Medical Nutrition Therapy
Therapeutic Nutrition
Clinical Nutrition
Diet Therapy

VNIVERSITAT DE VALÈNCIA
Facultat de Farmàcia

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ARA Group
Valencia, 2022

Departament de Medicina Preventiva i Salut Pública
Ciències de l'Alimentació, Toxicologia i Medicina Legal

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PDI - ASOCIADO/A UNIVERSIDAD
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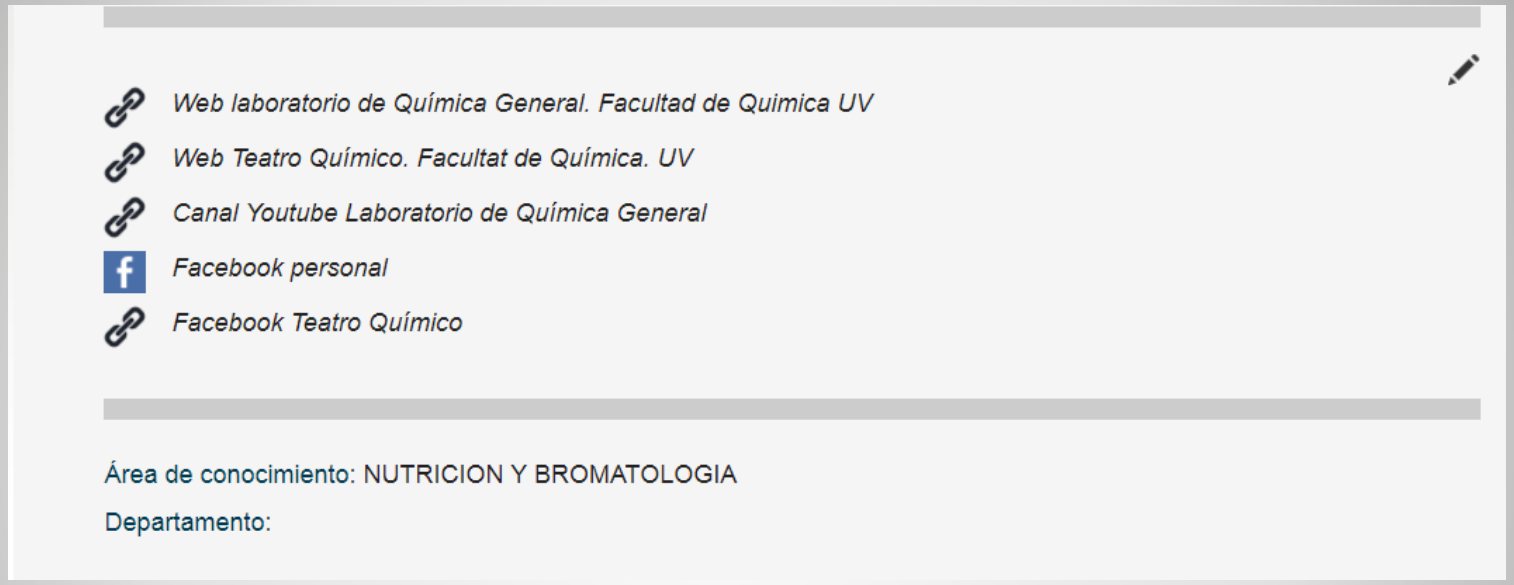
Por las tardes.

Info about the lecturer



Departament de Medicina Preventiva i Salut Pública
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Info about the lecturer

Tutorías

Anual

Día: Miércoles De 12:30 a 14:00. DESPATX 21. FACULTAT DE QUIMICA. EDIFICI E. PRIMERA PLANTA

Observaciones

Participa en el programa de tutorías electrónicas de la Universitat de València.

Asignaturas impartidas y modalidades docentes

33943 - Química de los alimentos	Química de los alimentos:L
33970 - Prácticum	Prácticum
34110 - Dietoterapia	Seminarios, Teoría, Tutorías

Info about the lecturer

VNIVERSITAT DE VALÈNCIA

Course Guide
34110 Clinical Nutrition

COURSE DATA

Data Subject	
Code	34110
Name	Clinical Nutrition
Cycle	Grade
ECTS Credits	4.5
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
1201 - Grado de Farmacia	Faculty of Pharmacy	3	Second term

Subject-matter

Degree	Subject-matter	Character
1201 - Grado de Farmacia	9 - Human feeding	Obligatory

SUMMARY

Clinical Nutrition is a compulsory subject taught in the second term of Year 3 in the Bachelor's Degree in Pharmacy.

It is worth 4.5 ECTS credits in the current curriculum (2009 Plan) (1 ECTS credit = 25 h).

This course aims to provide students with extensive knowledge on the effects of nutrition on different diseases and physiopathological situations.

It also prepares them to be able to design dietary guidelines for hospital and outpatient treatment, and to draw up nutritional plans for several diseases.

Additionally, they will learn how to perform the dietary control and monitoring of the patient.

As future professionals in the area of the Health Sciences, graduates will be required to master these concepts.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	20,00	100
Computer classroom practice	8,00	100
Laboratory practices	8,00	100
Seminars	4,00	100
Tutorials	2,00	100
Development of group work	10,00	0
Development of individual work	2,50	0
Study and independent work	40,00	0
Readings supplementary material	2,50	0
Preparing lectures	8,00	0
Preparation of practical classes and problem	1,50	0
Resolution of case studies	3,00	0
TOTAL	**109,50**	

The following course components will be considered:

Individual and/or group reports of the exercises carried out in the classroom, in the laboratory, and in the computer room, which will assess the acquisition of skills and attitudes defined *ad hoc* for the subject area, as well as the work carried out by the student and the acquisition of basic procedures and concepts.

Written test, which will assess the level of knowledge acquired on the theoretical concepts and procedures covered in each lesson.

Attitude of the student as assessed from group and individual tutorials, practical classes, and seminars presented and discussed in class.

LEARNING OUTCOMES

TEACHING METHODOLOGY

Theory classes (20)

Seminars (4): compulsory

These must be prepared in groups of 4 or 5 students with each student presenting a topic to be held during the seminar (oral presentation and written work). The presentations will be held on the days of seminars.

Seminars can also be held with current scientific articles related to the subject and completing the tasks requested.

Tutorials (2): compulsory
Two tasks must be completed.

EVALUATION

Evaluation of theoretical contents through theory questions in the final exam will contribute 6.5 points of the final mark for the course.

Evaluation of the practical lab classes will contribute 2.0 points of the final mark for the course and will be assessed through the practical questions included in the final exam.

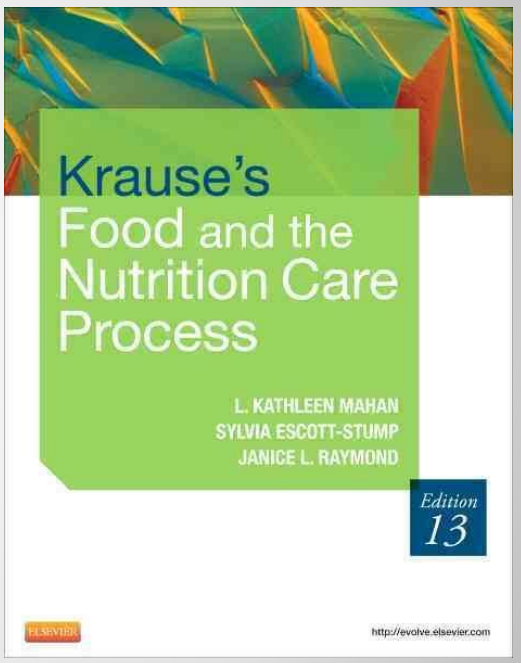
Evaluation of tutorials and tasks will contribute 0.5 points and will take account of the resolution of the tasks proposed (different from laboratory practicals and seminars) and attendance at tutorials.

Evaluation of the seminars will contribute a maximum of 1.0 point to the final mark for the subject.

To pass the course, a minimum overall score of 5 out of 10 in the final exam is required.

- Comprehensive text book for beginners
- 3 authors
- 58 contributors
- 3 reviewers

Edition 13 (English)



References:

Krause's Food and Nutrition Care Process

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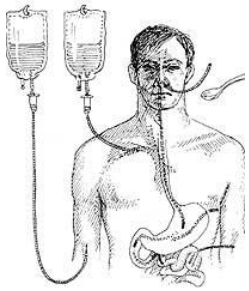


Artificial nutrition (enteral and parenteral) objectives, indications, and characteristics

Unit 1.2

Prepared by: Teresa Climent

Artificial nutrition

Introduction

Swallowing disorders, transit, digestion, absorption or metabolism can cause malnutrition, a situation in which the body is unable to maintain vital functions, loses the ability to defend against aggression, healing mechanisms and replacement of injured tissue are altered, and has less tolerance and response to adjuvant treatment.

Artificial nutrition
Definitions

Artificial nutrition (AN) is intended to cover the body's needs, providing the precise nutrients needed **quantitatively** and **qualitatively**.

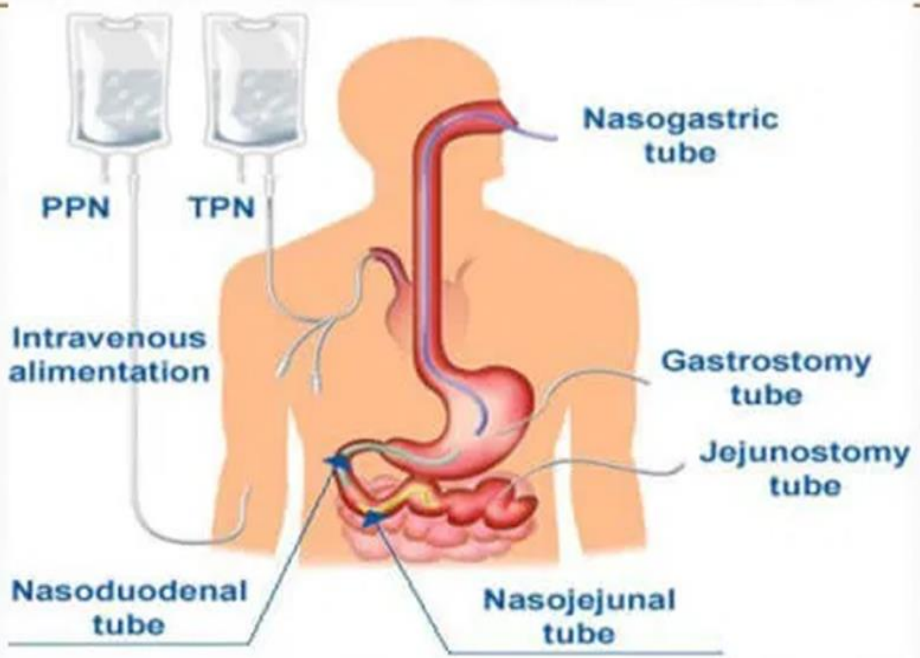
Enteral nutrition, EN (nutrients supply via digestive tract):

indicated in patients who are unable to ingest adequate amounts of food but have a gastrointestinal tract with suitable functional capacity.

Parenteral nutrition, PN (nutrients supply via intravenous)

indicated in patients unable or unwilling to be fed by themselves and enteral nutrition is not possible.

Parenteral Enteral



PPN: Peripheral parenteral nutrition

TPN: Total (or central) parenteral nutrition

Artificial nutrition

Indications

1. Essential for those who cannot eat food orally.
2. Must be adapted to the patient's disease.

The choice between EN/PN will be carried out based only in the proper **functionality** of the digestive system.

If the patient has enough intestinal surface, if it works properly and is accessible, the nutritional intake should be via **enteral**.

Enteral vs parenteral nutrition (EN/PN)

- EN is preferable to PN because:
  - it's more physiological
  - favours nutritional repletion
  - has fewer and less severe complications
  - patients can be fed at home

- PN when EN is not possible:
  - is more aggressive and involves more complications.
  - can be used as support to oral or EN to achieve the nutrient needs.

Artificial nutrition

Hospital team

In each hospital there is (should be) a multidisciplinary team to establish the **protocol** for:

- Indications for enteral or parenteral
- Assessment of patient's **nutritional status** (anthropometric and biochemical parameters)
- Calculation of **caloric requirements**
- Choice of the **administration route** depending on the pathology
- Technique of applying and maintaining **tubes and catheters**
- Technical management and prevention and treatment of **septic and / or mechanical complications**
- **Biochemical monitoring**: protocol and frequency
- **Standard formulations** (macro- and micronutrients content)

Artificial nutrition

Patient's initial assessment

◆ ANAMNESIS:
- Datos personales.
- Historia actual:
  - Patología de base.
  - Situación clínica.
  - Otras patologías.
  - Tratamientos concomitantes.
  - Función gastrointestinal.
  - Ingesta oral.
  - Pérdida de fluidos.

◆ ANTROPOMETRÍA:
- Peso (Kg, percentil).
- Talla (cm, percentil).
- Índice de masa corporal (percentil).
- Pliegue tricipital (mm, percentil).
- Circunferencia del brazo (cm, percentil).
- Circunferencia muscular del brazo.
- Puntuación Z en niños.

◆ DATOS ANALÍTICOS:
- Bioquímica básica.
- Hemograma.
- Albúmina.

◆ CÁLCULO DE NECESIDADES:
- Necesidades calóricas (actividad física).
- Necesidades proteicas.
- Necesidades especiales.

Enteral nutrition

Summary

- EN is an alternative for many patients who are **unable to eat food** because of their clinical situation.
- Progress in the formulas, methods, and routes of administration have made EN a simple and useful technique for treating many situations, including alterations in intake, digestion, or nutrient absorption.
- The current trend towards shortening hospital stays implies that **enteral nutrition should be done at home** for patients who require nutritional support but do not require hospitalisation.
- EN is one of the health benefits of the Spanish National Health System.

If EN formulas are to be funded, they must be registered in the General Health Register of Food as **"dietary foods for special medical purposes".**

https://www.sanidad.gob.es

Enteral nutrition

Indications

- **Inability to eat**
  - Neurologic disorders (dysphagia)
  - Facial, oral, or esophageal trauma
  - Respiratory failure
  - Congenital anomalies

- **Inability to eat enough**
  - Cancer
  - Congenital heart disease /heart failure
  - Anorexia nervosa
  - HIV/AIDS
  - Cystic fibrosis

- **Impaired digestion, absorption or metabolism**
  - Pancreatitis
  - Chron’s disease
  - Inborn errors of metabolism
  - Severe gastroparesis

Enteral nutrition

Formula

Enteral formula are a defined mixture of macro- and micronutrients which are administered by the digestive route.

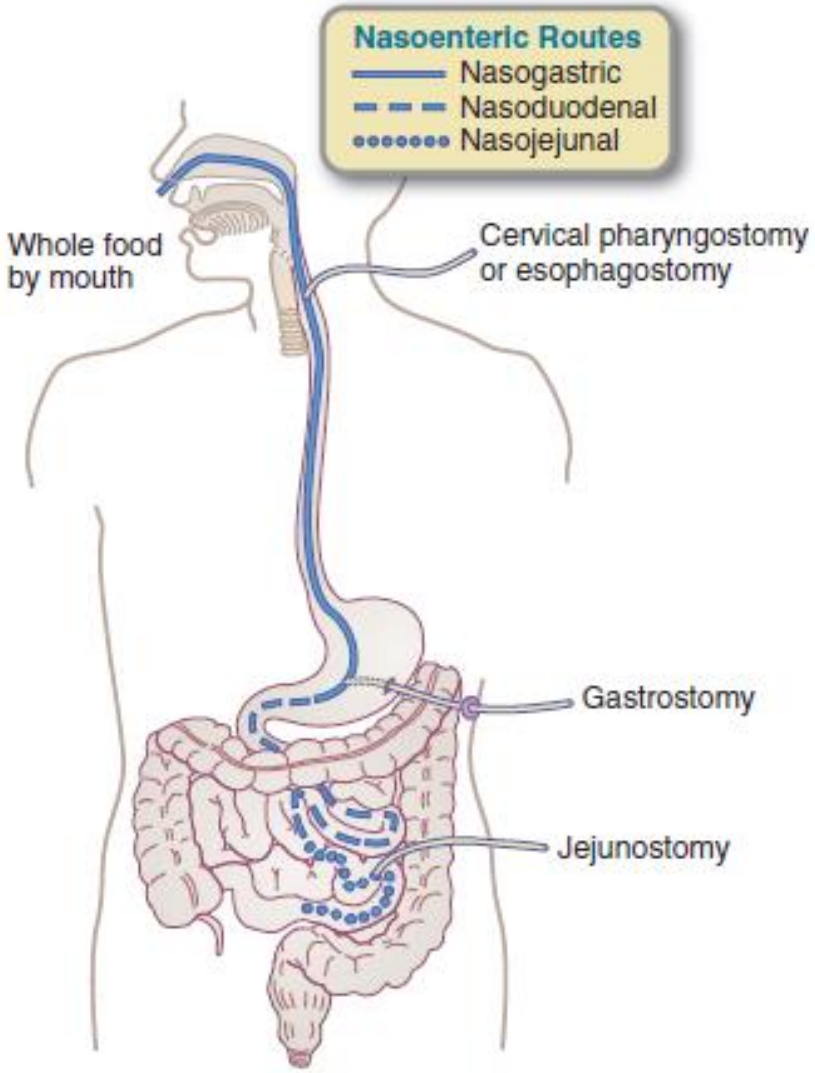
Nutritionally complete formula: contains enough of all required nutrients to cover all the patient's needs (with the indicated dose).

Modular: preparations that usually contain just a single nutrient (specific CH, lipids, proteins, minerals/vits.) The combination of several modules allows a complete diet.

Supplements: used in the treatment of metabolic situations with special requirements (energy or nutrients), designed to complement regular food consumption.

