



THE BASICS OF NUTRITION

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Nutrition is the science which deals with the study of physiological phenomena and the reactions of the body to the ingestion of food and the feeding behaviour of an individual or a population.

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1- Energy and kilocalories

Energy is expressed in kilojoules or **kilocalories** (kcal – most commonly used on food labelling etc.). It defines a food's "fuel" value for the body after ingestion. Energy comes from lipids (9 kcal/g), proteins (4 kcal/g) and carbohydrates (4kcal/g), as well as from alcohol (7 kcal/g).

The energy balance is the difference between energy intake and energy expenditure. It is balanced when energy intake equals energy expenditure.

Expenditure > Intake (balance deficit) → weight loss
Intake > Expenditure (balance surplus) → weight gain

Energy expenditure is the sum of:

- basic metabolic rate (energy expended at rest to sustain life): breathing, digestion, heart beat, etc.

- thermoregulation expenditure: the energy needed to maintain a body temperature of 37°C

- expenditure resulting from physical activity (the only expenditure that can be influenced voluntarily).

Energy needs differ according to age, gender, activity, etc. An adult diet below 1,500-1,600 kilocalories per day is unbalanced, leading to vitamin and mineral deficiencies. Requirements can exceed 5,000 kilocalories per day for certain athletes: during the mountain stages of the Tour de France or testing days spent under sail in the cold and rough areas of the Roaring Forties and Furious Fifties.

In our climate, the usual intake is between 1,800 and 2,800 kilocalories per day for a population of young people and adults.

2- Proteins and amino acids

Proteins and amino acids are nitrogenous compounds. A 70 kg adult in good health contains about 11 kg of proteins (muscle proteins, collagen, enzymes, hormones, etc.). They are renewed constantly, so the body needs them in its diet each day.

Amino acids are the building blocks of proteins. Twenty of them contribute to the development of our proteins, attaching to each other like pearls in a necklace. Of the 20 amino acids, 9 are considered essential as the body is unable to manufacture them. They must be provided by food. These are: histidine, leucine, isoleucine, valine, lysine, methionine, phenylalanine, tryptophan and threonine.

Protein requirements are proportionally higher in children than in adults because of needs during growth - formation of muscle, organs (liver, intestines, heart, stomach, etc.)

Between the ages of 3 and 10, protein needs are 0.9 g per kg body weight per day. A child weighing 15 kg needs 13.5 g of protein per day (about 70 g of meat or fish per day), while a child weighing 30 kg needs 27 g of protein per day (about 135 g of meat or fish per day).

In adults in good health, the needs are about 0.8 g of protein per kg body weight per day, and represent 10-15% of total energy intake.

Proteins in the diet are found in products of animal origin:

		For an adult portion
Meat, fish:	20% of proteins	30 g
Egg:	12%	12 g
Milk:	3.2% (1/2 cream UHT)	6.5 g
Camembert:	21%	6.3 g
Yoghurt:	4%	5 g

as well as in products of plant origin:

Tofu (soya):	11.5%	11.5 g
Chickpeas:	9%	9 g
Dry haricot beans, cooked:	7%	14 g
Peas:	6%	12 g
Broad beans:	5%	10 g
Sweetcorn:	3%	3 g
Pasta:	4.5%	9 g
Baguette:	8%	12 g

These figures show that it is extremely easy to exceed the necessary amounts of protein (56 g per day for a 70 kg person, 44 g per day for a 55 kg person). Most French people consume too much protein.

The excess protein absorbed is excreted by the kidneys, putting them under high stress. The excess can also lead to a disease called "gout" which is often the precursor to arthritis.

On the other hand, an insufficiency of protein can lead to diseases often associated with the nutrients accompanying them: iron and calcium deficiencies, for example.

3- Lipids and fatty acids

Lipids play a role in storing energy in the body (triglycerides), in the formation of cellular membranes (phospholipids, cholesterol) and as precursors of other molecules that regulate cell function.

The amount of lipids in the body varies from one individual to another, unlike proteins and carbohydrates, which have comparable values. The lowest levels of lipids are found in endurance athletes, especially marathon runners whose body fat can fall to below 5% of body weight, whereas this figure is 12 to 25% in a person of normal build. These are the food compounds that provide the most energy, at 9 kcal per gram of lipids.

