain allergies can cause serious reactions (anaphylaxis), requiring increased vigilance.

4.3. Pesco-vegetarian diet

This diet excludes all meat except fish, accompanied by vegetarian dishes.

4.4. Vegan diet

This diet consists only of foods of plant origin, excluding meat, fish, poultry, eggs, honey and dairy products.

4.5. Vegetarian diet

The vegetarian diet excludes meat, fish and poultry, but includes eggs, milk and dairy products. Its variations include:

- **Ovo-lacto vegetarians** : consume eggs and dairy products.
- **Lacto-vegetarians** : consume dairy products, but not eggs.
- **Ovo-vegetarians** : consume eggs, but not dairy products.

4.6. Paleo Diet

The Paleo diet is inspired by the diet of early humans, favoring meat, fish, fruits and vegetables, while excluding processed foods.

4.7. Diet related to pregnancy

Some pregnant women avoid certain foods such as cheeses, specific fish and raw meats, according to local or medical recommendations. These foods include:

- **Cheeses** : Certain cheeses, particularly those made from raw milk or soft cheeses, may contain bacteria such as Listeria monocytogenes, which are dangerous for pregnant women and the fetus;
- **Specific fish** : Fish high in mercury (such as bluefin tuna, swordfish or shark) are often avoided, as excess mercury can harm the developing nervous system of the baby.
- **Raw meats** : Consuming raw or undercooked meat can expose you to infections such as toxoplasmosis or salmonellosis, which can have serious consequences during pregnancy.

These recommendations aim to prevent food infections and poisoning that could affect pregnancy. They may vary between countries depending on eating habits and health regulations.

4.8. Special raw food diet

This diet favors uncooked and unprocessed foods.

4.9. Low-calorie diet

Intended for obese or diabetic people, this diet limits fast sugars, fats (butter, oil, cheese, eggs, etc.) and starchy foods. Protein, fiber and green vegetables are encouraged, combined with physical activity.

4.10. Cholesterol-lowering diet

This diet aims to reduce cholesterol by:

- Eliminating foods high in cholesterol (offal, egg yolk);
- Limiting saturated fats (butter, cold meats);
- Increasing unsaturated oils (olive, nuts) and fiber (wholemeal bread, salad).

4.11. Salt-free diet

This diet eliminates added salt and salty foods (cheese, canned goods, etc.), but remains difficult to follow.

5. Nutritional status and indicators

Nutritional status is assessed via clinical, biological parameters and composite indices. These diagnostics, generally accessible and inexpensive, may include more sophisticated methods for specific studies. The indicators make it possible to assess the nutritional status of different populations.

5.1. Biological indicators

These indicators measure the concentration of nutrients in the body (blood, excretions) to reflect the nutritional status of a particular constituent.

5.2. Functional markers

Functional markers assess a biological function or measure a blood component dependent on a specific nutrient. They make it possible to refine the nutritional diagnosis, particularly for the status of visceral proteins, while remaining affordable in clinical practice.

5.2.1. Plasma markers of protein synthesis

5.2.1.1. Albumin

- Normal: 35-50 g/L, synthesized by the liver (half-life: 20 days);
- Decrease: linked to malnutrition (<35 g/L), inflammation, liver failure, etc.;
- Limitations: unsuitable for acute nutritional variations.

5.2.1.2. Transthyretin (pre-albumin)

- Normal: 250-350 mg/L, synthesized by the liver (half-life: 2 days);
- Decrease: malnutrition (<200 mg/L), inflammation, pregnancy, etc.
- Usefulness: quickly detects recent renutritions, but remains not very specific.

5.2.1.3. Retinol carrier protein

- Normal: 45-70 mg/L (half-life: 12 hours);
- Decrease: malnutrition, liver failure, zinc or retinol deficiency;
- Usefulness: early marker of renutrition, but impractical for a simple diagnosis;
- Its level increases in alcoholics or when renal function is impaired, but its dosage is complex and little used routinely.

5.2.1.4. Transferrin

- Iron transporter, synthesized by the liver;
- Its variations (increase or decrease) depend on various physiopathological states such as iron deficiency or inflammation. It is less precise for assessing nutritional status than albumin.

5.2.1.5. IGF-1 (Insulin-like Growth Factor-1)

- Growth and renutrition indicator;
- Its level decreases in cases of malnutrition or hypothyroidism, and increases rapidly during renutrition. However, its dosage is difficult to integrate into current practices.

5.2.1.6. Lymphocyte rate

- Reveals the impact of malnutrition on the immune system;
- A concentration below 1500/mm³ may indicate malnutrition, but this measurement lacks specificity.

5.2.1.7. 24-hour creatininuria

- Marker of protein catabolism and indirect indicator of muscle mass;
- A reduction in creatinine reflects a reduction in lean body mass, but the complexity of the collection limits its use in clinical practice.

5.2.1.8. Urinary 3-Methylhistidine (3-MH)

- Reflection of muscle catabolism, measured over 24 hours after a 48-hour meat-free diet;
- Its rate increases in protein hypercatabolism and decreases in chronic malnutrition;
- Marker of protein catabolism, but little used in clinical routine.

5.2.1.9. Albumin

- Common nutritional marker, synthesized by the liver, with a half-life of 21 days;
- Normal: 35-50 g/L. Decrease associated with increased morbidity/mortality (<35 g/L);
- Limitations: lack of sensitivity and long half-life, which makes it of little use for rapid monitoring;

- Decrease influenced by inflammatory syndrome and other non-nutritional factors.

5.2.1.10. Transferrin

- Iron transport protein, half-life 8-10 days, normal level 2-4 g/L;
- Increases in iron deficiency or pregnancy (trimester 03) and decreases in case of protein malnutrition;
- Sensitive to pathologies (hepatitis, nephrotic syndrome, anemia, antibiotics);
- Less reliable for assessing energy status.

5.3. Biometric indicators

Human body biometrics are physical measurements used to assess an individual's nutritional status. They include parameters such as body mass index (BMI), upper arm circumference, and skinfold thickness. These indicators make it possible to identify nutritional imbalances such as malnutrition or obesity.

5.3.1. Weight

Weight variation is an indicator expressed as a percentage compared to usual weight:

$$\text{Weight Loss} = 100 \times \frac{(\text{Usual Weight} - \text{Current Weight})}{\text{Current Weight}}$$

A loss of 5% in one month or 10% in six months is critical. Weight measurement, although simple, must be interpreted with caution, because an obese or edematous subject may be malnourished.

5.3.2. Size

Height does not directly assess nutritional status, but it is essential for calculating indices such as Body Mass Index (BMI).

5.3.3. Body Mass Index (BMI)

The body mass index 'BMI' is calculated as follows:

$$\text{BMI } (\text{kg/m}^2) = \frac{\text{Weight (Kg)}}{\text{Height}^2\ (\text{m}^2)}$$

However, it can be distorted by the presence of edema or dehydration.

Table 11: Classification of nutritional status according to BMI, according to the **WHO** 'World Health Organization'.

Body Mass Index	**Nutritional status**
Less than 10	Grade 5 undernutrition
10 to 12.9	Grade 4 undernutrition
13 to 15.9	Grade 3 undernutrition
16 to 16.9	Grade 2 undernutrition
17 to 18.4	Grade 1 undernutrition
18.5 to 24.9	Normal
25 to 29.9	Overweight
30 to 34.9	Obesity grade 1
35 to 39.9	Obesity grade 2
40	Obesity grade 3

Remark :

From the age of 65, it is recommended to adjust the BMI standards between 24 and 29 kg/m² to detect subclinical malnutrition (i.e. a state of malnutrition which is not yet apparent or symptomatic). For people over 70 years old, the French-speaking Club of Geriatrics and Nutrition suggests a threshold of 21 kg/m² to diagnose malnutrition.

5.3.4. Skin folds (SF)

The skin fold corresponds to a double layer of skin and subcutaneous fat, making it possible to estimate the body's fat mass. There is a consistent relationship between total fat mass and the thickness of subcutaneous fat measured at certain locations. Values are expressed in millimeters.

Threshold used for the diagnosis of malnutrition:

Malnutrition can be considered when the thickness of the skin fold is less than:

- **10 mm** for man;
- **15 mm** for the woman.

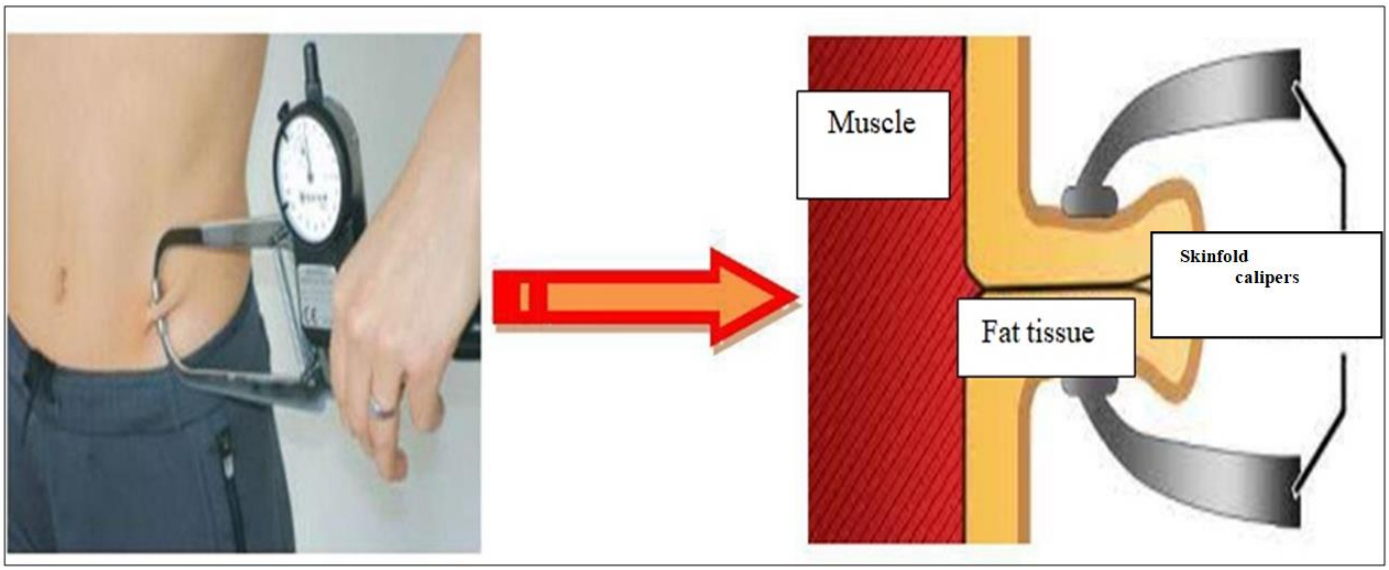


Figure 04: Skinfold measurement.

5.3.5. Upper arm circumference (AC)

The upper arm circumference, expressed in centimeters, makes it possible to estimate fat mass and muscle mass. Upper arm circumference is measured halfway between the acromion and the olecranon.

