

FOOD CHEMISTRY AND DIETARY PRODUCTS



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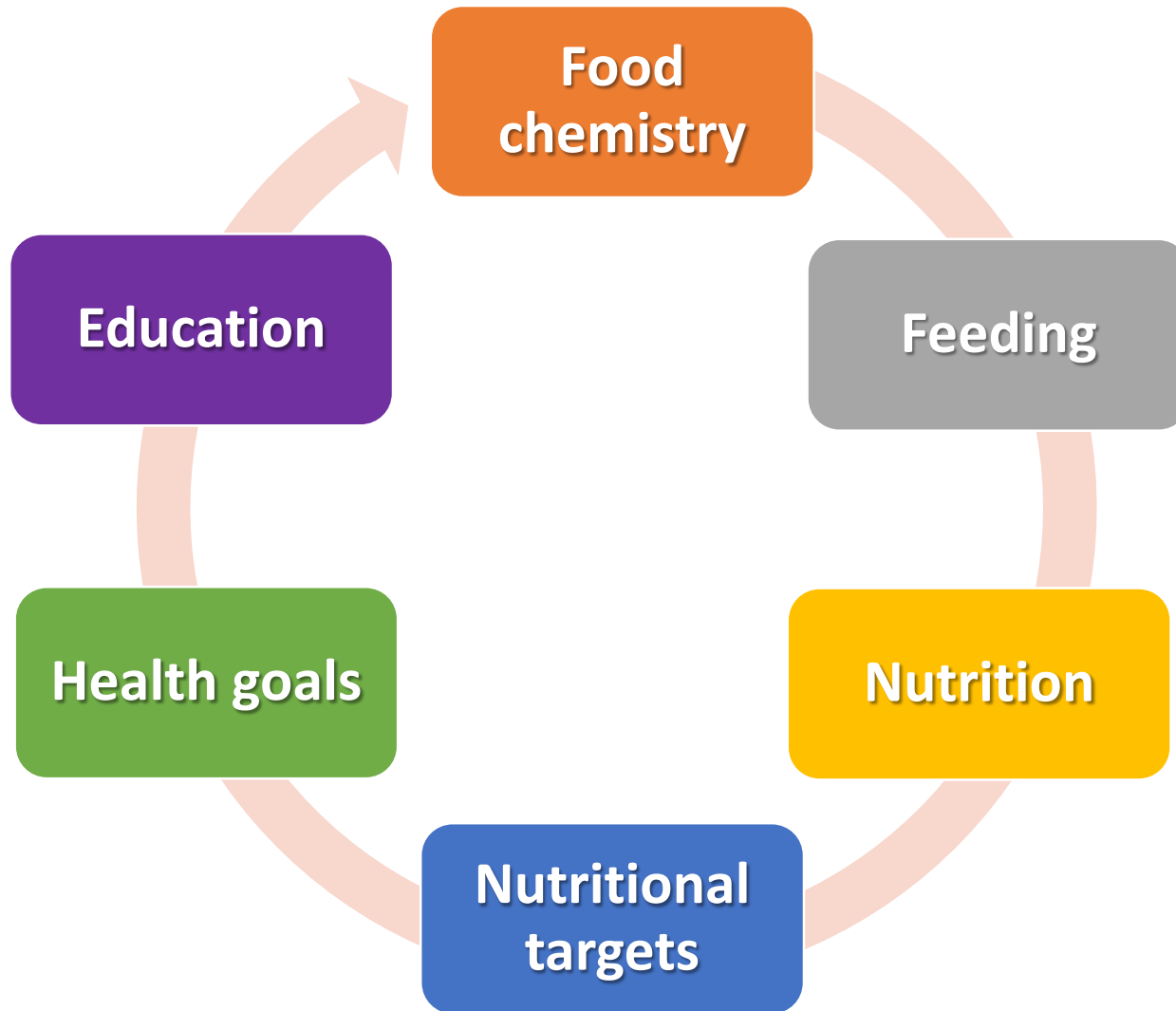
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PHYTO&FOOD CHEM www.unito.it/dstf

The virtuous circle

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Are they two sides of the same coin?

Although these two majors are similar in that they both center on food, their emphasis on its implications are very different.

- Food Science considers chemical, biological, and physical properties of food in relation to manufacturing, processing, and storage of food products
- Nutrition studies the relationship between foods and its effect on an individual's health. Nutrition considers topics such as obesity, malnutrition, food insecurity and nutritional deficiencies.

METABOLIC SYNDROME:

- lack of exercise
- irregular meals/unbalanced diet
- smoking/drinking
- stress

PERIODONTAL (GUM) DISEASE:

- smoking
- alcohol
- lack of dental care

OBESITY:

- large waistline/pot belly
- shrinking muscles / lack of exercise
- accumulation of bodyfat

DIABETES:

- high-calorie high-protein diet
- irregular meals

HIGH CHOLESTEROL:

- high-calorie
- lack of exercise
- smoking/unbalanced diet



CHRONIC FATIGUE SYNDROME:

- inactivity
- stress
- insufficient rest/sleep

OSTEOPOROSIS:

- calcium deficiency
- onset of menopause
- limited exposure to sunlight

GOUT:

- high alcohol intake
- high-calorie, high-protein diet
- obesity

HIGH BLOOD PRESSURE:

- obesity
- high intake of salt
- drinking / smoking / stress

Health goals

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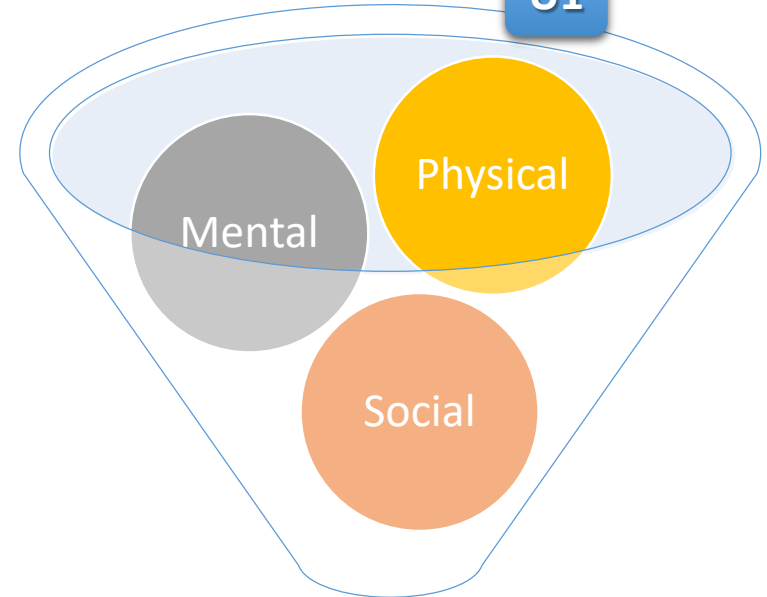
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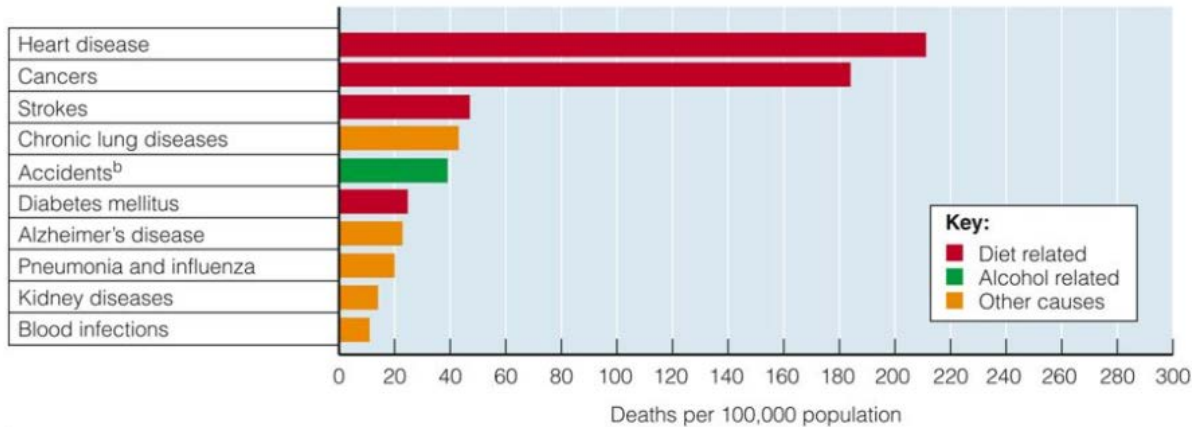
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Diet related causes of death



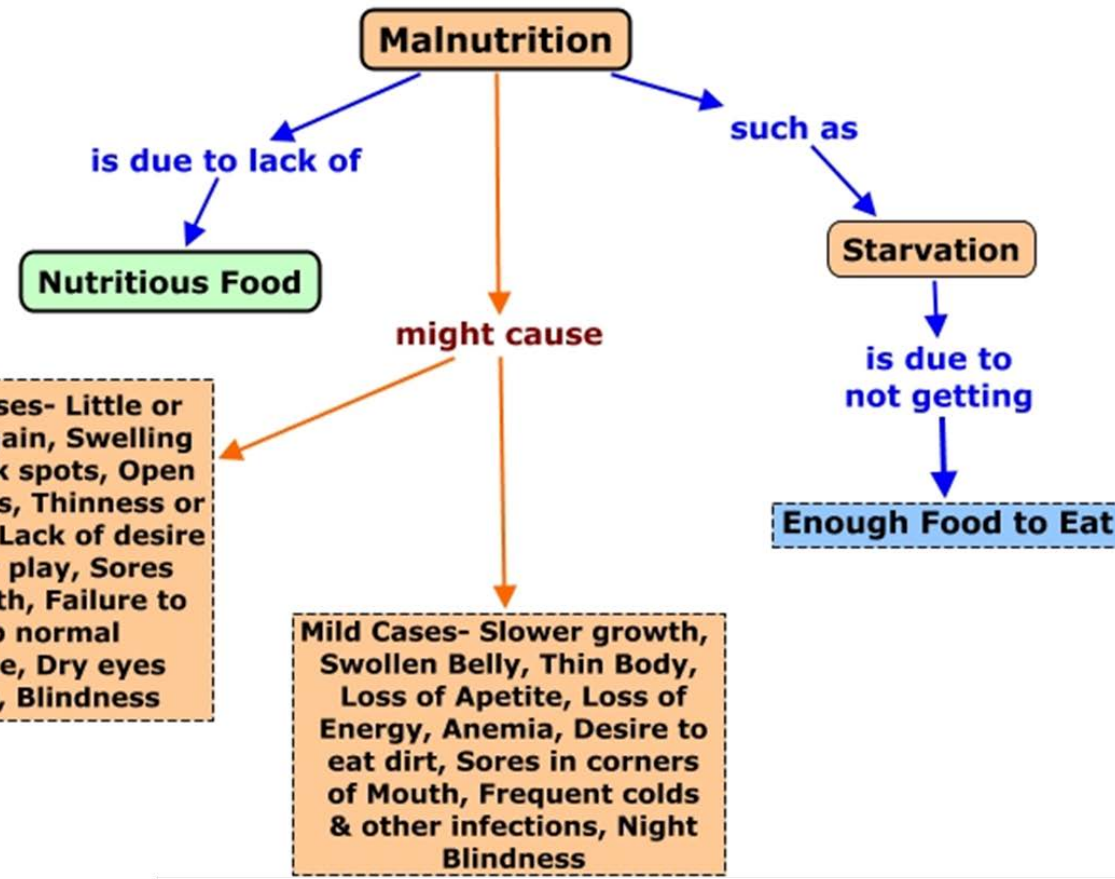
Health

No diseases

Wellness

Nutritional goals

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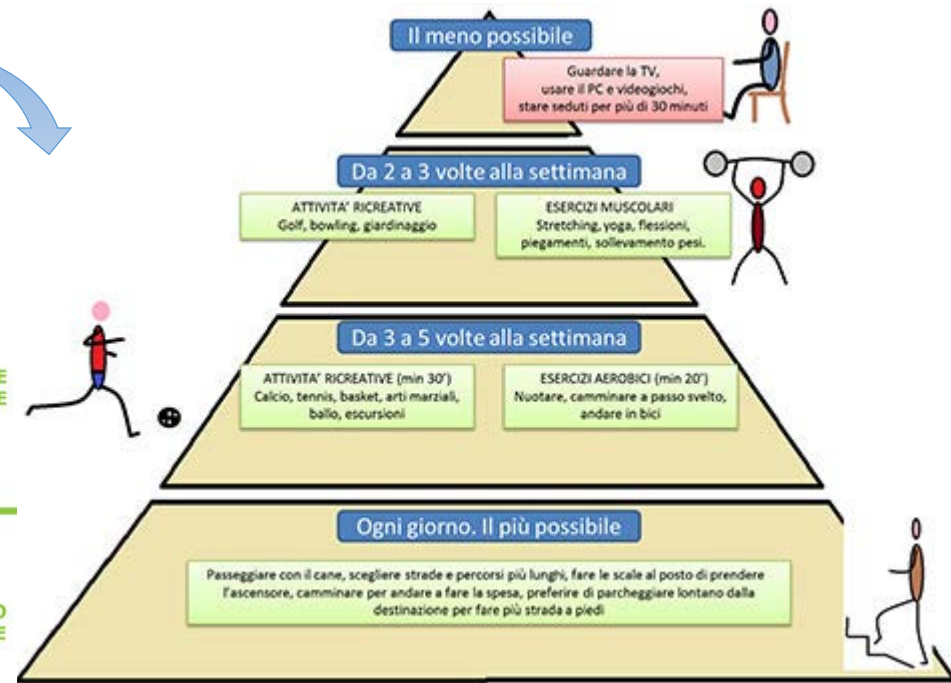


Malnutrition refers to an imbalance of nutrients. It can result from either consuming too many nutrients (overnutrition) or not consuming enough nutrients (undernutrition). In both cases, the balance of nutrients is not correct. Not enough or too many nutrients can result in diet-related diseases

Global strategies on lifestyle

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- standard national goals
- guidelines
- monitoring & interventional programs



What is a food?