Enteral nutrition

Routes and equipment



Enteral nutrition

Formula composition and indications

BOX 13-2 Factors to Consider when Choosing an Enteral Formula

Ability of the formula to meet the patient's nutrient requirements
Caloric and protein density of the formula (i.e., kcal/ml, g protein/ml, ml fluid/L))
Gastrointestinal function
Sodium, potassium, magnesium, and phosphorus content of the formula, especially for patients with cardiopulmonary, renal, or hepatic failure
Form and amount of protein, fat, carbohydrate, and fiber in the formula relative to the patient's digestive and absorptive capacity
Cost effectiveness of formula
Patient compliance
Cost-to-benefit ratio

Enteral nutrition

Complications

Access

Leakage from ostomy/stoma site
Pressure necrosis/ulceration/stenosis
Tube displacement/migration
Tube obstruction/occlusion

Metabolic

Drug-nutrient interactions
Glucose intolerance
Hyperglycemia/hypoglycemia
Dehydration/overhydration
Hypernatremia/hyponatremia
Hyperkalemia/hypokalemia
Hyperphosphatemia/hypophosphatemia
Micronutrient deficiencies (thiamin)
Refeeding syndrome

Administration

Microbial contamination
Regurgitation
Inadequate delivery (misconnections or misplacement)

Gastrointestinal

Constipation
Diarrhoea
Distention/bloating/cramping
Intolerance of nutrient components
Maldigestion/malabsorption
Nausea/vomiting

Parenteral nutrition

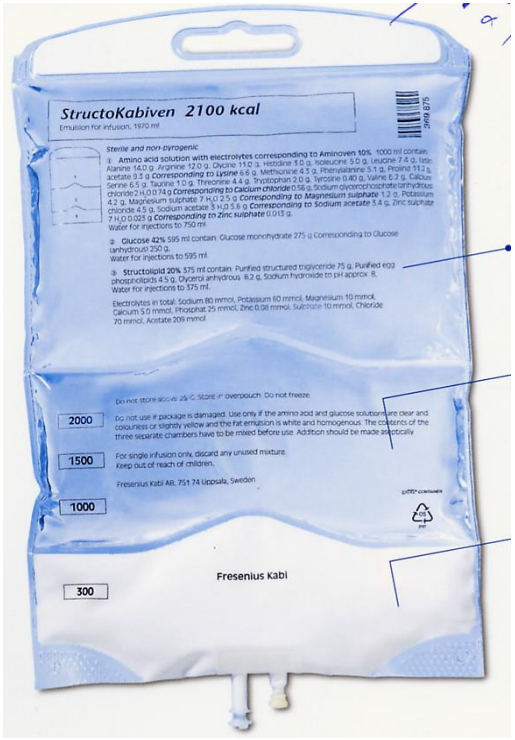
Indications

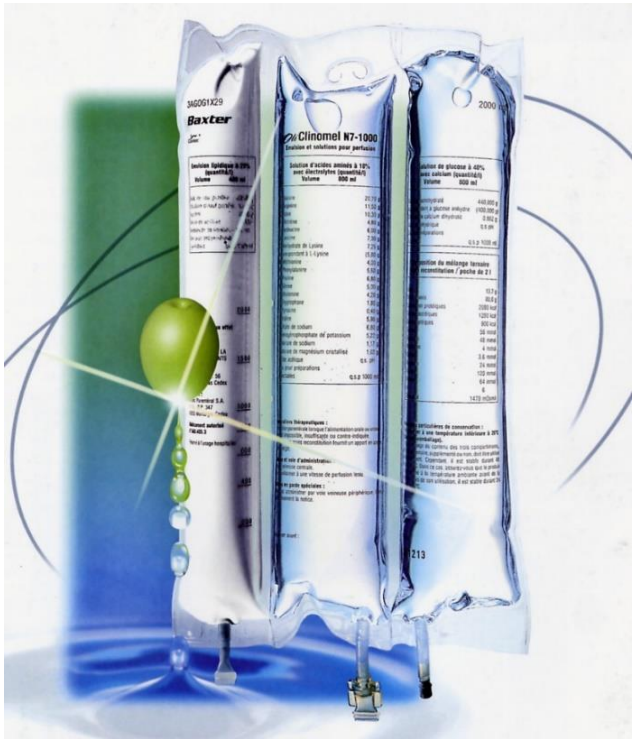
- Undernourished patients prepared for a major operation.
- Patients with impaired bowel function or partial bowel resection.
- When oral or **enteral nutrition is not possible**: peritonitis, intestinal obstruction, vomiting (untreatable), paralytic ileus, diarrhea, gastrointestinal ischemia, fistulas (jejunum/ileus)
- **Individualised** energetic and nutritional requirements.
- Nutrients in **elemental form**, during variable periods of time.
- Sometimes prepared by **hospital pharmacy services**

  Sterile (laminar flow cabin)
  Careful selection of processing products
  Generally administrated as 'unique' bag (system 'all in one')
  Sometimes (pediatric) lipids are supplied in 'Y' via catheter

Parenteral nutrition

Routes and equipments





Total Parenteral Nutrition

- **Water and electrolytes**
  - 35-50 mL/kg/day according to water balance
  - Na and K according to plasma level
  - Daily contribution of Ca and Mg

- **Vitamins and trace elements**
  - trace elements and vitamins separately on alternate days
  - it may be necessary to increase the concentration of some individual compound (Zn, Fe) and (folates, B_{12}, K, C)

- **Glucose**: is the best tolerated CH in PN
  - in normal situations 2-5 g/kg/day is recommended
  - sold between [5-70%] = 200-2800 kcal/L
  - at higher concentration, increased osmolality (>3500 mOsm/L)
  - at higher concentration, higher pH (almost neutral if administered with AA)
  - in **metabolic stress** there is an increased utilization rate and:
    - resistance to endogenous insulin
    - exogenous hyperglycemia and hyperinsulinemia
    - increases thermogenesis
    - osmotic diuresis and dehydration
    - breathing acidosis (CO_2 production)
    - hyperTG and hepatic steatosis
  - in **diabetes or stress** is administered in conjunction with fructose and xylitol (2F/ 1G/1X) to minimise problems of high doses
  - as the **only substrate** has many problems: hyperglycemia, osmotic diuresis and dehydration, need of exogenous insulin, hyperTG and fatty liver, higher CO_2 production, etc.

Total parenteral nutrition

- **Fat**:
  - 30-50% Cal in the form of lipids
  - Energy source that allows CHs reduction
  - Low osmolality
  - Provide EFA and fat vitamins
  - Provided as lipid emulsions [10-30%]
  - Should not be quickly infused
  - w6/w3 FA: 4-10 to 1

  - **Protein**:
    - measured in g of N_2 (6.25 g protein)
    - recommend 0.15-0.30 g/kg/day (max. 0.4 g/kg/day)
    - solutions of 18-20 AA in the levo form
    - with all essential and semi-essential AAs
    - non-protein Kcal/g N_2 according to the aggression factor:
      - Mild: 150-180 or severe: 80-120;
    - Ratio g EAA/g N_2 total = 3

Parenteral nutrition

Energy intake recommendations

Calculation based on the degree of metabolic stress

Avoid caloric overload (30-35 kcal/Kg/day)
Avoid glucose overload (<5 g /kg/day)
- CH election
- Only polyols + glucose if insulin resistance

Avoid fat overload (<1.5 g/kg per day)
- ≤ 50% no protein caloric intake
- ≤ 35% in case of decompensated sepsis

Avoid essential fatty acids deficit (6.3% Et)
- Fatty acids ω-6 /ω-3: (4-10/1)

In obese patients use: (ideal weight + 0.25 x [weight - ideal weight])
Usual caloric distribution: 20/30/50 (protein/lipids/HC)

Parenteral nutrition

Intake recommendations

Protein intake recommendations

Calculate based on degree of metabolic stress

grade	aa (kg/day)	kcal/g N
0	1.1-1.2	150:1
1	1.3-1.5	130:1
2	1.6-1.8	110:1
3	>1.9	80-100:1

Do not exceed 2 g protein or AA/kg and day

Adjust the pattern of AA according to the stress phase or the specific patient's disease.

Parenteral nutrition

Complications

Mechanical

- Failure in the catheter placement
- Deep vein thrombosis

Metabolic

- Impaired glucose tolerance in metabolic stress (insulin)
- Hypoglycemia after PN
- Acute respiratory failure due to overload of the glucose infusion (>250 g glucose/day)
- Acute intolerance to fats: vomits, tachycardia, sweating, skin allergy
- Deficient in essential fatty acids in long-term PN
- Nitrogen balance (-) due to low AA load
- Water overload
- Hypovitaminosis

Septic

- The most frequent and dangerous due to contamination of the catheter, mixture, or skin

Parenteral nutrition

Disadvantages

Intestinal

- Intestinal mucosa atrophy in long-term PN
- Changes in the intestinal flora
- Alters the permeability of the intestinal barrier

Immunological

- Decreases IgA levels, altering the immune status

Economic

- Very high costs, due to the value of the parenteral diet itself and due to the costs to its preparation and administration

Artificial nutrition
Pharmacist role

Role of the **hospital pharmacist:**

- ✓ **Enteral nutrition:** makes the correct selection among the already prepared products by the pharmaceutical industry

- ✓ **Parenteral nutrition:**
  Responsible for the **preparation of sterile** and **stable** (physicochemical parameters)

  Must report which drugs can be administered inside or in parallel ("Y" connection) with PN.

Artificial nutrition

Suggested references

http://www.msc.es/profesionales/prestacionesSanitarias/publicaciones/docs/guiaNED.pdf

Schoenenberger JA, Rodríguez Pozo A. Protocolización de la Nutrición Artificial por vía Parenteral. Bases metodológicas y organizativas para el diseño y revisión del proceso. Nutr Hosp, 2010:25(1): 26-33

SENPE: Sociedad Española de Nutrición Clínica y Metabolismo
http://www.senpe.com/
https://senpe.com/documentacion/consenso/senpe_consenso_prescripcion_3.pdf

Krause's Food and the Nutrition Care Process. L. Kathleen Mahan, Janice L Raymond Eds. 14th Edition. Elsevier 2018.

BLOCK 2. MODIFIED DIETS

- 2.1. Diets with modified texture.
- 2.2. Diet poor and rich in fiber.
- 2.3. High protein and energy diet.
- 2.4. Low-protein diet for kidney patients.
- ~~2.5. Controlled amino acid diet.~~
- 2.6. Controlled mineral diet.
- 2.7. Food allergy diet.
- 2.8. Diet on food intolerances.

TEXTURE MODIFIED DIETS

Types.
Nutritional objectives.
Characteristics and composition.
Indications and adverse effects.
Practical details of implementation.

Unit 2.1

Prepared by: Teresa Climent

TEXTURE-MODIFIED DIETS

These diets are indicated for patients who need a change in the texture of their diet or minimal gastrointestinal stimulation.

TYPES

- Liquid diet (2)
- Semi-solid diet
- Soft and Easy-chew diet
- Progressive diet

LIQUID DIETS

1. INCOMPLETE LIQUID DIETS

- **Aim:** to keep water and electrolyte balance with minimal gastrointestinal stimulation.
- **Indications:**
  a) Patients recovering from **paralytic ileus.**
  b) Patients with acute **diarrhoea.**
  c) As an intermediate step for patients between parenteral nutrition and oral nutrition.
- **Composition:** oral rehydration fluids (water, glucose, and some electrolytes like Na^+ and K^+) sold at the pharmacy store or liquid foods like juices, soups, homemade water of boiled rice or carrot, fat free milk, etc.
- **Characteristics:** as these diets cannot satisfy the patient's nutritional needs (energy), they should not be maintained for too long.
- **Tolerance:** depends on osmolality, volume, administration speed, and the time between meals: more osmolality, then less volume and lower speed.

2. COMPLETE LIQUID DIETS

- **Aim:** to satisfy the energy and nutritional requirements of patients who cannot chew, swallow, or digest solid foods.

- **Indications:**

a) Patients with oropharynx and oesophagus diseases (dental surgery, motor deficit, inflammation, ulcers) but without risk of bronco aspiration (if so use thickeners or jellies).

b) Patients with depression, asthenia, chronic paralysis illness that compromises intake.

c) Patients after an incomplete liquid diet.

- **Composition:** liquid food and liquefied solids, supplements, enteral nutrition formulas, and baby foods.

- **Characteristics:** can be prescribed for a long time if the patient's nutritional needs are assessed and the diet is adapted to the patient's tastes; flavour and presentation are important; the patient's evolution should be monitored.

- **Problems**: rich in sugars: hyper-osmolality, hypertriglyceridemia and/or hypercholesterolemia, poor in fiber: constipation, purees easily contaminated, danger of infection (keep refrigerated), lactose intolerance (give yogurt or lactose-free milk).

Examples of Liquid Diet Foods

Juice
(all kinds of fruits
and veggies)

Milk

Sports drinks

Broth or soup
(without chunks)

SEMI-SOLID DIETS

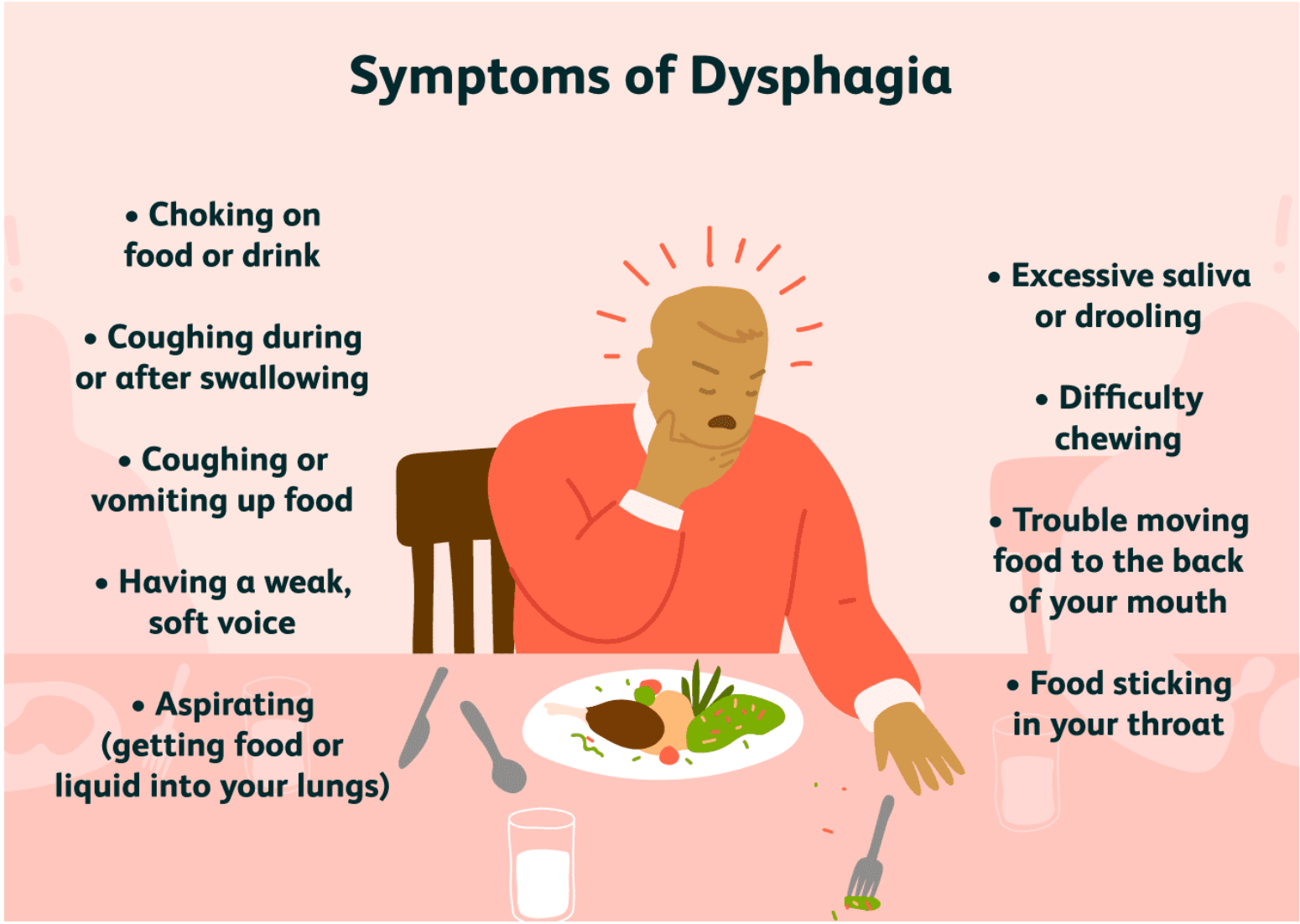
- Complete diets with **puree consistency**, more or less thicker foods than in the liquid diets (they are more palatable and easier to tolerate, to schedule, to make, and preserve) that can be used for a long time, and sometimes forever (elderly people).
- Easier to control their presentation and organoleptic characteristics.
- Nutritional requirements can be better adjusted.
- Nutritional status should be checked.

Composition

- Mashed solids plus liquids added to obtain a more or less thick puree.
- Should be given in small portions and frequent meals.
- **Should not include** foods:
  - with double texture (pasta soup, cereals with milk, etc.)
  - that form bolus that is not fluid (rice, pasta, meat, thick puree, etc.)

Indications

- **Patients with dysphagia**, chewing difficulty, or intermediate step in progressive diets.

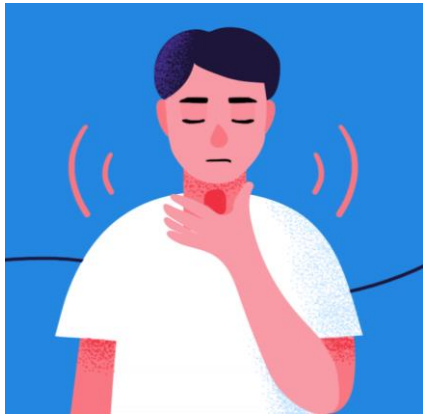


Dysphagia often leads to **malnutrition** due to inadequate intake (weight loss and anorexia).

Dysphagia or swallowing difficulties

Difficulty in swallowing (or dysphagia) is present in elderly patients, as well as in stroke and cancer patients.

These patients must be given smaller-sized food with specific textures, such as softer solids. This helps to minimise choking and bronco aspiration (inhaling food into the lungs).



SEMI-SOLID DIETS

EASY DIGESTION (SOFT) DIETS

- Complete diets based on solid foods **easily digestible**, whole foods that have been gently cooked with not much fat and no seasoning.

Composition

- These diets include all types of food.
- Choose those with few fats and little fibre.
- Always boiled, no spices, salt, or other seasonings.
- Patients should eat 5-6 meals that are not large and are suitably spaced out time-wise.
- The following foods should be avoided:
  - Stimulants (e.g. caffeine, theobromine, theine,'soft drinks', alcohol).
  - Physical irritants (e.g. fibrous meats, whole grains, nuts, raw vegetables and raw fruits).
  - Chemical irritants (e.g. acids, smoked foods, salted foods, meat concentrates).
- Use raw olive oil and avoid fried oil.

Indications

- Patients at an intermediate step in progressive diets, with **ulcers, hiatal hernia**, infections, or fever.

Easy digestion (soft) diet:

Mashed potato
Semolina
Boiled eggs
Crème caramel
Yogurt
Cooked apple
Purees
Boiled vegetables, meat or fish

FOODS

Soft foods and process-softened foods

Minced and moist foods

Purees and patés

Jellies and mouses

Creamy foods

Thickened liquids

Soups

Thin drinks

DRINKS

EASY TO CHEW DIETS

❖ **Aims:**

To provide a complete, balanced, and varied diet.

The only limitation is that they should not contain hard or shaped foods harmful for the patient.

❖ **Indications**:

Patients with missing teeth, or with a painful or inflamed oral cavity but willing to chew.

❖ **Characteristics:**

Implementation depends on the patient

Avoid irritants (acids, salted foods, hot and spicy) if the patient has damaged oral mucosa

Easy to chew diets

PROGRESSIVE DIETS

❖ **Aims:**

These dynamic diets, which are widely used in hospitals, are based on the need to adapt to various situations that affect patients as their illness evolves.

❖ **Indications:**

Patients at the post-operative stage, especially after major abdominal surgery.

Patients requiring oral refeeding after prolonged fasting.

Patients suffering from severe malnutrition or recovering from total parenteral nutrition.

❖ **Characteristics:**

Texture modifications are increasingly applied.

Modified textures range from oral fluids to the basal diet.

Progressive diets:
IMPLEMENTATION (sequence)

Liquid diets

↓

Semi-liquid/semi-soft /semi-solid diets

↓

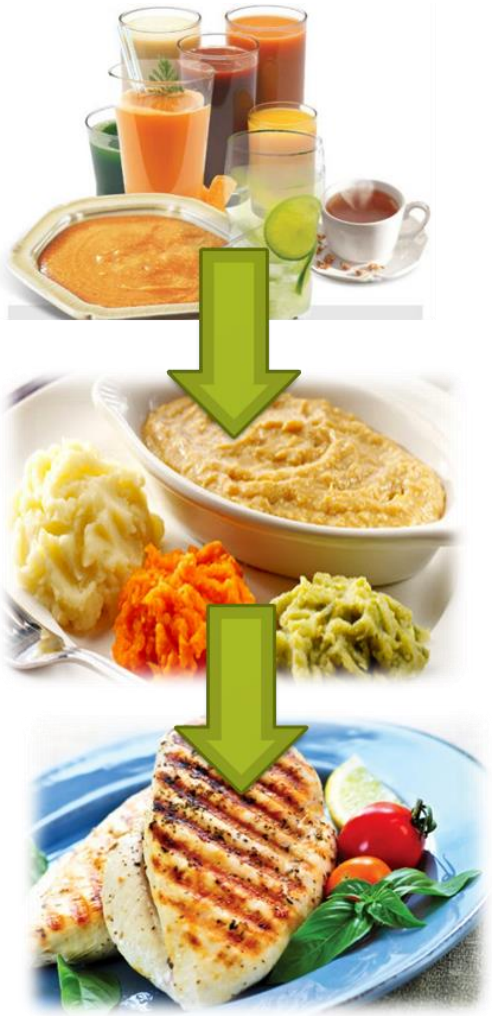
Easy-digestion diets

↓

Easy-chew diets

↓

in-hospital diets (basal diets)



Techniques to improve acceptance of modified-texture diets

- ✓ Take extra care when feeding individuals with dysphagia.
- ✓ Avoid foods that crumble easily since they can increase the risk of choking.
- ✓ Give patients small portions and frequent meals to encourage them to eat more.
- ✓ Make pureed meals look good, smell good, and taste good.
- ✓ Taste all foods and enhance seasoning as required.
- ✓ Cool temperatures facilitate swallowing, so patients may tolerate them better.