5.3.6. Brachial muscle circumference (BMC)

The brachial muscle circumference is calculated from the upper arm circumference (AC) and the tricipital skin fold (TSF), measured at the same location where the upper arm circumference is taken, according to the following formula:

$$\mathrm{BMC} = \mathrm{AC} - (\pi \times \mathrm{TSF})$$

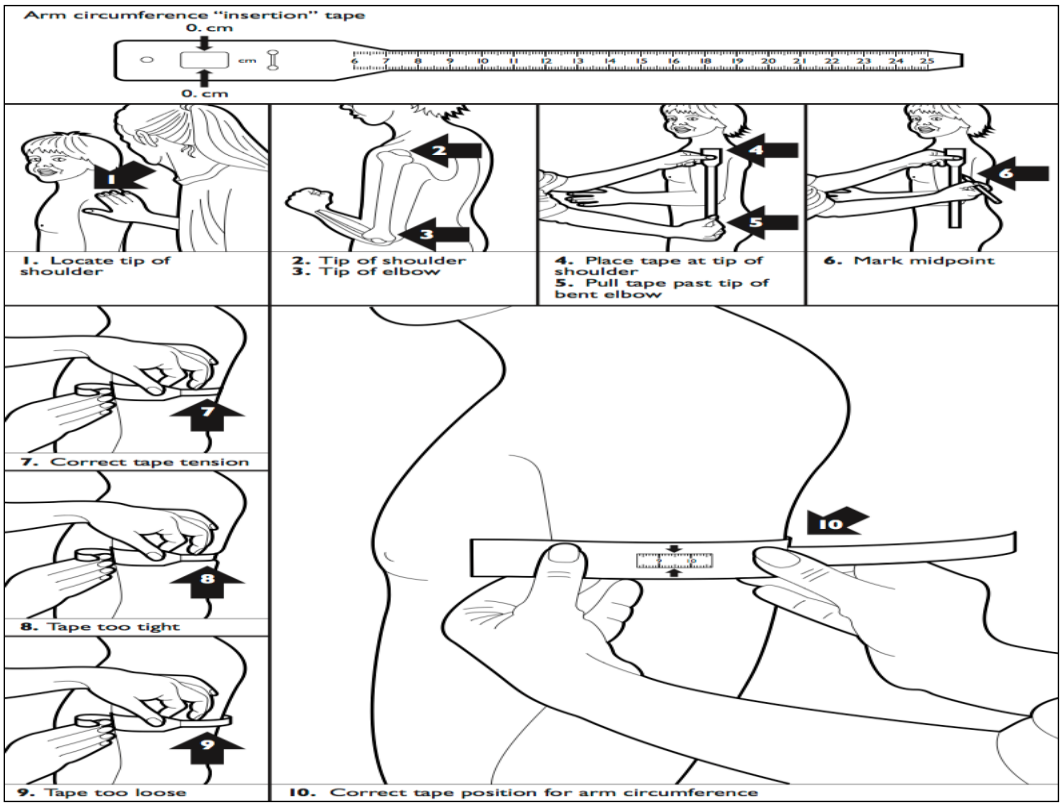


Figure 05 : Method for measuring brachial muscle circumference (BMC).

- **Reproducibility**

Just like measuring skinfolds, measuring upper arm circumference is operator dependent.

- **Standards**

Normal values for brachial muscle circumference are between 20 and 23 cm for women, and between 25 and 27 cm for men. This technique allows you to estimate fat mass. Although it is easy to perform at the bedside, it requires practice on the part of the examiner.

5.3.7. Lean mass, fat mass, and muscle mass

Lean body mass includes water, minerals and muscle. Muscle mass reflects protein reserves, varying by age and sex. Estimates of lean and muscle mass provide an indirect assessment of the body's protein composition.

Conclusion

Dietetics bridges the gap between nutritional science and everyday eating practices. It involves designing diets that meet individual health goals and medical conditions. Through dietetics, nutrition becomes a practical tool for improving quality of life.

Chapter 04: Nutritional Diseases

Introduction

Nutrition plays a vital role in maintaining overall health and well-being. However, imbalances in nutrient intake—whether deficiencies, excesses, or poor diet quality—can lead to a range of nutritional diseases. These conditions affect millions of people worldwide and contribute significantly to the global burden of illness.

In this chapter, we will explore the causes, symptoms, and prevention of common nutritional diseases, highlighting the importance of balanced, healthy eating habits.

1. Malnutrition

Malnutrition refers to:

- Nutritional deficit (weight loss);
- Nutritional excess (overweight and obesity);
- Specific deficiencies in essential micronutrients (iodine, iron, vitamin A).

It contributes to almost half of child deaths worldwide, more than any infectious disease. The main causes include inadequate dietary intake, diseases, and socio-economic factors.

2. Obesity

In 2016, 41 million children under the age of 5 were overweight, a sharply increasing trend in low- and middle-income countries, especially in urban areas (+50% in Africa since 2000).

2.1. Classification of obesity

Body mass index 'BMI' ≥ 30 kg/m² for obesity;

- **Moderate (type 1):** BMI 30-34,9 ;
- **Severe (type 2):** BMI 35-39,9 ;
- **Morbid (type 3) :** BMI ≥ 40.

2.2. The causes of obesity

An energy imbalance linked to excessive consumption of caloric foods rich in fat and an increasingly sedentary lifestyle.

2.3. The consequences of obesity

Obesity increases the risk of serious diseases:

- Cardiovascular diseases (stroke, heart failure);

- Type 2 diabetes (75-80% of diabetics are obese);
- Musculoskeletal disorders (osteoarthritis);
- Cancers (breast, liver, kidney, colon, etc.).

A 10% weight loss significantly improves health, reducing disease risks and mortality rates.

3. Diabetes

Diabetes, characterized by chronic hyperglycemia, is divided into two main types:

3.1. Type 1 Diabetes: it results from an insulin deficiency, requiring regular injections. This type is often linked to an autoimmune reaction and is usually not hereditary, although genetic predispositions may play a role.

3.2. Type 2 Diabetes: mainly associated with obesity and insulin resistance, this type is strongly influenced by heredity. Family history significantly increases the risk of developing the disease, combined with environmental factors such as a sedentary lifestyle and an unbalanced diet.

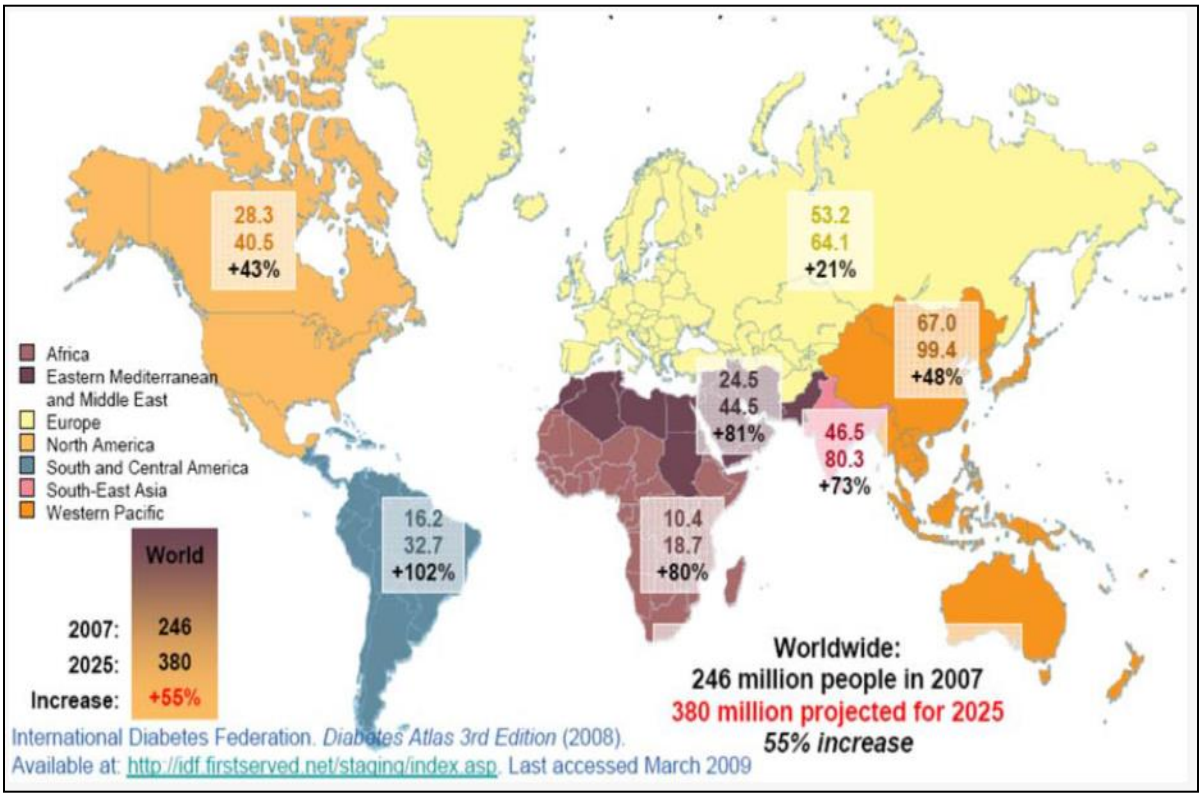


Figure 06 : Projections of global diabetes prevalence from 2007 to 2025.

3.3. Aggravating factors of diabetes

- Excess fats;
- Chronic inflammation due to hyperlipidemia;
- Alteration of the intestinal microbiota and increase in intestinal permeability.

These mechanisms damage pancreatic beta cells, reducing their ability to produce insulin and leading to their long-term destruction. Weight loss (10-20%) can improve metabolic control and reduce complications.

4. Dyslipidemia

Dyslipidemia corresponds to an abnormality of lipid concentrations in the blood, contributing to atherosclerosis, a process where the arteries become blocked, increasing the risk of heart attack.

4.1. Types of dyslipidemia

4.1.1. Hypercholesterolemia : excess cholesterol in the blood, mainly due to poor elimination of LDL ("bad cholesterol") by the liver. This imbalance can lead to the formation of plaques in the arteries, promoting cardiovascular disease.

4.1.2. Hypertriglyceridemia : increased blood triglycerides, with normal levels below 1.7 mmol/L. Very high levels (>10 mmol/L) increase the risk of pancreatitis.

Note :

Cholesterol is transported by lipoproteins:

- **LDL (“bad cholesterol”)** : can clog the arteries. Its ideal concentration is less than 1.6 g/L (or <1.3 g/L if several risk factors are present).
- **HDL (“good cholesterol”)** : protects the arteries by eliminating excess cholesterol and returning it to the liver. Its concentration must exceed 0.4 g/L;
- **Cholesterol** is necessary for certain vital functions:
  - Constitution of cell membranes;

- Production of steroid hormones;
- Synthesis of vitamin D;
- Production of bile acids and insulation of nerve fibers.

Cholesterol naturally increases with age. In women, LDL tends to increase after menopause. Genes and certain diseases (hypothyroidism, liver or kidney diseases) also influence cholesterol levels. A diet high in saturated fats or certain medications (steroids, progestins) can unbalance the LDL/HDL ratio.

4.2. Causes of dyslipidemia

- **Primary**: genetics.
- **Secondary** : diabetes, hypothyroidism, obesity, sedentary lifestyle, unbalanced diet (rich in saturated fats, cholesterol, or alcohol).

A balanced diet can reduce cholesterol and reduce cardiovascular risks thanks to its richness in fruits, vegetables, fish, and unsaturated fats.

5. Deficiency anemia

Anemia is defined by a hemoglobin level lower than:

- 14 g/dL in the newborn;
- 13 g/dL in men;
- 12 g/dL in women and children;
- 10.5 g/dL in pregnant women.

Deficiency anemia results from a lack of nutrients essential for erythropoiesis (the process of producing red blood cells in the bone marrow) such as iron, folic acid (B_9) and vitamin B_{12}.

5.1. Iron deficiency anemia

It is a microcytic (small cells) and hypochromic (pale coloring) anemia caused by iron deficiency, often benign and frequent. It is manifested by a ferritin level < 10 µg/L. Treatment is based on supplementation and a balanced diet rich in:

- Heme iron: red meat, liver, fish;
- Non-heme iron: lentils, spinach, dried vegetables.

5.2. Megaloblastic anemia

This macrocytic anemia (small cells) is due to a vitamin B_9 deficiency (insufficient intakes) or in B_{12} (malabsorption). They are characterized by megaloblasts in the bone marrow.

- Critical rate: $B_9 < 4$ µg/L and $B_{12} < 200$ ng/L.

6. Protein malnutrition

Undernutrition is an energy and protein deficit caused by insufficient intakes or excessive losses, leading to involuntary weight loss (> 5% in one month or > 10% in six months). It is identified by a low body mass index 'BMI' or significant muscle loss.

6.1. Forms of undernutrition

6.1.1. Marasmus: Slow and progressive malnutrition, characterized by extreme weight loss, often linked to anorexia nervosa or prolonged fasting.

6.1.2. Kwashiorkor : Rapid undernutrition, leading to muscle wasting, but no fat loss, accompanied by edema.

A balanced diet, tailored to individual needs, is essential to prevent or treat these conditions.