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REGULATION (EC) No 178/2002 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 28 January 2002

laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety

«...food (or 'foodstuff') means any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans. 'Food' includes drink, chewing gum and any substance, including water, intentionally incorporated into the food during its manufacture, preparation or treatment. It includes water.....»

'Food' shall not include:

- (a) feed;
 - (b) live animals unless they are prepared for placing on the market for human consumption;
 - (c) plants prior to harvesting;
 - (d) medicinal products within the meaning of Council Directives 65/65/EEC (1) and 92/73/EEC (2);
 - (e) cosmetics within the meaning of Council Directive 76/768/EEC (3);
 - (f) tobacco and tobacco products within the meaning of Council Directive 89/622/EEC (4);
 - (g) narcotic or psychotropic substances within the meaning of the United Nations Single Convention on Narcotic Drugs, 1961, and the United Nations Convention on Psychotropic Substances, 1971;
 - (h) residues and contaminants
-

What is a nutrient?

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A **nutrient** is a substance used by an organism to survive, grow, reproduce, Maintain and repair.

Nutrients are provided by foods.

A classification used primarily to describe nutrient for human nutrition divides nutrients into **macronutrients and micronutrients**.

Proteins: meat, dairy, legumes, nuts, seafood and eggs

Carbohydrates: pasta, rice, cereals, breads, potatoes, milk, fruit, sugar

Lipids (most commonly called fats): oils, butter, margarine, nuts, seeds, avocados and olives, meat and seafood

Water: As a beverage and a component of many foods, especially vegetables and fruits.

Vitamins: common vitamins include the water soluble B group vitamins and vitamin C and the fat soluble vitamins A, D, E and K

Fruits and vegetables are generally good sources of Vitamin C and A and folic acid (a B group vitamin)

Grains and cereals are generally good sources of the B group vitamins and fiber

Full-fat dairy and egg yolks are generally sources of the fat soluble vitamins A, D and E

Milk and vegetable or soya bean oil are generally good sources of vitamin K, which can also be synthesized by gut bacteria

Minerals: (sodium, calcium, iron, iodine, magnesium, etc.): all foods contain some form of minerals.

Milk and dairy products are a good source of calcium and magnesium

Red meat is a good source of iron and zinc

Seafood and vegetables (depending on the soil in which they are produced) are generally good sources of iodine

Food provides also non-nutrient and antinutrient substances

“...‘other substance’ means a substance other than a nutrient that has a nutritional or physiological effect...”
 framework Reg Claims
 1924/2006

Phytonutrients:	Found in:	Great for:
Allicin	Garlic, onions, jicama	Eliminating toxins from the body
Capsaicin	Cayenne peppers, red peppers	Preventing toxic molecules from invading cells; reducing inflammation
Carotenoids	Carrots, tomatoes, cantaloupe, arugula, spinach, collard greens, kale, mustard greens, Swiss chard, turnip greens, broccoli, Brussels sprouts, sweet potatoes, butternut squash, pumpkin, red peppers	Removing damaging free radicals from the cells, slowing macular degeneration, preventing cataracts, repairing DNA and blocking carcinogens from entering cells
Catechins	Green and black teas	Inhibiting the activation of carcinogens
Ellagic Acid	Grapes, strawberries, blackberries, cranberries, walnuts	Preventing cancer
Genistein	Tofu, soymilk, soybeans	Inhibiting the formation of the blood vessels that help tumors grow
Indoles and Isothiocyanates	Collard greens, kale, broccoli, cauliflower, cabbage	Blocking carcinogens and interfering with the action of a precancerous form of estrogen
Isoflavones	Kudzu, soybeans, peas, peanuts, legumes	Modulating estrogen levels; preventing breast, uterine and prostate cancers; and reducing the risk of heart disease and osteoporosis
Lignans	Seeds and grains, especially flaxseed	Inhibiting excessive estrogen action, and possibly reducing breast, colon and ovarian cancer
Limonoids	Citrus fruit peels	Clearing congestive mucus from the lungs, detoxifying enzymes in the liver, and supporting detoxification of hormones and other substances that cause cellular decay
Lycopene	Tomatoes	Fighting heart disease and prostate cancer, plus reducing the risk of stomach, lung and prostate cancers
Phenols	Black and red berries, celery, cabbage, grapes, eggplant, peaches, nectarines	Preventing cancer, blocking specific enzymes that cause autoimmune diseases, protecting against heart attacks and strokes, preventing platelets in the blood from clumping, reversing nerve-cell aging, and destroying hepatotoxins, which damage the liver
Phytosterols	Pumpkin, rice, soybeans, yams, all green and yellow vegetables	Blocking "bad" cholesterol uptake, reducing inflammation and blocking the growth of tumors
Polyphenols	Buckwheat, wheat germ	Restoring a lagging immune system
Saponins	Alfalfa, legumes	Lowering cholesterol and inhibiting the growth of cancer cells by interfering with their DNA
Zeaxanthin	Kale, daikon, collard greens, green sorrel, arugula	Enhancing immune function and preventing several types of cancer

Food provides also non-nutrient and antinutrient substances

Protease inhibitors	are substances that inhibit the actions of trypsin, pepsin and other proteases in the gut, preventing the digestion and subsequent absorption of protein. (soia seeds)
Lipase inhibitors	inhibitors interfere with enzymes, such as human pancreatic lipase, that catalyze the hydrolysis of some lipids, including fats. For example, the anti-obesity drug orlistat causes a percentage of fat to pass through the digestive tract undigested
Amylase inhibitors	prevent the action of enzymes that break the glycosidic bonds of starches and other complex carbohydrates, preventing the release of simple sugars and absorption by the body. Amylase inhibitors, like lipase inhibitors, have been used as a diet aid and obesity treatment. Amylase inhibitors are present in many types of beans; commercially available amylase inhibitors are extracted from white kidney beans
Phytic acid	has a strong binding affinity to minerals such as calcium, magnesium, iron, copper, and zinc. Phytic acids are common in the hulls of nuts, seeds and grains
Oxalic acid and oxalates	are present in many plants and in significant amounts particularly in rhubarb, tea, spinach, parsley and purslane. Oxalates bind to calcium and prevent its absorption in the human body
Avidin	is an antinutrient found in active form in raw egg whites. It binds very tightly to biotin
Glucosinolates	Glucosinolates prevent the uptake of iodine, affecting the function of the thyroid and thus are considered goitrogens. They are found in plants such as broccoli, brussel sprouts, cabbage, mustard greens, radishes and cauliflower
Tannins	These compounds chelate metals such as iron and zinc and reduce the absorption of these nutrients, but they also inhibit digestive enzymes and may also precipitate proteins

Digestion and adsorption

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la bile è in grado di emulsionare i grassi

Stomaco



Pancreas:

secerne bicarbonato ed enzimi che digeriscono grassi, carboidrati e proteine

Digiuno:

ha luogo l'assorbimento dei nutrienti

Intestino tenue



Ileo:

ha luogo l'assorbimento dei nutrienti

entrano nel piccolo intestino secrezioni provenienti dal pancreas e dalla bile



Pancreas



Duodeno

Duodeno:

la maggior parte dei processi digestivi avviene qui

Colon trasverso

Colon ascendente



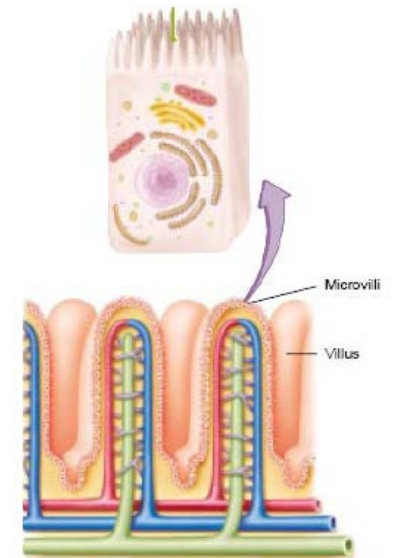
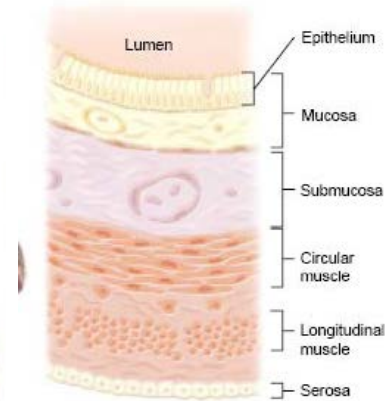
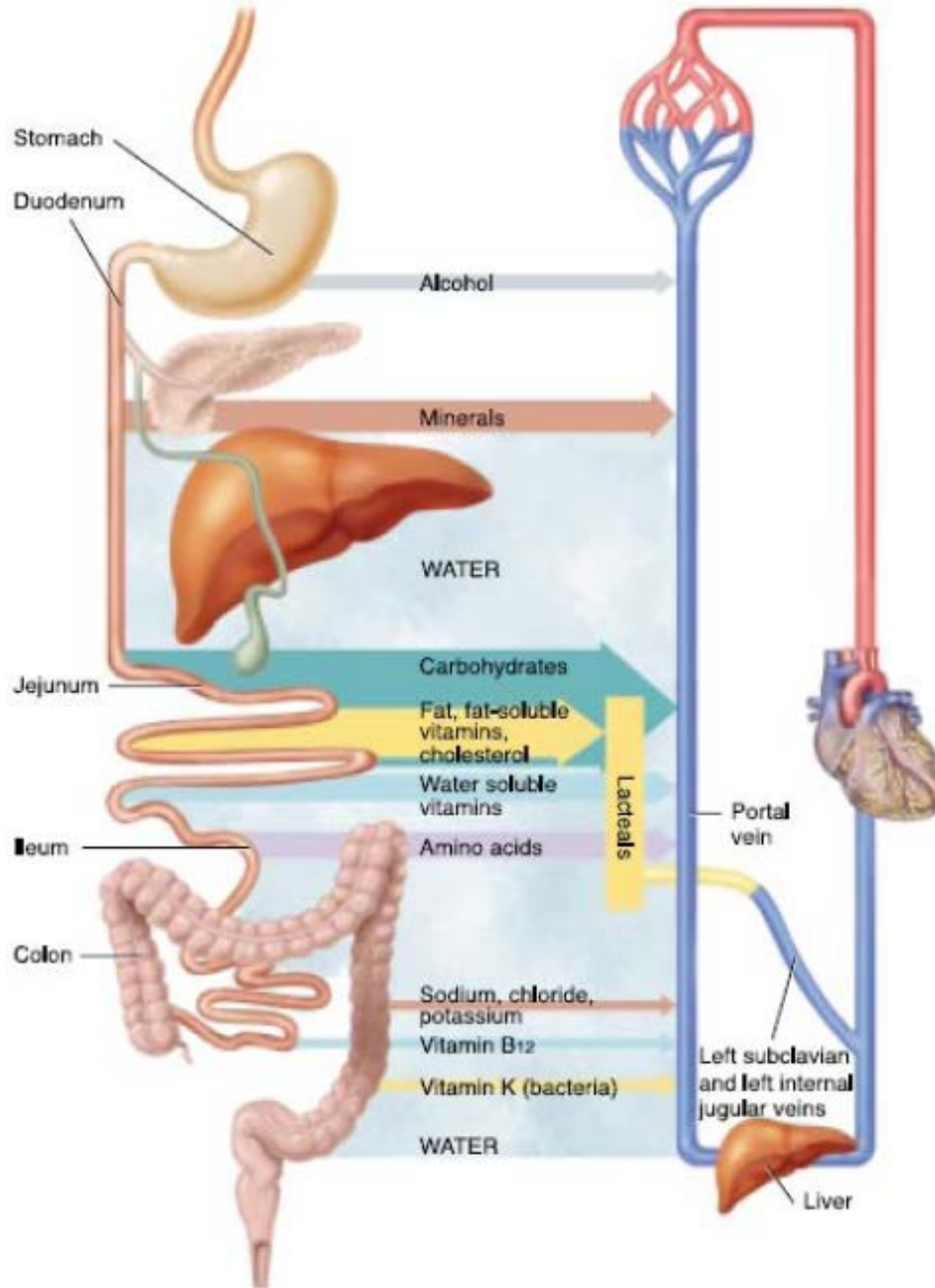
Intestino crasso

Colon discendente

Retto

Digestion and adsorption

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Insel P. et al., Discovering Nutrition, Jones and Bartlett Eds., 2005

Diet and nutrients availability?