Lipids are made up mostly by the family of fatty acids consisting primarily of triglycerides and phospholipids, as well as steroids (cholesterol), fat-soluble vitamins, (A, D, E, K), etc.

Fatty acids are linear chemical compounds that can contain either no double bond (saturated fatty acid or SFA), a double bond (mono-unsaturated fatty acid or MUFA), or several double bonds (polyunsaturated fatty acid or PUFA).

Saturated fatty acids These are synthesised by the human body and are present in foods mainly of animal origin (cattle, sheep) and in hydrogenated plant fats (e.g. copra). SAF do not always have the same nutritional value. Some play a role in the formation of phospholipid and triglyceride reserves or in the structure of certain nerve membranes such as myelin, others present in excess contribute to hypercholesterolaemia and are therefore an important risk factor in cardiovascular disease, while butyric acid, produced in the body by fibre degeneration, inhibits tumour proliferation.

Mono-unsaturated fatty acids These represent the largest proportion of ingested fatty acids, with the highest amount coming from oleic acid, found mainly in olive oil but also in some animal fats (goose fat). They are used as a source of energy and are found in the triglyceride deposits which they keep liquid at body temperature.

Polyunsaturated fatty acids These are the most important in our diet from a quality standpoint as some (which the body cannot synthesise) are considered essential: these are linoleic acid (C18:2, n-6) and alpha-linolenic acid (C18:3, n-3). The two main functions of PUFAs are the formation of membranes and their fluidity, and the synthesis of specific mediators.

They are found in vegetables such as rape, soya bean and sunflowers (in the form of seed or oil).

There is also an even more important family - **long-chain polyunsaturated fatty acids: EPA and DHA.**

The specific physiological roles of the **Omega 6 (n-6) PUFA family**: reproductive function, skin integrity, platelet function (blood coagulation), regulation of lipemia (cholesterol), the immune and inflammatory systems.

The specific physiological roles of the **Omega 3 (n-3) PUFA family**: vision, nervous system, and regulation of circulating triglyceride levels
PUFA n-6 may compete with PUFA n-3, so it is important to maintain a ratio of 5:1 between these 2 families.

PUFAs are found mainly in plant oils and in animal fats:

- **n-6 family**: ground nut, walnut, soya, sunflower, maize and grapeseed oils
- **n-3 family**: rapeseed, walnut, soya and fish oils (especially in cold sea fish).

Recommended fatty acid requirements

A balanced diet should contain an amount of lipids equal to between 30 and 35% of total energy intake (TEI). Below 30%, the fatty acid balance is not assured, while above 35% there is considerable risk of fat being stored in the body.

The recommended breakdown is:

Saturated fatty acids: 8% of TEI

Mono-unsaturated fatty acids: 20% of TEI

Polyunsaturated fatty acids: 5% of TEI, with a ratio of 1:5 between alpha-linolenic acid (n-3) and linoleic acid (n-6).

The agro-industrial processing of food sometimes modifies the chemical structure of unsaturated fatty acids, making them a 'trans' form. This form increases the level of LDL cholesterol and therefore the risk of cardio-vascular disease.

4- Carbohydrates and sugars

The carbohydrates contain the simple sugars (mono- and disaccharide) and the complex sugars or polysaccharides. Dietary fibre forms part of the same family but is dealt with in a separate section because it guarantees particular functions in the body.

Main carbohydrates:

Monosaccharides glucose, galactose, fructose Disaccharides saccharose (sugar), lactose Polysaccharides cellulose, starch, inulin, glycogen

The carbohydrates are characterised by their glycaemic index, that is their ability to increase the level of glucose in the blood.

Low glycaemic index (less than 50) (preferred in the diet): fructose, lactose, cherry, apple, pear, peach, grapefruit, bran bread, pasta, chickpeas, green peas, lentils, dry beans, milk, yoghurt

Intermediate glycaemic index (between 50 and 74): saccharose, kiwi fruit, banana, mango, pineapple, orange juice, baguette, rye bread, rice, new potatoes, beetroot, carrots, chips, pizza, pastries, croissant, ice-cream

High glycaemic index (above 75) (to limit in the diet): honey, glucose, maltose (beer), watermelon, corn flakes and other ready-made cereals, quick-cook rice, swedes, chips, mashed potato mix, waffles, broad beans

A balanced diet contains 50-55% of its energy intake in the form of carbohydrates (or 1,000 to 1,100 kcal for a 2,000 kcal balanced diet). This means a minimum of 250 g of carbohydrates should be ingested each day.