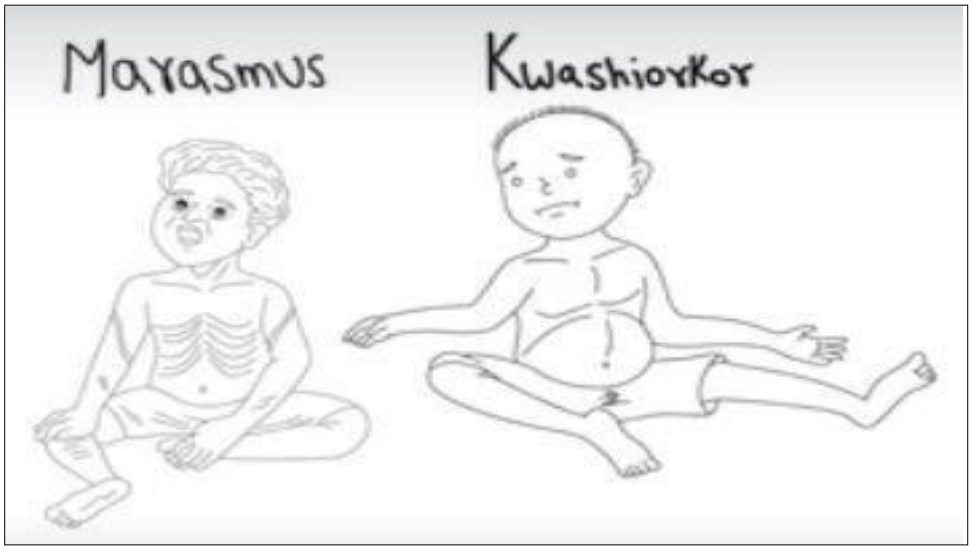


Figure 07 : Marasmus and Kwashiorkor in children**.**

7. Rickets

Vitamin D deficiency (**hypovitaminosis D**) causes rickets in children and osteomalacia in adults, a condition causing softening of bones. Osteomalacia causes bone pain, particularly in the pelvis, thorax and spine, with mechanical intensity. On x-rays, it manifests itself as an increase in bone transparency, due to insufficient production of calcium and phosphate for the bones. Vitamin D deficiency could also be linked to conditions such as cancer, multiple sclerosis, rheumatoid arthritis, osteoarthritis, type 1 diabetes in children, hypertension, schizophrenia and depression.

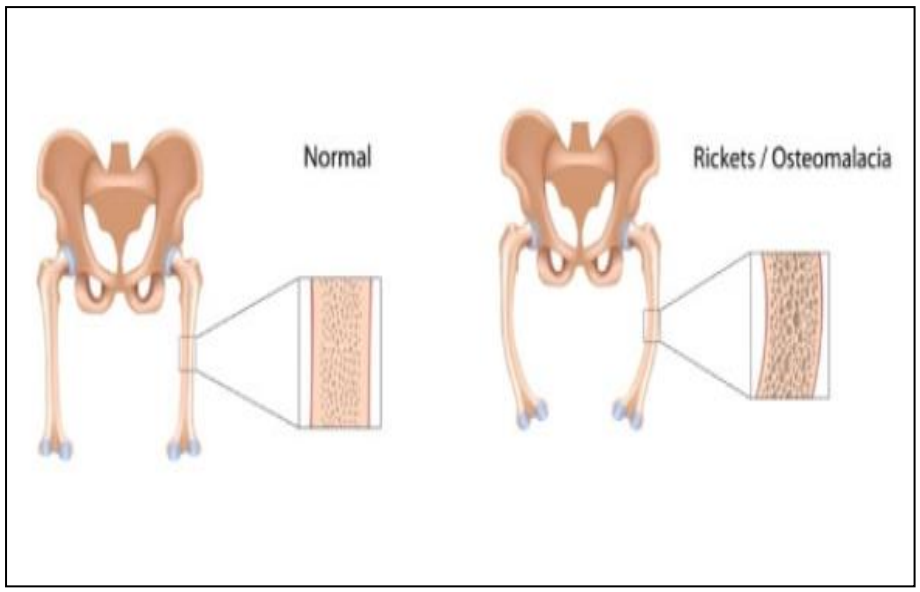


Figure 08 : Pelvis of a normal person and a rickets person.

8. Eating disorders

Eating disorders can be divided into two main categories: **bulimic disorders** (excessive food intake) and **anorexic disorders** (strict dietary restriction). These two forms can coexist, forming **anorexia bulimia**.

People with bulimia have binge eating episodes, often several times a week. Some compensate by making themselves vomit, fasting or doing intensive sports. Binge-eating bulimics do not compensate and suffer from overweight or obesity.

Anorexics, for their part, are obsessed with the fear of gaining weight and submit to severe food restriction, which can alternate between anorexic phases and binge eating attacks.

9. Iodine deficiency disorders

Iodine deficiency, often caused by insufficient diet, affects around two billion people worldwide. It can lead to growth abnormalities, hypothyroidism, goiter and thyroid disease. In infants, it can cause physical and intellectual delay, including cretinism. Regions far from the sea, without iodine enrichment programs, are particularly affected. Deficiency can be assessed by blood tests (TSH, T_3, T_4), iodine concentration in urine or ultrasound to detect goiter.

Table 12 : Epidemiological criteria for assessing iodine intake based on median urinary iodine concentrations in school-age children.

Median urine iodine concentration (mg/L)	Iodine intake	Nutritional iodine status
Less than 20	Insufficient	Severe iodine deficiency
From 20 to 49	Insufficient	Moderate iodine deficiency
From 50 to 99	Insufficient	Mild iodine deficiency
From 100 to 199	Adequate	Optimal

Conclusion

Nutritional imbalances, whether excesses or deficiencies, are major causes of disease worldwide. Early diagnosis and appropriate dietary management can prevent severe health complications. Nutrition education is vital to reduce the incidence of such disorders.

Chapter 05: Nutrition and Health Protective Factors

Introduction

Nutrition plays a crucial role in maintaining overall health and preventing disease. A balanced diet provides the body with essential nutrients that support immune function, growth, andrepair. Scientific research increasingly highlights nutrition as a key protective factor against chronic illnesses such as diabetes, cardiovascular diseases, and cancer. Understanding the relationship between diet and health empowers individuals to make informed lifestyle choices.

This chapter explores how optimal nutrition contributes to long-term wellness and disease prevention.

1. General overview

A healthy diet is essential to prevent malnutrition and many noncommunicable diseases. However, urbanization, the increase in processed foods and modern lifestyles have changed eating habits, with increased consumption of products high in fats, sugars and salt, and low consumption of fruits, vegetables and fiber.

2. Balanced diet

A balanced diet varies by age, gender, lifestyle, cultural background and available foods, but follows basic principles for good health.

2.1. For adults

A healthy diet includes:

- Fruits, vegetables, legumes, dried fruits and whole grains (400 g of fruits and vegetables per day);
- Less than 10% of energy intake from free sugars (50 g max) and ideally less than 5%;
- Less than 30% of energy intake from fat, with a preference for unsaturated fats (fish, avocado, vegetable oils) and a reduction in saturated fats and trans fatty acids;
- Less than 5 g of salt per day, preferably iodized.

2.2. For infants and young children

An optimal diet during the first two years promotes growth and cognitive development, and reduces the risk of being overweight. Recommendations include:

- Exclusive breastfeeding for the first six months;
- Continuation of breastfeeding up to two years and beyond;

- Introduction of food supplements from six months, without added salt or sugar.

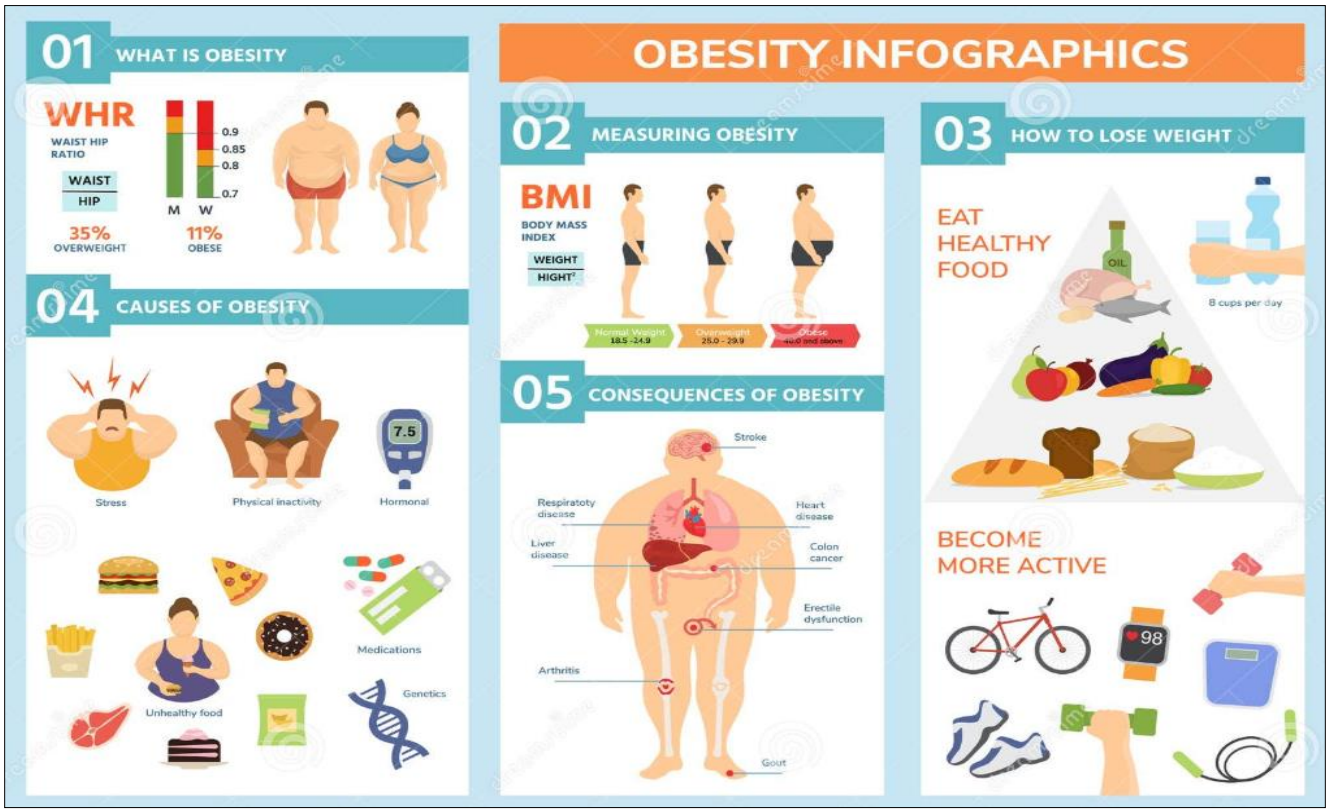


Figure 09: Factors influencing weight gain.

3. Practical tips for healthy eating

3.1. Fruits and vegetables

Consuming at least 400 g (5 servings) of fruit and vegetables per day reduces the risk of disease and ensures sufficient fiber intake. To increase this consumption:

- Eat vegetables with every meal;
- Eat fresh fruits and raw vegetables as a snack;
- Choose seasonal products and diversify the varieties.

3.2. Fats

Reducing fat intake to less than 30% of total calories helps prevent weight gain. Tips :

- Limit saturated fats to less than 10% of calories and replace trans fats with unsaturated fats, particularly polyunsaturated fats;

- Steam or boil instead of fry, choose polyunsaturated oils and low-fat dairy products, and limit fried and baked foods.

3.3. Salt, sodium and potassium

Reduce salt intake to less than 5 g per day to prevent hypertension and cardiovascular disease. Noticed:

- Limit salt and high-sodium condiments when preparing meals;
- Choose products with a low salt content and avoid adding salt at the table;
- Increase potassium intake by consuming fresh fruits and vegetables.