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Bioavailability is defined as „the efficiency with which a dietary component is used systematically through normal metabolic pathways.

It is expressed as a percentage of intakes and is known to be influenced by dietary and host factors. Aggett, Am.J.Clin.Nutr. 2010, 91(S), 1433S

Bioavailability is the technical term used to convey the fact that not 100% of nutrients ingested will be absorbed, irrespective of whether consumed in the form of food or supplements. Bioavailability aims to describe the effect of a sequence of metabolic events, including digestion, solubilization, absorption, organ uptake and release, enzymatic transformation, secretion and excretion, on nutrient utilization.

The supply of nutrients to the human body thus not only depends on the amount of the nutrient in a food, but also on its bioavailability. Understanding nutrient bioavailability helps to optimize diets and set appropriate nutrient recommendations.

There are many factors, both dietary and physiological, that influence nutrient bioavailability.

- (1) the physical form of the nutrient within the food structure and the ease with which the nutrient can be released from that structure;
- (2) the chemical form of the nutrient in a foodstuff and its solubility in the lumen;
- (3) the presence of proteolytic enzyme inhibitors (commonly associated with legumes such as soybeans) which reduce the body's ability to digest protein;

Diet and nutrients availability?

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Diet-related factors include:

1. Food structure
2. Physicochemical form of the nutrient
3. Enhancers of absorption, e.g., ascorbate (for iron), some organic acids, sugars, amino acids, bulk lipid (for fat-soluble vitamins), and specific fatty acids
4. Inhibitors (primarily of inorganic micronutrient absorption), e.g., phosphates (especially phytate), polyphenols (including tannins), and oxalate
5. Competition for transport proteins or absorption sites, e.g., between metals.

Physiological factors include:

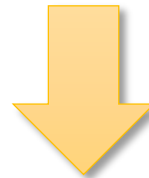
1. Gastric acidity
2. Intestinal secretions
3. Gut motility
4. Gut microflora.
5. Luminal redox state
6. Anabolic demands (e.g., growth in infancy and childhood, pregnancy, and lactation)
7. Endocrine effects
8. Infection and stress
9. Genetic polymorphisms and inborn errors of metabolism

ESSENTIALITY

- substance required for growth
- absence leads to signs of illness
- inability to grow / deficiency linked to a single nutrient / precursor
- gravity of the deficiency inversely proportional to the quantity consumed
- not synthesized in low quantity by the body

CONDITIONAL ESSENTIALITY

- immaturity of development
- pathological states
- genetic defects

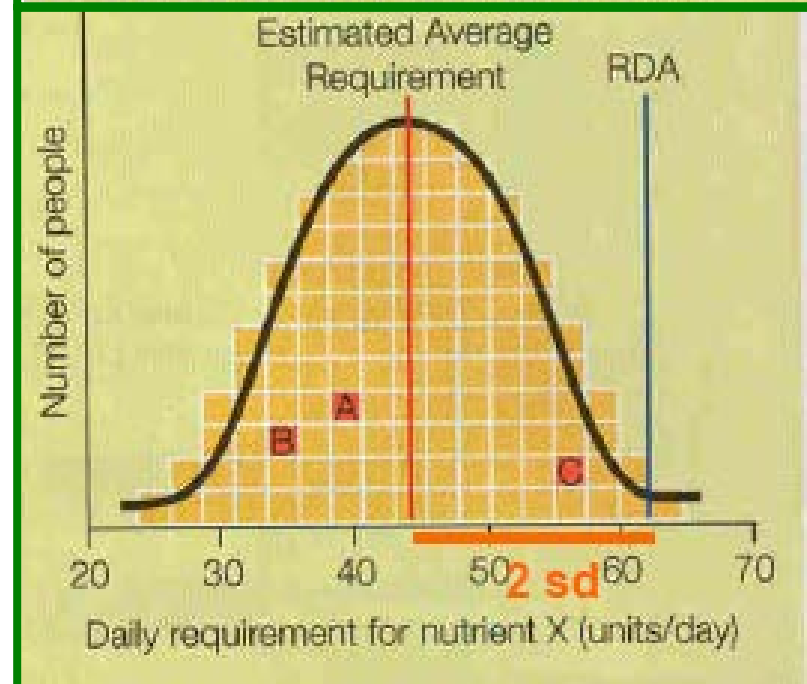
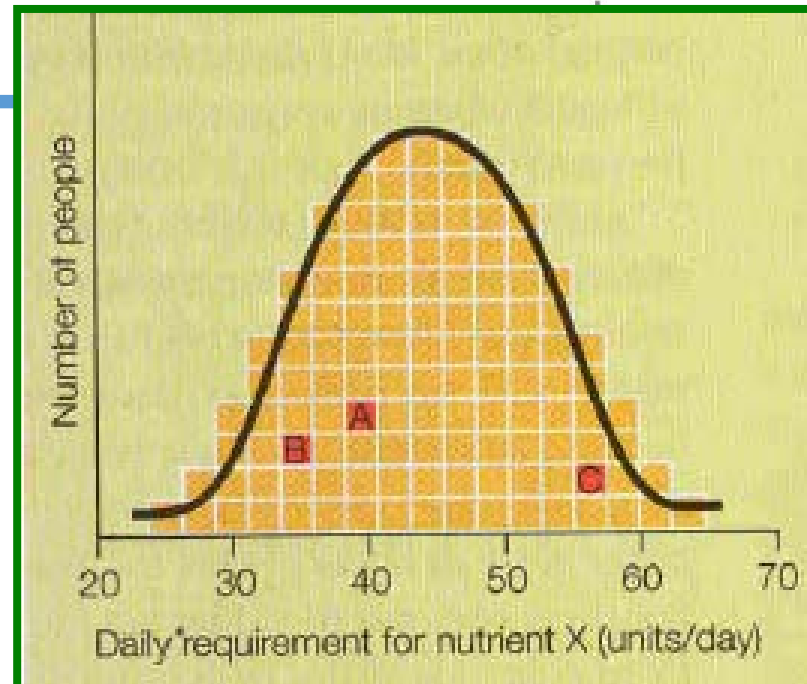
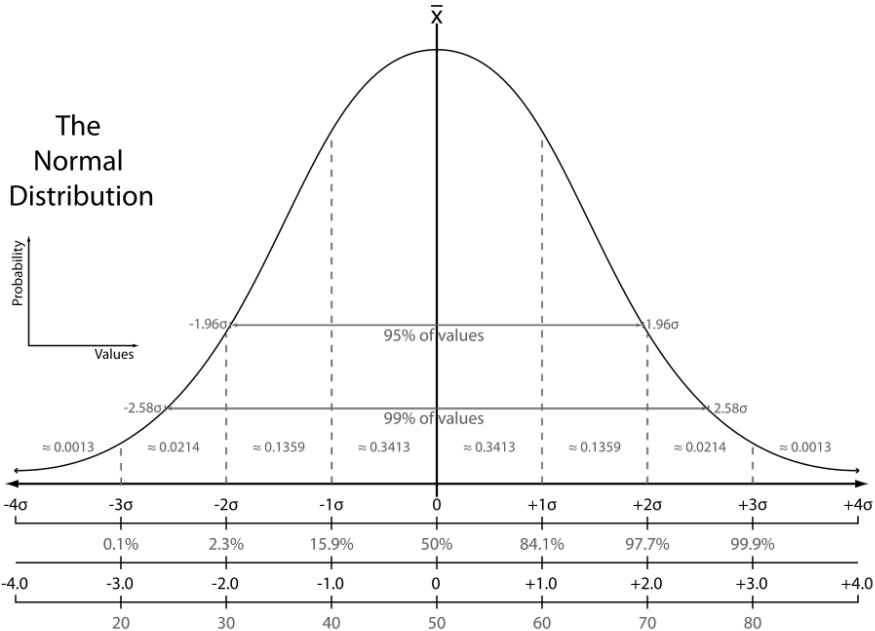


Nutritional Requirement:

it is the quantity of each nutrient necessary to maintain a healthy human being

Diet and nutrients requirements?

Probabilistic approach

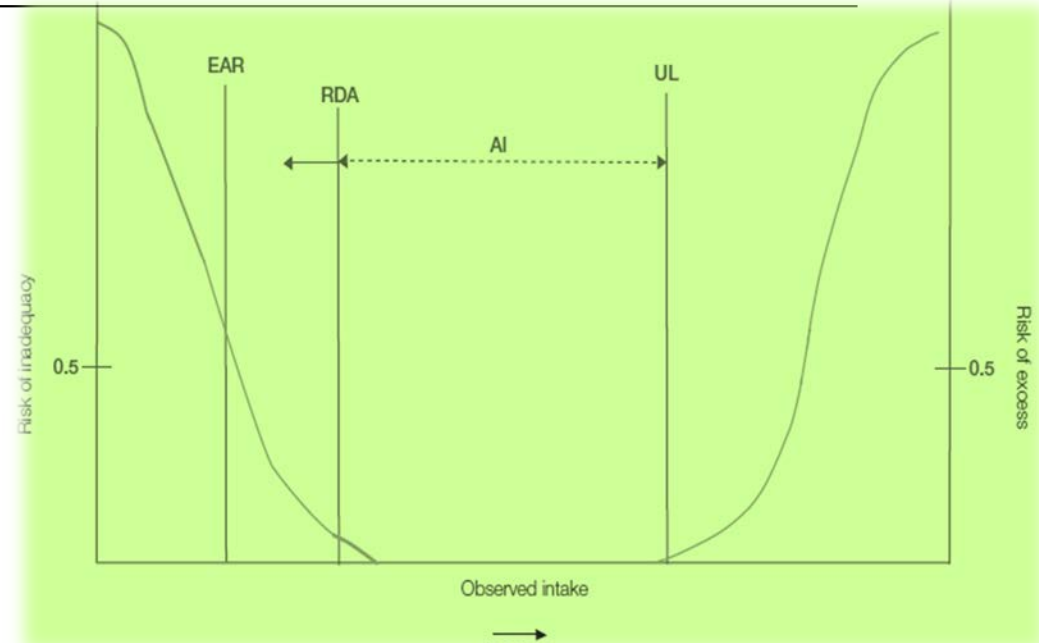
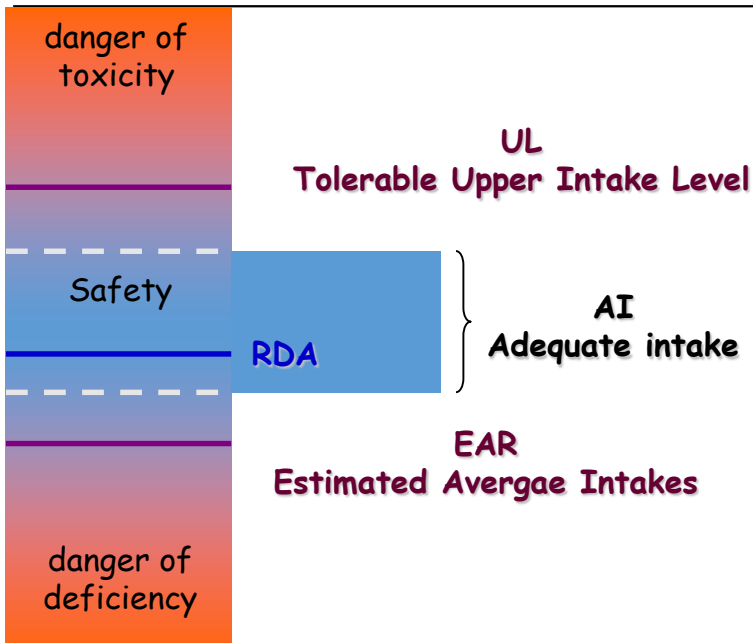
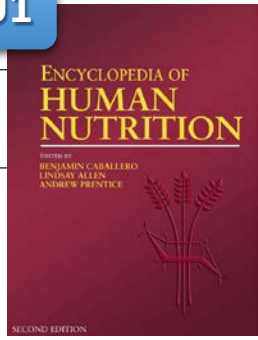


Diet and nutrients requirements?