Well-presented modified-texture meals

High-protein and high-energy diets.
Nutritional objectives and indications. Characteristics.

Prepared by: Teresa Climent

Unit 2.3

PROTEINS

Molecular structures made up of amino acids chains.

Play a very important role in body functions: transport, structural, and reaction catalysts.

Our body contains around 6-10 kg of protein and unlike carbohydrates and fats, proteins do not have a storage system, which means that a loss of proteins will lead to a deterioration of functions if we do not provide extra protein in the diet.
Losing between 30-40% of our body proteins leads to death.

PROTEIN BALANCE

In healthy people the amount of **protein** ingested is balanced by the amount of protein used for body maintenance.

The products resulting from protein digestion are free **amino acids** and oligopeptides (di and tripeptides).

Proteins contain **nitrogen** which the body (kidney) eliminates in the urine as urea.

Protein supplies nitrogen in the form of amino acids according to the average of 16%, so in food:

protein (%) = 6.25***N** (%)

NITROGEN BALANCE

Normal use of protein **Nitrogen intake = nitrogen excreted**	**NEUTRAL BALANCE**
Higher use of protein Nitrogen intake > nitrogen excreted (pregnancy or growth periods)	**POSITIVE BALANCE**
Body nitrogen is under supplied Nitrogen intake < nitrogen excreted (fasting, some diseases, injuries and wounds)	**NEGATIVE BALANCE**

If nitrogen intake is equal to nitrogen loss
a person is in a state of protein balance.

Factors leading to a negative nitrogen balance:

- Metabolic stress
- Inadequate (insufficient) protein intake (anorexia, aging, malnutrition)
- Deficit of essential amino acids
- Catabolic state (using protein faster than protein is being synthesised, inflammatory disease)

The current recommended dietary reference intake (DRI) **for healthy individuals per day** is:
0.8 g of protein/kg of body weight

High-protein and high-energy diets

Diets with high protein intakes **(>1.5 g/kg/day)** and more energy (**kcal/kg/day)** than the recommended for healthy people.

High-protein diets are prescribed for those patients with increased energy and nutritional requirements to prevent or correct protein catabolism and weight loss associated with higher morbidity and mortality rates.

- ❖ Energy-protein malnutrition (EPMN)
- ❖ Systemic inflammatory response syndrome (SIRS)
- ❖ HIV/AIDS (human immunodeficiency virus infection and acquired immunodeficiency syndrome)
- ❖ Multiple trauma
- ❖ Burns
- ❖ Cancer

❖ Energy-protein malnutrition (EPMN)

- ✓ Malnutrition results from a negative balance between dietary intake and body requirements.
- ✓ Deficiency is generally caused by insufficient nutrient intake (proteins, vitamins, energy) or by higher energy expenditure.
- ✓ Protein-energy malnutrition affects every system in the body and results in greater vulnerability to illness, increased complications, and greater morbidity/mortality, especially in the elderly.
- ✓ Malnutrition affects the body composition, worsening physiological weight loss due to ageing.

Requirements for nutritional recovery of EPMN:

0.22 g proteins/g tissue lost

5 kcal/g tissue lost

Any electrolyte and acid-base imbalances must be first corrected .

Renutrition should be slow and gradual, especially in severe and/or chronic diseases, to prevent refeeding syndrome (RS)

❖Systemic inflammatory response syndrome (SIRS)

Can be generated by infectious (sepsis) or non-infectious stimuli (trauma, pancreatitis, burns, etc.). It develops in three main phases:

First stage

Local liberation of cytokines

Second stage

Cytokines are released into the bloodstream (amplification of local response)

Acute phase response begins:
- Fever may occur
- Hypothalamus is stimulated and catecholamine and glucocorticoids are released in the pituitary gland

-Glucagon is released in the liver, and C-reactive protein and fibrinogen are synthesised

Third stage

A **systemic response** is initiated with a massive loss of microvascular integrity and dysfunction of multiple organs and systems

Acute Phase Response (hypermetabolic phase): hormonal and metabolic changes

Oxygen consumption increases (80%)

⇩

Metabolism increases (10-15 times)

⇩

Protein turnover is increased

- gluconeogenesis
- synthesis of 'acute phase reactants'

⇩

Negative nitrogen balance (-)

- protein intakes should be: 1.5-2 g/kg/day.

⇩

Lipolysis increases, each degree above 37 °C increases caloric expenditure by 13%.

⇩

Loss of weight

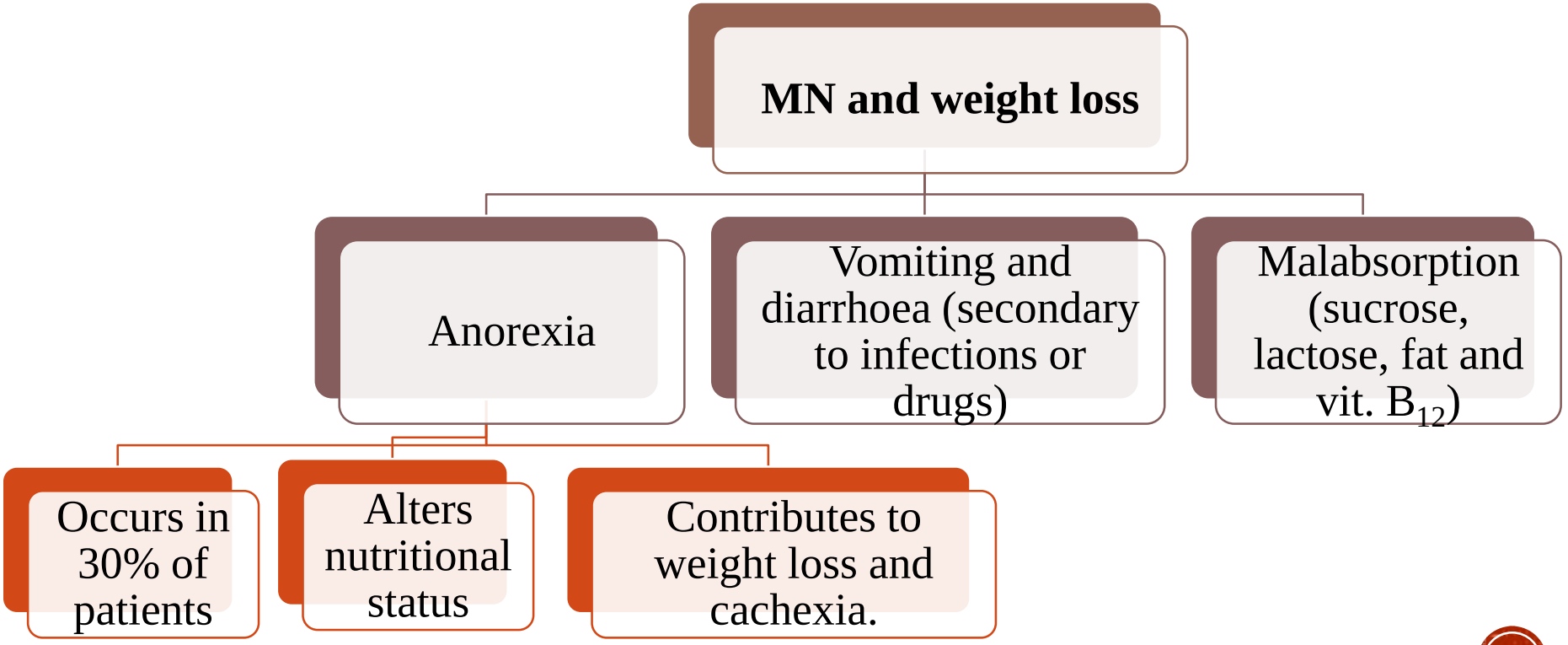
⇩

Total energy expenditure increases (25-45%)

AIDS infection

- MN is a major cause of morbidity.
- Weight loss is a (negative) prognostic indicator.

The main causes of MN, which affect the patient's physical activity and cognitive function, are:



MULTIPLE TRAUMA

- Trauma is a stress situation that generates an **inflammatory response** and **promotes** haemostasis, exclusion, degradation, and lysis of damaged tissues.
- In cases of severe injury, SIRS can occur and metabolic and biochemical processes are significantly accelerated, so **the patient's nutritional needs** are **increased.**

Consequences of EPMN

Weight loss and reduced protein reserves:

- lead to a loss of muscle strength; courage and adaptation are required.
- affect responsiveness, immunity and healing adversely.
- delay recovery.

and increase the risk of potentially serious complications.

BURNS

Major BURNS→ severe trauma

↓

SIRS

↓

Exaggerated protein catabolism, water and electrolyte losses.

↓

Increased energy and nutritional needs:

- **Energy**: (2 x TEE)
- **Protein**: 1.5-3 g/kg/day
- **Micronutrients**: Double the fat-soluble vitamins and Zn than the recommended intake (the rest = DRI).

Protein-energy malnutrition

- Affects physical activity and cognitive ability.
- Reduces quality of life.
- Influences the clinical course of the disease.

The diet should try to improve nutritional status and avoid:

- Weight loss and loss of lean mass.
- Micronutrient deficiencies.
- Foodborne infections.

Supplements

- **Calorie-protein**
- **Formulas with arginine, ω-3 fatty acids, and vitamins**:
  - Improve overall quality of life and keep immune system stronger.
  - Increase energy intake.
- **Mineral-vitamin**:
  - Can improve immune system function.
  - Slow down the progression of illness.
  - Megadoses can have suppressive effects and contribute to rapid disease progression.

Intake pathways:

- Oral administration is always the first choice.
- Enteral nutrition is used if vomiting or digestive intolerance occurs.
- Parenteral nutrition is used if the digestive tract cannot be used or if the oral/enteral intake are insufficient for the nutritional support.
- Renutrition should be progressive and in accordance with the evolving status of the patient and the nutritional deficiencies.
- Intake and nutritional status must be periodically assessed.

Formulas used:

Easily digestible liquid formulas, supplemented with vitamins (folate and multivitamins) and minerals (Fe, Zn, Mg, Cu, Ca and phosphates).

Carnitine supplementation may also be required.

If the patient is able to ingest the recommended amounts, **oral intake (gastrointestinal feeding)** is the best choice because:

- It is cheaper, safer, and more physiological.
- It maintains/improves intestinal structure and function.

If anorexia or, less commonly, ileus (intestinal obstruction) occurs, then other nutritional support measures are recommended, e.g. the use of:

- Nasogastric tubes, ostomy
- Parenteral nutrition

DIETETIC ADAPTATIONS

- Intake should be divided into frequent servings.
- The consistency of the diet should be adjusted.
- The caloric density of the food should be increased.
- The food that a patient dislikes should be changed.
- Avoid:
  - Strong flavours or odours
  - Alcohol
  - Spicy, greasy, or irritating foods
  - Excessive amount of liquids during meals
- Foods should be presented nicely.
- Foods should be kept at a suitable temperature.
- Strict hygienic measures should be maintained regarding to:
  - the patient's mouth and hands and food preparation.

Nutritional requirements

- 35-45 kcal/kg/day.
- 1.5-2 g protein/kg/day.

Depend on the intensity of the injury and the patient's prior nutritional status

Nutrients affecting healing capacity

- Arginine, methionine and cysteine: collagen synthesis
  - Arginine deficiency > cytotoxicity of killer lymphocytes
- Fe, Mn, Cu, Mg, Ca: cofactors collagen synthesis
- Zn: promotes epithelialization and resistance of collagen
- Se: deficiency < humoral immunity and peroxidase activity
- I: favours the bactericidal activity of polymorph nuclear
- vitamin C: collagen polymerization
- vitamin A: promotes lymphocyte proliferation
- vitamin E: increases humoral immunity
- nucleotide: synthesis of DNA, RNA and ATP
- ω-3FA: improves the cellular immune response

Cancer

Energy-protein malnutrition (EPMN)

- It is the most common secondary diagnosis in neoplasms.
- It is an important mortality risk factor.
- Contributes to immunosuppression.
- Promotes the appearance of infectious complications.
- Makes protein synthesis difficult.
- Delays proper healing and tissue repair after treatment (surgery and/or radiotherapy).
- Favours the appearance of dehiscence (opening of a wound), hernias, and fistulas.
- Alters gastrointestinal structure and function (maldigestion and malabsorption).
- Reduces muscle strength (constipation, fatigue, and weakness).
- Increases the patient’s tendency to depression.
- Worsens the patient’s quality of life.

The aims of the cancer patient's **nutritional intervention** are:

- To avoid MN and its complications.
- To improve tolerability and the efficacy of the treatment.
- To improve the patient's quality of life.

Dietary treatments should be individualised and adapted to the circumstances, stage of treatment, and type of cancer.

40-80% of cancer patients suffer **malnutrition** because cancer causes serious nutritional and metabolic alterations that are expressed clinically as **cancer cachexia**, characterised by:

- **Severe anorexia** (85% cases):
  - Anorectic secretion
  - Sickness
  - Feeling full
  - Abdominal pain
  - Alterations in taste and smell
- **Intense asthenia** (90% cases):
  - Loss of muscle tissue
  - Cytokines release (biological response tumour)
- **Weight loss**

Cancerous cachexia contributes to EPMN symptoms due to several factors:

Patient-dependent factors

Cytokine secretion

- lymphocytes (interferon-alpha)
- macrophages (tumor necrosis factor, interleukins 1 and 6)
  - anorexia
  - decreased muscular and subcutaneous fat mass
  - inhibition of lipoprotein lipase (avoid triglyceride storage and release)

Energy consumption

- 35-45 kcal / kg / day (hematopoietic tumours)
- 25-30 kcal / kg / day (solid tumours)
- REE is not reduced when intake is energy balance (-)

Increase of protein requirements: ≈1.5 g/kg/day

Increase of micronutrient needs

Intermediary metabolism disorders

- increased protein catabolism
- nitrogen balance (-)
- depletion of muscle and visceral protein
- TG lipolysis and increased circulating rate
- decreased lipoprotein synthesis and lipogenesis
- subcutaneous fat depletion with hypertriglyceridemia
- insulin resistance
- increased gluconeogenesis

Tumoral factors

High anaerobic consumption of glucose

Secretion of lipolytic and anorexigen substances

- (serotonin, bombesin)

Head and neck surgery

- chewing and swallowing

Radiotherapy

- oropharyngeal mucosa
- taste buds (taste disturbance)
- salivary glands (reduced secretion and increased susceptibility to infections)

Treatment factors

Oesophageal and/or gastric resection can produce dumping syndrome

- fullness and abdominal distension
- abdominal cramps and diarrhoea
- sudden decrease in blood volume:
  - cold sweats and tremors
  - paleness and lipothymia

Large bowel resections can cause malabsorption

Pelvic radiotherapy and chemotherapy cause acute enteritis

Chemotherapy has emetogenic effects

❖ **The cancer patient requires**:

- Strict INDIVIDUALISED dietary control
- Highly frequent adaptations
- Information about the importance of adequate caloric intake for maintaining nutritional status
- A climate of trust
- Treatment of anxiety-depressive syndrome

Dietary modifications must be made for:

- Anorexia
- Disturbance of taste and smell
- Nausea and vomiting
- Dysphagia
- Enteritis
- Constipation

Anorexia

- modify meal times
- use foods/supplements with:
  - high energy density that are easy to digest
  - a liquid or pasty consistency that reduces the time and effort needed for eating

Taste and smell alteration

Hypogeusia:
diminished sense of taste

Dysgeusia:

unpleasant perception

- in hypogeusia: strengthen the usual flavours of dishes
- in dysgeusia: substitute meat with other foods or supplements with high biological value proteins

Nausea and vomiting

- prescribe antiemetics (serotonin antagonists)
- use cold foods (less flavour and aroma)
- eat slowly
- divide intakes (<gastric distension)
- **Avoid:**
- acids, greasy, and fried foods with excessive flavouring
- liquid foods and drinking during meals
- noisy environments, arguments, and unpleasant food odours

Dysphagia

Causes oedema, ulceration, stomatitis and dental pain can be complicated by local infections

Decreases saliva secretion

Increases salivary viscosity

Causes spasms or muscle fibrosis

- to facilitate swallowing and reduce pain, it is advisable to:
  - maintain good hydration
  - remove irritants or hard food
  - divide intakes
  - use pasty foods or supplements with soft textures
  - eat food at room temperature
  - in the case of neurological dysphagia, commercial thickeners and jellies may be useful

Enteritis

Causes oedema and ulcerations

Causes malabsorption (diarrhoea/abdominal pain)

- replace lost fluids and ions (with vegetable broths, degreased soups, and soothing sugary teas)
- **Avoid:**
- foods that are difficult to digest (e.g. fats, fried foods)
- milk (lactase deficiency)
- conditions that stimulate intestinal motility (e.g. with insoluble fibre, spices, tea, coffee, extreme temperatures, voluminous intakes)

Constipation

secondary to:

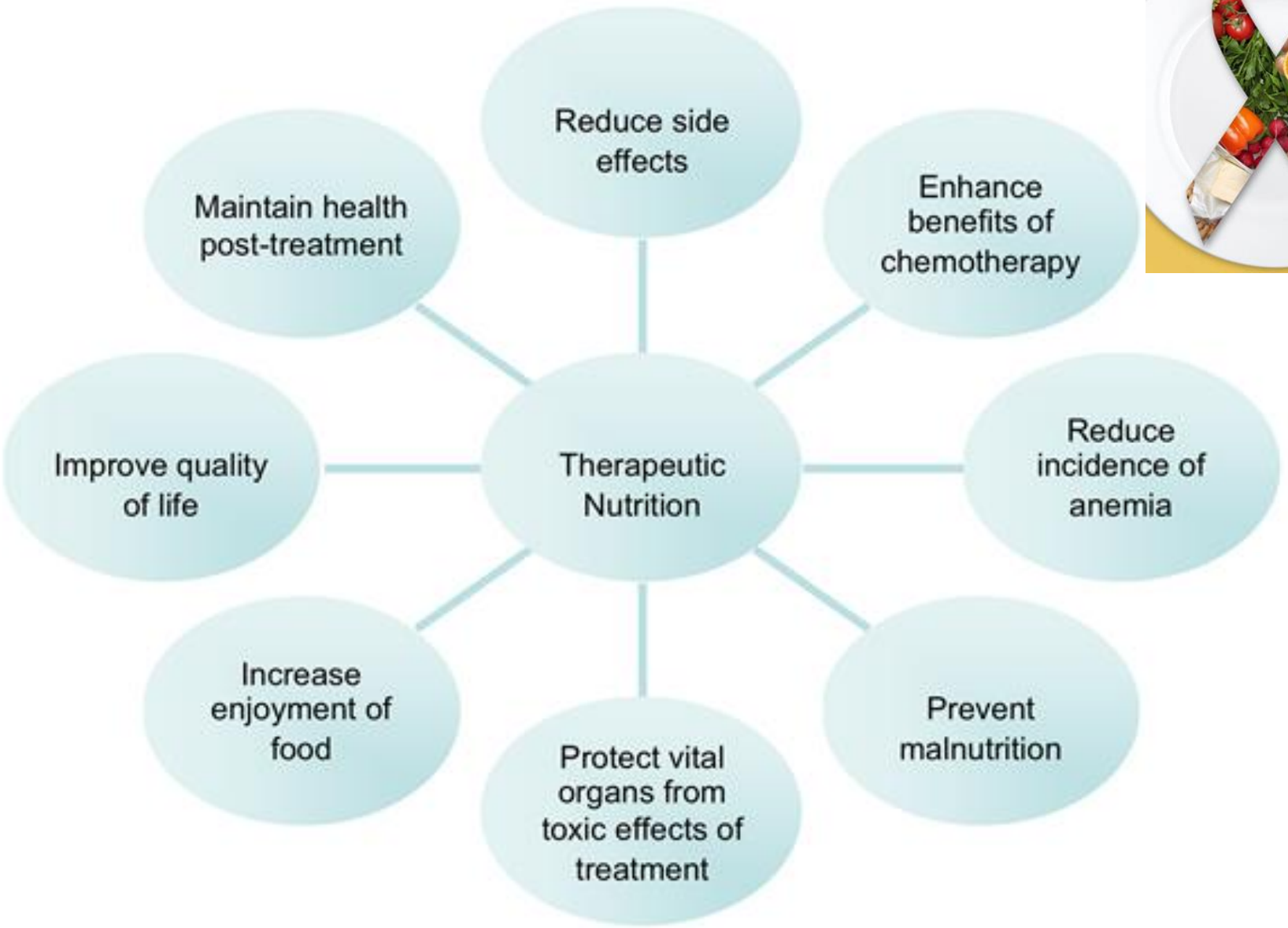
Low caloric intake, fluids and fibre

Loss of muscle mass (cachexia)

Decreased physical activity

Analgesics, narcotics and some types of chemotherapy drugs

- increase the volume and hydration of stools and facilitate removal using food or supplements that are rich in fibre and drinking plenty of fluids


Therapeutic Nutrition
Reduce side effects
Enhance benefits of chemotherapy
Reduce incidence of anemia
Prevent malnutrition
Protect vital organs from toxic effects of treatment
Increase enjoyment of food
Improve quality of life
Maintain health post-treatment

Mineral restricted diets.