Their role is like that of fuel. The ingested carbohydrates are transformed into glucose which provides energy for the brain, muscles, etc.

Glucose is the preferred fuel for the brain, lens of the eye and retina. The other organs function either with glucose or with energy provided by lipids. Carbohydrates are stored in very small quantities in the body, in the form of glycogen. Glycogen is found in the liver and muscle, but this energy reserve (about 2,500 kcal for 600 g) is tiny compared to the lipid reserves (11 kg, 100,000 kcal). Its energy is used during the fasting period of the night (liver glycogen) and at the beginning of physical exercise (liver + muscle) until the fat reserves are mobilised. This occurs after 20 to 45 minutes of effort, depending on the individual's intensity of training and store of glycogen.

5- Dietary fibre

Dietary fibre consists of carbohydrate compounds undigested by the body. It consists mainly of vegetable products such as cellulose, pectins, carrageenan, gums, and resistant starches. It also contains the fibres of compounds such as oligosides (FOS), microbial products (xanthan gum), and shellfish shell compounds (chitin).

Except for lignin, these are large, complex polysaccharides. They are especially hydrophilic.

Fibres are either soluble (pectins, glucans, gums, algae fibre, etc.) or insoluble (cellulose, lignin, resistant starches, etc.) and have different physiological properties.

Fibre is found mainly in cereals, vegetables and fruit.

5.1- Soluble fibre

By absorbing intestinal water, soluble fibres form a gel which coats the lining of the intestine, slowing the absorption of certain nutrients such as glucose, biliary acids (produced by the breakdown of cholesterol in the liver), and cholesterol. This lowers the glucose level in the blood and reduces cholesterol. These mechanisms probably explain the effect in preventing cardiovascular diseases observed in some clinical studies.

Soluble fibre is found in certain fruits (apple, pear, grape, peach, apricot, etc.), vegetables (endive, onion, broccoli, cabbage, carrots, turnip, etc.), legumes and oats.

5.2- Insoluble fibre

By absorbing intestinal water, insoluble fibre increases stool volume for better transit and dilution of biliary acids.

Most insoluble fibre is present in wheat bran, cereals and brown rice, vegetables (asparagus, beetroot, carrots, peas, spinach, etc.), and unpeeled fruit (apple, pear).

5.3- Fibre and colorectal cancer

When it ferments, fibre produces short-chain fatty acids such as butyrate which have a beneficial effect on different parts of the chain differentiating healthy from cancerous cells.

In addition, the action of fibre on biliary acid protects the intestinal mucosa from acid attack, either by dilution, inhibition of intestinal absorption, or enzymatic inhibition of the conversion of primary biliary acids.

Most studies indicate protection against colorectal cancer in association with high fibre consumption. The recommendation is 30 g per day, 10 to 15 g of which should be soluble fibre, whereas consumption in France is around 17 g per day.

6- Minerals and trace elements

The major minerals are classified into:

Macronutrients: sodium (Na), potassium (K), chlorine (Cl), calcium (Ca), phosphorus (P) and magnesium (Mg).

Trace elements: iron (Fe), zinc (Zn), copper (Cu), manganese (Mn), iodine (I), selenium (Se), chromium (Cr), fluorine (F), molybdenum, cobalt, silicon, vanadium, nickel, boron and arsenic.

Their presence in the body varies from more than 1 kg for calcium to less than 1 g for some trace elements such as cobalt and chromium.

Besides their specific functions, most minerals occur in low concentrations in vital phenomena as enzyme activators, regulators or carriers.

Calcium

Calcium is the mineral present in the largest amount in the body as a constituent of bone (99% of the body's calcium). It provides rigidity and strength for the skeleton and hardness for the teeth.

Human beings form their bone capital during the early stages of life: childhood, adolescence and early adult life. Growth in size occurs up to 16-18 years, then thickness and hardness up to 20-25 years. After 20-25 years of age, there is no further increase in the amount of calcium. The intake of calcium is therefore crucial during childhood and especially between 10 and 14 years of age.