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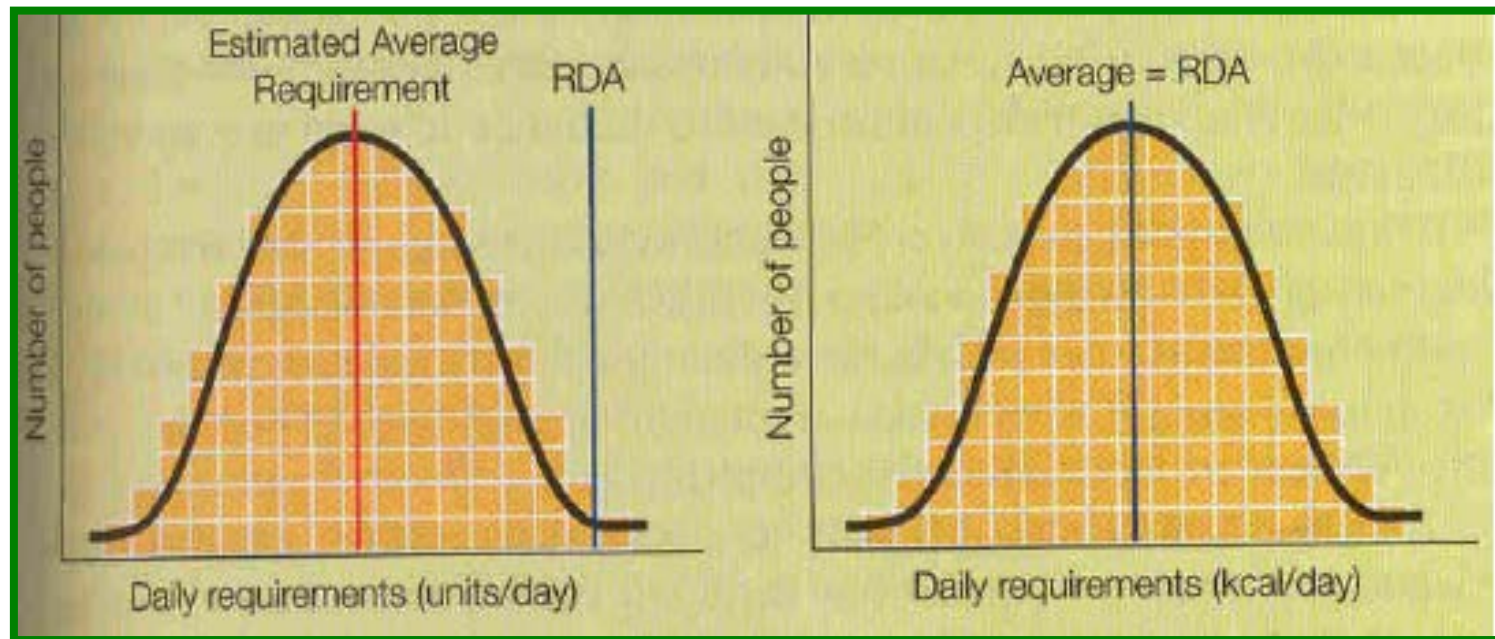
Table 1 Terminology for nutritional recommendations

Authority	Mean – 2SD	Mean	Mean + 2SD	Less evidence-based data	Upper limit of intake
United Kingdom	Lower Reference Nutrient Intake (LNRI)	Estimated Average Requirement (EAR)	Reference Nutrient Intake (RNI)	Estimated Safe + Adequate Dietary Intake (ESADI)	
European Union	Lowest Threshold of Intake (LTI)	Average Requirement (AR)	Population Reference Intake (PRI)	Acceptable Ranges	
USA/ Canada	—	Estimated Average Requirement (EAR)	Recommended Dietary Allowance (RDA)	Adequate Intake (AI)	Tolerable Upper Intake Level (TUL)
FAO/WHO	—	Estimated Average Requirement (EAR)	Recommended Dietary Intake (RDI)	—	Upper Tolerable Nutrient Intake (TUL)



Diet and nutrients requirements?

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NUTRIENTS

RDA covers the almost entire population

ENERGY

covers half of the needs of the population

Concetto di valori dietetici di riferimento (DRV) per l'energia

I valori dietetici di riferimento per il fabbisogno energetico sono basati sulle stime di esigenze di individui sani, rappresentante di un particolare gruppo di popolazione, come conseguenza di variabilità biologica, vi è una distribuzione del fabbisogno di energia all'interno di ogni gruppo. Considerando che la DRV per proteine e vari micronutrienti sono dati come valori di riferimento della popolazione (PRI), DRV per energia sono forniti come fabbisogno medio (AR) dei gruppi specificati. A causa della elevata variazione nei livelli di attività fisica (PAL) e parametri antropometrici, la definizione di un PRI sarebbe inappropriato, in quanto implicherebbe un apporto sopra il requisito di adeguatezza per quasi tutti i soggetti e che porterebbe ad un bilancio energetico positivo con la promozione di un aumento sfavorevole della massa corporea e lo sviluppo di obesità nel lungo termine. L'AR per l'energia è espresso su base giornaliera, ma rappresenta la media del fabbisogno energetico nel corso di un minimo di una settimana.

LARN	Livelli di Assunzione di Riferimento di Nutrienti ed energia per la popolazione italiana <i>Dietary Reference Values</i>	L'insieme dei valori di riferimento per la dieta nella popolazione e nel singolo individuo sano. Sono fondati su criteri di natura biologica e preventiva, e formulati sulla base del parere di una commissione di esperti. I LARN formano la base per definire strumenti come linee guida e obiettivi nutrizionali per la popolazione, e possono essere usati per la sorveglianza nutrizionale e in dietetica. Comprendono AR, PRI, AI, RI, UL e SDT.
AR	Fabbisogno medio <i>Average Requirement</i>	Il livello di assunzione del nutriente che è sufficiente a soddisfare i fabbisogni del 50% di soggetti sani in uno specifico gruppo di popolazione.
PRI	Assunzione raccomandata per la popolazione <i>Population Reference Intake</i>	Il livello di assunzione del nutriente sufficiente a soddisfare il fabbisogno di quasi tutti (97,5%) i soggetti sani in uno specifico gruppo di popolazione.
AI	Assunzione Adeguata <i>Adequate Intake</i>	Il livello di assunzione del nutriente che si assume adeguato a soddisfare i fabbisogni della popolazione. In genere si ricava dagli apporti medi osservati in una popolazione apparentemente sana ed esente da carenze manifeste. È usato quando AR e PRI non possono essere ragionevolmente formulati sulla base delle evidenze scientifiche disponibili.
RI	Intervallo di riferimento per l'assunzione di macronutrienti <i>Reference Intake range for macronutrients</i>	L'intervallo di assunzione di lipidi e carboidrati (espresso in funzione dell'apporto totale con la dieta) che permette un'introduzione adeguata di tutti gli altri micro- e macronutrienti. Tiene conto degli effetti sulla salute associati ad apporti o a livelli estremi (bassi o alti) di apporto dello specifico macronutriente.
UL	Livello massimo tollerabile di assunzione <i>tolerable Upper intake Level</i>	Il valore più elevato di assunzione del nutriente che si ritiene non associato a effetti avversi sulla salute nella totalità degli individui di uno specifico gruppo di popolazione. Superato l'UL, il rischio potenziale di eventi avversi cresce all'aumentare degli apporti.
SDT	Obiettivo nutrizionale per la prevenzione <i>Suggested Dietary Target</i>	Obiettivi (quantitativi o qualitativi) di assunzione di nutrienti o di consumo di alimenti e/o bevande, il cui raggiungimento indica la riduzione del rischio di malattie cronico-degenerative nella popolazione generale.

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L'acronimo **LARN** corrisponde a **“Livelli di Assunzione di Riferimento di Nutrienti ed energia per la popolazione italiana”**.

Revisione 2014 rappresenta l'insieme dei valori di riferimento per la popolazione italiana utili a valutare l'adeguatezza della dieta.

Nutrients requirements?

Società Italiana di Nutrizione Umana-
SINU, 2014

LARN - Livelli di assunzione di
riferimento per la popolazione
italiana: VITAMINE.

Assunzione raccomandata per la
popolazione (PRI in grassetto) e
assunzione adeguata (AI in corsivo):
valori su base giornaliera.

Per le fasce d'età si fa riferimento all'età anagrafica;
ad esempio per 4-6 anni s'intende il periodo fra il
compimento del quarto e del settimo anno di vita.
L'intervallo 6-12 mesi corrisponde al secondo
semestre di vita.

La niacina è espressa come niacina equivalenti (NE) in
quanto comprende anche la niacina di origine
endogena sintetizzata a partire dal triptofano (60 mg
di triptofano = 1 mg di NE).

Per i folati, i livelli di assunzione di riferimento per le
donne in età fertile (che programmano o non
escludono una gravidanza) e in gravidanza non
includono supplementazioni indicate per la
prevenzione dei difetti del tubo neurale.

La vit. A è espressa in µg di retinolo equivalenti (1 RE =
1 µg di retinolo = 6 µg di beta-carotene = 12 µg di altri
carotenoidi provitaminici).

La vit. D è espressa come colecalciferolo (1 µg di
colecalciferolo = 40 IU vit. D). La PRI considera sia gli
apporti alimentari sia la sintesi endogena nella cute.

La vit. E è espressa in alfa-tocoferolo equivalenti (1 α-
TE = 1 mg RRR-tocoferolo = 1,5 UI = 2 mg β-tocoferolo
= 3 mg γ-tocotrienolo = 10 mg γ-tocoferolo).

		Vit. C (mg)	Tiamina (mg)	Riboflavina (mg)	Niacina (mg)	Ac pantotenico (mg)	Vit. B ₅ (mg)	Biotina (µg)	Folati (µg)	Vit. B ₁₂ (µg)	Vit. A (µg)	Vit. D (µg)	Vit. E (mg)	Vit. K (µg)
LATTANTI	6-12 mesi	35	0,3	0,4	5	2,0	0,4	7	110	0,7	450	10	4	10
BAMBINI-ADOLESCENTI														
	1-3 anni	35	0,4	0,5	7	2,0	0,5	10	140	0,9	300	15	5	50
	4-6 anni	45	0,5	0,6	8	2,5	0,6	15	170	1,1	350	15	6	65
	7-10 anni	60	0,8	0,8	12	3,5	0,9	20	250	1,6	500	15	8	90
Maschi	11-14 anni	90	1,1	1,3	17	4,5	1,2	25	350	2,2	600	15	11	130
	15-17 anni	105	1,2	1,6	18	5,0	1,3	30	400	2,4	700	15	13	140
Femmine	11-14 anni	80	1,0	1,2	17	4,5	1,2	25	350	2,2	600	15	11	130
	15-17 anni	85	1,1	1,3	18	5,0	1,3	30	400	2,4	600	15	12	140
ADULTI														
Maschi	18-29 anni	105	1,2	1,6	18	5,0	1,3	30	400	2,4	700	15	13	140
	30-59 anni	105	1,2	1,6	18	5,0	1,3	30	400	2,4	700	15	13	140
	60-74 anni	105	1,2	1,6	18	5,0	1,7	30	400	2,4	700	15	13	170
	≥75 anni	105	1,2	1,6	18	5,0	1,7	30	400	2,4	700	20	13	170
Femmine	18-29 anni	85	1,1	1,3	18	5,0	1,3	30	400	2,4	600	15	12	140
	30-59 anni	85	1,1	1,3	18	5,0	1,3	30	400	2,4	600	15	12	140
	60-74 anni	85	1,1	1,3	18	5,0	1,5	30	400	2,4	600	15	12	170
	≥75 anni	85	1,1	1,3	18	5,0	1,5	30	400	2,4	600	20	12	170
GRAVIDANZA		100	1,4	1,7	22	6,0	1,9	35	600	2,6	700	15	12	140
ALLATTAMENTO		130	1,4	1,8	22	7,0	2,0	35	500	2,8	1000	15	15	140

Why it is important to know nutritional requirements?