3.4. Sugars

Limit the consumption of free sugars to less than 10% of total calories, and ideally less than 5%. To reduce sugar intake:

- Avoid sugary snacks and sugary drinks.
- Prefer fresh fruits and raw vegetables as a snack.

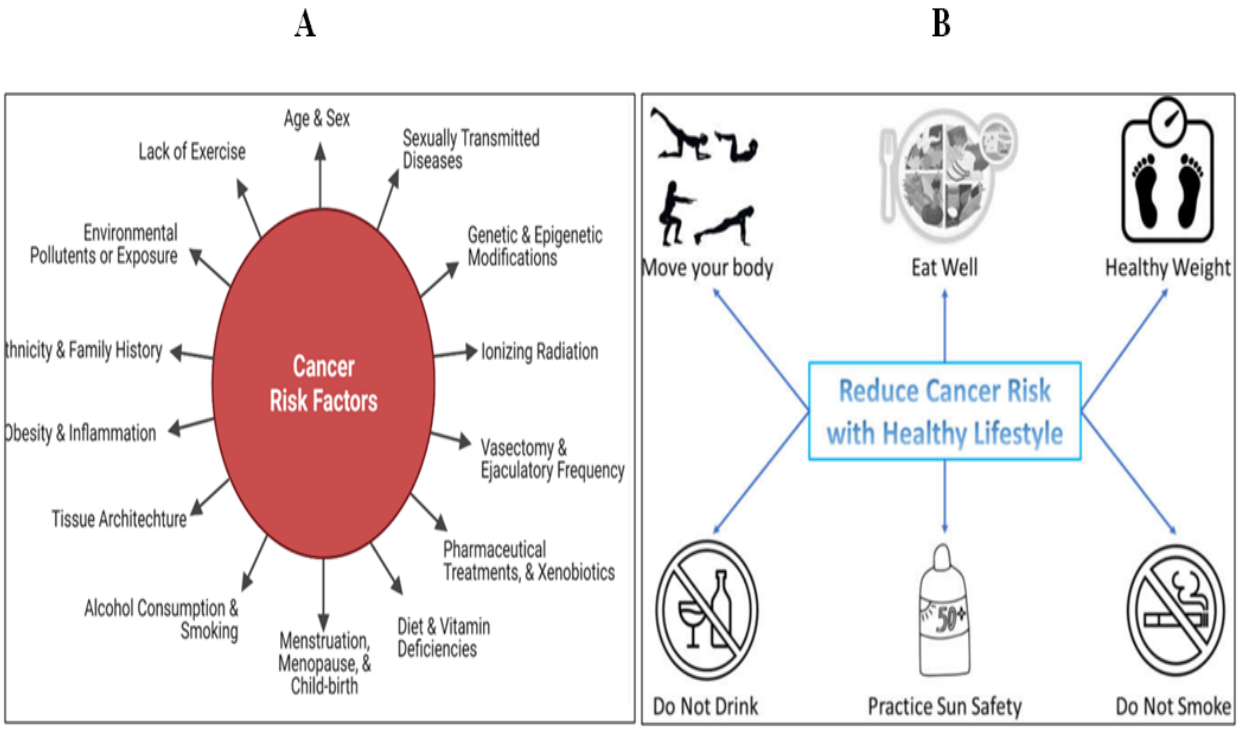


Figure 10 : Risk factors (A) and protective factors (B) of cancer.

4. How to promote healthy eating

Dietary habits depend on many social, economic and environmental factors, such as income, food prices, cultural traditions and personal preferences. Promoting healthy diets requires the collaboration of various actors, including governments, which play a key role.

4.1. Role of governments

- **Consistent policy** : Encourage the production of fruits and vegetables, reduce foods high in fats, sugars and salt, and reformulate products to eliminate trans fatty acids;
- **Food standards** : Ensure access to healthy food in schools, public places and workplaces **;**
- **Economic instruments** : Adopt taxes and subsidies to guide food choices and implement clear nutritional labels **;**
- **Product quality** : Improve the food offering of catering services with healthy and affordable portions.

4.2. Consumer education

- Raise awareness of healthy eating from childhood through school programs;
- Promote culinary know-how and disseminate nutritional information via clear labels;
- Encourage breastfeeding and appropriate feeding practices for infants.

4.3. WHO actions

WHO supports governments through strategies such as:

- The **Global strategy on diet and physical activity** (2004);
- Global targets to reduce malnutrition and non-communicable diseases by 2025;
- The **Commission to End Childhood Obesity** (2014);

- The REPLACE initiative to eliminate industrial trans fatty acids.

4.4. Key facts

- A healthy diet prevents malnutrition and diseases like diabetes and heart disease;
- Reducing free sugars to less than 10% of total energy intake and salt to less than 5 g per day is essential;
- WHO Member States are aiming for a 30% reduction in salt consumption and an end to the increase in obesity and diabetes by 2025.

These efforts aim to ensure healthy living and well-being at all ages.

5. Nutrition and mental health

Nutrition influences brain chemistry, affecting mood, emotions and cognitive abilities. Essential nutrients like omega-3, B vitamins, magnesium and zinc play a key role in regulating neurotransmitters and brain hormones. Deficiencies in certain nutrients are linked to mood disorders, depression and anxiety.

5.1. Impact of eating habits on cognition

A balanced diet improves memory, concentration and stress management. Omega-3s and antioxidants protect the brain, while fiber promotes a healthy gut microbiota, directly impacting cognition and mood.

5.2. Micronutrients and prevention of mental disorders

Zinc, iron, magnesium and vitamins D and B are crucial for mood regulation and prevention of mental disorders. Deficiencies, particularly among vegetarians, are linked to disorders such as depression and schizophrenia.

5.3. Nutrition and stress management

A diet rich in vitamins and minerals strengthens the ability to manage stress. Foods rich in magnesium and protein support the production of neurotransmitters, thereby regulating mood and anxiety.

6. Influence of nutrition on the prevention of chronic diseases

Studies have shown that a diet rich in nutrients, fiber, and antioxidants reduces the risk of type 2 diabetes, obesity, heart disease, and even certain types of cancer. Incorporating anti-inflammatory foods into the diet, such as turmeric, garlic, and spices like ginger, can also help regulate the body's inflammatory processes.

On the other hand, excessive intake of saturated and trans fats, refined sugars and sodium increases the risk of metabolic diseases. This can lead to hormonal balance disorders, blood sugar fluctuations, cardiovascular problems, as well as being overweight. It is therefore essential to favor healthy food choices, limit ultra-processed foods and opt for a more natural and nutrient-rich diet.

7. Diet and Longevity: How Nutrition Contributes to a Healthy Life

Studies show that traditional diets, such as the Mediterranean diet, are associated with greater longevity and better quality of life. These diets are characterized by high consumption of fruits, vegetables, whole grains, fish and olive oils, and low intake of red meats and processed products. These eating habits help reduce the risk of serious illnesses and promote vitality and energy over the years.

8. Nutrition and physical performance

Good nutrition is essential to maintaining an optimal level of physical performance, whether for athletes or anyone wishing to improve their general well-being. Macronutrients (protein, carbohydrates, fats) play a crucial role in muscle repair, energy and recovery. Additionally, adequate hydration and sufficient micronutrient intake are essential for a healthy, high-performance body.

9. The challenges and perspectives of healthy eating

Despite the many benefits of a healthy diet, several obstacles exist to its widespread adoption. This chapter looks at current challenges, including inequalities in access to healthy foods, and possible solutions to overcome them.

9.1. The economic and social challenges of nutrition

Poverty, unequal access to quality food and rising prices of healthy products are major obstacles to adequate nutrition. This chapter explores these challenges and proposes policy and community solutions.

9.2. The impact of food marketing

Food marketing transforms consumer behavior, often in harmful ways. This chapter analyzes the influence of advertising campaigns on food choices and proposes solutions for effective regulation of food marketing.

9.3. Future perspectives for sustainable food

The concept of sustainable food, which takes into account human health and the environment, is booming. This chapter examines the prospects for a diet that supports both the health of individuals and the planet, with particular attention to sustainable agriculture and the reduction of food waste.

10. Importance of a healthy diet for a better future

The effects of diet on physical and mental health are undeniable. A balanced diet, rich in essential nutrients, constitutes a fundamental pillar for the prevention of many chronic diseases and for the preservation of mental health. By adopting healthy eating habits and favoring a diet rich in fruits, vegetables, fiber, lean proteins and unsaturated fatty acids, we can not only improve physical health, but also support optimal psychological well-being.

Conclusion

A diet rich in protective nutrients strengthens the body's defenses against chronic diseases. Antioxidants, fibers, and essential fatty acids are key elements in preventive nutrition. Promoting healthy eating habits is crucial for sustaining long-term health.

Conclusion

The Human Nutrition module constitutes an essential basis for students in Agri-Food Technology and Quality Control. It allows them to better understand the nutritional issues associated with the production and control of food, taking into account public health imperatives and consumer expectations. By providing them with solid theoretical knowledge and practical applications, this module prepares them to become competent and responsible players in the agri-food sector.

Furthermore, this training highlights the importance of nutrition as a lever for innovation in the design of food products, while promoting strategies to improve eating habits and combat nutritional imbalances. Ultimately, the trained students will be able to meet the challenges linked to tomorrow's food, combining health, sustainability and quality.

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People's Democratic Republic of Algeria

Ministry of Higher Education and Scientific Research

UNIVERSITY AMAR TELIDJI -LAGHOUAT-

FACULTY : SCIENCE

DEPARTMENT : AGRONOMIC SCIENCES

Subject Handout

Human Nutrition: 2-Directed work

LEVEL: LICENSE (L3)

SECTOR: FOOD SCIENCES

OPTION: AGRI-FOOD TECHNOLOGY AND QUALITY CONTROL

Presented by: Dr. MENASRA Amina

Academic year : 2024-2025.

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Foreword

Nutrition education plays an essential role in promoting good health. Nutrition is directly linked to food, which serves to cover the nutritional needs of the body. It is necessary to have a good diet to stay healthy. Conversely, poor nutrition can lead to reduced productivity and immunity, increased vulnerability to disease, and disrupted physical or mental development. Nutrition affects the development of the body at all stages of life, from conception to death. Not suffering from hunger or malnutrition is a fundamental right, which must be respected above all else, in the name of human and national development.

This document will be dedicated to presenting several types of exercises to students whose main objectives are to help them improve their understanding of the courses and expand their knowledge in the field of nutrition and health.

Introduction

Human nutrition is a complex and multidisciplinary field that encompasses a wide range of topics, from the biochemistry and physiology of the human body to the sociology of dietary habits. To fully understand this crucial area for health and well-being, it is essential to combine academic theory with practical applications. Exercises and tutorials (TD) play an essential role in this learning process by allowing students to put into practice the knowledge acquired in class.

This document (handout) provides series of exercises of great importance which help students in License 3 in food technology to understand the human nutrition module and to apply it through practical exercises. These exercises allow them not only to consolidate their theoretical knowledge, but also to develop practical skills essential for their future career in the field of food and nutrition.

TD 01: Nutritional surveys/Food consumption surveys

Exercise 1:

- Complete the table below.

Table 01: The different food groups.

Band	Main contributions	Example	Main role
1. Dairy products		Milk, cheese, yogurt	
2.		Red or white meats, cold meats, offal, fish, shellfish, eggs	
3.	Simple sugars, vitamins C and A, fibers, mineral salts, water	Pear, cherry, melon, banana, apple…	
4. Starchy foods (carbohydrates)		Bread, flour, pasta, rice, cereals, pulses, potatoes..	
5.	Plant lipids, vitamins A/D		
6.	Simple, quick carbohydrates	Pastries, sweets	
7.	Water, mineral salts		Functional

Exercise 2:

- Check the correct answer(s)

The need for protein is important:

- For building tissue during growth ☐
- To provide energy ☐
- To strengthen bones ☐

The carbohydrate requirement is necessary:

- For fabric construction ☐
- To provide energy ☐
- To strengthen bones ☐

Adolescents have a greater need for calcium because:

- Teenagers' bones are harder ☐
- Adolescent bones are more fragile ☐
- Teenagers are still growing ☐

Obesity is caused by:

- Great physical activity ☐
- Balanced diet ☐
- Sedentaryism ☐

The energy value of a 30 g milk chocolate bar, containing 2 g of proteins, 17 g of carbohydrates and 10 g of lipids is:

- 212 Kcal ☐
- 189 Kcal ☐
- 166 Kcal ☐

A person is said to be malnourished when they:

- Is overfed. ☐
- Is undernourished. ☐
- Not at ideal weight ☐

Honey belongs to the group of:

- Dairy products ☐
- Sweet products ☐
- Starchy foods. ☐

Is the energy provided by carbohydrates used to support muscle contraction?