After the age of 50 for women and a little later for men, bone mineral density decreases and should be compensated for by high dietary calcium intake in order to avoid the risk of osteoporotic fractures (vertebrae, hips, wrists).

Calcium intake comes mainly from dairy products:

300 mg Ca = 2 yoghurts
250 ml milk
30 g beaufort cheese
300 g fromage frais

Vegetables and some mineral waters offer additional sources of calcium intake. Vegetables, for example, can contribute between 10 and 30% of requirements: spinach, cabbage, green beans, dandelions, etc. are valuable sources of calcium.

300 mg Ca = 150 g spinach + 150 g green beans +
150 g cabbage/celery salad, or
150 g broccoli + 1 artichoke + dandelion salad.

Phosphorus

Phosphorus is mainly linked to calcium in the skeleton and teeth in the form of calcium phosphate. The body contains about 700 g of phosphorus.

It is also found in cells and biological membranes (phospholipids) as an enzyme activator and as an actor in energy metabolism (ATP).

Phosphorus is present in many foods, and average intake in Europe is far greater than needed.

1/3 of all intake comes from meat, fish and eggs

1/3 from dairy products

1/3 from vegetables, cereals and fruit.

The Ca/P ratio in the diet should be greater than 1. Given the large amount of phosphorus ingested, it is important to monitor optimal calcium intake closely.

Magnesium

Its main role is as an activator of numerous enzymes. It plays a key role in the transmission of neuromuscular impulses. Half the magnesium in the body is located in the bones, some of it mobilisable, but the quantities are small compared to Ca and P. The body contains 25 g of magnesium.

Foods containing most magnesium include vegetables, wholegrain cereals, nuts and pulses.

Sodium

Sodium is usually associated with chlorine in the form of sodium chloride or salt. Sodium contributes to the transmission of impulses in nerve and muscle tissue, and to the osmotic balance of cells and extracellular fluids. It has a major role in the balance of the fluid compartments of the body: the balance between cell interiors, extracellular environment, circulating fluids, etc.

The relationship between salt intake and blood pressure has been demonstrated in some sensitive individuals. They are about 12% in France. In their case, it is recommended to reduce the amount of salt in the diet.

A healthy subject needs a reasonable amount of salt. This amount varies between 5 g and 12 g per day, and preferably between 6 and 8 g per day.

1 g of sodium consumed equals 2.5 g of salt.

Examples of food intake:

Salt, 1 g	400 mg sodium
10 olives	600-900 mg
Smoked ham, 40 g	650 mg
1 chocolate pastry	400 mg
15 g Roquefort	240 mg
1/2 litre milk	220 mg
30 g white bread	150 mg

Potassium

Potassium is necessary for the functioning of numerous enzymes and to maintain the volume of cells and their metabolism. A balance is needed between sodium and potassium. Does excess potassium have a diuretic effect?

It is found in most foods and deficiencies are rare. Fruit, vegetables, meat, milk and cocoa are especially rich in potassium.

Iron

There are 4 g of iron in the body. It is found in red blood cells, where it carries oxygen, and in muscle. It also contributes to the function of numerous enzymes.

In the diet, iron is found in meat and fish (25% of the iron consumed), vegetables, cereals and dairy products (75% of the iron consumed). The iron in meat and fish is absorbed better than the iron in plants. However, it is the structure of the meal that defines the absorption of the iron consumed: the iron in plants is absorbed better if it is combined with meat, fish or vitamin C. It is less well absorbed in the presence of tannins and certain fibres. When the iron reserves in the body are low, iron from plants is better absorbed by the body to compensate for the deficit more rapidly.