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You need to know nutritional requirements of an individual or group for two major reasons:

Prescriptive reasons: that is, to provide or dispense food supplies; for example:

- to procure food for national consumption
- to secure food for institutional consumption
- to run nutritional supplementation programmes.

Diagnostic reasons: mainly to identify whether a group or an individual is suffering from malnutrition of any kind; for example:

- to evaluate nutritional intervention programmes
- to determine whether the food available in the stock is adequate to feed the household or nation for a certain duration of time.
- In order to estimate nutritional requirements of individuals or groups, we need to consider the following factors:

Physical activity — whether a person is engaged in heavy physical activity

The age and sex of the individual or group

Body size and composition — what the general build is of a person or group

Climate — whether a person or group is living in hot or cold climate

Physiological states, such as pregnancy and lactation.

Based on these factors, nutritional requirements in the different segments of the population can be classified into four groups. These correspond to different parts of the lifespan, namely (a) pregnancy and lactation, (b) infancy and childhood (c) adolescence and adulthood, and (d) old age.

A healthy diet is a sustainable diet: recommendations for healthy eating

Currently, few dietary guidelines take sustainability issues into account. However, there is growing evidence that human health and environment “win-wins” are possible and some common messages are emerging to promote both human and environmental well-being (15):

- › Eat a wide variety of foods from different food groups, with an emphasis on plant-based foods.
- › Consume just enough calories to meet energy needs. Overeating is detrimental to human and planetary health.
- › Choose fresh and home-prepared, locally produced foods. Avoid highly processed foods, especially those which are high in fat, sugar or salt and/or low in vitamins, minerals and fibre. It is important to check food labels.
- › Eat at least two to three portions of fruit every day, preferably fresh, seasonal and locally sourced. WHO recommends eating more than five portions (400 grams) of fruits and vegetables combined per day (10).
- › Eat at least two to three portions of vegetable every day. Choose vegetables grown in fields, rather than in a greenhouse or those preserved in sustainable ways (such as fermentation) and which do not need rapid, energy-intensive transport. Reduce food wastage by also eating “ugly” vegetables and fruits – cosmetic imperfections do not mean less nutritious produce.
- › Potatoes, sweet potatoes, cassava and other starchy roots do not count as portions of vegetables, but do feature in a healthy diet, preferably in minimally processed forms.
- › Cereals should be mainly consumed as whole grains – such as unprocessed maize, millet, oats, wheat or brown rice – rather than in refined forms (e.g. white rice, bread or pasta).
- › Consume moderate amounts of milk and dairy products (or dairy alternatives) and choose versions that are low in fat, salt and sugar.
- › Limit consumption of red meat and processed meat products (10) – some national and international bodies suggest limits of around 500 grams of cooked meat per week, with very small amounts, if any, of processed meat products (21,22,23,24).
- › Consume fish and shellfish around twice a week, preferably from recognized/certified sustainable sources.
- › Eat pulses (sometimes known as legumes) regularly. Dried beans, peas and lentils are excellent sources of protein, fibre and other nutrients and are naturally low in fat. Pulses are a good alternative to meat, and can play a key role in future healthy and sustainable diets.
- › Include modest amounts of fats and oils, mainly from vegetable sources, and, preferably those containing unsaturated fats. Avoid industrially produced *trans*-fats (e.g. partially hydrogenated oils), which can be found in processed food, fast food, snack food and fried foods. Use healthier cooking methods, use vegetable oils and boil, steam or bake rather than fry.
- › Drink safe tap water (or from other improved sources such as protected boreholes) in preference to other drinks, especially sugar-sweetened drinks. Intakes of fruit juice should also be limited, since these contributes to free sugars – one 150 ml glass of unsweetened orange juice, for example, contains around 15 g of free sugars (9).
- › Prepare food using hygienic practices – washing hands before handling food and after going to the toilet, sanitizing surfaces and protecting them from insects, pests and animals, separating raw and cooked food, cooking food thoroughly and storing at safe temperatures, and using safe water to wash produce eaten raw (25).



1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE
2. MORE CEREALS, LEGUMES, VEGETABLES AND FRUITS
3. FATS: CHOOSE THE QUALITY AND LIMITS THE AMOUNT
4. SUGARS, SWEETS AND SUGARY DRINKS: WITHIN JUST LIMITS
5. DRINK WATER EVERY DAY
6. THE SALT? BETTER A LITTLE
7. SOFT DRINKS: ONLY IN CONTROLLED AMOUNTS
8. VARY OFTEN YOUR FOOD CHOICES

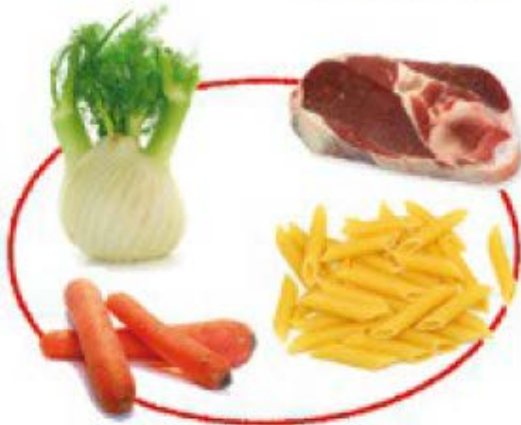
Ripartizione giornaliera dei pasti:



Colazione 20%



Spuntino 5%



Pranzo 40%








Merenda 5%



Cena 30%

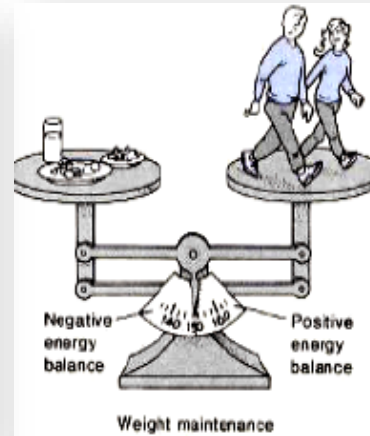
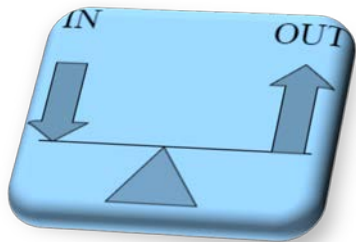
LARN e dieta equilibrata

I nuovi principi guida dell'alimentazione giornaliera

	ORA*	PRIMA
 PROTEINE	0,90 g per chilogrammo di peso corporeo	0,95 g per chilogrammo di peso corporeo
 GRASSI	20-35% delle calorie totali	25% delle calorie totali
<ul style="list-style-type: none">• Colesterolo	Non viene indicato un valore di riferimento, ma più attenzione ai grassi saturi	Meno di 300 mg al giorno
 CARBOIDRATI	45-60% delle calorie totali	Almeno 55% delle calorie totali
<ul style="list-style-type: none">• Zuccheri• Fibra	Meno del 15% delle calorie totali Da 12 a 17 g circa per 1.000 kcal con un minimo di 25 g	Meno del 10-12% delle calorie totali 30 g
 VITAMINE	Vitamina C 105 mg per gli uomini 85 mg per le donne	60 mg
	Folati 400 mcg	200 mcg
	Vitamina D 15 mcg	0-10 mcg
 CALCIO	1.000 mg (1.200 mg per le donne in menopausa che non sono in terapia estrogenica)	800 mg (1.200-1.500 mg per le donne in menopausa che non sono in terapia estrogenica)

*I dati si riferiscono all'adulto sano, età 30-59 anni

1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE



To maintain physiologic functions, the human body continuously expends energy by oxidative metabolism. This energy is used to maintain chemical and electrochemical gradients across cellular membranes for the biosynthesis of macromolecules such as proteins, glycogen, and triglycerides, and for muscular contraction. Another part of the energy is lost as heat because of the inefficiency of metabolic transformations. Ultimately all the energy produced by the organism is dissipated as heat. The energy expended by an individual can be assessed by two different techniques: indirect and direct calorimetry.

1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE

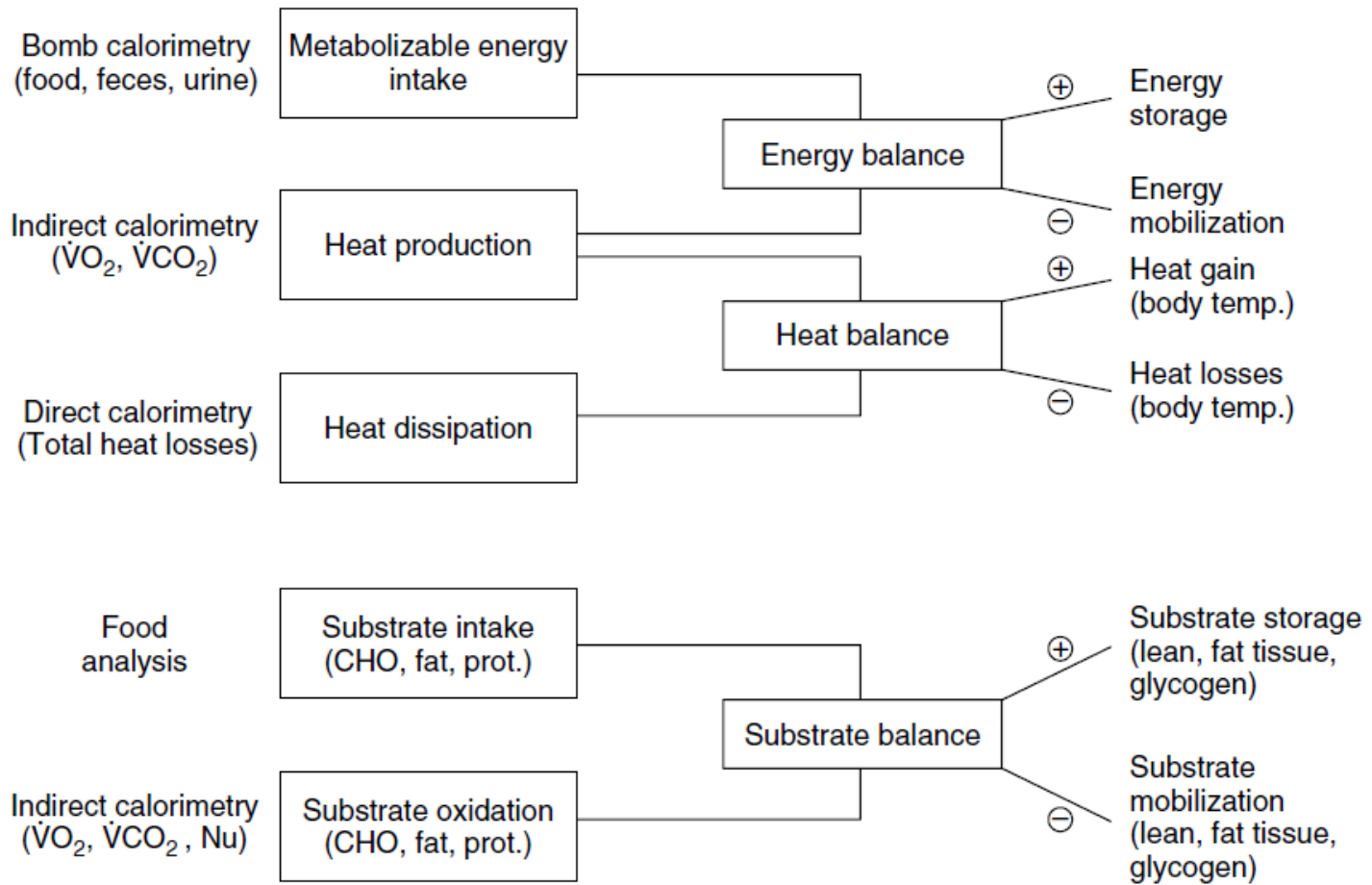


Figure 1 Heat balance, energy balance, and substrate balance: three different concepts.