- True ☐
- False ☐

The main role of carbohydrates is builder

- True ☐
- False ☐

Proteins have a plastic role

- True ☐
- False ☐

Exercise 3:

- How do you define a vitamin? What are its main properties?
- What impact does vitamin C have on the body and in which food groups can it be found?
- What measures should we adopt to ensure the proper conservation, preparation and cooking of fruits and vegetables?

Exercise 4:

Asma, aged 11, eats in the school canteen at lunchtime. The daily menu includes: grated carrots, vinaigrette, steak, potatoes and flan.

1. Indicate the food categories present in this meal.
2. What are the two main nutrients needed for Anna's development?
3. Before returning home, Anna buys candy and other sweets. Name three possible impacts on his health.
4. Estimate the caloric value of 100 g of Gruyère using the table below:

Table 02: Asma's lunch in the school canteen.

Organic matter (grams)			
For 100 g of	**Proteins**	**Lipids**	**Carbohydrates**
Whole milk	3.5	4	5
Skimmed milk	3.6	0.5	5
Cottage cheese	20	2	1
Gruyere	28	30	4

Correction of TD 01

Exercise 1:

1.

Table 03: The different food groups.

Band	Main contributions	Example	Main role
Dairy products	Calcium, animal proteins, lipids, carbohydrates, vitamin B	Milk, cheese, yogurt	Builder (plastic)
Meat, fish, eggs (animal proteins)	Animal proteins, animal lipids (+/- depending on the product), carbohydrates, vitamins A, B, D, iron	Red or white meats, cold meats, offal, fish, shellfish, eggs	Builder (plastic)
Fruits and vegetables (fiber)	Simple sugars, vitamins C and A, fiber, mineral salts, water	Pear, cherry, melon, banana, apple…	Functional (+ energetic)
Starchy foods (carbohydrates)	Complex carbohydrates (starch), fiber, vitamin B, calcium, phosphorus	Bread, flour, pasta, rice, cereals, pulses, potatoes..	Energetic (+ functional)
Fats (lipids)	Plant lipids, vitamins A/D	Butter, oil, cold meats...	Energetic (+ functional)
Sugars and sweet products	Simple, quick carbohydrates	Pastries, sweets	Energy
Water	Water, mineral salts	Water, mineral water	Functional

Exercise 2:

The need for protein is important:

- For building tissue during growth **X**
- To provide energy **X**
- To strengthen bones

The need for carbohydrates is necessary:

- For fabric construction **X**
- To provide energy **X**
- To strengthen bones

Adolescents have a greater need for calcium because:

- Teenagers' bones are harder
- Adolescent bones are more fragile **X**
- Teenagers are still growing **X**

Obesity is caused by:

- Great physical activity
- Balanced diet
- Sedentaryism **X**

The energy value of a 30 g milk chocolate bar, containing 2 g of proteins, 17 g of carbohydrates and 10 g of lipids is:

- 212 Kcal
- 189 Kcal
- 166 Kcal **X**

A person is said to be malnourished when they:

- Is undernourished **X**
- Is overfed **X**

- Not at ideal weight **X**

Honey belongs to the group of:

- Dairy products
- Sweet products **X**
- Starchy foods.

Is the energy provided by carbohydrates used to support muscle contraction?

- True **X**
- False

The main role of carbohydrates is builder

- True
- False **X**

Proteins have a plastic role

- True **X**
- False

Exercise 3:

1. A vitamin is an essential molecule, in small quantities, for metabolism, and that the body cannot produce itself. It must therefore be provided by the power supply. It does not provide any energy value.
2. Vitamin C, found in fresh fruits and vegetables, helps prevent scurvy. It plays an important role in growth and helps strengthen the body's natural defenses (immune system).
3. Store them away from light in a cool space and consume them as soon as possible. Prepare vegetables without immersing them to avoid loss of vitamins. If possible, cook them with their skin on. Eat fruits and vegetables immediately after peeling them to prevent oxidation. Limit the cooking time, as it partially destroys the vitamins.

Exercise 4:

1. Food groups:

- Grated carrots: vegetables
- Dressing: fat
- Steak: meat, fish and eggs
- Fried potatoes: starches + fat

2. Proteins for building cells, calcium for building bone tissue.
3. Obesity, diabetes and dental caries.

4.

- 28 g of proteins × 4 Kcal = 112 Kcal
- 30 g of lipids × 9 Kcal = 270 Kcal
- 4 g of carbohydrates × 4 Kcal = 16 Kcal

Total: 398 Kcal for 100 g of Gruyère.

Additional exercises in Chapter 01

Exercise 01:

1. Answer True/False for each proposition in table 04 and correct the false propositions.

Table 04: Information in the food sector.

Propositions	True/False	Correction
The essential role of carbohydrates is plastic		
The energy released by carbohydrates is used for muscle contraction		
An excess of carbohydrates in the diet leads to an infectious disease		
Proteins mainly have a building role		
98 g of protein releases 135 kcal		
15 g of lipid releases 27 kcal		
Lipids have a building role		
An excess of lipids in the diet leads to the kwashiorkor		
Protein is a chain made up of a sequence of simple carbohydrates		

Exercise 02:

For a 16 year old adolescent, a balanced diet requires approximately 2800 Kcal daily. Sami, aged 16, is overweight because he exclusively eats prepared meals (fast food). His usual midday meal is shown in the following table.

Table 05: Sami's daily lunch menu.

Meal	Energy and Kcal
Hamburger	500 Kcal
Fries (potato)	630 Kcal
Chicken (roasted piece)	700 Kcal
Coca-cola	300 Kcal

1. Indicate the food categories present in the meal chosen by Sami.
2. Determine the energy intake of this meal.
3. Knowing that the meal must represent 45% of an individual's nutritional intake, calculate the energy to be ingested during this meal.
4. Prove that Sami's diet is proportionally unbalanced.
5. What essential food group is missing from Sami's lunch?
6. Suggest two recommendations for Sami to prevent obesity.

TD 02: Methods for establishing nutritional needs

Exercise 1:

1. Specify the main purpose of the diet.
2. Define simple food and compound food. Give an example for each.
3. Explain the importance of food equivalencies and provide an example.
4. Give the definition of the following terms: food intake, nutritional deficiency, energy needs, food excess, eating habits.
5. Describe how energy needs change throughout a person's life.
6. Compare the energy needs of girls versus boys.
7. Differentiate between the qualitative need and the quantitative need.
8. Indicate and justify the nutritional needs necessary for the child, the intellectual, the athlete, and the manual worker.

Exercise 2:

A 14 year old teenager requires 2400 kilocalories/day.

1. Indicate the number of calories that should come from protein, carbohydrates and fat.
2. Calculate the weight in grams of protein, carbohydrates and fat corresponding to these calories.
3. Mention, for each nutrient, two typical dietary examples.
4. What are the other essential components for a balanced diet?

Exercise 3:

A 15 year old adolescent, a balanced nutrition implies a need of approximately 2800 Kcal/day. Rami, aged 15, is an overweight child because he exclusively consumes ready-to-eat meals. Its daily lunch menu is shown in the table below.

Table 06: Rami's daily lunch menu.

Meal	Energy and Kcal
Bread	500 Kcal
Piece of meat (roasted)	700 Kcal
Fries	630 Kcal
Pepsi	300Kcal

1. Name the food categories present in the menu selected by Rami.
2. Determine the total energy provided by this lunch.
3. Knowing that lunch should represent 45% of an individual's food intake, determine the amount of energy to consume during this meal.
4. Prove that Rami's food ration presents a quantitative imbalance.
5. Identify the essential food group missing from Rami’s lunch.
6. Suggest two recommendations to Rami to avoid obesity.

Correction of TD 02

Exercice1:

1. Food must provide all the elements necessary to satisfy the body's needs and guarantee good health.

2.

- Simple food: composed of a single element, such as oil or powdered sugar.
- Complex food: made up of several components, such as Camembert which contains proteins, fats and calcium.

3. Food equivalences make it possible to replace one food with another while preserving the same nutritional or energy intake. This helps diversify food choices on menus, while respecting personal preferences, financial constraints, cultures and food intolerances.

- Example of calcium equivalence: 125 ml of milk = 100 g of cream cheese = 1 yogurt.

4.

- The food intake represents the quantity and diversity of foods that a person must ingest daily to satisfy the needs of their body. It includes all meals and snacks consumed during the day.

- The term dietary deficiency refers to a situation where our body does not receive all of the nutrients (proteins, fats and sugars) as well as micronutrients (vitamins, minerals and trace elements) necessary for its proper functioning.

- Our energy needs are the energy (from nutrients) that our body needs to function optimally.

- Overeating refers to eating a larger meal, containing more calories than one should consume. It is often high in fats and sugars. “It’s a meal where we go beyond our natural satiation.”

- These are the choices a person or group of people make about what foods they choose, how often they eat them, and how much they take each time. Eating habits are based on sensory (taste, texture, scent, color), sociocultural, psychological factors, as well as socioeconomic, environmental and political elements.

5. An individual's energy needs fluctuate depending on their age, gender, environment, health status and level of physical activity.

6. A man's energy needs are higher than those of a woman, due to physiological differences.
7.

- Quantitative needs: the body requires a certain quantity of nutrients to meet its energy needs.
- Qualitative needs: these are the various types of nutrients that must be provided by food, such as amino acids (some of which are essential), fatty acids (some of which are essential), vitamins, carbohydrates, etc.

8.

- Due to his constant growth, the child has considerable plastic needs: he forms numerous cells daily. Additionally, from birth to adolescence, a child's energy needs increase due to their basal metabolism and rapid development.
- The intellectual will require more carbohydrates: essential nutrients for the proper functioning of the brain.
- The diet of athletes and manual workers must compensate for the energy losses caused by their physical activities. An intake of carbohydrates and fats is recommended.

Exercice2:

1. Number of calories provided

Proteins:

2400 Kcal….100%

Kcal Proteins?…… 15%

Proteinss: 2400 x 15/100= 360 kcalories

Carbohydrates:

2400 Kcal….100%

Kcal Carbohydrates?…… 55%

Carbohydrates: 2400 x 55/100= 1320 kcalories

Lipids:

2400 Kcal….100%

Kcal Fat?……30%

Lipids:2400 x 30/100= 720 kcalories

2. Representation in grams of these calories

Proteins:

gram?….360 Kcal 1g

Proteins……4Kcal

Proteins: 360 x 1/4= 90 g

Carbohydrates:

gram?….1320 Kcal 1g

Carbohydrates……4Kc

al

Carbohydrates: 1320 x 1/4= 330 g

Lipids:

gram? …. 720 Kcal 1g

Lipids …… 9 Kcal

Lipids: 720 x 1/9= 80g

3. Foods representative of these nutrients: Animal proteins: meat, fish, eggs, milk, etc.
   Carbohydrates: bread, potatoes, rice, pasta, etc.
   Lipids: butter, oil, fats from meat or fish, etc.

4. The other component elements essential to a balanced diet include vitamins, mineral salts, trace elements, etc.

Exercise 3:

1.

- Starchy products (starchy foods): Bread+fries

- Meat: piece of meat

- Drinks: Pepsi

2.

2130 Kcal

3.

2800 Kcal….100%

X (lunch)……45%

X= 1260 Kcal

4.

2130 is greater than 1260 Kcal

Rami's food ration is quantitatively unbalanced

5.

Fruits and vegetables

6.

- A balanced diet is diversified (meat, fruits and vegetables, dairy products, etc.).
- It respects the recommended nutritional intakes (ANC).
- It includes regular physical activity (sport).