Mineral needs of the French population (RDA, 3rd edition):

	Ca mg	P mg	Mg mg	Fe mg	Zn mg	Cu mg	F mg	I µg	Se µg	Cr µg
1-3 years	500	360	80	7	6	0.8	0.5	80	20	25
4-6 years	700	450	130	7	7	1	0.8	90	30	35
7-9 years	900	600	200	8	9	1.2	1.2	120	40	40
10-12 years	1200	830	280	10	12	1.5	1.5	150	45	45
13-15 years ♂	1200	830	410	13	13	1.5	2	150	50	50
13-15 years ♀	1200	800	370	16	10	1.5	2	150	50	50
16-19 years ♂	1200	800	410	13	13	1.5	2	150	50	50
16-19 years ♀	1200	800	370	16	10	1.5	2	150	50	50
♂ adult	900	750	420	9	12	2	2.5	150	60	65
♀ adult	900	750	360	16	10	1.5	2	150	50	55
♂ ≥ 65 years	1200	750	420	9	11	1.5	2.5	150	70	70
♀ ≥ 65 years	1200	800	360	9	11	1.5	2	150	60	60
♀ pregnant	1000	800	400	30	14	2	2	200	60	60
♀ breast-feeding	1000	850	390	10	19	2	2	200	60	55
p. ≥ 75 years	1200	850	400	10	12	1.5	2	150	80	-

7- Vitamins

There are 13 vitamins, divided into two families:

Water-soluble vitamins

B1	thiamine
B2	riboflavin
B3 or PP	nicotinic acid or nicotinamide
B5	pantothenic acid
B6	pyridoxine
B8	biotin
B9	folic acid
B12	cobalamins
C	ascorbic acid

Fat-soluble vitamins

A	retinol, beta carotene (provitamin A)
D	cholecalciferol (D3), ergocalciferol (D2)
E	tocopherols
K	phyloquinol (K1), menaquinone (K2)

7.1- Water-soluble vitamins These water-soluble vitamins belong to group B, and also include vitamin C. They are found mainly in food that contains a high amount of water, such as fruit and vegetables, as well as in cereals (B1) and meat (B12).

B1 plays an essential role in the metabolism of carbohydrates and alcohol. It is sensitive to light (UV). The main sources are cereals (bran and wheat germ), legumes and yeasts. A deficiency, or beriberi, has been known since ancient times.

B2 contributes to the functioning of numerous enzymes during energy metabolism. Sensitive to light, it is provided by yeast, liver, dairy products and mushrooms, as well as some meats. Deficiencies are rare.

B3 or PP plays a part in the metabolism of carbohydrates, fatty acids and amino acids. It is a stable vitamin and is found in yeast, meat and fish, mushrooms, legumes and wholegrain cereals. A deficiency leads to pellagra. This disease is common in populations which eat almost nothing but maize, sorghum or millet (Africa, India), and in chronic alcoholics.

B5 is present in the diet in the form of a precursor called coenzyme A. It plays a role in the composition of numerous metabolic intermediaries, in the utilisation of glucose, fatty acids and some amino acids, and in the synthesis of fatty acids. It is found in most foods, though there is little in fruit and vegetables. Deficiencies are rare.

B6 is involved as a coenzyme in the metabolism of amino acids. It is relatively stable, and most losses come from its solubility in water during cooking. Yeast, wheat germ and meat contain the most vitamin B6. Then come dairy products and cereals. Vegetables contain very little, except for cauliflower and green beans, which contain significant amounts (about 20% of RDA).

B8 or biotin is a coenzyme of 4 enzymes which participate in the metabolism of carbohydrates, lipids and some amino acids. It is relatively stable, and the foods which contain the most are liver, kidneys and egg yolk.

B9 is present in leaf vegetables – hence the term folate. It is also present in yeast, liver, walnuts and almonds, eggs and fermented cheese. It is sensitive to oxidation. It is needed for cell multiplication (growth) and maintenance. It plays a basic role in the formation of the neural tube of the foetus during the first few weeks, then in the development of the foetus until the time of birth.

B12 is found exclusively in animal products. It occurs during the normal development of red blood cells. Our normal intestinal flora synthesises it for us. A standard diet is sufficient to provide our requirements.

C is the most famous of the water-soluble vitamins and prevents scurvy, one of the oldest known diseases. It is also an activator in the intestine for the absorption of iron of plant origin. It is sensitive to heat, light and oxidation. It is not stored in the body, so must be consumed regularly. It is found in large amounts in blackcurrants, kiwi and citrus fruit, as well as in peppers, the cabbage family, cress, etc. In France, approximately 70% of the vitamin C consumed comes from fruit and vegetables.

7.2- Fat-soluble vitamins These are vitamins A, D, E and K. They are soluble in lipids. They are found in butter, oil, meat and coloured vegetables (β -carotene, provitamin A).