1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE

$$\text{energy intake} = \text{energy expenditure} + \Delta \text{ energy stores}$$

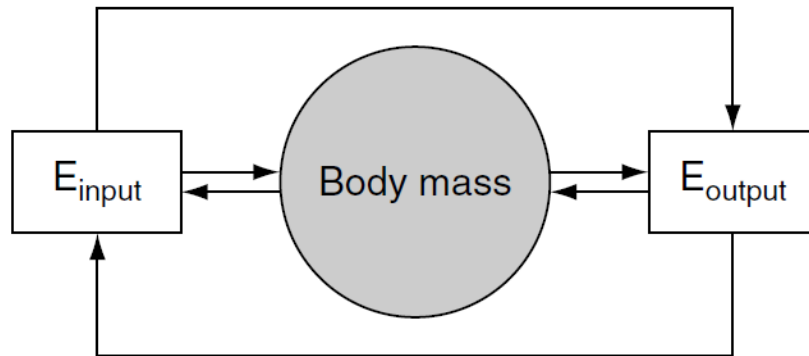


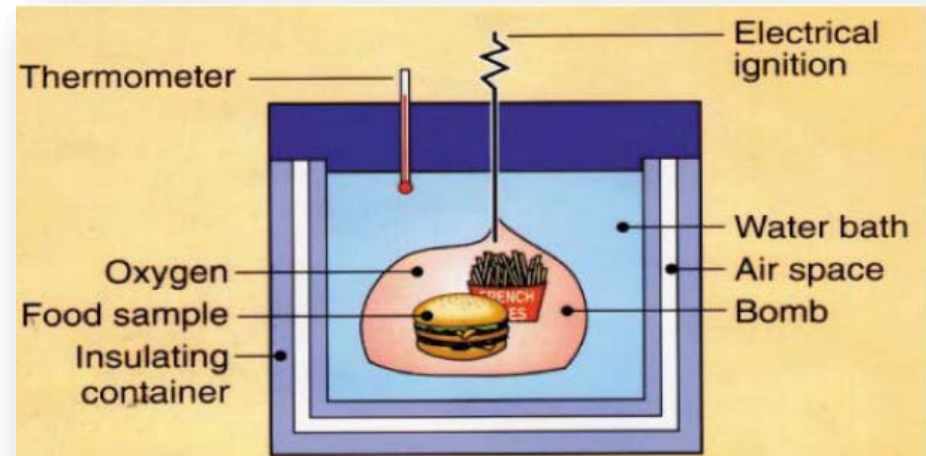
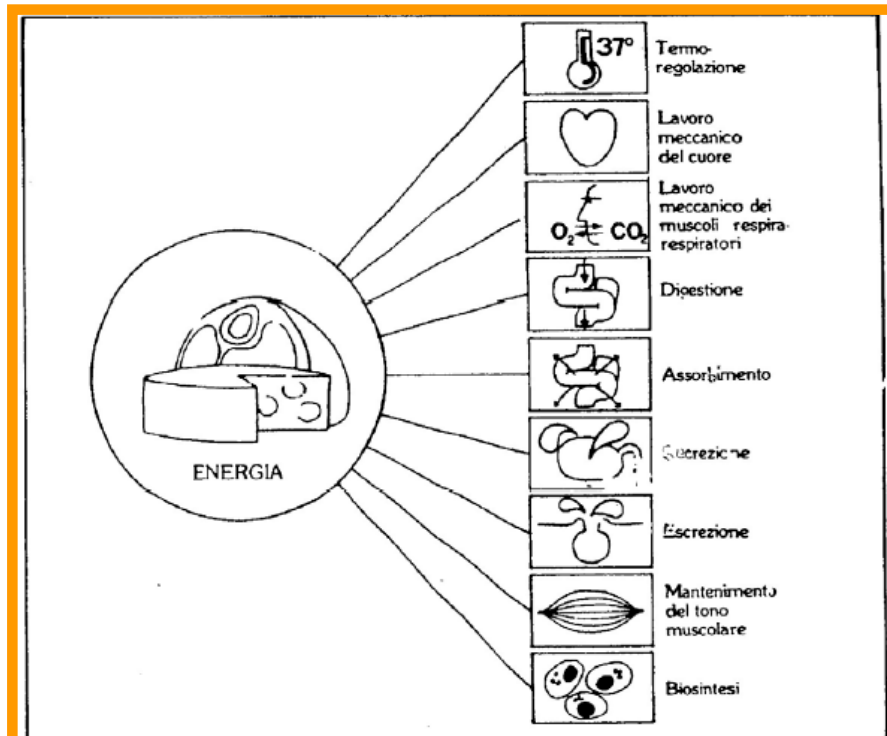
Figure 2 Simple model of energy (E) balance. Long-term constancy of body weight through the regulation of energy balance is achieved through a highly complex network of regulatory systems operating through changes in food intake, in energy expenditure, and body energy content (i.e., change in body composition).

Thus, if the total energy contained in the body (as fat, protein, and glycogen) is not altered (i.e., energy stores=0), then energy expenditure must be equal to energy intake. In this case, the individual is said to be in a state of energy balance.

Negative energy balance resulting in the utilization of the body's energy stores (glycogen, fat, and protein)

Positive energy balance resulting in an increase in body energy stores, primarily as fat.

1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE



In human digestibility and adsorbtion influence the total energy released from food

Table 1 Metabolizable energy (ME) and Atwater's factors

Nutrient	Gross energy in kJ g^{-1} (kcal g^{-1})	% Absorbed (Atwater's values)	Digestible energy in kJ g^{-1} (kcal g^{-1})	Urinary loss in kJ g^{-1} (kcal g^{-1})	Metabolizable energy in kJ g^{-1} (kcal g^{-1})	Atwater's factor ¹ (kcal g^{-1})
Starch	17.5 (4.2)	99	17.3 (4.15)	–	17.3 (4.15)	4
Glucose	15.6 (3.75)	99	15.4 (3.7)	–	15.4 (3.7)	4
Fat	39.1 (9.35)	95	37.1 (8.88)	–	37.1 (8.88)	9
Protein	22.9 (5.47)	92	21.1 (5.04)	5.2 (1.25)	15.9 (3.8)	4
Alcohol	29.8 (7.1)	100	29.8 (7.1)	Trace	29.8	7

1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE

Esempio Metodo per calcolare il valore calorico di un alimento conoscendo la sua composizione e gli equivalenti calorici secondo Atwaters

Gelato alla vaniglia(100g)	proteine	carboidrati	lipidi
Percentuale (%)	4	13	21
Peso in un g di sostanza	0.04	0.13	0.21

$(0.04 \times 4 \text{Kcal}) + (0.13 \times 4 \text{Kcal}) + (0.21 \times 9 \text{Kcal})$ Calorie totali per g = 2.57 Kcal

Calorie totali per 100g = 257 Kcal



Diet composition and guidelines

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PORTION SIZE

standard amount of food expressed in g, which is assumed as a unit of measurement to be used for a balanced diet

GRUPPI ALIMENTI	ALIMENTI	PORZIONI (gr.)	
CEREALI E TUBERI	Pane	1 rosetta piccola/1 fetta media	50
	Prodotti da forno	2-4 biscotti - 2,5 fette biscottate	20
	Pasta o riso (*)	1 porzione media	80
	Pasta fresca all'uovo (*)	1 porzione piccola	120
	Patate	2 patate piccole	200
ORTAGGI E FRUTTA	Insalate	1 porzione media	50
	Ortaggi	1 finocchio/2 carciofi	250
	Frutta o succo	1 frutto medio (arance, mele)	150
		2 frutti piccoli (albicocche mandarini)	150
CARNE, PESCE, UOVA, LEGUMI	Carne fresca	1 fettina piccola	70
	Carne stagionata	3-4 fette medie prosciutto	50
	Pesce	1 porzione piccola	100
	Uova	1 uovo	60
	Legumi secchi	1 porzione media	30
	Legumi freschi	1 porzione media	80-120
GRASSI DA CONDIMENTO	Olio	1 cucchiaio	10
	Burro	1 porzione	10
	Margarina	1 porzione	10
LATTE E DERIVATI	Latte	1 bicchiere	125
	Yogurt	1 confezione piccola	125
	Formaggio fresco	1 porzione media	100
	Formaggio stagionato	1 porzione media	50

Diet composition and guidelines

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Porzioni dei principali alimenti dei vari gruppi e numero di porzioni per comporre una razione alimentare giornaliera di circa 2000 kcal.

GRUPPI DI ALIMENTI	ALIMENTI	PORZIONE	N.° PORZ./DIE
LATTE E DERIVATI	Latte	g 125 (un bicchiere)	2
	Yogurt	g 125 (un vasetto)	
	Formaggio stagionato Formaggio fresco	g 50 g 100	0-1
CARNI	Carni fresche	g 100	1
	Carni conservate	g 50	
PESCI	Pesce	g 150	0-1
UOVA	Uovo	uno (circa g 50)	
LEGUMI	secchi freschi	g 100 g 30	0-1
CEREALI E TUBERI	Tuberi	g 200	0-1
	Pane	g 50	3-4
	Prodotti da forno	g 50	0-1
	Pasta o riso (*)	g 80	1
	Pasta fresca all'uovo (*)	g 120	
	Pasta fresca e ripiena (*)	g 180	
ORTAGGI E FRUTTA	Insalate	g 50	2-4
	Ortaggi	g 250	
	Frutta o succo	g 150	2-4
GRASSI DA CONDIMENTO	Olio	g 10	3
	Burro	g 10	0-1
	Margarina	g 10	

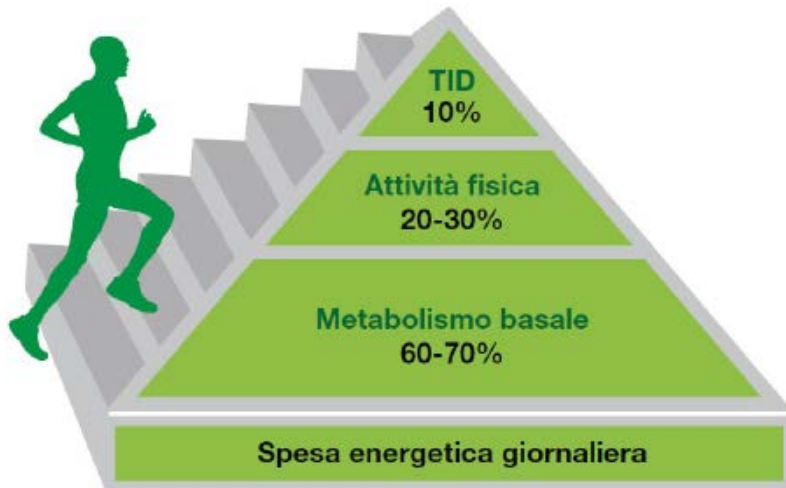
Diet composition and guidelines

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1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE – ENERGY REQUIREMENTS

Energy expenditure of individuals

The actual amount of energy needed varies from person to person and depends on their basal metabolic rate (BMR) and how active they are.



Stima della ripartizione in % dei vari tipi di fabbisogno energetico.

The energy requirement total is defined as the amount of energy, expressed in kcal (kilocalories) or kJ (kilojoule), necessary for keep the organism in good health for long time, according to a certain level of activity physics.

Basal metabolic rate (BMR) (the amount of energy expended while at rest at a neutral temperature and in the fasting state). BMR is the rate at which a person uses energy to maintain the basic functions of the body – breathing, keeping warm, keeping the heart beating – when at complete rest.

The **thermic effect of food (TEF)** (otherwise known as dietary-induced thermogenesis). The TEF is the energy cost of digesting food, and is rarely assessed separately.

Physical activity level is the energy expended in movement of all types.

An estimate of the amount of energy an individual will need can be calculated by multiplying their BMR by a factor appropriate to the amount of activity that person does (known as the Physical Activity Level (PAL))

Energy expenditure = BMR x Physical Activity Level (PAL)

TABELLA 6.4 – CONTRIBUTO DI DIFFERENTI ORGANI E TESSUTI AL DISPENDIO ENERGETICO BASALE

ORGANI E TESSUTI	PESO (%)	kcal/kg/DIE	MB (%)
Visceri:	5,5	1320	58
• Fegato	2,6	200	21
• Cervello	2,0	240	20
• Cuore	0,5	440	9
• Reni	0,4	440	8
Muscoli	40,0	13	22
Tessuto adiposo	21,4	4,5	4
Altro (ossa, ghiandole, ecc)	33,1	12	16
Totale	100		100 (1680 kcal/die)

Il metabolismo di base per l'uomo di riferimento (1680 kcal/die) rappresenta il valore medio ottenuto da vari standard per un tipico soggetto adulto di 30 anni e IMC 22,5 kg/m².

Da: Elia M, 1992b.

Mariani-Costantini, Cannella, Tomassi, Alimentazione e Nutrizione Umana, Il Pensiero Scientifico

Basal metabolic rate (BMR)

**La massa magra contribuisce principalmente
al dispendio energetico basale**

Diet composition and guidelines

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1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE – ENERGY REQUIREMENTS

Table 3 Determinants of resting (basal) metabolic rate

- Body size
- Body composition (lean vs. obese)
- Gender
- Age
- Physiological status (growth, pregnancy, and lactation)
- Genetic make-up
- Hormonal status (e.g., Follicular ve luteal phase)
 - Temperature (body internal and environment)
 - Pharmacological agents (e.g., nicotine and caffeine)
 - Disease (fever, tumors, burns, etc.)