Additional exercises in Chapter 02

Exercise 1

Mohammed, aged 55, weighs 70 kg. His daughter Maya, 13, weighs 30 kg. Both consume 750 g of rice and 300 g of beef in a day. Knowing that for 100 g of rice, there are 7 g of proteins and that for 100 g of beef, there are 19 g of proteins:

1. What is the protein content of their meal or food ration?
2. What is everyone's daily energy requirement?
3. Which food group provides the most protein?

Exercise 2

Mourad, aged 40, weighs 80 kg. His daily meal includes 400 g of carbohydrates, 70 g of lipids and 160 g of proteins.

1. Calculate the total energy provided by his meal.
2. Determine its daily energy needs.
3. Compare the energy value of his meal with his energy needs.

Exercise 3

A bar of milk chocolate weighing 30g includes 2g of protein, 17g of carbohydrates and 10g of fat. Determine the total energy value of this chocolate bar.

Exercise 4

The qualitative and quantitative requirements of an individual are: 72 g of proteins, 63 g of fats, 261 g of carbohydrates.

- Calculate the energy needs of this individual.

TD 03: Energy balance assessment methods

Exercice1:

Based on the body's various needs (functional, plastic and energetic), we define the concept of suggested intakes. These average energy intakes ensure that body needs are covered. These needs fluctuate depending on several factors: age, sex, level of physical activity, and physiological condition.

Table 07: The daily energy needs of man and woman.

Man	11300 Kj
Woman	9200 Kj

This energy comes from the three main energy nutrients: carbohydrates, fats and proteins.

Table 08: The daily distribution of carbohydrates, lipids and proteins for a balanced diet.

Carbohydrates	50-55 %
Lipids	30-35 %
Proteins	10-15 %

1) Complete the following table:

Table 09: The daily distribution of carbohydrates, lipids and proteins in men and women.

	Distribution in %	**Man**		**Woman**	
		Kj	**grams**	**Kj**	**grams**
Carbohydrates					
Lipids					
Proteins					
Total					

Data:1 **Kilocalorie** is equal to **4.18 kilojoules.**

Basal metabolic rate (BM) varies between individuals depending on factors such as age, gender, weight, height, physiological state, physical activity and dietary habits.

2) Complete the table below

Table 10: Variation of basal metabolism according to weight and height in humans.

Man		**Basal metabolism (Kcal)**
Weight	**Size**	
69	1,75	
77	1,80	
82	1.87	

Data: Apply these coefficients to determine the basal metabolism: **11,3**x…+**16**x…+ **901**=…kcal per day.

Exercise 2:

A pregnant woman consumed the following foods in 24 hours:

Table 11: One day menu for a pregnant woman.

Breakfast	**Lunch**	**Diner**
150 g of milk 20 g of chocolate 150 g of bread 20 g of butter 1 egg (45 g)	100 g of meat 100 g of rice 50 g of concentrated tomato 30 g of oil 1 orange (150 g)	150 g of meat 100 g of salad 20 g of oil 250 g of bread

1. What does all the food ingested during the day represent?

The table below shows the composition of foods:

Table 12: Quantity of carbohydrates, lipids and proteins contained in 100 g of food.

Quantity of carbohydrates, lipids and proteins contained in 100 g of food			
	Proteins	**Lipids**	**Carbohydrates**
Lamb meat	16	20	0
Chicken egg	12.8	11.5	0.7
Whole cow's milk	3.5	3.9	4.9
Butter	0.6	81	0.4
White bread	6.9	0.7	57
White rice	7	0.5	77
Chocolate	7	24	64
Oranges	0.9	0.2	11.2
Salads (lettuce)	1.25	0.25	3
Concentrated tomato	1.5	0.5	8
Vegetable oil	0	100	0

Based on the food composition table, determine the quantity of proteins, carbohydrates and lipids in the daily meals consumed by this woman.

2. Estimate the total energy intake from this diet.
3. Given that this woman's energy needs are 3000 Kcal per day, assess whether, at the end of her pregnancy, she will gain or lose weight. Justify your answer.
4. Check if the menu mentioned above complies with the 421 rule.

Data:

- **Energy balance=Energy intake-Energy needs.**
- Generally, the **energy intake** are expressed in **kilocalories**, while the **Energy needs** are expressed in **Kilojoules**.
- 1 **Kilocalorie** is equal to **4.18 kilojoules**.
- The rule of **sevenths** (421) says that every meal must include **4 portions** of **carbohydrates**, **2 portions** of **proteins** And **1 portion** of **lipids**.

Correction TD 03

Exercise 1:

Filling in tables.

1)

Table 13: The daily distribution of carbohydrates, lipids and proteins in men and women.

	Distribution in %	Man		Women	
		Kj	grams	Kj	grams
Carbohydrates	55	6215	365	5060	300
Lipids	33	3729	100	3036	80
Proteins	12	1356	80	1104	65
Total	100	11300		9200	

2)

Table 14: Variation of basal metabolism according to weight and height in humans.

Man		Basal metabolism (Kcal)
Weight	Size	
69	1,75	1778.7
77	1,80	1799.9
82	1.87	1857.52

Exercise 2:

1. What makes up all the foods ingested daily?

   - All the foods ingested daily form the food ration.

2. Determine the energy value of this food, that is to say of this food ration.

- The main sources of energy are carbohydrates, lipids and proteins.

First of all, it is essential to evaluate the nutritional value of this food ration. In other words, it is necessary to identify the quantity of carbohydrates, proteins and lipids it contains.

Using the food composition table, we determine the quantity of proteins, carbohydrates and lipids provided by this food ration.

This table presents the values of carbohydrates, lipids and proteins for each food, expressed per 100 grams of food.

For example, in 100 grams of lamb meat, there are 16 grams of proteins, or 16%, 20 grams of lipids, or 20%, and 0 grams of carbohydrates, or 0%.

Likewise, in 100 grams of chicken egg, there are 12.8 grams of proteins, or 12.8%, 11.5 grams of lipids, or 11.5%, and 0.7 grams of carbohydrates, or 0.7%.

The carbohydrate, protein and lipid content of a food is calculated as follows:

- The number of grams of carbohydrates contained in a food corresponds to the amount consumed in grams multiplied by the percentage of carbohydrates.
- The number of grams of proteins contained in a food is calculated by multiplying the quantity consumed in grams by the percentage of proteins.
- The number of grams of lipids contained in a food is obtained by multiplying the quantity consumed in grams by the percentage of lipids.

Applications: Milk protein intake is calculated by multiplying the quantity consumed, 150 grams, by 3.5 out of 100.

Do the calculation. The result will be expressed in grams.

Likewise, the protein intake from chocolate is equal to the quantity consumed in grams, multiplied by 7 out of 100. The result will be expressed in grams.

Thus, the protein intake of the food ration is calculated by adding the intake of each food consumed during the day.

The lipid intake of milk is obtained by multiplying 150 by 3.9 over 100. The lipid intake of chocolate is calculated by multiplying 20 by 24 over 100. By adding these values, we obtain the total lipid intake of the food ration.

The carbohydrate intake of milk is calculated by multiplying 150 by 4.9 over 100. The carbohydrate intake of chocolate is calculated by multiplying 20 by 64 over 100. The total carbohydrate intake of the food ration is the sum of all the carbohydrate intake from the different foods consumed.

To determine the quantity of proteins provided by this food ration, start by carrying out the following calculations:

The food ration includes: 150 g of milk, 20 g of chocolate, 150 g + 250 g of bread, 20 g of butter, 45 g of egg, 100 g + 150 g of meat, 100 g of rice, 50 g of concentrated tomato, 30 g + 20 g of oil, 150 g of orange, and 100 g of salad.

The quantity of proteins provided by this food ration is calculated as follows:

150 multiplied by 3.5 over 100, + 20 multiplied by 7 over 100, + 400 (150 grams of breakfast + 250 grams of dinner) multiplied by 6.9 over 100, +20 multiplied by 0.6 over 100, +45 multiplied by 12.8 over 100, + 250 multiplied by 16 over 100, + 100 multiplied by 7 over 100, + 50 multiplied by 1.5 over 100, +50 multiplied by 0 over 100,+150 multiplied by 0.9 over 100,+100 multiplied by 1.25 sur100.

Do the math and you will get 90.48 grams. This is the total quantity of proteins provided by this food ration.

The next step is to calculate the quantity of lipids provided by this food ration.
You will get a value of **136,725 grams**.

Next, determine the amount of carbohydrates provided by this food intake. You will arrive at **349,345 grams**. Perform the calculation to confirm these results.

- What is the energy contribution of this food ration?

Reminder :

- 1 gram of protein provides **4 kilocalories**,
- 1 gram of lipids provides **9 kilocalories**,
- 1 gram of carbohydrates generates **4 kilocalories**.

Thus, energy intake is calculated by multiplying the quantity of proteins by 4, that of lipids by 9, and that of carbohydrates by 4, then adding the three results.

Do the calculation, and you will get a value of **2989,825 kilocalories**.

3. Given that this woman's energy requirements amount to **13749 kilojoules per day**, determine if, at the end of her pregnancy, she will gain or lose weight. Justify your answer.

To do this, calculate the **energy balance**, which corresponds to the difference between energy intake and energy requirements. Note that energy intake is expressed in **kilocalories**, while energy needs are in **kilojoules**.

It is therefore necessary to convert one of the two units:

1 Kilocalorie is equal to 4.18 Kilojoule. So the energy intake is equal to 2989.825 multiplied by 4.18. You will find 12497.468 Kilojoules. Or convert energy requirements to Kilocalories. It's simple, you divide the energy needs by 4.18

- 13749 over 4.18 is equal to 3300 Kilocalories.

Compare the two values to analyze the energy balance and conclude.

The energy balance is therefore calculated as follows: **2989,825 - 3300**, which gives a result of **-310,175 kilocalories**.

- The energy balance is **negative**.
- Therefore, this woman will lose weight at the end of her pregnancy.

4. Check if the menu complies with the **rule of sevenths**.

The rule of sevenths states that every meal should include **4 servings of carbohydrates**, **2 servings of protein**, And **1 serving of fat**.

This menu does not respect these proportions, it is therefore **not compliant** with the rule of sevenths.

Additional exercises in Chapter 03

Exercise 1:

1. List the different functions of **seven food groups**.
2. A banana contains **25% carbohydrates**. How many bananas would you have to eat to get **75 g of carbohydrates**, knowing that a banana has a weight of **90 g** ?

Exercise 2:

1. **What does a vitamin mean?** And what are its main characteristics?
2. What is **the specific role** vitamin C, and in what foods can we find it?
3. What precautions should be taken for the conservation, culinary preparation, and cooking of fruits and vegetables?

Exercise 3:

1. **Describe changing needs** energy throughout an individual's life.
2. Compare the energy needs of girls with those of boys.
3. Identify and justify essential nutritional intakes for normal and pregnant women.

TD 04: Caloric values of foods

Exercice1:

1. Calculate the body mass index (BMI) for each child.

Table 15: Variation in body mass index as a function of weight and height.

Name, age	Weight, height	BMI
Mourad, 5 years	25kg, 1 m10	
Sami, 2 years	10kg, 0 m80	
Asma, 3 years	16kg, 1 m00	
Sara, 5 years	23kg, 1 m17	
Soumia, 4 years	20g, 1m15	

1. Record the BMI indices determined on the charts in the medical record.
2. Identify the child(ren) who are severely overweight.
3. Provide three recommendations for guardians to prevent excess weight.
4. Propose a balanced food ration for Mourad and Asma (refer to the nutritional intake table of foods).

Data:

BMI is calculated by dividing a person's weight in kilograms by the square of their height expressed in meters.

Table 16: Classification of weights based on body mass index 'BMI'.