Characteristics and implementation.
Food sources.
Dietary recommendations.

Unit 2.6 A

Prepared by: Teresa Climent

MINERALS

- ✓ Inorganic elements that are essential to the nutrition of humans, animals, and plants.
- ✓ Represent approximately 4 to 5% of body weight.
- ✓ Of this weight, 50% is **calcium**, 25% is **phosphorus** and the remaining 25% is:
  - ✓ magnesium, sodium, **potassium**, chloride and sulphur (>100 mg/day) and
  - ✓ **iron**, zinc, iodide, selenium, manganese, fluoride, molybdenum, **copper**, chromium, cobalt, and boron (<100 mg/day).

… REMEMBER …

Table: 10 Classification of essential minerals

Macro minerals (> 100 mg/day)*	Micro minerals (<100 mg/day)*
Calcium	Iron
Phosphorus	Zinc
Magnesium	Copper
Sulfur	Iodine
Sodium*	Fluoride
Potassium*	Manganese
Chloride*	Selenium
	Chromium
	Molybdenum

ELECTROLYTE BALANCE

- ✓ In solution some form positive ions (cations), whereas other form negative ions (anions) and play a vital role in maintaining homeostasis in the body.

- ✓ They help to regulate heart and neurological function, fluid balance, oxygen delivery, acid-base balance, and much more.

- ✓ The most serious electrolyte disturbances involve abnormalities in the levels of sodium, potassium, and calcium.

THE ROLE OF ELECTROLYTES IN THE BODY

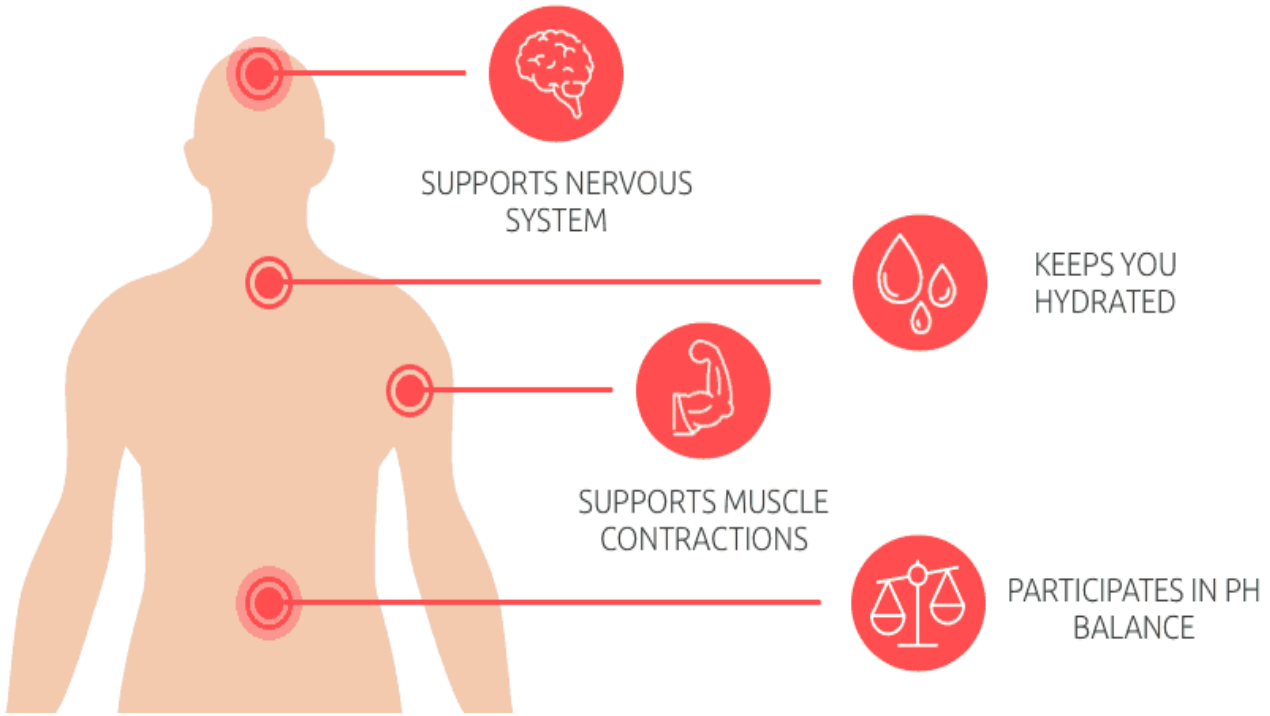


TABLE 6-1 Concentrations of Extracellular and Intracellular Electrolytes in Adults

Electrolyte	Extracellular Concentration*	Intracellular Concentration*
Sodium	135–145 mEq/L	10–14 mEq/L
Potassium	3.5–5.0 mEq/L	140–150 mEq/L
Chloride	98–106 mEq/L	3–4 mEq/L
Bicarbonate	24–31 mEq/L	7–10 mEq/L
Calcium	8.5–10.5 mg/dL	<1 mEq/L
Phosphate/ phosphorus	2.5–4.5 mg/dL	4 mEq/kg†
Magnesium	1.8–3.0 mg/dL	40 mEq/kg†

*Values may vary among laboratories, depending on the method of analysis used.

†Values vary among various tissues and with nutritional status.

Electrolyte minerals (dietary sources)

Potassium: fruits and vegetables such as bananas, avocado and sweet potato.

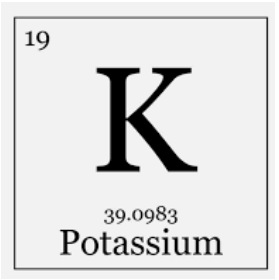
Calcium: dairy products, fortified dairy alternatives, and green leafy vegetables.

Phosphorus: milk and dairy products, meat, beans, lentils, nuts, vegetables and fruits.

Iron: meat products, pâté, black pudding

Copper: oysters, lobster, nuts, seeds, liver, leafy greens and dark chocolate.

POTASSIUM



- ✓ **Intracellular cation (**140 mmol/L located inside the cells, vs the extracellular amount of 3.5-5.0 mmol/L).

- ✓ The body must keep the potassium level in the blood within a narrow range:

  - **Hyperkalaemia: $[K^+]_{Plasma}$ > 5.0 mmol/L**
  - **Hypokalaemia: $[K^+]_{Plasma}$ < 3.5 mmol/L**

- ✓ Both may have serious consequences, such as abnormal heart rhythm or even cardiac arrest (when the heart stops).

- ✓ The body can use the large reservoir of potassium stored in cells to help maintaining a constant level of potassium in the blood.

Foods: Potassium is widely available in many foods, especially fruits and vegetables (bananas, avocado and sweet potato) and protein-dense foods (meat, fish and eggs).

Absorption: Absorbed by diffusion (especially in the colon). The same amount is eliminated, mostly in urine if kidneys are working properly.

Daily requirements

Healthy individuals

3.5-4.7 g K^+ /day

For renal patients, always less!

Chronical renal failure with no hyperkalaemia: 1-1.5 g K^+/day

Hemodialysis: 2.3-2.7 g K^+/day

Peritoneal dialysis : 3 g K^+ /day

•Hyperkalaemia: $[K^+]_{Plasma}$ > 5.0 mmol/L

Aetiology:
Use of the so-called 'K-sparing diuretics'.
Drugs that contain it (for instance, KCl instead of NaCl).
Acidosis (H^+ exchange by intracellular K^+).
Excessive intake of fruits and vegetables.
Renal failure requiring dialysis (see unit 2.4*).

Symptoms:
Muscle weakness or abdominal cramps
Paraesthesia
Irritability
Diarrhoea
Mental confusion
Hypotension
Arrhythmia

*If renal K^+ excretion decreases [GFR≤10 mL/min, diabetes,…], hyperkalemia may occur and cause heart rhythm disturbances

•Hypokalaemia: $[K^+]_{Plasma} < 3.5$ mmol/L

It's one of the most common water-electrolyte imbalances.

Aetiology:
Vomiting or profuse diarrhoea.
Use of diuretics.
Corticosteroids or laxatives.
Cushing's disease: a disorder caused by the body's exposure to an excess of the hormone cortisol.

Symptoms: legs cramps, tiredness, hypotonicity, weakness, arrhythmias, constipation, cardiac arrest.

Recommended diets:
Eat foods rich in potassium.
Use KCl instead of NaCl.
Eat fresh food rather than boiled food: cooked foods have less K^+ (it is soluble in water used for cooking).
Drink the vegetable cooking water.

CALCIUM AND PHOSPHORUS

Calcium (**Ca^{2+} or Ca^{++}**) and phosphorus (**P*i***) are essential elements, representing 99% and 85%, respectively, of the bone tissue, among other functions.

Both together form **hydroxyapatite, the main structural component in bones and tooth** enamel.

Requirements (variable needs depending on age, gender, illness)**:**
Ca^{2+}: 400–1500 mg/day (0-4-1.5 g/day)
P*i*: 300–1200 mg/day (0.3-1.2 g/day)

Hormone regulated by:
Parathyroid hormone (PTH), calcitonin and vitamin D.

Recommended Dietary Allowances (RDAs) for calcium

1300 mg for children aged 9 to 18.
1000 mg for adults aged 19 to 50.
1200 mg for women aged over 51 and for all adults over 70.

Recommended dietary allowances (RDAs) for phosphorus
(see next slide*)

Lower than that of calcium for all groups.
700 mg/day adults

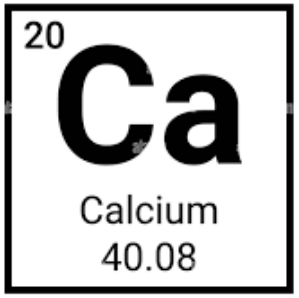
RDAs are provided in the dietary reference intakes (DRIs) developed by the Food and Nutrition Board (FNB) at the National Academies of Sciences, Engineering, and Medicine

Recommended dietary allowances (RDAs) for phosphorus
Lower than that of calcium for all groups.
700 mg/day adults

Table 1: Recommended dietary allowances (RDAs) for phosphorus [2]

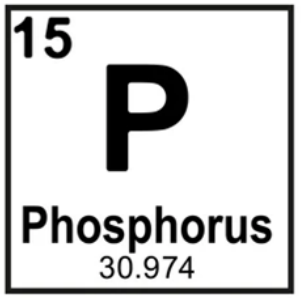
Age	Male	Female	Pregnancy	Lactation
Birth to 6 months*	100 mg	100 mg		
7–12 months*	275 mg	275 mg		
1–3 years	460 mg	460 mg		
4–8 years	500 mg	500 mg		
9–13 years	1,250 mg	1,250 mg		
14–18 years	1,250 mg	1,250 mg	1,250 mg	1,250 mg
19+ years	700 mg	700 mg	700 mg	700 mg

CALCIUM

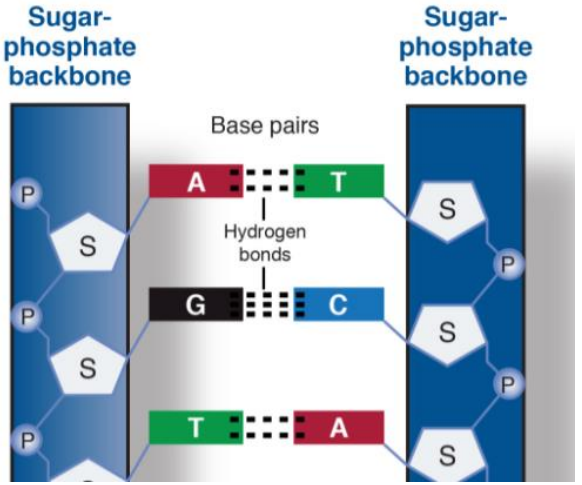


- Helps bone structure to develop and grow during pregnancy, lactation, infancy, childhood and adolescence.
- Helps postmenopausal women maintain healthy bones.
- Involved in ion transition across the membranes of cell organelles.
- Involved in nerve transmission and the regulation of heart muscle function.
- Is a cofactor for several enzymatic reactions.

PHOSPHORUS



- Contained in deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).
- Adenosine triphosphate (ATP), the major cellular form of energy, contains phosphate bonds.
- Is a component of phospholipids in membrane cells.
- Involved in the phosphate buffer system.



Regulation of serum calcium and phosphorus

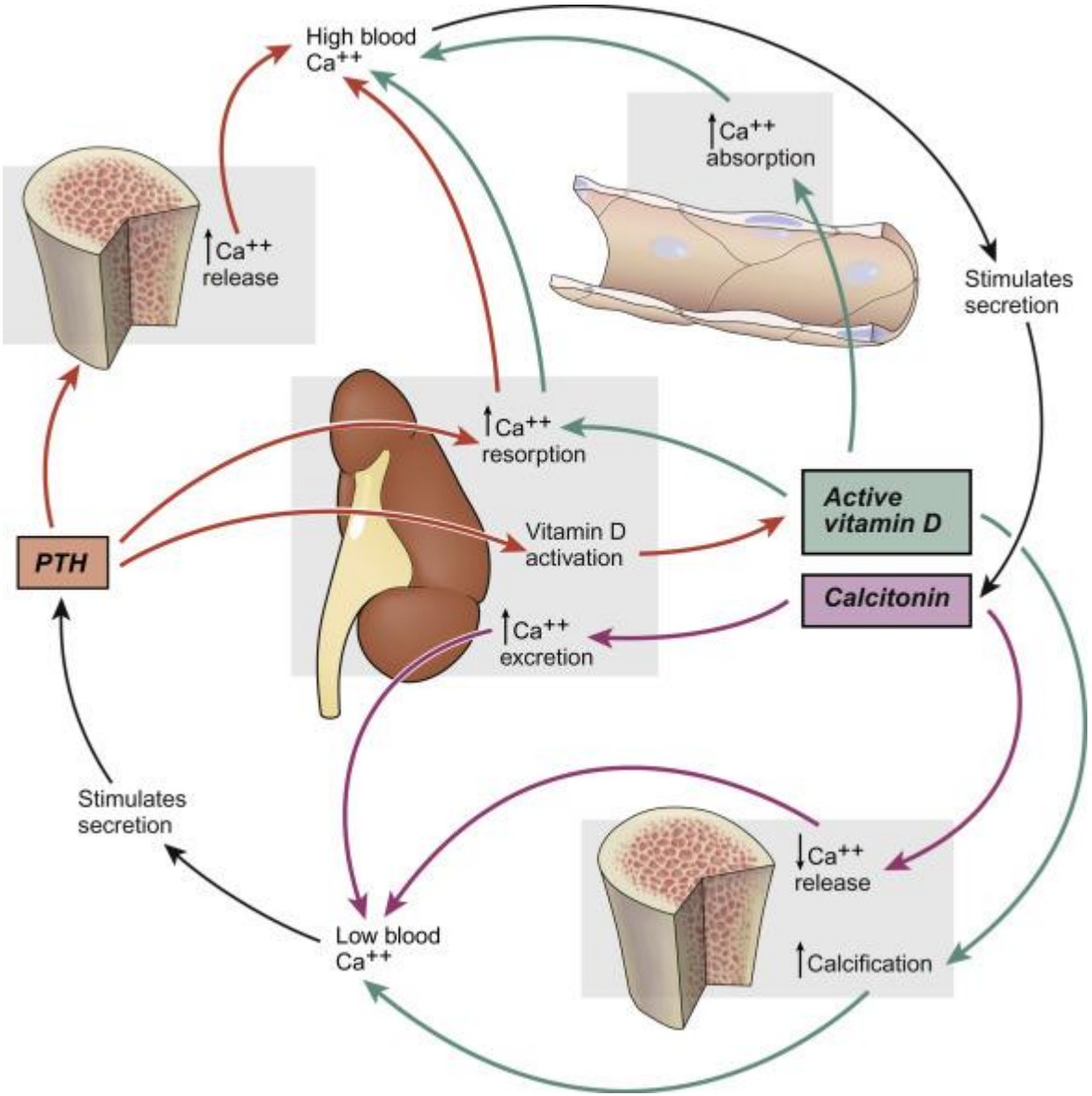
- Phosphorus and calcium are interrelated because hormones, such as vitamin D and parathyroid hormone (PTH), regulate the metabolism of both.

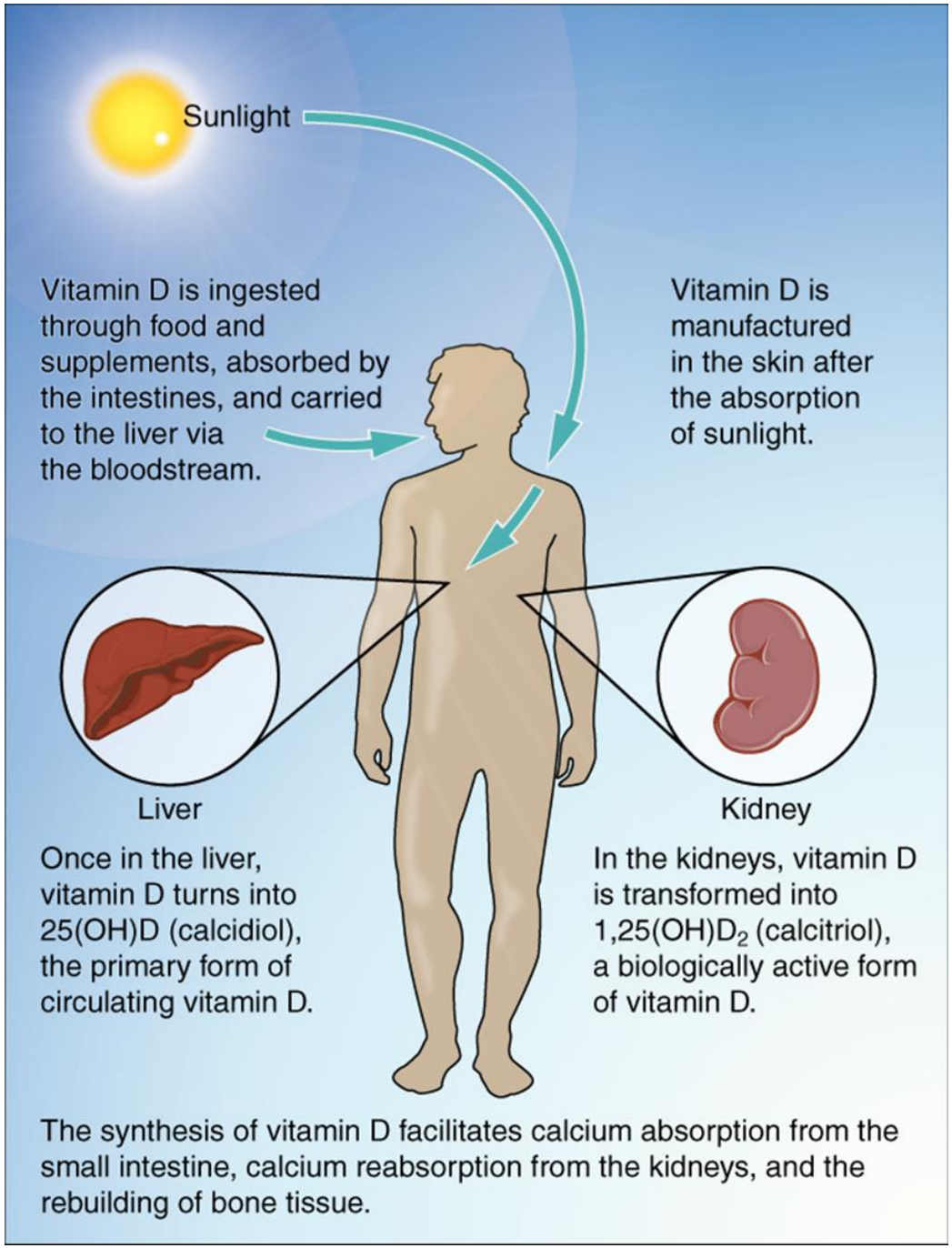
- The amount of Ca^{2+} in bones is in equilibrium with Ca^{2+} in the blood.