A is present in the form of retinol in products of animal origin, and as β -carotene or provitamin A in plant products. Its main role is to contribute to the quality of night vision. Vitamin A is also an antioxidant. It is sensitive to light and oxidation. Retinol is found in cod liver oil, animal liver, butter, eggs and cheese, and β -carotene in coloured vegetables (carrots, spinach, green beans) and fruits such as apricots.

D: The main role of vitamin D is to fix calcium in bones. It guarantees optimal bone mineralisation.

A vitamin D deficiency is known as rickets, which can take the form of bone deformation in advanced cases. Vitamin D is synthesised from cholesterol by the epidermis under the effect of UV radiation. That is why it is preferable to give a supplement to babies during winter, because they do not often go out into natural light. The amount produced by the body is often insufficient and it is necessary to supplement the intake. Previously, this was mainly achieved through cod liver oil, but these days it is provided as a medicine. Dietary intake is often low because vitamin D is only present in small quantities in a few foods. It is found especially in fatty sea fish such as salmon, sardines and anchovies, and to a lesser extent in mackerel, eel and tuna.

The authorities have recently authorised the enrichment of fresh dairy products with vitamin D. It is important for babies, children, the elderly and anyone who is sensitive or fragile and not exposed to sufficient daylight.

E plays a role as an antioxidant for polyunsaturated fatty acids by trapping and preventing the propagation of free radicals. Plants contain 8 different vitamin E compounds, with the most active form being α -tocopherol.

The main dietary sources of vitamin E are plant oils. Fruit and vegetables contain low amounts of vitamin E but still represent the secondary dietary source after oils, or about 15% of intake.

K is probably the least known of the vitamins. However, it plays a very important role in blood coagulation. The foods richest in vitamin K are green vegetables and some oils.

Vitamin needs of the French population (RDA, 3rd edition):

	A	D	E	K	B1	B2	PP	B5	B6	B8	B9	B12	C
	µg	µg	mg	µg	mg	mg	mg	mg	mg	µg	µg	µg	µg
newborns	350	20-25	4	5-10	0.2	0,4	3	2	0.3	6	70	0.5	50
1-3 years	400	10	6	15	0.4	0.8	6	2.5	0.6	12	100	0.8	60
4-6 years	450	5	7,5	20	0.6	1	8	3	0.8	20	150	1.1	75
7-9 years	500	5	9	30	0.8	1.3	9	3,5	1	25	200	1.4	90
10-12 years	550	5	11	40	1	1.4-1.3	10	4	1.3	35	250	1.9	100
13-15 years ♂	700	5	12	45	1.3	1.6	13	4.5	1.6	45	300	2.3	110
13-15 years ♀	600	5	12	45	1.1	1.4	11	4.5	1.5	45	300	2.3	110
16-19 years ♂	800	5	12	65	1.3	1.6	14	5	1.8	50	330	2.4	110
16-19 years ♀	600	5	12	65	1.1	1.5	11	5	1.5	50	300	2.4	110
♂ adult	800	5	12	45	1.3	1.6	14	5	1.8	50	330	2.4	110
♀ adult	600	5	12	45	1.1	1.5	11	5	1.5	50	300	2.4	110
♂ ≥ 75 years	700	10-15	20-50	70	1.2	1.6	14	5	1.6	60	330-400	3	120
♀ ≥ 75 years	600	10-15	20-50	70	1,2	1.6	11	5	1.6	60	330-400	3	120
♀ pregnant	700	10	12	45	1.8	1.6	16	5	1.6	50	400	2.6	120
♀ breast-feeding	950	10	12	45	1.8	1.8	15	7	1.8	55	400	2.8	130

8- Free radicals and antioxidants

Cell oxidation is an unavoidable phenomenon as the body gets older. It is one of life's paradoxes: the oxygen that sustains life is also the substance that gradually oxidises us.

Some molecules or ions have free radicals (i.e. atoms with an unpaired number of electrons, reversing the magnetic field). These elements are very unstable and very reactive. They are termed "aggressive". These are free radicals: they look for an unpaired electron. Most of the time, this is a hydrogen atom on a nearby carbon chain. The radical formed will itself be aggressive ... starting a chain reaction.

Oxidative stress is generated by the numerous oxidation events.