Classification	BMI
Underweight	< 18.5
Normal weight	18.5 – 24.9
Overweight	25 – 29.9
Obese Category 1	30 – 34.9
Obese Category 2	35 – 39.9
Obese Category 3	≥ 40

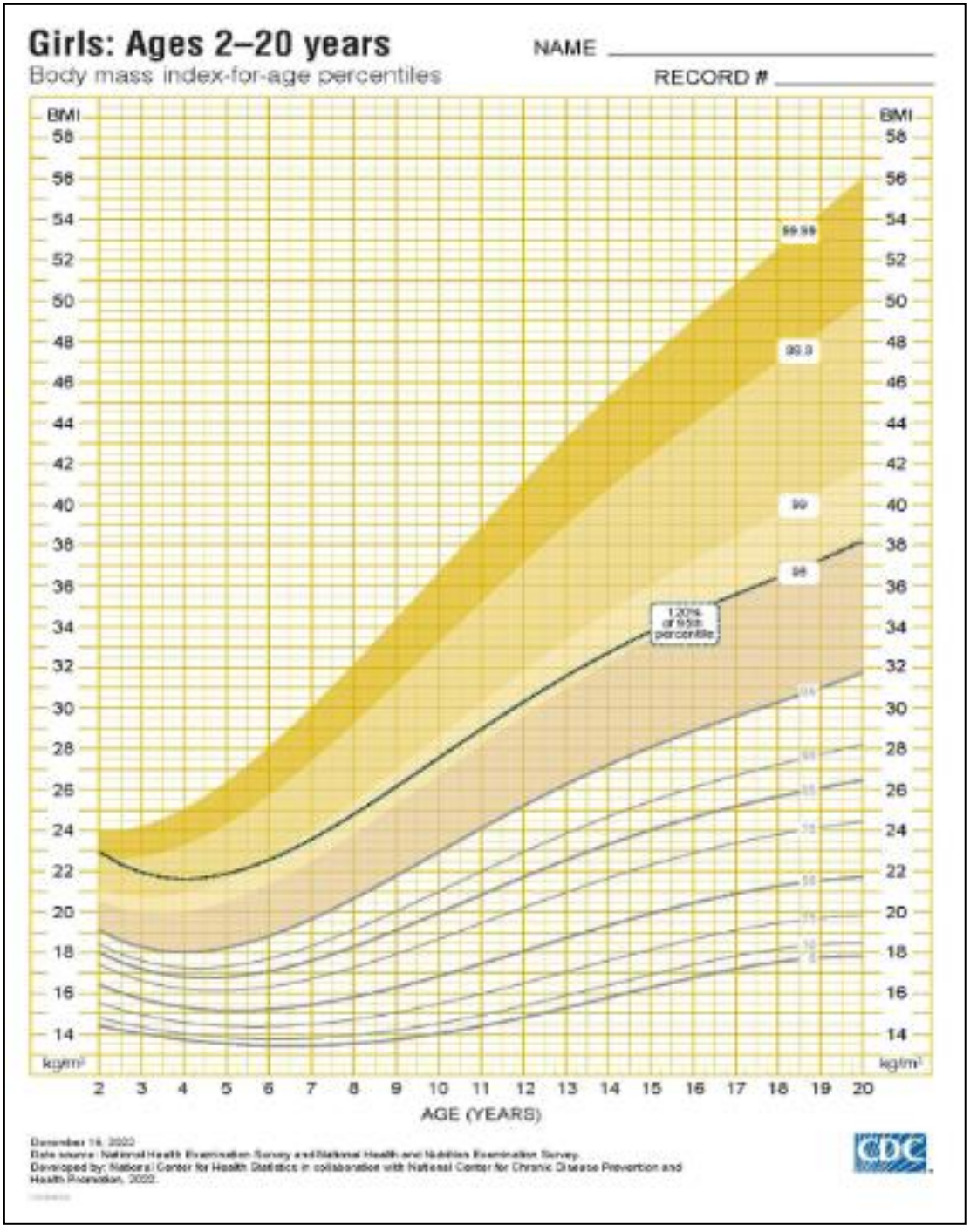


Figure 01 : Growth curve for girls.

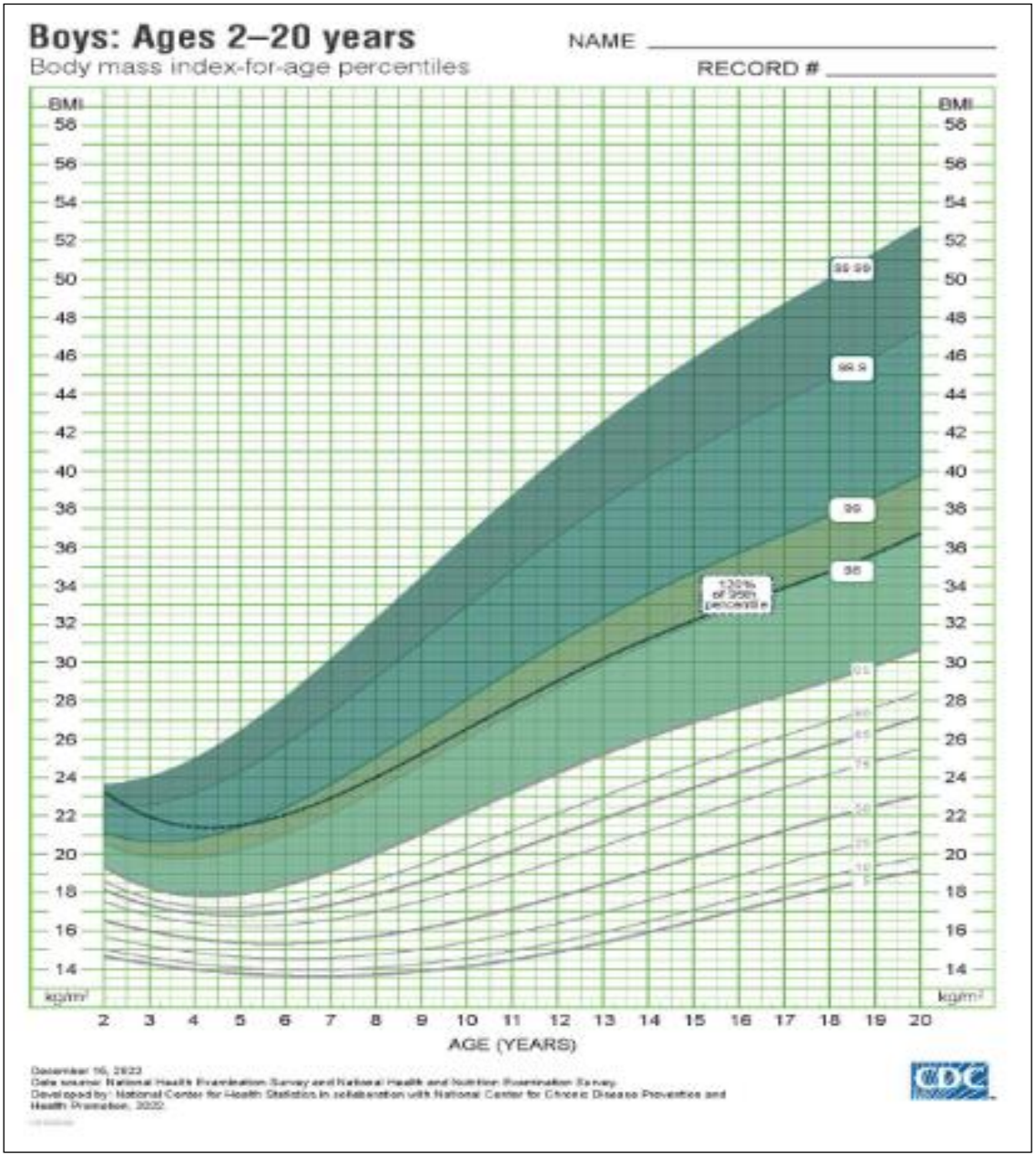


Figure 02 : Height and weight growth curve for boys.

Table 17: Variation in recommended calorie intake for boys and girls depending on age.

	Recommended caloric intake (Kcal/day)	
Age	**3 years**	**5 years**
Boys	1200 kcal	1600 kcal
Girls	1100 kcal	1400 kcal

Exercise 2:

A poultry leg (prepared without skin or bones) contains 25.96% protein.

1. How much thigh should a pregnant woman eat to get 27 g of protein, knowing that one thigh weighs 52 g?
2. What portion of thigh should this woman consume to meet 10% of her daily protein intake?

Data:

Table 18: Variation in the recommended caloric intake for pregnant and breastfeeding women.

Recommended caloric intake (Kcal/day)	
Pregnant woman	2150-2250
Breastfeeding woman	2500

Correction of TD 04

Exercise 1:

1.

Table 19: Variation in body mass index as a function of weight and height.

Name, age	Weight, height	BMI
Mourad, 5 years	25kg, 1 m10	20,7
Sami, 2 years	10kg, 0 m80	15,6
Asma, 3 years	16kg, 1 m00	16
Sara, 5 years	23kg, 1 m17	16,8
Soumia, 4 years	20g, 1m15	15,1

2. Mourad is an obese child.

3.

- Reduce snacks between meals;
- Restrict the ingestion of fatty foods or foods rich in sugar;
- Adjust portions according to the age of the child;
- Avoid dietary diversification too early.

4. Free choice not exceeding **Recommended caloric intake (Kcal/day).**

Exercice2:

1.

52 g... 100 X proteins=13.5g

X g thigh…. 25.96 Protein

27g/13.5=2

So you have to eat 2 thighs

2.

2250 Kcal …. 100 X proteins=225kcal

X Kcal proteins…. 10

1 g protein……. 4 Kcal X proteins=56.25g

X g proteins …… 225 Kcal

56.25/13.5=4.16

So you have to eat 4 thighs.

Additional exercises in Chapter 04

Exercise 1:

One way to prevent kwashiorkor is to eat plenty of ……

1. Mention four foods that are rich in it.
2. Knowing that a person receives a ration of 2400 kcal per day with 60 grams of protein, calculate the number of calories provided by these 60 g.

Exercise 2:

A banana contains 25% carbohydrates. How many bananas should we eat to ingest 75 g of carbohydrates, knowing that one banana weighs 90 g?

Exercise 3:

Here are the quantities needed to prepare a cottage cheese cake for 12 guests: 600 g of cottage cheese, 60 g of caster sugar, 45 g of cornstarch, 6 eggs, 1/4 teaspoon of salt (3 small pinches).

- What nutrients does this cake provide?

TD 05: Caloric values of foods

Exercice1:

Asma, aged 16, is having lunch in a fast-food restaurant. His meal consists of:

Table 20: Asma's fast food lunch menu.

Meal	Proteins (g)	Lipids (g)	Carbohydrates (g)
1 burger with: 24 g of raw vegetables 14 g of cheese 75 g of meat 105 g of bread	75.6 34	35.4 13.7	37.7 34.3
1 portion of fries (80g) **300 ml of Coca-Cola** **1 glass of milk**	0 9.1	0 8.5	32 55

1. Estimate the energy provided by this meal.
2. Given that the recommended daily energy intake for an adolescent is 2900 kcal, what is your opinion on the energy intake of this meal?
3. Asma's fat requirement represents 30% of her energy needs. How much fat can she still consume during the day to maintain a nutritional balance?
4. What are your observations on this fat intake?
5. Mention two health consequences of such an eating habit.

Exercice2:

A child weaned at 12 months and weighing 10 kg receives a food ration composed of powdered milk made from wheat, called “milk infant cereal”. The label on the 400 g box of milk indicates: lipids 10.5%, proteins 15%, carbohydrates 67%, mineral salts, vitamins A, B, D, E, C.

The child is given 6 meals a day; each meal contains 150 ml of water and 50 g of “milk infant cereal”.

1. What are the quantities of carbohydrates, lipids and proteins in the ration?
2. What is the total energy value of this ration?
3. Does this energy value cover the child's needs? Justify your answer.
4. Does this ration meet the child's protein needs? Justify your answer.
5. Is the child protected against malnutrition and Marasmus? Make a conclusion.

Remark :

- A 1 year old child needs 70 kcal/kg of weight/day; its protein requirements are 3 g/kg of weight/day.
- 1 g of protein, 1 g of lipid and 1 g of carbohydrate provide 4 kcal, 9 kcal and 4 kcal respectively.