- When the concentration of blood calcium falls, PTH stimulates the transfer of exchangeable Ca^{2+} from the bone to the blood.

- At the same time, PTH promotes renal tubular resorption of Ca^{2+} and indirectly increases the intestinal absorption of Ca^{2+} by increasing the kidney's production of vitamin D.

CALCIUM BALANCE




Sunlight
Vitamin D is ingested through food and supplements, absorbed by the intestines, and carried to the liver via the bloodstream.
Vitamin D is manufactured in the skin after the absorption of sunlight.
Liver
Kidney
Once in the liver, vitamin D turns into 25(OH)D (calcidiol), the primary form of circulating vitamin D.
In the kidneys, vitamin D is transformed into 1,25(OH)D_2 (calcitriol), a biologically active form of vitamin D.
The synthesis of vitamin D facilitates calcium absorption from the small intestine, calcium reabsorption from the kidneys, and the rebuilding of bone tissue.

High calcium diets (in hypocalcaemia)

When:

- Increased needs (growth, pregnancy, lactation, menopause, ageing).
- Intestinal malabsorption.
- Hypocalcaemia in low weight or preterm neonates.
- Hyperphosphatemia (high phosphate reduce the Ca^{2+} concentrations).
- Strict vegetarian diets.
- Corticosteroids, antiacids, hypochlorhydria (gastrectomy, etc.).
- Osteoporosis.
- Hypertension: Ca^{2+} decreases blood pressure (see next slide*).
- Colon cancer: diets rich in Ca^{2+} seem to offer protection against it.
- Rickets and osteomalacia (defective bone growth, Vit. D, Ca^{2+} and P).

Recommendations:

• Diet rich in dairy products and/or oral supplements of calcium (with meals). The Ca:P ratio should be 1-2:1 (see next slide**).

• Provide good exposure to sunlight.

• Avoid the ingestion of calcium with fat, phytates or oxalates (which reduce Ca^{2+} absorption).

High calcium diets

- *Hypertension: Ca^{2+} decreases blood pressure (BP).

Increases in calcium intake have been shown to lower BP in hypertensive and normotensive subjects. Dietary calcium interventions, such as supplementation or food fortification, were found to significantly reduce systolic blood pressure (SBP) and diastolic blood pressure (DBP) in normotensive subjects [1]. A meta-analysis of prospective cohort studies revealed that higher calcium intake from food and supplements is associated with lower risk of hypertension [2]. Calcium intake has been considered to have the effect of inhibiting the renin-angiotensin system and reducing the contractions of vascular smooth muscles cells [3]. Although the hypotensive effects of dietary calcium intake are weak, small reductions in BP are considered to have important health implications for cardiovascular diseases.

1. Cormick G., Ciapponi A., Cafferata M.L., Belizán J.M. Calcium supplementation for prevention of primary hypertension. *Cochrane Database Syst. Rev.* 2015;30:CD010037. doi: 10.1002/14651858.CD010037.pub2.
2. Jayedi A., Zargar M.S. Dietary calcium intake and hypertension risk: Dose-response meta-analysis of prospective cohort studies. *Eur. J. Clin. Nutr.* 2018;10 doi: 10.1038/s41430-018-0275-y.
3. Zemel M.B. Calcium modulation of hypertension and obesity: Mechanisms and implications. *J. Am. Coll. Nutr.* 2001;20:428S–435S; discussion 440S–442S. doi: 10.1080/07315724.2001.10719180.

**The Ca:P ratio should be 1-2:1

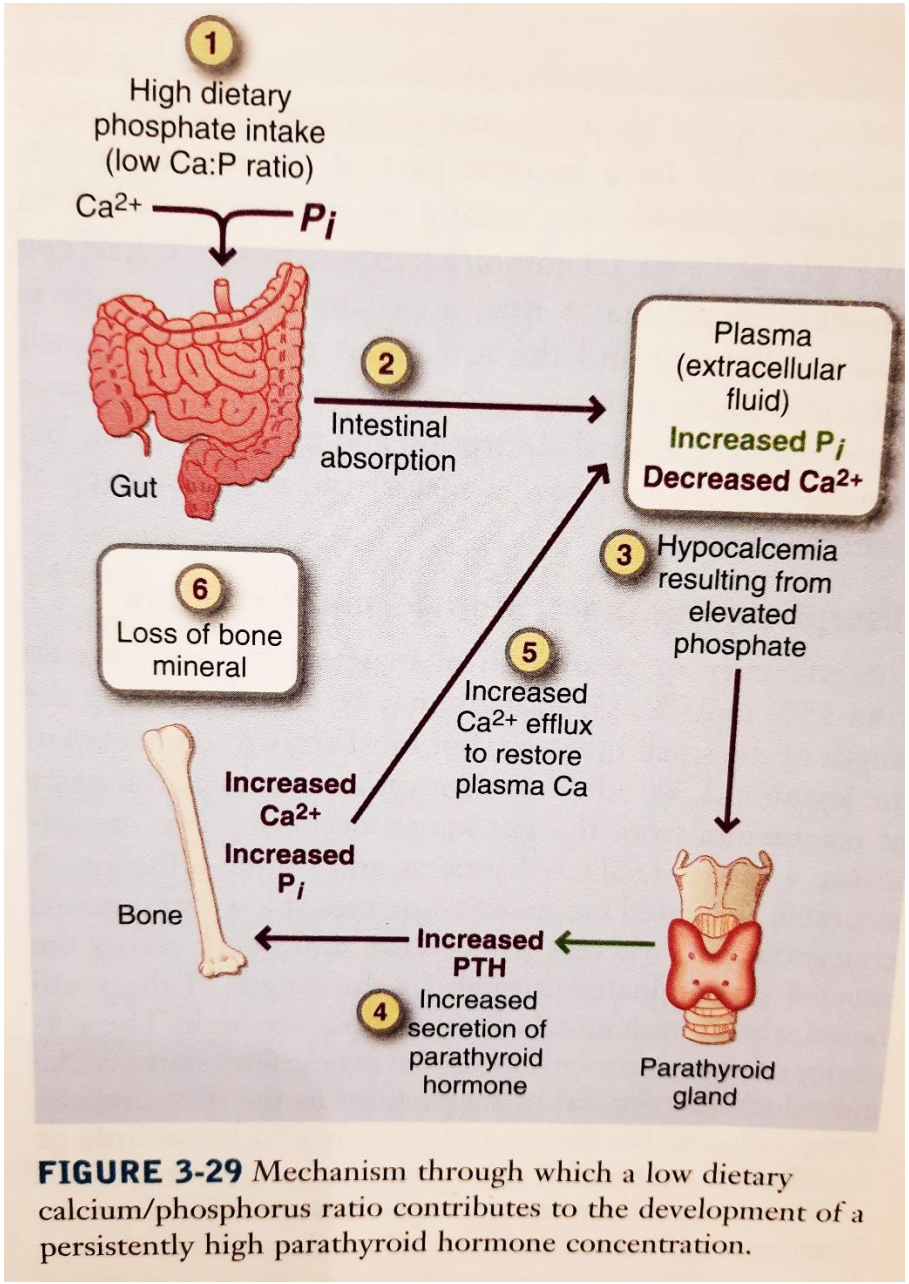


FIGURE 3-29 Mechanism through which a low dietary calcium/phosphorus ratio contributes to the development of a persistently high parathyroid hormone concentration.

Sources of calcium

- ✓ Milk and other dairy products.
- ✓ Green leafy vegetables such as curly kale, okra, spinach, broccoli, and collards.
- ✓ Clams, oysters, kale, turnip greens, mustard greens, and tofu.
- ✓ Bread and foods made with calcium-fortified flour.
- ✓ Fish with eatable bones, such as sardines.
- ✓ Soybean.
- ✓ Calcium-fortified foods.

→ Oxalates limit the availability of calcium in rhubarb, spinach, chard and beet greens.

Food	Serving Size	Calories per Portion	Calcium Content (mg)
Dairy foods			
Milk			
Whole milk	8 oz	149	276
Reduced fat milk (2%)	8 oz	122	293
Low-fat milk (1%)	8 oz	102	305
Skim milk (nonfat)	8 oz	83	299
Reduced-fat chocolate milk (2%)	8 oz	190	275
Low-fat chocolate milk (1%)	8 oz	158	290
Yogurt			
Plain yogurt, low-fat	8 oz	143	415
Fruit yogurt, low-fat	8 oz	232	345
Plain yogurt, nonfat	8 oz	127	452
Cheese			
Romano cheese	1.5 oz	165	452
Swiss cheese	1.5 oz	162	336
Pasteurized processed American cheese	2 oz	187	323
Mozzarella cheese, part skim	1.5 oz	128	311
Cheddar cheese	1.5 oz	171	307
Muenster cheese	1.5 oz	156	305
Nondairy foods			
Salmon	3 oz	76	32
Sardines, canned	3 oz	177	325
White beans, cooked	1 cup	307	191
Broccoli, cooked	1 cup	44	72
Broccoli, raw	1 cup	25	42
Collards, cooked	1 cup	49	226
Spinach, cooked	1 cup	41	249
Spinach, raw	1 cup	7	30
Baked beans, canned	1 cup	680	120
Tomatoes, canned	1 cup	71	84
Calcium-fortified food			
Orange juice	8 oz	117	500
Breakfast cereals	1 cup	100–210	250–1000
Tofu, made with calcium	0.5 cup	94	434
Soy milk, calcium fortified[a]	8 oz	104	299

Data source: Dietary Guidelines for Americans, 2010. Available at: www.ndb.usda.gov.

[a] Not all soy beverages are fortified to this level.

Low-calcium diets (in hypercalcemia)

In **renal lithiasis**, dietary treatment is effective if these recommendations are followed:

- ✓ Increase the intake of liquids.
- ✓ Limit the intake of proteins (it favours hypercalciuria).
- ✓ Acidify the urine (increase the solubility of Ca^{2+}).
- ✓ Decrease the intake of salt NaCl (in Na-dependent calciuria).

- ✓ Avoid:
  - ✓ overload of vitamin C (source of the endogenous oxalate)
  - ✓ oral supplements of calcium
  - ✓ more than one portion of dairy products/day

- ✓ Calcium supplies must be adjusted to needs (400-600 mg/day), in order to avoid hypercalcaemia and calciuria but not too low to stimulate PTH and consequently bone resorption.

- ✓ Calcium restriction is not effective in hypercalcemia of bone or paraneoplastic origin.

- ✓ In case of fat malabsorption, the intake of oxalates should be restricted. Fatty acids plus calcium form soaps and free oxalate is easily absorbed in the colon and eliminated in the urine causing hyperoxaluria, with no calcium absorption increase.

PHOSPHORUS

Metabolism:

- Intestinal absorption: 50-90%.
- Renal elimination: 80%.
- PTH → ↑ renal excretion of P → ↓ [P] pl.

Nutritional objectives:

- Hypophosphatemia: alleviate pluriorganic symptoms.
- Hyperphosphatemia: improve the toxic-metabolic symptoms.

Phosphorus deficiency is rare and hypophosphatemia may be common among older adults due to poor intake in general. It could also develop in individuals who take phosphate binders for renal disease.

DIETARY SOURCES OF PHOSPHORUS

- In general, good sources **of protein** are good sources of phosphorus: meat, poultry, fish, eggs, milk, dairy products, nuts, legumes, cereals and grains.

Low-phosphorus diets (in hyperphosphatemia)

These diets are indicated in hyperphosphatemia secondary to:

- ✓ The use of phosphorus in laxatives, enemas, supplements, etc.
- ✓ An important cellular lysis (rhabdomyolysis, tumour lysis).
- ✓ The tubular reabsorption of phosphorus due to severe dehydration, hypoparathyroidism, hyperthyroidism, acromegaly, etc.
- ✓ Chronical renal disease

Symptoms:

Due to the concomitant hypocalcaemia and soft tissue calcification.

Recommendations:

Protein reduction, but if high levels of phosphorus remain, P-chelators (calcium, magnesium, or aluminium salts) are recommended and the coexistent hypocalcaemia should be corrected as well.

High-phosphorus diets (in hypophosphatemia)

These diets are indicated in hypophosphatemia secondary to:

- ✓ Malabsorption.
- ✓ Chronic intake of aluminium-based antacids.
- ✓ Reduced dietary intake (this is difficult, so it is better to reduce renal excretion).
- ✓ Massive entrance of phosphorus into the cells (refeeding syndrome, respiratory alkalosis, too quick intravenous glucose infusion, etc.).
- ✓ Excessive urinary losses due to alcoholism, hyperparathyroidism (PTH reduces tubular reabsorption of phosphorus), polyuria in diabetic patients or massive burns to the body.
- ✓ Treatments with calcitonin: increases renal elimination of phosphorus.

What are **high phosphorus foods?**

- Dairy products such as milk, cheese, custard, cottage cheese, yogurt, ice cream, pudding

- Nuts, seeds, peanut butter

- Dried beans and peas such as baked beans, black beans, chick peas, garbanzo beans, kidney beans, lentils, limas, northern beans, pork and beans, split peas and soybeans

- Bran cereals, whole grain products

- Beverages such as cocoa, ale, beer, chocolate drinks, and dark cola drinks

What are **low phosphorus foods?**

- Fresh fruits such as apples, apricots, blackberries, grapes, tangerines, pears, peaches, pineapple, plums and strawberries

- Fresh vegetables such as cauliflower, carrots, cucumber, celery, green beans and broccoli

- Popcorn, crackers

- Rice cereal

- Sherbert

- Coffee or tea without milk, light-colored sodas (such as ginger ale), fruit juices

IRON AND COPPER.

Metabolism.
Objectives and indications.
Deficiency and overload.
Food sources.
Dietetic recommendations.

Unit 2.6 B

Prepared by: Teresa Climent

MICRO MINERALS

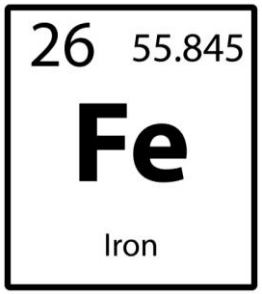
<100mg/day required

Table: 10 Classification of essential minerals

Macro minerals (> 100 mg/day)*	Micro minerals (<100 mg/day)*
Calcium	Iron
Phosphorus	Zinc
Magnesium	Copper
Sulfur	Iodine
Sodium*	Fluoride
Potassium*	Manganese
Chloride*	Selenium
	Chromium
	Molybdenum

Ferrum

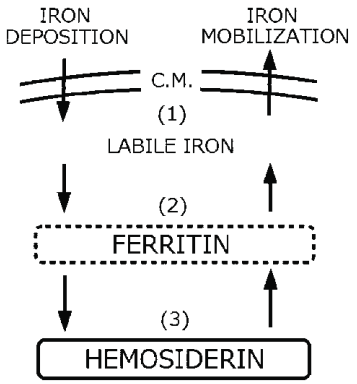
IRON



Is an **essential** component of the body (around 4 g*) as:

- **Heme IRON or functional iron (**70%**):**
  - haemoglobin, myoglobin, enzymes.
- **Nonheme IRON or ionic form** (as coenzyme and ferritin).

Storage iron: ferritin (reversibly stored), hemosiderin (irreversibly stored).



*Adult women store less iron than men.

Healthy adult men: 3.6 g

Healthy adult women: 2.4 g

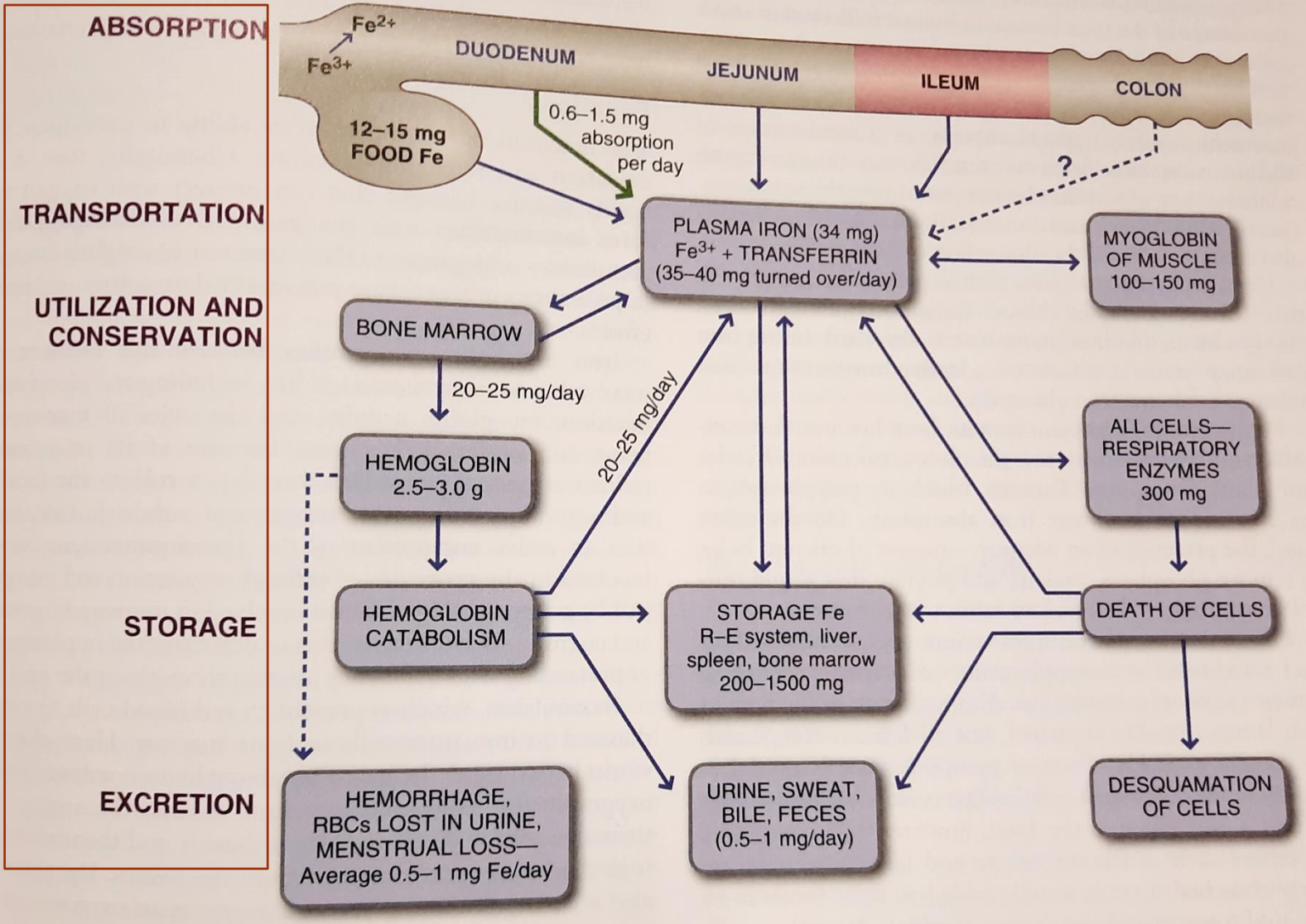


FIGURE 3-33 Iron metabolism in adults. Most iron is absorbed from the duodenum and jejunum, after which it is transported as plasma iron or bound to transferrin. *RBCs*, Red blood cells; *R-E system*, reticuloendothelial system.

MAIN FUNCTIONS OF IRON

- Iron participates in **oxidation and reduction reactions**.
- It participates in **red blood cell function**.
- **Hemoglobin**: transports oxygen from the lungs to the tissues.
- **Myoglobin:** transports and stores oxygen in the muscle.
- The roles of **numerous *heme and non-heme* enzymes** depend on their oxidation-reduction properties:
  - → *Heme*: electron transport, oxidative degradation of drugs
  - → *Non heme*: oxidative metabolism
- It is involved **in immune functions and cognitive** performance.
- **Transferrin** is involved in the transport of iron and other minerals.