This chain reaction ceases with the intervention of a scavenger of free radicals or by the recombination of two free radicals.

There are several protective systems in the body: an enzyme – superoxide dismutase, some ions (selenium, zinc), antioxidant vitamins (A, C and E), and natural substances introduced by the plants we eat: fruit, vegetables, herbs, some spices.

These provide carotenoids, polyphenols (flavonoids, tannins), etc.

Fruit and vegetables are the main sources of antioxidants. One major study (SUVIMAX) has shown a correlation between the consumption of antioxidants and the reduced risk of occurrence of serious diseases.

This is one of the reasons for the "5 to 10 portions of fruit and vegetables a day" recommendation.

9- RDA, DRI : USA recommended nutrition intakes :

Recommended Dietary Allowance

Dietary Reference Intakes

1989

1997

RDA	A	E	K	B1	B2	PP	B5	B6	B8	B9	B12	C
	µg	mg	µg	mg	mg	mg NE	mg	mg	µg	µg	µg	µg
0-6 mois	375	3	5	0,3	0,4	5		0,3		25	0,3	30
6-12 mois	375	4	10	0,4	0,5	6		0,6		35	0,5	35
1-3 ans	400	6	15	0,7	0,8	9		1		50	0,7	40
4-6 ans	500	7	20	0,9	1,1	12		1,1		75	1	45
7-10 ans	700	7	30	1	1,2	13		1,4		100	1,4	45
11-14 ans	1000	10	45	1,3	1,5	17		1,7		150	2	50
15-18 ans	1000	10	65	1,5	1,8	20		2		200	2	60
19-24 ans	1000	10	70	1,5	1,7	19		2		200	2	60
25-50 ans	1000	10	80	1,5	1,7	19		2		200	2	60
> 51 ans	1000	10	80	1,2	1,4	15		2		200	2	60
men												
11-14 ans	800	8	45	1,1	1,3	15		1,4		150	2	50
15-18 ans	800	8	55	1,1	1,3	15		1,5		180	2	60
19-24 ans	800	8	60	1,1	1,3	15		1,6		180	2	60
25-50 ans	800	8	65	1,1	1,3	15		1,6		180	2	60
> 51 ans	800	8	65	1	1,2	13		1,6		180	2	60
women												
enceinte	800	10	65	1,5	1,6	17		2,2		400	2,2	70
breast feeding												
0-6 mois	1300	12	65	1,6	1,8	20		2,1		280	2,6	95
> 6 mois	1200	11	65	1,6	1,7	20		2,1		260	2,6	90

RDA	Fe	Zn	I	Se
	mg	mg	µg	µg
0-6 mois	6	5	40	10
6-12 mois	10	5	50	15
1-3 ans	10	10	70	20
4-6 ans	10	10	90	20
7-10 ans	10	10	120	30
11-14 ans	12	15	150	40
15-18 ans	12	15	150	50
19-24 ans	10	15	150	70
25-50 ans	10	15	150	70
> 51 ans	10	15	150	70
men				
11-14 ans	15	12	150	45
15-18 ans	15	12	150	50
19-24 ans	15	12	150	55
25-50 ans	15	12	150	55
> 51 ans	10	12	150	55
women				
enceinte	30	15	175	65
breast feeding				
0-6 mois	15	19	200	75
> 6 mois	15	16	200	75

DRI	vit D	Ca	P	Mg	F
	µg	mg	mg	mg	mg
0-6 mois	5	210	100	30	0,01
6-12 mois	5	270	275	75	0,5
1-3 ans	5	500	460	80	0,7
4-8 ans	5	800	500	130	1,1
9-13 ans	5	1300	1250	240	2
14-18 ans	5	1300	1250	410	3,2
19-30 ans	5	1000	700	400	3,8
31-50 ans	5	1000	700	420	3,8
51-70 ans	10	1200	700	420	3,8
>70 ans	10	1200	700	420	3,8
men					
9-13 ans	5	1300	1250	240	2
14-18 ans	5	1300	1250	360	2,9
19-30 ans	5	1000	700	310	3,1
31-50 ans	5	1000	700	320	3,1
51-70 ans	10	1200	700	320	3,1
>70 ans	10	1200	700	320	3,1
women					
enceinte				40	

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