Correction of TD 05

Exercise 01:

1. Proteins: 40.1g; lipids: 57.6g; carbohydrates: 159g.

Or proteins (40.1 x 4Kcal) + lipids (57.6 x 9Kcal) + carbohydrates (159 x 4Kcal) = 1315Kcal.

2. This meal constitutes 45% of the daily energy intake required for the young girl. This percentage is excessively high. Additionally, this meal has a nutritional imbalance.

3. Asma's lipid requirement represents 30% of her energy needs, i.e. 2900 Kcal x 30% = 870 Kcal. She consumed 518 at lunch. It therefore remains 870 - 518= 361 Kcal in lipids to consume.

4. This intake is excessively high, and she is unlikely to maintain nutritional balance throughout the day.

5. Excess fat can lead to obesity and cause cardiovascular problems.

Exercise 02:

1. Quantity of carbohydrates, lipids and proteins in the ration:

- Carbohydrates: (67/100 x 50) x 6= 201g

- Lipids: (10.5/100 x 50) x 6= 31,5g

-Protides: (15/100 x 50) x 6=45g

2. Total energy value of the ration:

- Carbohydrates:4 kcal x 201 = 804kcal

- Lipids:9 kcal x 31,5= 283,5 kcal

- Protein: 4 kcal x 45= 180 kcal

- Total energy value= 804+283.5+180=1267.5 kcal

3. The child's energy needs are: 70kcal x 10=700 kcal

Justification: The food ration meets the child's energy needs, because the intake of 1267.5 kcal exceeds the child's needs, which are 700 kcal.

4. The child's protein needs are: 3g x10=30 g

Justification: The ration meets the child's protein needs, because the intake of 45 g of protein exceeds the needs of 30 g.

5. The child is protected against malnutrition thanks to a ration rich in protein, as well as vitamins A (promoting growth) and D (preventing rickets).

- The child is also protected from marasmus, because his ration is adequate and his energy needs are largely met.
- Conclusion: This child's diet is appropriate.

Additional exercises in Chapter 05

Exercise 1:

Nutritional disorders frequently result from dietary imbalances, where certain nutrients are ingested in excess or, conversely, in too low quantities.

1. What impacts negative on the health can occur has the suite excessive consumption of fats and sugars?
2. What are the consequences for the body of an insufficient intake of iron, calcium, vitamin D, vitamin C and water?

Exercise 2:

A man should ingest on average 70 g of protein per day, 275 g of carbohydrates and 85 g of fat. It is recommended to eat three meals daily with a calorie intake of 25% at breakfast, 45% at lunch and 30% at dinner.

- For the three categories of elements: proteins, carbohydrates and fats, indicate the necessary intake for each meal.

Additional exercises for all chapters of human nutrition with their solutions

Theme: Nutritional surveys / Food consumption surveys

Exercise 1 :

Design a 10-question questionnaire to collect dietary data on a typical day.

Solution :

- What meals do you usually eat (breakfast, lunch, dinner)?
- Do you eat snacks?
- What is your portion of fruits and vegetables per day?
- How much water do you drink each day?

Exercise 2: Analysis of a survey

An individual consumes the following foods in a day:

- Breakfast: Sweet coffee, white bread with butter.
- Lunch: White rice, fried chicken, salad (50 g).
- Dinner: Homemade pizza.

Analyze and suggest improvements.

Solution :

Lack of fruit and fiber. Add fruits to breakfast and increase the amount of vegetables at lunch.

Reduce fried foods and use healthier cooking methods (grill, steam).

Theme: Food groups and their role

Exercise 1:

Classify the following foods in their food group: Rice, milk, apple, fish, olive oil, lentils, chocolate.

Solution :

- Starchy foods: Rice.
- Dairy products: Milk.
- Fruits: Apple.
- Animal proteins: Fish.
- Fats: Olive oil.
- Legumes: Lentils.
- Sweet products: Chocolate.

Exercise 2: Complete the table of roles of food groups

Table 21: Main role of food in health.

Food group	Main role
Fruits and vegetables	(A)
Meats and fish	(B)
Grain products	(C)
Dairy products	(D)

Solution :

Table 22: Functions of foods in maintaining health.

Food group	Main role
Fruits and vegetables	Source of vitamins and minerals.
Meats and fish	Protein intake.
Grain products	Supply of energy from carbohydrates.
Dairy products	Source de calcium.

Theme: Content and nutritional values of foods

Exercise 1:

A food contains 8 g of proteins, 5 g of lipids, and 20 g of carbohydrates per 100 g. Calculate its energy value.

Solution :

- Protein: 8 × 4 = 32 kcal.
- Lipids: 5 × 9 = 45 kcal.
- Carbohydrates: 20 × 4 = 80 kcal.
- Total : 32 + 45 + 80 = 157 kcal/100 g.

Exercise 2:

Compare the dietary fiber content between an apple (2 g/100 g) and a banana (1.5 g/100 g). What is the best source of fiber?

Solution : Apple is a better source of fiber.

Exercise 3:

Identify the main nutrients in the following foods:

- Egg: (A).
- Pain complet : (B).
- Salmon: (C).

Solution :

- A: Proteins, fat-soluble vitamins.
- B: Complex carbohydrates, fiber.
- C: Proteins, omega-3 fatty acids.

Theme: Energy needs

Exercise 1:

A 70 kg man, with moderate activity, has a basic metabolism of 1600 kcal.
Knowing that its activity coefficient is 1.6, calculate its energy needs.

Solution :

Energy requirements = 1600 × 1.6 = 2560 kcal/day.

Exercise 2:

For an energy ration of 2000 kcal, divide the caloric intake between carbohydrates (55%), lipids (30%), and proteins (15%).

Solution :

- Carbohydrates: 2000 × 0.55 = 1100 kcal → 1100/4 = 275 g.
- Lipides : 2000 × 0,30 = 600 kcal → 600/9 = 67 g.
- Protein: 2000 × 0.15 = 300 kcal → 300/4 = 75 g.

Theme: Energy balance assessment methods

Exercise 1:

An individual consumes 2200 kcal/day and expends 2000 kcal/day. Analyze its energy balance.

Solution : The balance is positive (2200 - 2000 = +200 kcal/day). This excess leads to long-term weight gain.

Exercise 2:

Track your food consumption for 3 days and calculate your average daily energy intake. Compare it to your estimated needs.

Solution : To be personalized according to the student's results.

Exercises on methods of establishing nutritional needs

Exercise 1:

The Recommended Dietary Allowance (ANC) for protein is 0.8 g/kg/day. Calculate the needs of an individual weighing 70 kg.

Solution :0.8 × 70 = 56 g/day.

Exercise 2:

Compare the Recommended Dietary Allowances (ANC) for vitamins C and D between an adult and a pregnant woman. Why do needs vary?

Solution : Requirements are increased to support fetal growth and metabolism.

Topic: Caloric value of foods

Exercise 1:

Rank the following foods according to their increasing caloric density:

Nuts (600 kcal/100 g), skimmed milk (40 kcal/100 g), apple (52 kcal/100 g).

Solution : Skimmed milk < Apple < Nuts.

Exercise 2:

Study the label of a product (example: cereal) and identify critical nutrients. Offer healthier alternatives.

Solution : Example: reduce added sugars, favor fiber.

Exercise 3:

A meal contains:

- Chicken (150 g, 200 kcal).
- Riz (200 g, 300 kcal).
- Vegetables (100 g, 50

kcal). Calculate the total

value.

Solution :200 + 300 + 50 = 550 kcal.

Exercise 4:

Compare a vegetarian diet and an omnivorous diet in terms of nutrients and diversity. What adjustments would you recommend?

Solution : Add plant-based sources of protein (legumes) for a vegetarian diet.

Exercise 5:

A woman consumes 1800 kcal/day, but her need is 2000 kcal/day. What risks does it face in the long term?

Solution : Risk of energy deficit, weight loss.

Exercise 6:

Evaluate whether the following menu is balanced for an adult:

- Breakfast: Coffee, croissant.
- Lunch: Pasta, meat.
- Dinner: Soup.

Solution : Lack of fruits, vegetables, dairy products.

Exercise 7:

Calculate a balanced food ration for a 60 kg individual with needs of 2200 kcal. Break down the macronutrients and provide example foods.

Solution : To be personalized with calculations similar to previous exercises.

Exercise 8:

An individual consumes the following foods during a day:

- 120 g of protein.
- 200 g of carbohydrates.
- 80 g of fat.

Calculate this individual's total energy intake in kilocalories (kcal).

Solution :

1 g of protein = 4 kcal. 1

g of carbohydrates = 4

kcal. 1 g of fat = 9 kcal.

Calculation :

Energy intake from proteins: 120 g × 4 kcal/g = 480 kcal.

Energy intake from carbohydrates: 200 g × 4 kcal/g = 800 kcal.

Energy intake from fat: 80 g × 9 kcal/g = 720 kcal.

Total energy intake = 480 + 800 + 720 = 2000 kcal.

Exercise 9:

Associate the following nutrients with their main role in the body:

- Vitamin A
- Zinc
- Calcium
- Omega-3

Solution :

- Vitamin A – Role in vision, cell growth and the immune system.

- Zinc - Participates in protein synthesis and the proper functioning of the immune system.
- Calcium - Essential for bone and tooth formation, and muscle function.
- Omega-3 – Contributes to cardiovascular health and brain function.

Exercise 10:

Describe the difference between nutrition and dietetics.

Solution :

- Nutrition: It is the set of processes by which an organism assimilates and uses the nutrients necessary for its metabolism. It includes the study of foods and their effect on health.
- Dietetics: It is a branch of nutrition that focuses on developing and recommending diets tailored to specific needs, whether to maintain or improve health, or to treat diseases.

Exercise 11:

What are the main food sources of vitamin D and why is it important for health?

Solution :

- Food sources of vitamin D: Fatty fish (salmon, mackerel), fish liver oils, eggs, fortified dairy products, exposure to sunlight.
- Role of vitamin D: It is crucial for calcium absorption and bone health. It also helps maintain immune function.

Exercise 12:

Explain the effects of excess sodium in the diet.

Solution :

- Excess sodium (salt) can lead to health problems such as:

- High blood pressure
- Increased risk of cardiovascular diseases
- Deterioration of kidney function
- Water retention, causing swelling and weight gain.
- WHO recommendations are not to exceed 5 g of salt per day for an adult.

Exercise 13:

An average adult has a daily calorie need of around 2000 kcal. If this individual eats a 30% fat diet, what is his daily fat intake in grams?

Solution :

30% of 2000 kcal = 600 kcal from fat

Knowing that 1 g of fat = 9 kcal, we divide 600 kcal by 9 to obtain the number of grams of fat.

600 ÷ 9 = 66.67 g of fat per day.

Exercise 14:

Explain the impact of excessive consumption of added sugars on health.

Solution :

Excessive consumption of added sugars can lead to several health problems, such as that:

- Obesity and excessive weight gain.
- Increased risk of type 2 diabetes.
- Cardiovascular diseases.
- Dental caries.
- Blood sugar fluctuations and fatigue.

Exercise 15:

What are the consequences of vitamin B deficiency$_{12}$ in food?

Solution :

- Vitamin B deficiency$_{12}$ can cause:
- Megaloblastic anemia
- Fatigue and weakness
- Neurological disorders such as tingling in the hands and feet
- Cognitive disorders and mental confusion.

Conclusion

In the field of human nutrition, theory alone is not enough to ensure a complete and in-depth understanding of concepts and practices.

In conclusion, practical exercises and tutorials play an essential role in acquiring an in-depth understanding of human nutrition at undergraduate level. These activities allow students to put into practice the theoretical concepts covered in class, by confronting them with real situations and engaging them in concrete exercises.

Tutorials also provide a valuable opportunity to deepen acquired knowledge by encouraging critical thinking, problem solving and collaborative discussion. By participating in these exercises and working on specific case studies, students can not only better absorb the course content, but also develop essential practical and analytical skills in the field of human nutrition. Thus, the importance of exercises and tutorials within the human nutrition module lies in their ability to enrich theoretical learning, promote in-depth understanding and prepare students to apply their knowledge in various professional contexts related to nutrition.

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