IRON

FUNCTIONS

BLOOD PRODUCTION

HEALTHY IMMUNE SYSTEM

NORMAL BRAIN FUNCTION

MUSCLES FUNCTION

ENERGY INCREASE

HEALTHY PREGNANCY

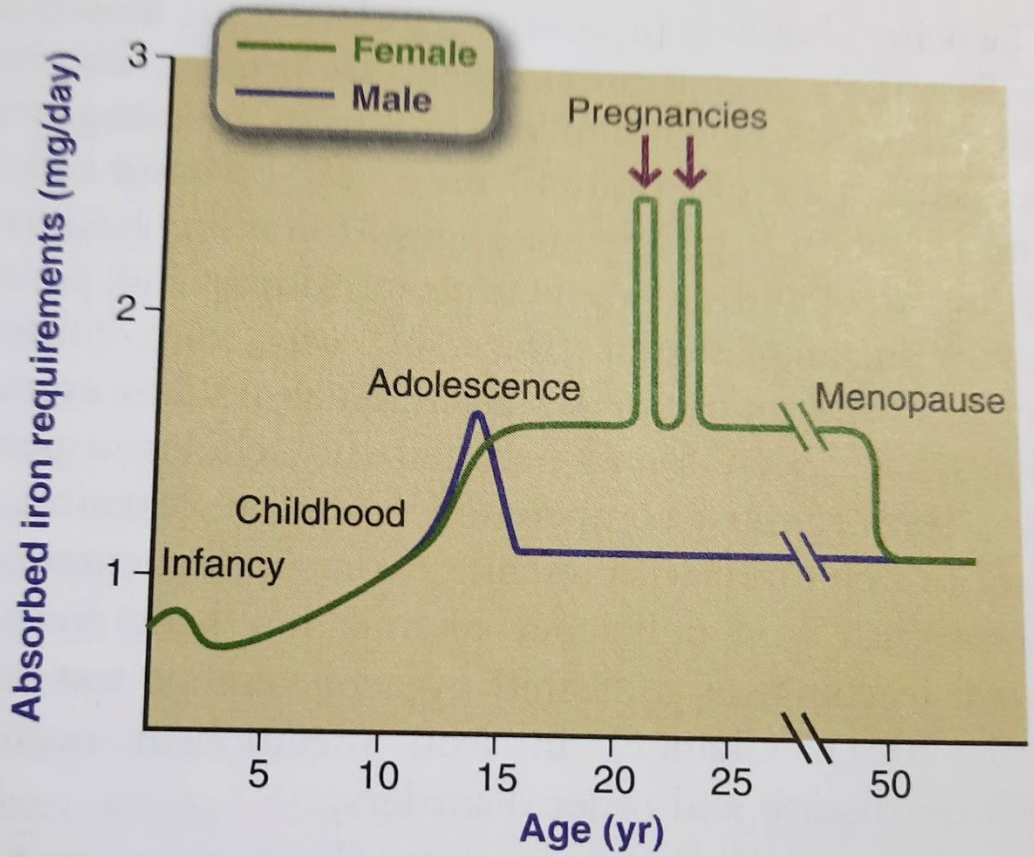


FIGURE 3-34 The absorbed iron requirement for various ages. The greatest requirements for iron occur during infancy. During childhood, requirements are the same for boys and girls. During the adolescent growth spurt, iron needs increase and are greater for boys than girls. However, because of menstruation, the requirements after adolescence remain high for females but decrease for males.

Dietary iron

There are two main types of iron in the diet:

- **Heme iron is** derived from hemoglobin and myoglobin and found in meat, fish, and poultry. Of the total dietary iron intake around ~ 15–35% of it is absorbed.

- **Non heme iron** found in meat, fish, and poultry as well as cereals, legumes, nuts, seeds, eggs, and some vegetables.

In animals: 40% is heme iron and 60% is non-heme iron

In plants:100% is *non heme* iron

Although the majority of dietary iron is non heme, less than 25 % of it is absorbed by the body.

HEME IRON
VERSUS
NONHEME IRON

HEME IRON	NONHEME IRON
Iron that comes from the animal sources	Iron that comes from plant sources
Occurs in oysters, red meat, poultry, beef liver, and fish like sardines	Occurs in beans, nuts, lentils, greeny-leaves such as spinach, and pumpkin seeds
Consists of a heme protein attached to the iron	Does not contain a heme protein attached to the iron
Absorption rate is high	Absorption rate is comparatively low

Heme iron and non heme iron

Heme iron (25 % absorption)	Non Heme iron (< 25 % absorption)
Fish / Seafood 	Dark green leafy vegetables (Spinach and Kangkung) 
Meat (Beef/ Lamb/ Pork)	Legumes (Bean, dried fruits and Seed)
Poultry	Eggs

Factors affecting iron absorption

Absorption activators or e**nhancers.**

Heme iron:

- ✓ Meat and soy protein have been shown to enhance heme iron absorption.

Non heme iron:

- ✓ Vitamin C (ascorbic acid).
- ✓ Other organic acids (e.g., citric acid), alcohol, and fermented foods.
- ✓ An unidentified factor in meat, commonly known as the meat–fish–poultry factor.

Dietary factors enhancing non heme iron absorption act by converting the insoluble ferric form of iron (Fe^{3+}) to the more soluble ferrous form (Fe^{2+}) or by maintaining the iron released from food during digestion in a soluble form prior to entering the intestinal cell.

Factors affecting iron absorption

Absorption inhibitors.

Heme iron:

✓ Calcium.

Non heme iron:

✓ Calcium.

✓ Phytic acid or phytates (found in whole grain breads, cereals, legumes, nuts, and seeds).

✓ Polyphenols, oxalates, tannates (found in tea, coffee, fruit, vegetables, some cereals and legumes, and red wine).

✓ Some proteins (e.g., soy protein).

These bind non heme iron to form insoluble complexes inhibiting **entry** into the intestinal cell.

✓ Supplemental doses (rather than the amounts found in food) of elements such as zinc, manganese, and copper also compete with non heme iron to **transport** it into the intestinal cell.

DAILY RECOMMENDED INTAKES OF IRON

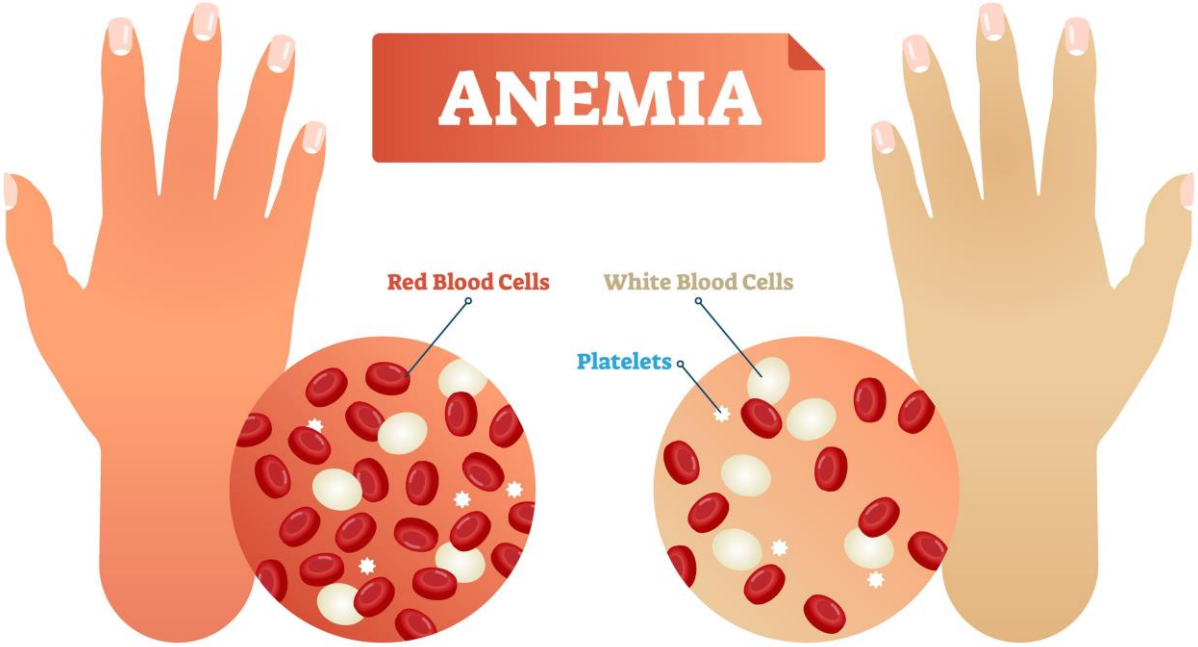
Age	Sex	Conditio	Hierro	Flúor	
			Comité Científico AESAN (2019)	FESNAD (2010)	EFSA (20
Reference values:			INR	IDR	AI
Units:			mg/día	mg/día	mg/dí
0-6 months	-	-	4,3	0,01	-
7-12	-	-	8	0,5	0,4
months	-	-	8	0,7	0,6
4-5 years	-	-	8	1	1
6-9 years	-	-	10	1	1,5
10-13 years	Men	-	11	2	2,2
	Mujer	-	15	2	2,3
14-19 years	Men	-	11	3	3,2
	Woman	-	15	3	2,8
20-29 years	Hombre	-	9,1	4	3,4
	Woman	-	18	3	2,9
30-39 years	Men	-	9,1	4	3,4
	Woman	-	18	3	2,9
40-49 years	Men	-	9,1	4	3,4
	Woman	-	18	3	2,9
50-59 years	Men	-	9,1	4	3,4
	Woman	-	15	3	2,9
60-69 years	Men	-	9,1	4	3,4
	Woman	-	9	3	2,9
>70	Men	-	9,1	4	3,4
	Woman	-	9	3	2,9
-	Mujer	Pregnan	27	3	2,9
-	Mujer	B/feedir	15	3	2,9

IRON DEFICIENCY: FERROPENIA

• This is the most prevalent nutritional deficiency worldwide, affecting:
•15% of the total population, and
•15-50% of the population in developing countries.

• In Spain it affects:
  • 15% of children
  • 5% of women of childbearing age
  • almost 2% of men.

ANEMIA



Normal

Anemia

SYMPTOMS

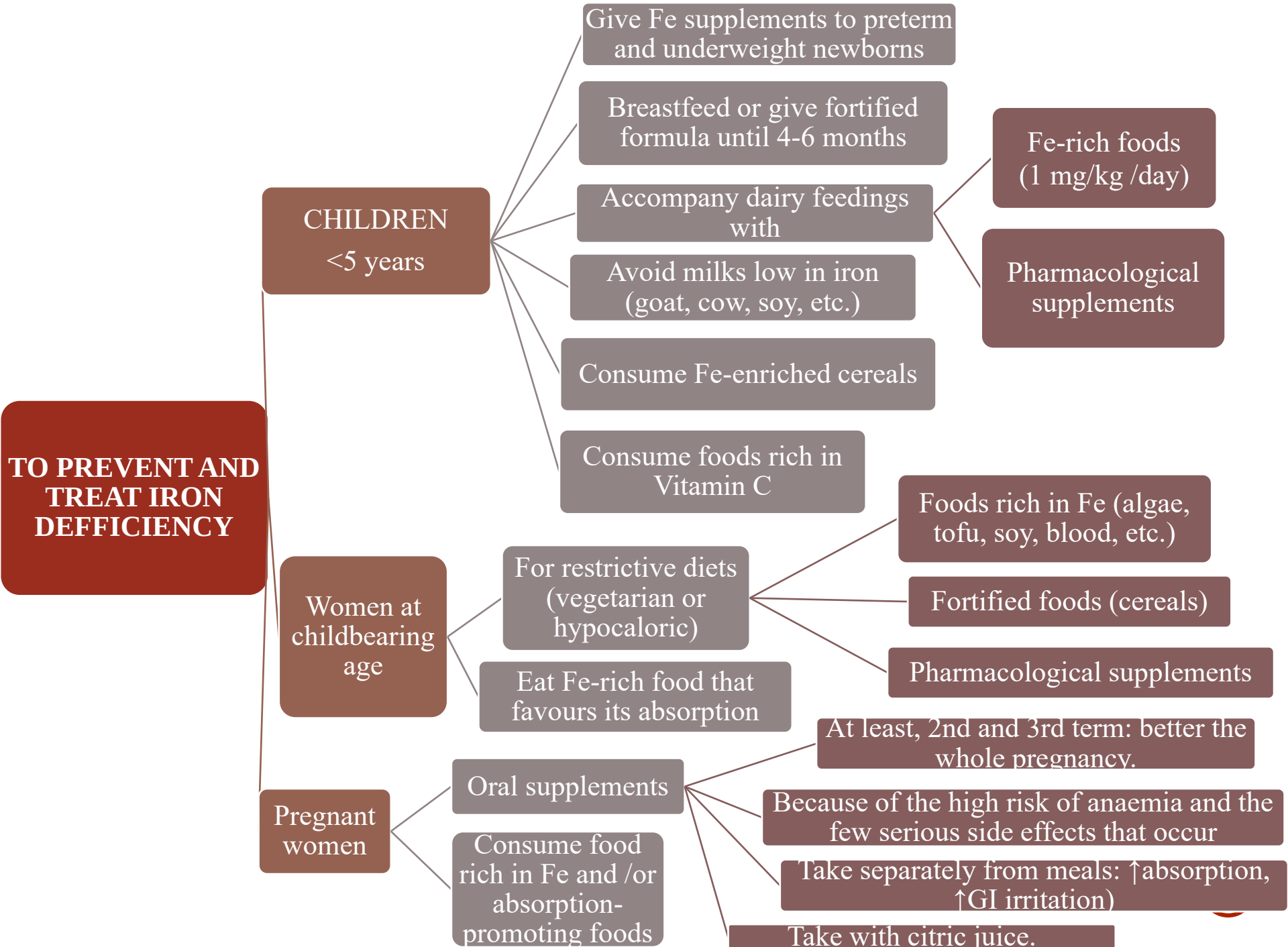
- Fatigue
- Weakness
- Pale or Yellowish Skin
- Irregular Heartbeats
- Shortness of Breath
- Dizziness or Lightheadedness
- Chest Pain
- Cold Hands and Feet
- Headache

Iron deficiency (even without anaemia) leads to:

- The risk of prematurity and underweight in newborns.
- Delays in child development.
- A lack of concentration, poorer work performance, and poorer intellectual performance.
- Weaker immune response to infection.

Iron deficiency may be due to:

- Insufficient contributions (very rich diets in vegetables, monotonous or low-calorie diets).
- Blood loss (menstruation, bleeding, gastrointestinal bleeding by ulcus, Crohn's disease, parasitosis, abuse of anti-inflammatory drugs, etc.).
- Higher needs (children < 2 years, adolescence, pregnancy, breastfeeding).
- Lower absorption (gastrectomy, achlorhydria, malabsorption).
- Alterations in iron transport (transferrrin deficit, although this is unusual).


TO PREVENT AND TREAT IRON DEFFICIENCY
CHILDREN <5 years
Give Fe supplements to preterm and underweight newborns
Breastfeed or give fortified formula until 4-6 months
Accompany dairy feedings with
Fe-rich foods (1 mg/kg /day)
Pharmacological supplements
Avoid milks low in iron (goat, cow, soy, etc.)
Consume Fe-enriched cereals
Consume foods rich in Vitamin C
Women at childbearing age
For restrictive diets (vegetarian or hypocaloric)
Foods rich in Fe (algae, tofu, soy, blood, etc.)
Fortified foods (cereals)
Pharmacological supplements
Eat Fe-rich food that favours its absorption
Pregnant women
Oral supplements
At least, 2nd and 3rd term: better the whole pregnancy.
Because of the high risk of anaemia and the few serious side effects that occur
Take separately from meals: ↑absorption, ↑GI irritation)
Take with citric juice.
Consume food rich in Fe and /or absorption-promoting foods

To increase the dietary intake of BIOAVAILABLE iron:

- Reinforce the consumption of:
  - Iron-dense foods or foods fortified with iron.
  - Foods with activators of the iron absorption (foods rich in vitamin C).
- Decrease the consumption of:
  - Tea or coffee.
  - Dairy products.
  - Fibre (foods or supplements).

THE MONSEN MODEL

AVAILABILITY Fe	CONTENTS
LOW	<30 g meat and/or fish and <25 mg vit. C
AVERAGE	<30 g meat and/or fish and 25-75 mg vit. C
HIGH	30-90 g meat and/or fish and 25-75 mg vit. C > 90 g meat and/or fish > 75 mg vit C

IRON OVERLOAD:

When iron level increases it accumulates as hemosiderin, causing:

- tissue damage
- higher oxidative potential
- higher risk of chronic diseases related to oxidative stress (e.g. liver cancer, cardiovascular disease, and other metabolic disorders related to insulin resistance).

Overload may occur in cases of:

- repeated blood transfusions.
- chronic, excessive consumption of alcohol, and iron and/or excess of vitamin C.
- toxic doses of iron or high doses of parenteral iron.
- **HAEMOCHROMATOSIS**, a disease that is characterized by the hyper-absorption of dietary iron and produces excessive deposits in the whole body.

HAEMOCHROMATOSIS

- It affects 0.1% of the European population and 3-0.5% of the U.S.
- It's the genetic disorder most prevalent in people of Western Europe
- It affects men more often
- It usually manifests between 30 and 50 years of age

TREATMENT OF HAEMOCHROMATOSIS

OBJECTIVES.

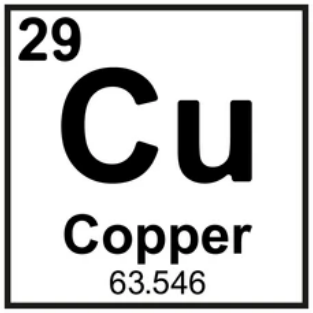
Remove excess of body iron:
extract 0.5 L of blood/week for 2 or 3 years until iron deposits are exhausted.
Then less frequent iron extractions to maintain normal levels.
Provide supportive care for damaged organs.

RESTRICT OR ELIMINATE the consumption of:

- Alcohol.
- Supplements and vitamin C.
- Foods rich in haeme iron.
- Raw seafood (the seafood can be eaten cooked).
- Processed foods fortified with Fe.

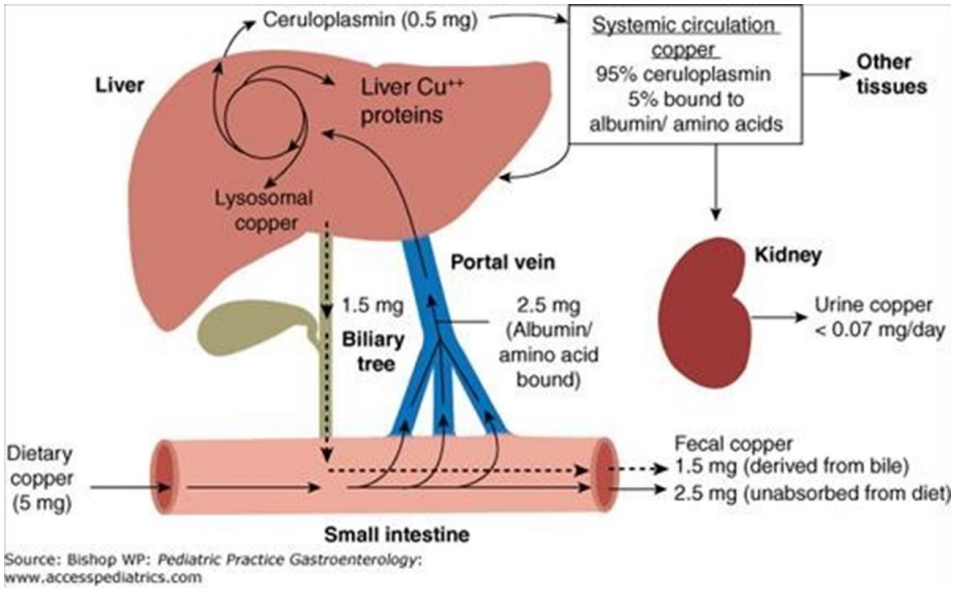
Avoid using kitchen utensils made out of iron.