Predictive equation

Età (anni)	Formule di Schoenfield (kcal/die)	
	Maschi	Femmine
9	$22,706 \times PC^* + 504,3$	$20,315 \times PC + 485,9$
18-29	$15,057 \times PC + 692,2$	$14,818 \times PC + 486,6$
30-60	$11,472 \times PC + 873,1$	$8,126 \times PC + 845,6$

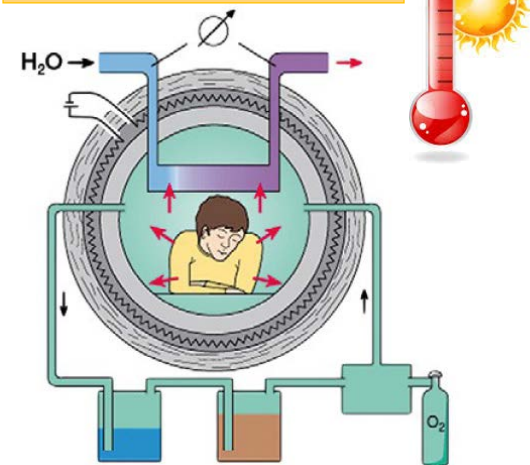
*PC = peso corporeo espresso in kg

	Formule di Harris- Benedict (kcal/die)	
	Maschi	Femmine
Maschi	$66,5 + 13,75 \times PC + 500 \times A - 6,75 \times E$	
Femmine		$655 + 9,56 \times PC + 185 \times A - 4,67 \times E$

PC = peso corporeo espresso in kg; A = altezza in metri; E = età in anni

Basal metabolic rate (BMR)

Direct calorimetry



Indirect calorimetry

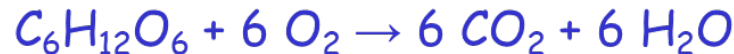
$$\frac{\text{Vol CO}_2}{\text{Vol O}_2}$$



1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE – ENERGY REQUIREMENTS

La produzione di CO_2 ed il consumo di O_2 è direttamente relazionato ai substrati utilizzati

carboidrato



Il quoziente respiratorio sarà pertanto uguale a: $6 CO_2 / 6 O_2 = 1$

lipide (acido palmitico)



Il quoziente respiratorio sarà pertanto uguale a: $16 CO_2 / 23 O_2 = 0,696$

Proteina (albumina)



Il quoziente respiratorio sarà pertanto uguale a: $63 CO_2 / 77 O_2 = 0,818$

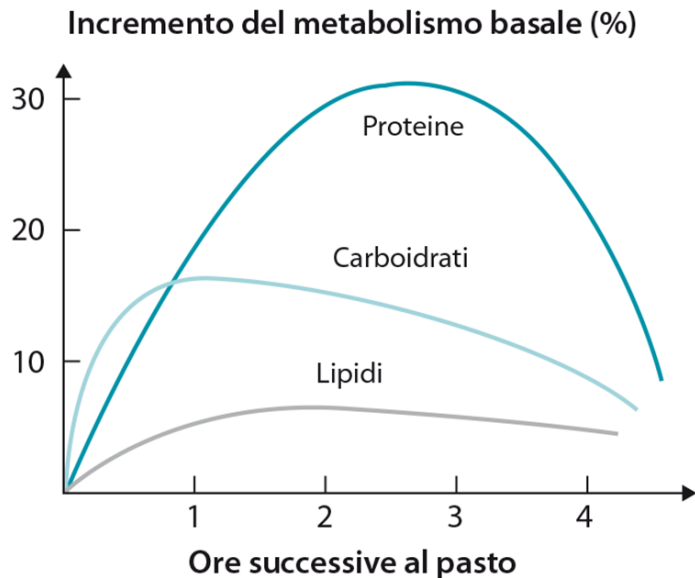
Fattori che possono modificare il QR sono: diabete e digiuno, lavoro muscolare intenso, ipo e iperventilazione

Diet composition and guidelines

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1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE – ENERGY REQUIREMENTS

thermic effect of food (TEF)



proteins equal to 10-35% of the energy ingested
) Ingested proteins are degraded in the gut into amino acids. After absorption, amino acids are deaminated, their amino group transferred to urea, and their carbon skeleton converted to glucose. These biochemical processes require the consumption of energy amounting to 25% of the energy content of amino acids. The second pathway of amino acid metabolism is protein synthesis. The energy expended for the synthesis of the peptide bonds also represents 25% of the energy content of amino acids. Therefore, irrespective of their metabolic pathway, the thermogenesis induced after absorption of amino acids represents 25% of their energy content

carbohydrates equal to 5-10% of the energy ingested

Glucose storage as glycogen requires 2 mol ATP/mol. In comparison with the 38 mol ATP produced on complete oxidation of glucose, the energy cost of glucose storage as glycogen corresponds to 5% (or 2/38) of the energy content of glucose stored. Cycling of glucose to glucose-6-phosphate and back to glucose, to fructose-1,6-diphosphate and back to glucose-6-phosphate, or to lactate and back to glucose, is occurring at variable rates and is an energy-requiring process that may increase the thermic effect of carbohydrates

lipids equal to 2-5% of the energy ingested

The thermic effect of dietary fat is very small. This slight increase in energy expenditure is explained by the ATP consumption in the process of free fatty acid reesterification to triglyceride. As a consequence, the dietary energy of fat is used very efficiently

Diet composition and guidelines

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1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE – ENERGY REQUIREMENTS

Level of physical activity (LAF)



The energy spent on physical activity depends on the type and intensity of the physical activity and on the time spent in different activities. Physical activity is often considered to be synonymous with 'muscular work', which has a strict definition in physics (force distance) when external work is performed in the environment.

There is a wide variation in the energy cost of any activity both within and between individuals. The latter variation is due to differences in body size and in the speed and dexterity with which an activity is performed. In order to adjust for differences in body size, the energy cost of physical activities are expressed as multiples of BMR.

Diet composition and guidelines

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1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE – ENERGY REQUIREMENTS

Level of physical activity (LAF)

IEI Integrated Energy Index
energy cost of a specific occupation.
The IEI includes the caloric cost of the various simple activities that constitute a specific occupation.
The IEI expresses itself as a multiple of the MB.

Energy expenditure=
BMR giornaliero x LAF + 10%TEF

Esempio : calcolo del fabbisogno energetico giornaliero per un soggetto di sesso femminile, attività occupazionale di commessa, età 25 anni, normopeso , in salute.

MB 1306 kcal/die (54,4 kcal/ora)

		Giornata 1		Giornata 2	
		Casalinga		Impiegata	
	IEI	ore	kcal	ore	kcal
1) A letto	1,0	8	460	8	460
2) Attività professionali					
<i>a) cura della casa</i>	2,5	2	287	1	144
<i>b) lavoro da commessa</i>	1,9	-	-	8	873
3) Attività discrezionali					
<i>a) manutenzione casa</i>	2,5	2	287	-	-
<i>b) socialmente auspic.</i>	1,8	4	413	2	207
<i>c) att. fisica auspic.</i>	6,0	0,25	86	-	-
4) Resto del giorno	1,4	7,75	623	5	402
LAF GIORNALIERO		1,56		1,51	
Dispendio energetico			2156		2086

	Maschi	Femmine
Leggera		
•Casalinghe		1,6
•Impiegati	1,6	1,6
•Personale amministrativo e dirigenziale	1,6	1,6
•Liberi professionisti, tecnici	1,6	1,6
Moderata		
•Collaboratori domestici	2,25	1,90
•Commessi	2,25	1,90
Moderata /Pesante		
•Agricoltori, allevatori, pescatori	3,0	2,3
•Manovali	3,0	2,3
Pesante		
Come sopra, ma con scarsa meccanizzazione	3,8	2,8

Attività occupazionali dell'adulto medio e Indice Energetico Integrato (si riferiscono esclusivamente alla parte della giornata dedicata al lavoro)

Attività discrezionali dell'adulto medio e Indice Energetico Integrato

Cure personali	IEI	Attività produttive	IEI	Tempo libero	IEI
Igiene personale	2,50	Istruzione	1,50	Attività sportive	6,00
Pasti	1,50	Cura della casa	2,50	Att. relig., civile, polit.	1,80
Dormire+riposo	1,00	Cura dei figli	3,00	Camminate	4,00
		Acquisti - spesa	2,50	Lettura	1,10
				TV, Radio	1,10
				Freq. luoghi pubblici	1,50
				Hobbies	1,80
				"Non specificato"	1,40
				Spostamenti	2,00

Diet composition and guidelines

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1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE – ENERGY REQUIREMENTS

Stima dei fabbisogni energetici giornalieri totali di soggetti adulti italiani (18-60 anni)
in funzione del peso e attività condotta

TABELLA 26.2 VALORI INDICATIVI DI FABBISOGNO ENERGETICO (KCAL/DIE) PER ADULTI (18-60 ANNI) IN FUNZIONE DEL PESO E DEL TIPO DI ATTIVITÀ

	Peso (kg)	Attività lieve	Attività moderata	Attività pesante
Maschi	65-70	2300-2450	2800-3000	3300-3500
	70-75	2400-2550	2900-3100	3400-3700
Femmine	50-55	1750-1850	1900-2050	2100-2250
	55-60	1850-1950	2000-2150	2250-2400

Diet composition and guidelines

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1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE – ENERGY REQUIREMENTS

Table 4 Exogenous and endogenous factors influencing the three components of energy expenditure

<i>Components</i>	<i>Endogenous</i>	<i>Exogenous</i>
<ul style="list-style-type: none">• Basal metabolic rate	<ul style="list-style-type: none">• Fat-free mass• Thyroid hormones• Protein turnover	
<ul style="list-style-type: none">• Thermogenesis	<ul style="list-style-type: none">• Nutritional status• Sympathetic nervous system activity• Insulin resistance (obesity)	<ul style="list-style-type: none">• Macronutrient intake (+alcohol)• Cold exposure• Stress• Thermogenic stimuli (coffee, tobacco)• Thermogenic drugs
<ul style="list-style-type: none">• Physical activity	<ul style="list-style-type: none">• 'Fidgeting'• Muscular mass• Work efficiency• Fitness level ($\dot{V}O_2\text{max}$)	<ul style="list-style-type: none">• Duration intensity, and frequency of physical activity

Diet composition and guidelines

1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE

5. VALORI INDICATIVI DEL DISPENDIO ENERGETICO COMPLESSIVO PER OGNI MINUTO (KCAL/MINUTO) DI ALCUNE ATTIVITÀ

Dormire	0.9
Stare seduto	1.0
Stare in piedi inattivo	1.1
Scrivere al computer	1.3
Lavare la biancheria a mano	3.0-4.0
Pulire i pavimenti	3.6
Stirare	3.5-4.2
Pulire e battere i tappeti a mano	7.8
Montare circuiti elettronici	2.7
Intonacare una parete	4.1-5.5
Fare lavori agricoli	5.5-7.0
Spalare	6.0
Camminare in piano (4 km/ora)	2.5-3.5
Correre in bicicletta (22 km/ora)	11.1
Correre a piedi (12 km/ora)	15.0

6. KILOCALORIE APPORTATE DA ALCUNI ALIMENTI E TEMPO NECESSARIO PER SMALTIRLE SVOLGENDO ALCUNE ATTIVITÀ.

Alimento	Quantità g	Energia kcal	Camminare (4 km/ora) minuti	Bicicletta (22km/ora) minuti	Stare in piedi inattivo minuti	Stirare minuti
Biscotti secchi (n. 2-4 unità)	20	83	28	7	75	21
Cornetto semplice (n.1)	40	164	55	15	149	42
Merendine con marmellata (n.1)	35	125	42	11	114	32
Cioccolata al latte (4 unità)	16	87	29	8	79	22
Caramelle dure (n. 2 unità)	5	17	6	2	15	4
Aranciata (n. 1 lattina)	330	125	42	11	114	32
Panino imbottito con prosciutto cotto e formaggio	120	250	83	23	227	64
Pasta e fagioli (1 porzione)	350	300	100	27	273	77
Torta farcita con crema (1 porzione)	100	370	123	33	336	95
Gelato alla crema	150	330	110	30	300	85

1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE, THE IMPORTANCE OF BODY COMPOSITION