COPPER



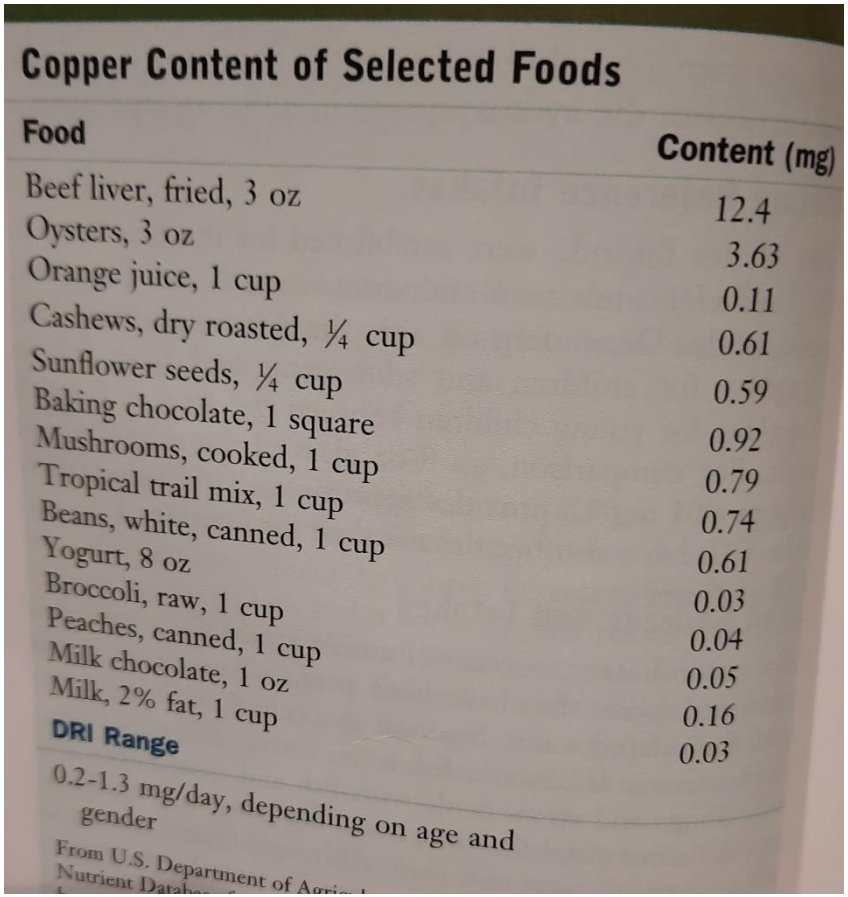
- **It is an essential micro nutrient** (≈ 80 mg in adults) for growth, immunity, brain and bone development, erythropoiesis, glucose and cholesterol metabolism, etc.
- **Its main function** is to serve as a coenzyme to various metalloenzymes involved in the oxidation of iron, melanin formation, mitochondrial oxidative phosphorylation, collagen synthesis, elimination of free radicals (SOD), etc.
- The DRI is 2-3 mg/day (adults).

Absorbed in the duodenum (where it competes with Zn for metallothionein).
Transported attached to ceruloplasmin and albumin.
Stored in small amounts in tissues, especially the liver and brain.
Excreted in bile.



COPPER FOOD SOURCES

- Copper is well distributed in foods such as animal products (except milk), shellfish (e.g. oysters), organ meats (e.g. liver, kidney), muscle meats, chocolate, nuts, cereal grains, dried legumes and dried fruits. Drinking water.



Copper Content of Selected Foods

Food	Content (mg)
Beef liver, fried, 3 oz	12.4
Oysters, 3 oz	3.63
Orange juice, 1 cup	0.11
Cashews, dry roasted, ¼ cup	0.61
Sunflower seeds, ¼ cup	0.59
Baking chocolate, 1 square	0.92
Mushrooms, cooked, 1 cup	0.79
Tropical trail mix, 1 cup	0.74
Beans, white, canned, 1 cup	0.61
Yogurt, 8 oz	0.03
Broccoli, raw, 1 cup	0.04
Peaches, canned, 1 cup	0.05
Milk chocolate, 1 oz	0.16
Milk, 2% fat, 1 cup	0.03
DRI Range	
0.2-1.3 mg/day, depending on age and gender	

From U.S. Department of Agri... Nutrient Data...

Copper deficiency

It causes iron deficiency (anemia) and neutropenia
Rarely from a dietary source

Etiology

- ✓ Feeding only with cow milk during lactation period.
- ✓ Some illness that reduces the absorption of cupper: short bowl syndrome, chronic diarrhea, hipoclorhydria, Crohn and celiac diseases, etc.
- ✓ Treatments with anti-acids, zinc, vitamin C, D-penicillamide
- ✓ Genetic disorders such as **Menkes disease (**in which copper absorption fails), malnutrition, prolonged parenteral nutrition, malabsorption and gastric bypass.

Treatment

Supplements of copper sulphate (Cu ≈3 mg / day) and intake of foods rich in copper.
Not for Menkes disease.

MENKES DISEASE

Menkes disease affects copper levels in the body.

- ✓ It is characterized by sparse, kinky hair, a failure to gain weight and grow at the expected rate (i.e. a failure to thrive), and a deterioration in the nervous system.

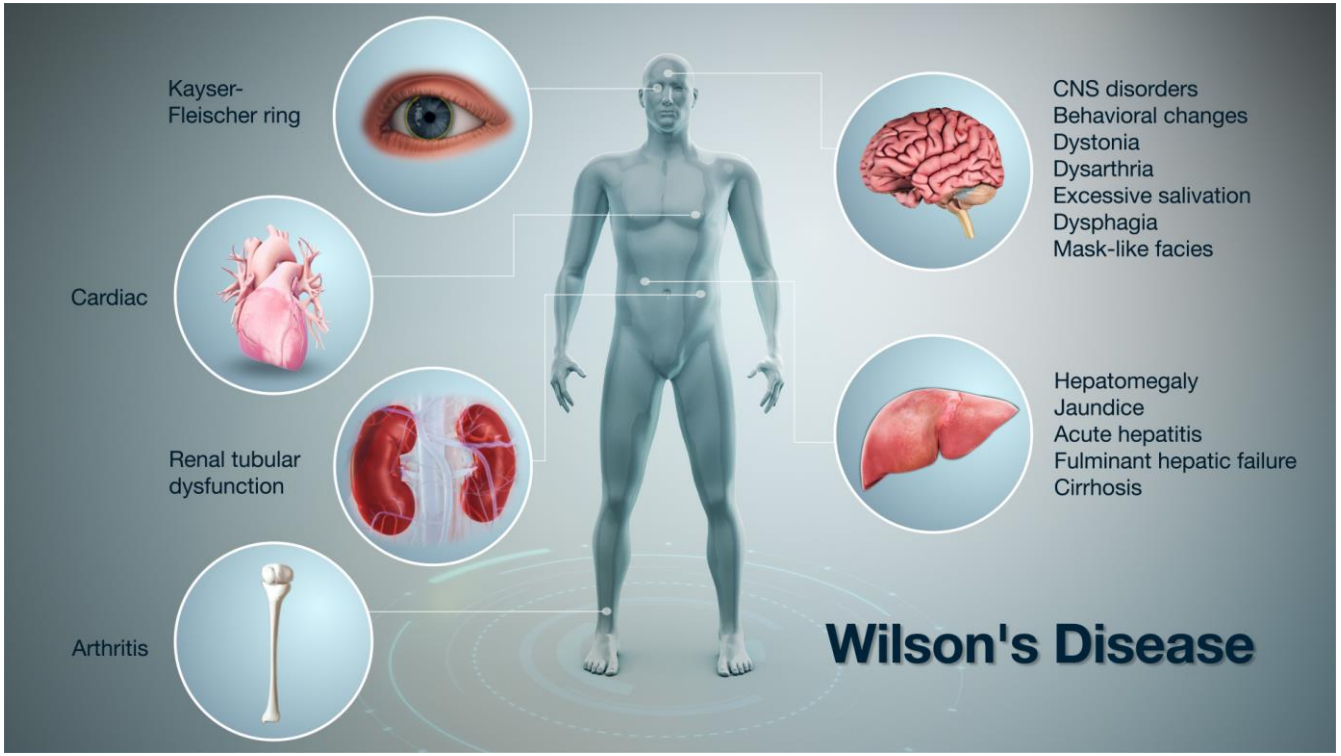
- ✓ A weak muscle tone (hypotonicity), sagging facial features, seizures, developmental delay, and intellectual disability.

- ✓ Children with Menkes syndrome begin to develop symptoms during infancy and often die before they are 2.

→ **Early treatment with copper may improve prognosis in some affected individuals.** In rare cases, symptoms begin in later childhood.

Cupper accumulation: WILSON'S DISEASE

Wilson disease is a rare genetic **disorder** characterized by **excess of copper stored in various body tissues,** particularly the liver, brain, and corneas of the eyes. It is a progressive **disease** which, if left untreated, may cause liver (hepatic) **disease**, central nervous system dysfunction, and death.



WILSON'S DISEASE

- An inborn error of metabolism that avoids cupper removal through the bile.
- Symptoms usually appear in late adolescence and may include:
  - Jaundice, intestinal inflammation, blood vomiting and abdominal pain (liver is the first organ affected and, in half of the patients, the only one).
  - Tremors and difficulty in walking, speaking, and swallowing.
- Symptoms of mental illness, including homicidal or suicidal behavior, depression and aggression.
- Women may have menstrual irregularities, lack of menstruation, infertility or multiple spontaneous abortions.
- A green corneal ring (copper deposits in the cornea).
- Affected renal tubules.

Regardless of how it begins, Wilson's disease is always fatal if not diagnosed and treated with:

- D-penicillamide (indefinitely even without symptoms).
- Zn salts (block copper absorption).
- Dietary restriction of foods rich in Cu, e.g. seafood, dried fruits, and liver.

Diet for overweight and/or obese patients

Nutritional goals.
Indications and adverse effects.
Education and practical recommendations for the body weight control.
Types of low-calorie diets.

Unit 3.2

Prepared by: Teresa Climent

Obesity according to the WHO

World Health Organization

"**Is one of the greatest public health challenges** of **the 21st century**"

Its prevalence has tripled in many countries in the WHO European Region since the 1980s, and the numbers of those affected continue to rise"

"Obesity has reached epidemic proportions globally, with at least 2.8 million people dying every year as a result of being overweight or obese"

https://www.who.int/es/news-room/fact-sheets/detail/obesity-and-overweight

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health.

Body mass index (BMI) is a simple index of weight-for-height that is commonly used to classify overweight and obesity in adults.

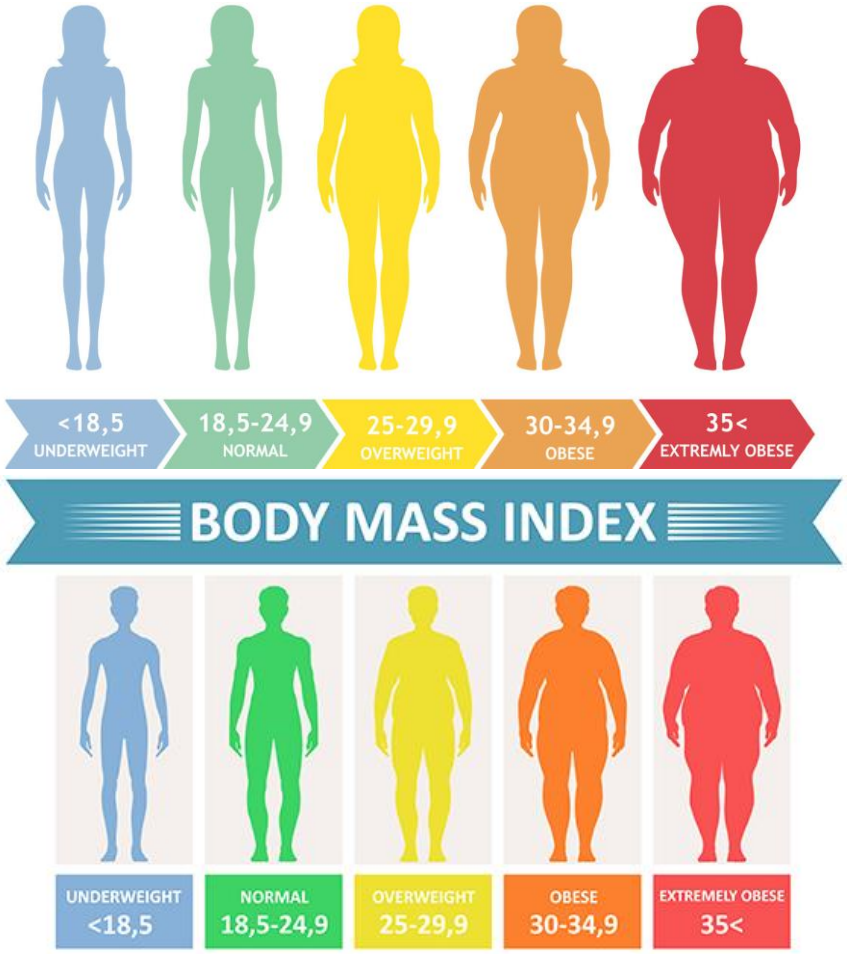
BMI is defined as a person's weight in kilograms divided by the square of their height in metres (kg/m2).

$$\text{BMI} = \frac{\text{weight in kg}}{(\text{height in m})^2}$$

For adults, WHO defines:

- overweight is a BMI greater than or equal to 25; and
- obesity is a BMI greater than or equal to 30.

BMI	Weight status
Below 18.5	Underweight
18.5-24.9	Normal weight
25.0-29.9	Overweight
30.0-34.9	Obesity class I
35.0-39.9	Obesity class II
Above 40	Obesity class III



However, it should be considered a rough guide because it may not correspond to the same degree of fatness in different individuals.

WAIST CIRCUMFERENCE (WC)

- ✓ It is an assessment tool that **can complement BMI** to assess disease risk.
- ✓ **Excess of fat located in the upper abdominal region (visceral fat)** is associated with **a higher risk** than fat located in other areas. Abdominal fatness is an independent risk factor (even when BMI does not increase) and it is a predictor of comorbidities (hypertension, coronary heart disease and type-II diabetes) and mortality.

The **risk of metabolic complications** increases for:

- **Men** with a waist circumference > 102 cm
- **Women** with a waist circumference > 88 cm.

Obesity consequences

- **Metabolic disorders**
  - ✓ Gout, cholelithiasis, diabetes mellitus type 2, hyperlipidemia, and arteriosclerosis.
- **Cardiovascular effects**
  - ✓ Hypertension, ischemic heart disease, and impaired venous return in the lower limbs, which induces the appearance of varicose veins, with increased risk of thrombophlebitis.
- **Effects on respiratory system**
  - ✓ Syndrome of chronic hypoventilation and obstructive sleep apnea.
- **Mechanical impact**
  - ✓ Hernia of hiatus by stomach compression.
  - ✓ Muscular and skeletal alterations due to mechanical stress.
- **Endocrine effects**
  - ✓ Gonadal dysfunctions, due to increased conversion in peripheral adipose tissue of androgens to estrogens.
  - ✓ In men, gonadal hypofunction with erectile dysfunction and oligoespermia.
  - ✓ In women, menstrual alterations, amenorrhea, and decreased fertility.
- **Psychopathological and some cancers**

The treatment must be individualised

Comprehensive clinical assessment

- physical examination and laboratory analysis
- clinical, dietetic, and weight history (previous anti-OBs)
- level of physical activity (at work and leisure)
- psycho-social characteristics
- comorbidity (diabetes mellitus, hypertension, dyslipidemia, sleep apnea, etc.)
- risk factors (smoking, central distribution of fat, menopause, family history of obesity, etc.)

Identify if there are organic causes and / or stable habits

- the conditions that precede the act of eating (hunger, boredom, tension, depression, seeing others eating, offers, and invitations), hours, places, situations, etc.
- the habits of intake (speed, quantity, quality, frequency, etc.)
- this will allow establishing specific objectives and facilitating and reinforcing behaviour that specifically address their problems.

The **hypocaloric diet** (is always the first treatment step).

OBJECTIVES

- Decrease body fat while preserving lean mass
- Maintain long-term weight loss and avoid future weight gain
- Reeducate eating behavior and correct lifestyle habits
- Decrease CVD risk factors (hypertension, dislipidemia, and diabetes)
- Improve functional capacity and quality of life

From the 2011 consensus document for the obesity treatment

Hypocaloric diets that force the body to oxidize its fat reservoirs should be balanced and nutritionally complete

they need to include a good **supply of fibre**: gives satiety, modulates digestion and absorption, improves peristaltic movement.

they must be complemented with **continuous physical exercise.**

should not be maintained indefinitely: negative nitrogen balance and loss of efficacy.

they are **complicated to establish**, since they are based on a **difficult equilibrium and must**:

- Contain sufficient amounts of all essential nutrients
- Be hypocaloric enough to force the consumption of fat reservoirs, despite the metabolic adjustments that the body immediately starts up.

PROTEIN is the most critical nutrient in the intake, since a positive nitrogen balance must be kept while fat is lost, so it is necessary that:

Carbohydrates intake:

- sufficient to avoid the amino acids degradation to synthesize glucose.

Protein content::

- **15-25** %
- distributed in **several meals** (less weight is lost, but more fat than protein)
- **high biological quality**:
  - with enough supply of the essential amino acids
  - with right protein turnover
  - minimum amount of protein that is converted to energy (hepatic and renal overload)

Following these requirements, the diets will provide 1300-1900 kcal and they are far from the 800-1200 kcal we need to lose weight.

To lose fat mass → The energy balance must be negative

↓

dietary allowances < total energy expenditure

More or less, to lose **1 kg of fat one** must 'burn' or 'stop entering' 7200 kcal (800 g x 9 kcal / g) and, **as the contributions are restricted**:

- the body adapts and decreases the resting energy expenditure and the thermic effect of foods, minimizing the total energy expenditure (TEE) (1000-1200 kcal/ day).
- **w**ater and proteins are lost too with fewer kcal, which decreases muscle mass, resulting in mental and physical fatigue that tends to decrease energy expenditure for physical inactivity.

The diets should not be very restrictive (because they are unhealthy, lean mass is also lost and they greatly diminish energy expenditure) so patients feel tired, reduce even more their physical activity and increase their tendency to depression, bulimia, or compulsive eating

Specific recommendations

Moderate weight reduction

- losing 5-10 kg /year reduces a 25% the mortality rate.
- 225-450 g /week.

Increase physical activity

- 1 hour of daily activity of moderate intensity - such as walking - most days will help maintain the lean mass and increase the total energy expenditure

Moderately hypocaloric satiating diets:

reduce the calculated total energy expenditure by about 500-600 kcal

- **15 - 25% proteins of high biological value**: satiating effect, positive nitrogen balance and increased thermogenesis of food
- **45 - 55% carbohydrates**
- **20 - 40 g fiber**: more chewing time, early satiation, delay gastric emptying and digestion and decrease fat absorption
- **25 - 35% fat**: more lipogenetic, less mechanisms of control of intake
- Evaluate if it is necessary to **supplement with micronutrients** (recommended in diets <2000 kcal and compulsory if <1500 kcal
- **Drink a lot of water** (increases satiety)

Hypocaloric diets: dietary recommendations

Patient must re-educate or change the lifestyle to keep the weight lost and not gain again.

Here is some advice to follow:

- never buy foods when hungry
- buy only what you will use and read labels
- cook the right and never excessive amounts
- eat from small dishes
- bring to the table only what is placed in the dish
- not eat alone, if possible
- drink plenty of liquids while eating (water and/or light soft drinks)
- be the last to be seated at the table and the last to start eating
- avoid other activities while eating (TV, phone, tablet, etc.)
- chew slowly and pay attention to the food
- leave the table immediately after finishing the meal
- go to parties keeping in mind what you can eat and drink
- convince the family to eat like you - if possible

Diets

- Low carbohydrate diet
- Low fat diets
- Fibre-enriched diets
- Hyper-proteic diets
- Meal replacements
- Low caloric diets
- Very low caloric diets

How can overweight and obesity be reduced?

World Health Organization

At the individual level, people can:

- limit energy intake from total fats and sugars;
- increase consumption of fruit and vegetables, as well as legumes, whole grains and nuts; and
- engage in regular physical activity (60 minutes a day for children and 150 minutes spread through the week for adults).

The food industry can play a significant role in promoting healthy diets by:

- reducing the fat, sugar, and salt content of processed foods;
- ensuring that healthy and nutritious choices are available and affordable to all consumers;
- restricting marketing of foods high in sugars, salt and fats, especially those foods aimed at children and teenagers; and
- ensuring the availability of healthy food choices and supporting regular physical activity in the workplace.

Learn to eat properly… is it so difficult?

What to do if diets don’t work

- Satiating drugs **(SAXENDA®)** that diminish hunger.
  - Not covered by the social security system and expensive.
  - Not everybody can afford it

- Lipases inhibitors (Orlistat®) cheaper but less effective

- Bariatric surgery.
  - Depending on the obesity grade and risk factors.
  - It cannot be done in young people, or adults over 62, pregnant women, during breastfeeding, or in patients with eating disorders like bulimia.

FESNAD
FEDERACIÓN de NUTRICIÓN

SEEDO
Sociedad Española de Obesidad

- ✓ FESNAD (Spanish Federation of Nutrition, Food and Dietetic Associations)

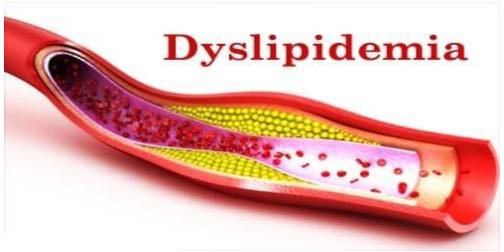
https://www.fesnad.org/

- ✓ SEEDO (Spanish Association for the Study of Obesity)

http://www.seedo.es/

Dyslipidemic patient's diet.

Types, treatment, options, associated pathologies.
Influence of dietary components on lipid profile.
General and specific recommendations.



UNIT 3.4

Prepared by: Teresa Climent

What is dyslipidemia?

Dyslipidemia, also known as hyperlipidemia or hyperlipoproteinemia, is defined as an elevation of lipid level in the bloodstream (above values where there is minimal risk of ischemic heart disease and stroke) of:

- **Total cholesterol** and/or
- **LDL-cholesterol** (low-density lipoprotein cholesterol) and/or
- **Triglycerides**

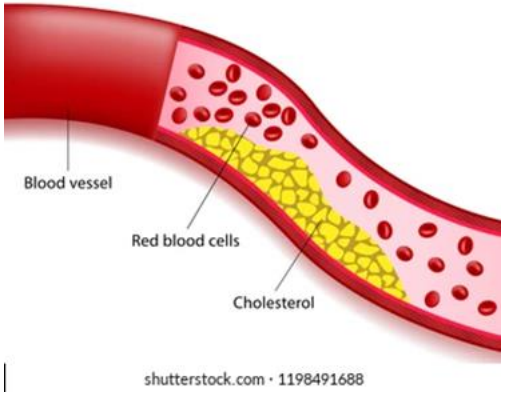
The decrease of the **HDL**-cholesterol (high-density lipoprotein cholesterol) level also implies coronary risk.

Lipid disorders are classified by their dyslipidemia profile as:

- ✓ Elevated LDL-c
- ✓ Elevated LDL-c accompanied by high triglyceride (TG)
- ✓ Elevated TG
- ✓ Low HDL-c
- ✓ Elevated LDL-c accompanied by low HDL-c
- ✓ Inherited lipoprotein disorders that are often presented in young patients at high risk of future CVD include:
  - ✓ familial hypercholesterolemia,
  - ✓ familial hypercholesterolemia combined with hyperlipidemia,
  - ✓ familial hypoalphalipoproteinemia,
  - ✓ apolipoprotein A-I mutations,
  - ✓ lecithin cholesterol acyl transferase deficiency, and
  - ✓ hyper-TG associated with lipoprotein lipase deficiency.

Lipids	Values	Level
Total Cholesterol (TC)	< 200	Ideal
	200-239	Borderline
	≥ 240	High
LDL-cholesterol (LDL-c)	< 100	Ideal
	100-129	Desirable
	130-159	Borderline
	≥ 190	Very High
HDL-cholesterol (HDL-c)	< 40	Low
	> 60	High
	< 150	Ideal
Triglycerides (TAG)	150-200	Borderline
	201-499	High
	≥ 500	Very High

- Approximately 20 % of adults have total cholesterol > 250 mg/dL.
- 50-69 % of middle-aged adults have total cholesterol > 200 mg/dL.
- Most dyslipidemic patients receive treatment (drugs, or diet) but only one-third of patients achieve adequate control.



DYSLIPEMIA CAUSES

NON MODIFIABLE

1. GENETICS:
   5% of general population
2. PREGNANCY

MODIFIABLE

1. DIETARY FACTORS: Intake of foods rich in saturated fatty acids, cholesterol, simple sugars and/or excessive alcohol.
2. SEDENTARISM
3. STRESS
4. OBESITY OR OVERWEIGHT
5. TOBACCO ABUSE

- DISEASES: poorly controlled diabetes mellitus, hypothyroidism, chronical kidney disease, liver disease, etc.
- DRUGS: Progestins, estrogens, corticosteroids, diuretics, beta-blockers, cyclosporine, tacrolimus, isotretinoin, protease inhibitors, antiretrovirals, fluconazole, etc.

The latest joint European guide on CVD prevention recommends the use of the **SCORE system** because it is based on data series derived from large and representative European cohorts.

ESC
European Society of Cardiology

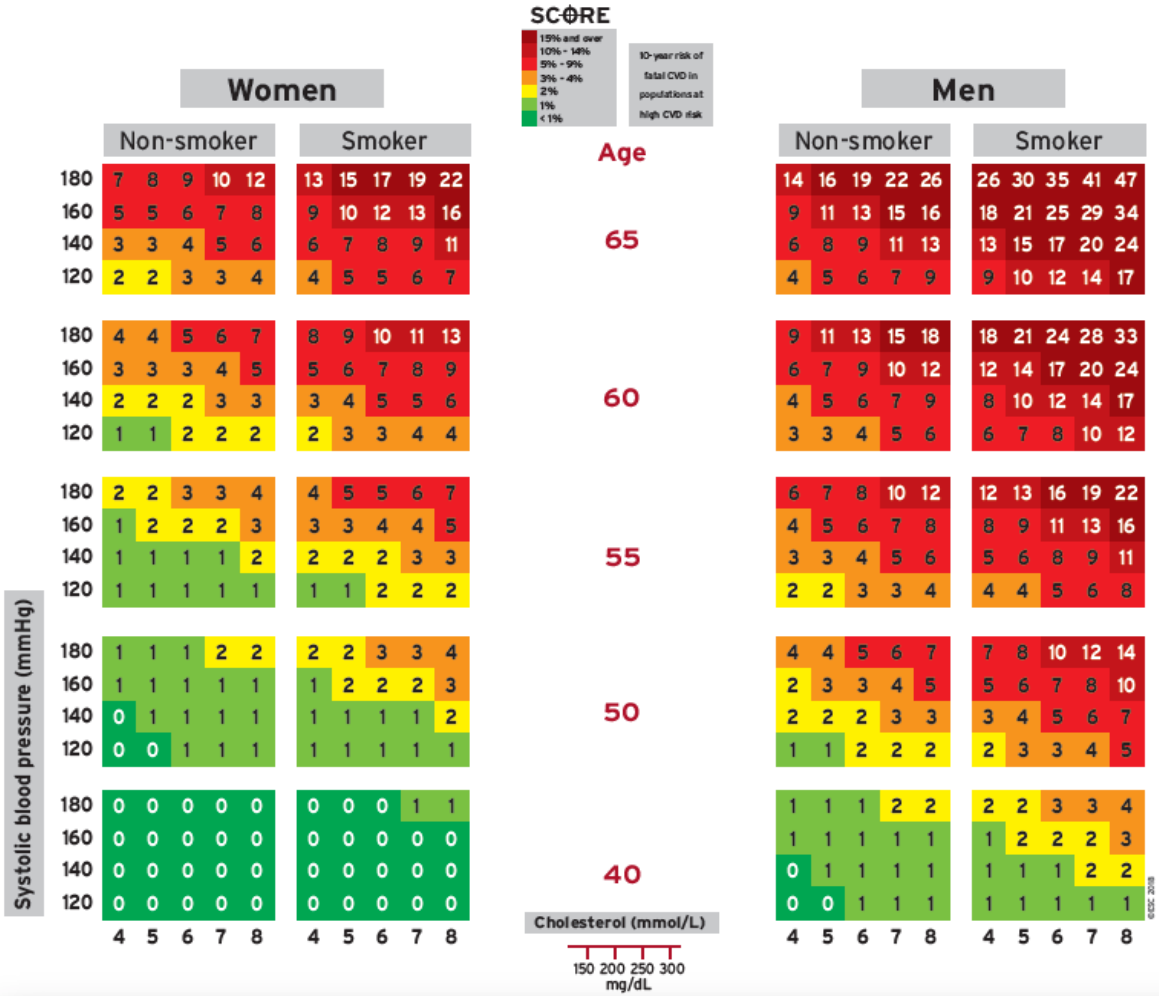
SCORE Risk Charts

The European cardiovascular disease risk assessment model **systematic coronary risk evaluation (SCORE):** these high and low cardiovascular risk charts are based on gender, age, total cholesterol, systolic blood pressure and smoking status. They also comprise relative risk charts, qualifiers and instructions.

https://www.escardio.org/static-file/Escardio/Subspecialty/EACPR/Documents/score-charts.pdf

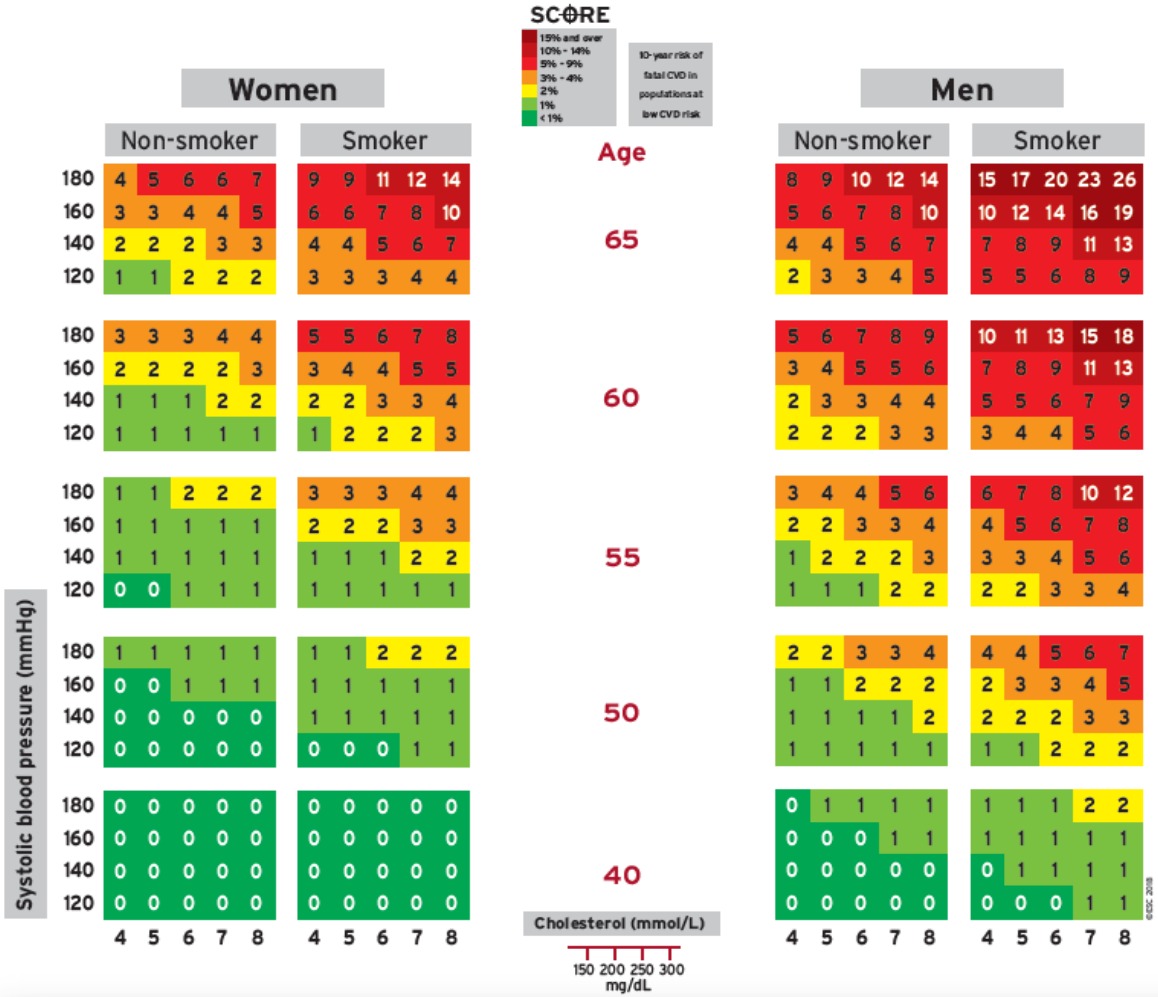
SCORE - European High Risk Chart

10 year risk of fatal CVD in high risk regions of Europe by gender, age, systolic blood pressure, total cholesterol and smoking status



SCORE - European Low Risk Chart

10 year risk of fatal CVD in low risk regions of Europe by gender, age, systolic blood pressure, total cholesterol and smoking status



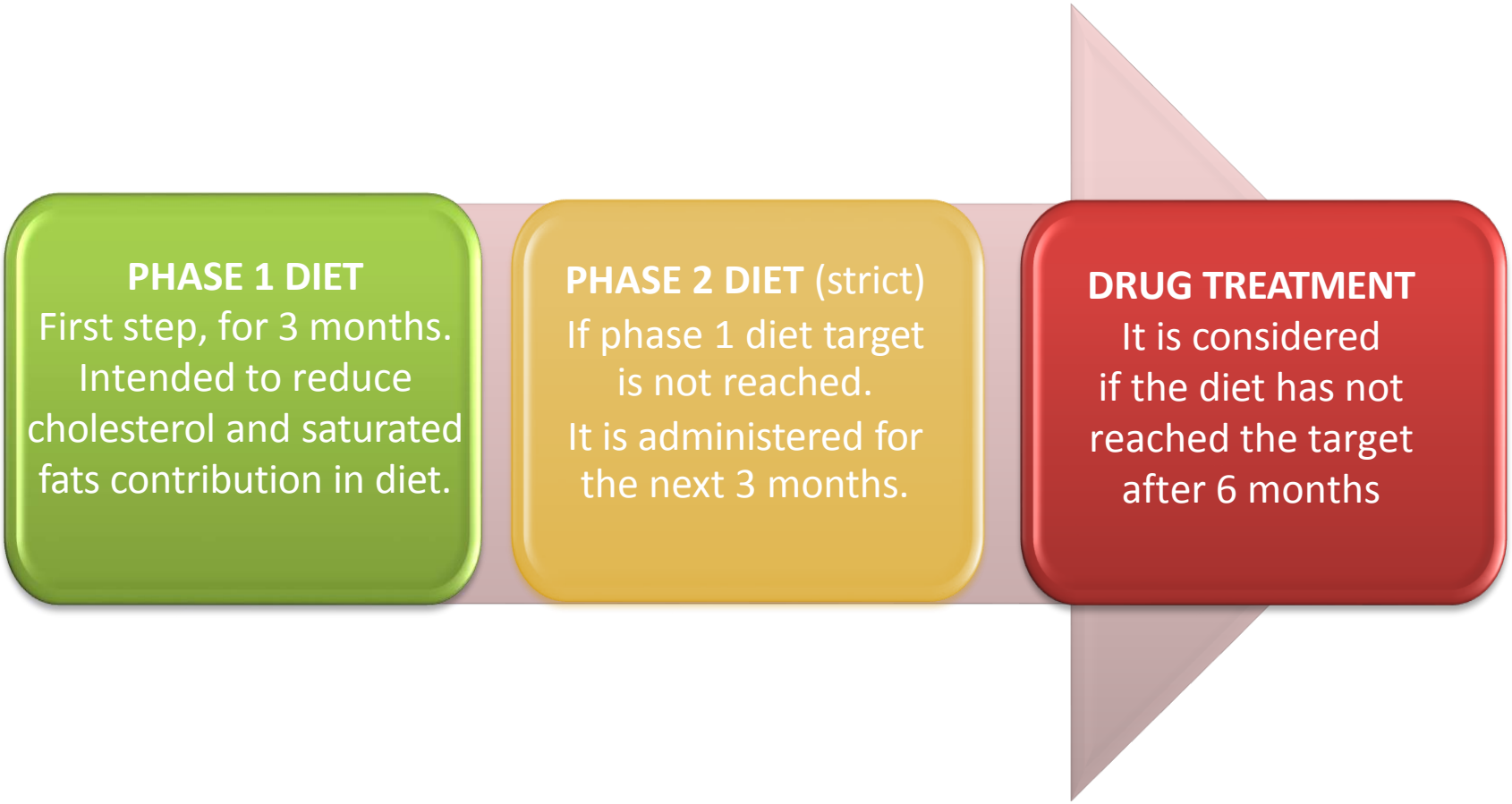
The SCORE database combines results from:

- ✓ 12 European cohort studies.
- ✓ 250,000 patient data sets.
- ✓ 3 million person-years of observation.
- ✓ 7,000 fatal CV events.

Advantages of SCORE database:

- ✓ It is based on a large data set that has been thoroughly tested with European data.
- ✓ It operates with hard reproducible endpoints (CVD death).
- ✓ The risk of death by CVD or stroke can be derived separately.
- ✓ It enables the development of an electronic interactive version of the risk chart.
- ✓ The SCORE risk function can be calibrated to each country's national mortality statistics.

TREATMENT OF DYSLIPIDEMIA



EFFECT OF DIET ON PLASMA LIPIDS

	LDL-Cholesterol	HDL-Cholesterol	VLDL-Cholesterol
Unfavourable			
Saturated fatty acids	↑	-	-
MUFA *trans*	↑	↓	-
Cholesterol	↑	↓	-
CH without fibre	↑	↓	-
Beneficial			
MUFA *cis*	↓	↑	-
Soluble fibre	↓	-	-
Beneficial with posibles unfavourable effects			
Omega 6 FA	↓	↓	-
Omega 3 FA	↑	-	↓

Assuming that unsaturated fatty acids (UFAs) are generally healthier than saturated ones (SFAs), another question that has gained attention in recent decades is the risks and benefits of monounsaturated fatty acids (MUFAs, with a single double bond) versus polyunsaturated fatty acids (PUFAs, with two or more double bonds).

Recommended daily intake in dyslipidemia DIETS

Up to 50 g of oil, preferably extra virgin olive oil.

2-6 rations of starch CH (integral derivatives are better).

Take care with products made with unknown fats.

2-3 servings of milk and low-fat dairy products.

2-4 servings of all kinds of fruit in any form.

Use nuts to replace other fatty foods.

2-4 servings of vegetables.

2 servings of protein foods from animal origin.

Exceptionally red meat with no visible fat: duck, goose, sausages, fatty procesed meats, and viscera.

Moderate consumption of fat-free pork and lean meats, crustaceans, cephalopods, egg yolks.

Limit alcohol and avoid it if the patient is overweight and/or suffers from hypertriglyceridemia.

Nutrition therapy for dyslipidemia

- ✓ National guidelines indicate that patients with elevated LDL cholesterol should consume less than 30 % of the total energy intake in fat (less than 7% of the calories from saturated fat) and less than 300 mg of cholesterol.
- ✓ Trans fatty acids should also be limited.
- ✓ Encourage the intake of fibre-rich cereals and vegetables, legumes, nuts, whole grains, beans, sunflower seeds, etc.
- ✓ Physical activity should always be encouraged.
- ✓ In individuals with hypertriglyceridemia there are more benefits with a diet that is moderate in fat and CH rather than a low-fat diet.
- ✓ Including monounsaturated or omega-3 fatty acids lowers serum triglycerides.
- ✓ Many of the dietary strategies to minimize serum lipids also contribute to glycemic control in patients with diabetes mellitus.

https://link.springer.com/content/pdf/10.1007/s11892-003-0084-z.pdf