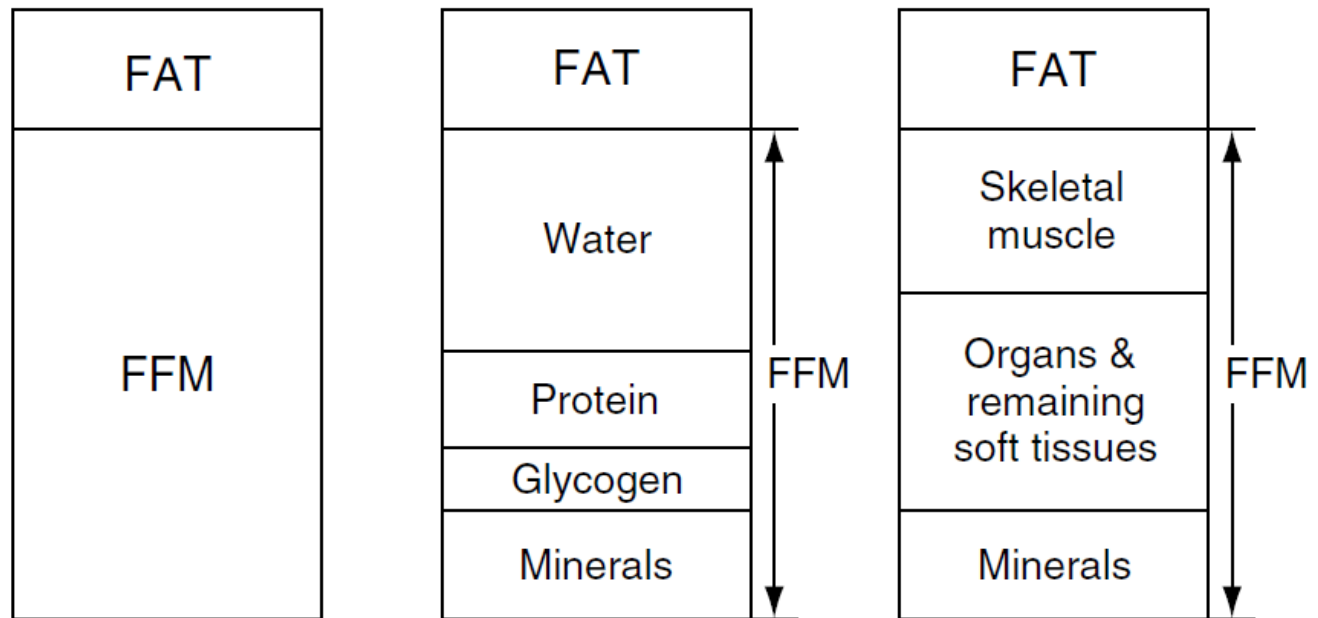


Figure 1 Three different models for characterizing body composition compartments. Components are as labeled: FFM, fat-free body mass.

1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE, THE IMPORTANCE OF BODY COMPOSITION

How body composition can be measured?

Dual-Energy X-Ray Absorptiometry (DXA)

Hydrodensitometry

Dilution Techniques

Anthropometry

Bioimpedance Analysis (BIA)

Body Mass Index

(BMI= weight kg/height m²)



IMC	Classificazione
< 18,5	Sottopeso
≥ 18,5 < 25,0	Intervallo di normalità
≥ 25,0 < 30,0	Sovrappeso
≥ 30,0 < 35,0	Obesità di I livello
≥ 35,0 < 40,0	Obesità di II livello
≥ 40,0	Obesità di III livello

Basic measurements

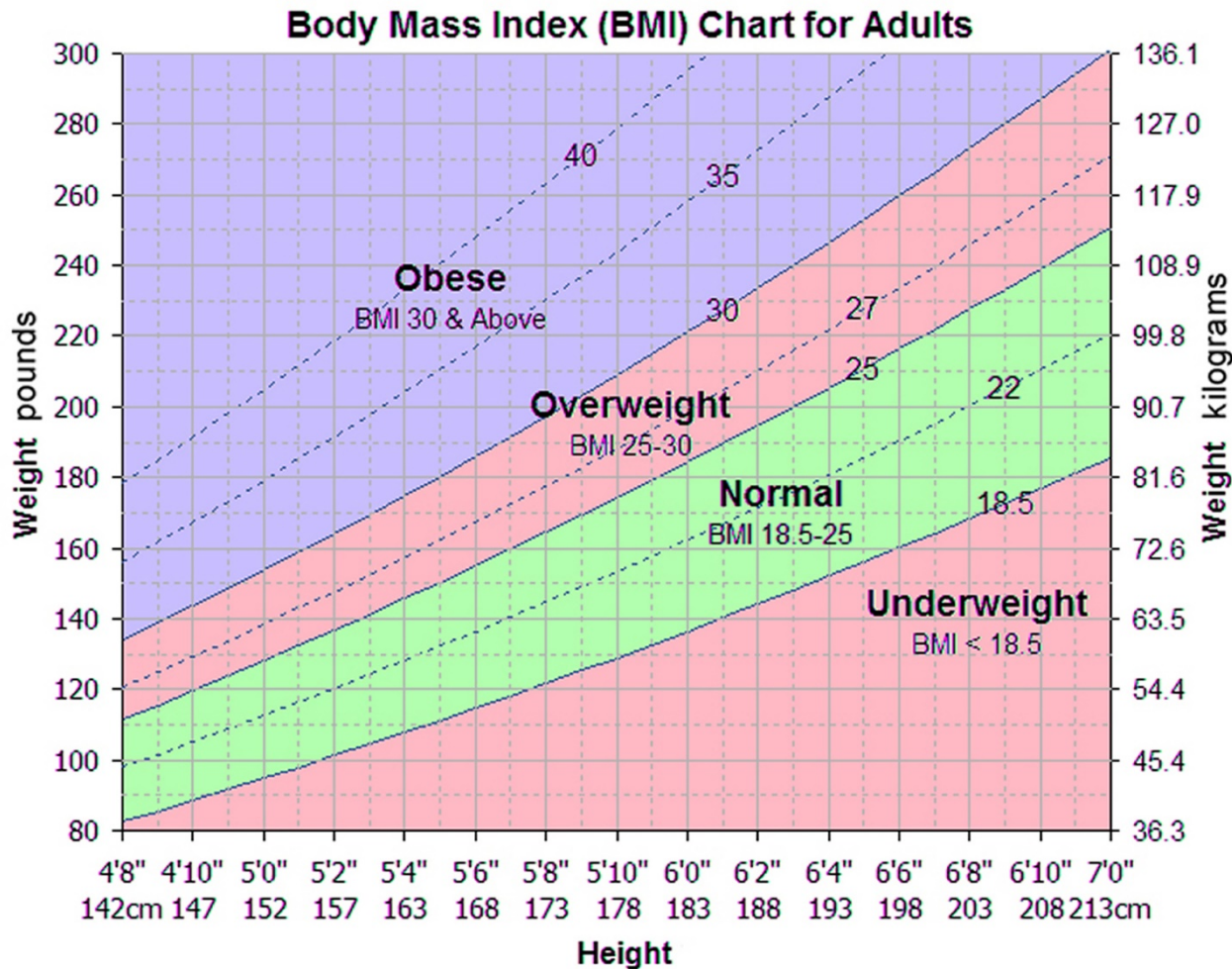
- Height (length)
- Weight (mass)
- Circumference eg OFC (infant up to age 2years only)
- Skin-fold thickness

Derived measurements of body composition and interrelationships (e.g BMI, waist-hip ratio)

Some measurements used for nutritional assessment include:

- Height
- Mass
- BMI
- Triceps skin-fold
- Waist, Hip and Mid-arm circumference (MAC) and derived measurements/ ratios

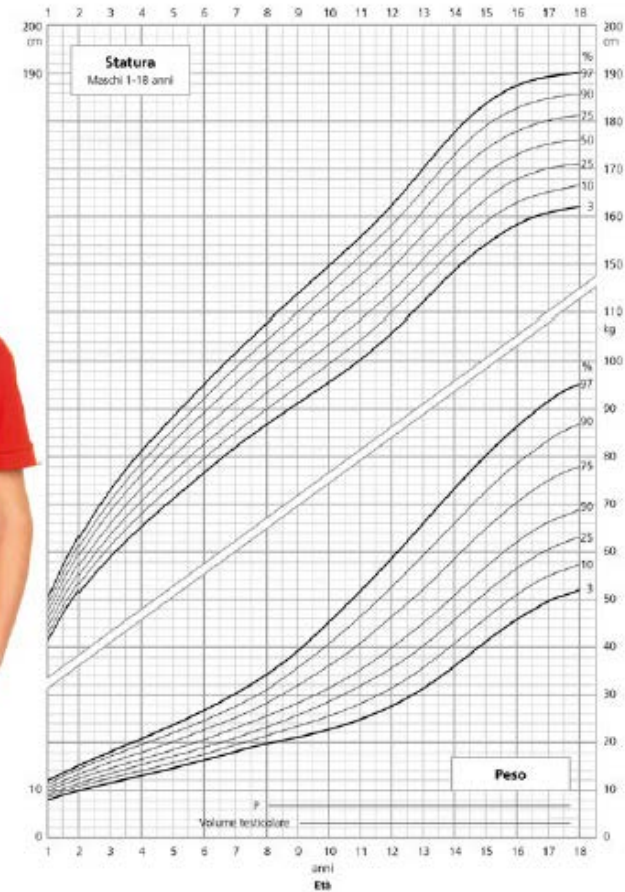
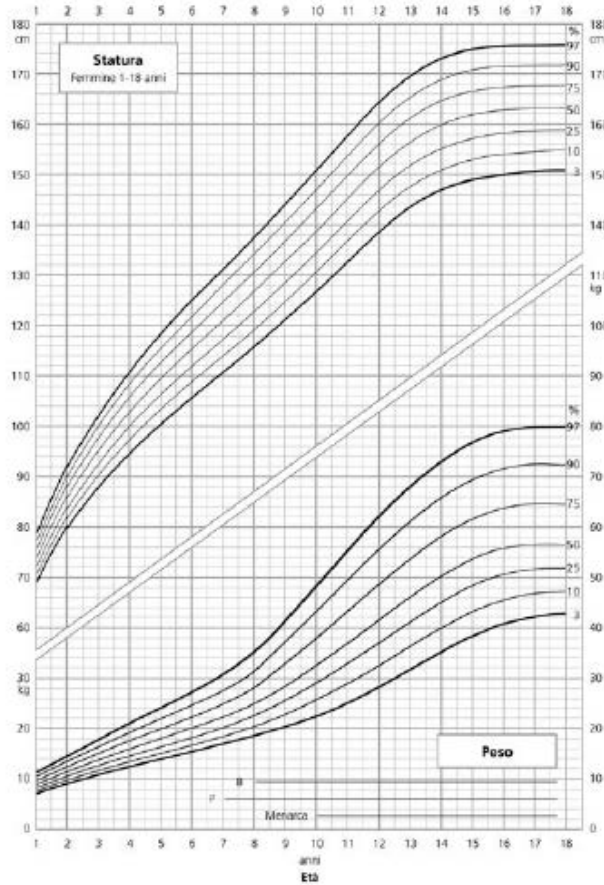
1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE, THE IMPORTANCE OF BODY COMPOSITION



Diet composition and guidelines

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1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE, THE



1. CHECK YOUR WEIGHT AND BE ALWAYS ACTIVE, THE IMPORTANCE OF BODY COMPOSITION

METODI PER LA VALUTAZIONE DELLO STATO DI NUTRIZIONE

Metodi clinici	Comprendono l'esame clinico e la valutazione dell'apporto dietetico dei vari nutrienti. Tra i più semplici vi è lo SGNA (<i>Subjective Global Nutritional Assessment</i>) che si basa sull'anamnesi di disturbi a carico dell'apparato gastroenterico, variazioni del peso corporeo, edemi, anoressia, vomito, diarrea, malattie croniche, riduzione del pannicolo adiposo e massa muscolare.
Metodi antropometrici	Sono di semplice esecuzione e non invasivi. Comprendono la misurazione dell'altezza, del peso, delle pliche cutanee, delle circonferenze degli arti, della vita e dei fianchi. Da queste misure si ricavano i dati per calcolare l'IMC.
Metodi biumorali	Consistono nell'analisi del sangue e delle urine per valutare il ricambio delle proteine viscerali. Si considerano l'albuminemia, l'emoglobinemia, la transferrinemia, la sideremia, il dosaggio RBP (<i>Retinol Binding Protein</i>) e la prealbumina, la cretinuria, l'indice creatinina/altezza.
Metodi immunologici	Riguardano sia l'immunità cellulo-mediata sia quella umorale: per esempio la conta dei linfociti, il dosaggio delle immunoglobuline e delle proteine del complemento, test cutanei di ipersensibilità ritardata o <i>skin test</i> .