

## NUTRITION

A balanced diet has to maintain the activity of tissues in resting and activity conditions, to assure the reparation of tissues and the growth of young organisms.

In certain regions/areas of the world the main problem is represented by overeating. In developing countries, lack of food and poor usage of the available food results in protein- energy malnutrition.

Nutritive needs of organism are covered by six types of foodstuffs: proteins (P), glucides (G), lipids (L), vitamins, mineral salts and water. P, G, L are used as energy source and plastic materials. From physiological point of view G and L have a higher energy value than proteins, which are especially used for repair of tissues and also in morphogenesis. Vitamins, minerals and water, although do not supply energy, they influence the normal metabolism, being indispensable for the synthesis of hormones and enzymes. Minerals, such as iron and calcium are included into the structure of the tissues or they have an important role in maintaining the ionic balance and osmotic pressure.

For the maintaining of health/well being all foodstuffs must be present in the daily diet. The excess or lack of some foodstuffs may be injurious to health. In making up of a diet one has to take into account the person's needs, which varies with: *age, sex, body size, environment conditions, physical activity, as well as the proportion of foodstuffs in the daily intake.*

An insufficient calorie intake produces the catabolism of lipids, while an excess of foods causes the obesity/fatness.

### Daily intake of proteins (P)

The food ingested daily must contain a minimum amount of P, necessary for: synthesis of hormones and enzymes, replacing the tissue proteins from muscles, cutaneous epithelium, intestine and plasmatic proteins.

The catabolites of P, for example: urea, uric acid, ammonia are excreted especially through the urine and to a little extent through digestive tract.

**Nitrogen balance** represents the ratio between the quantity of ingested nitrogen and the amount of excreted nitrogen through urine and feces. When the amount of ingested nitrogen is equal to the amount of excreted nitrogen, the person is nitrogen balanced. When the amount of excreted nitrogen is higher than the amount of ingested nitrogen the nitrogen balance is negative and when less nitrogen is ingested than excreted nitrogen, the balance is positive.

A positive nitrogen balance occurs during: growth period, pregnancy, nursing, after a severe disease (in convalescence), after the administration of growth hormone, testosterone. Starvation, immobilization, excess of glucocorticoids produce a negative nitrogen balance. The P intake must maintain the nitrogen balance.

The amount of proteins that can maintain the nitrogen balance depends on:

- *The presence of G and L in the diet* - G and L ingested have a role of sparing/saving of P, explained to a great extent by their capacity to replace proteins as energetic material.
- *Biological value of proteins*- the daily intake of P is not only quantitative, but also qualitative. The absence of proteins from an animal diet induces disturbances and finally the death of animal. In human beings, the nitrogen balance can not be maintained without a diet with enough proteins or without the presence of the eight essential amino acids in food, amino acids which cannot be synthesized in organism. They are: phenylalanine, valine, tryptophan, threonine, lysine, leucine, isoleucine, and methionine. For children other two amino acids are important: arginine and histidine.

The biological value of P depends on their content in essential amino acids. The closer the composition of P in amino acids is to the structure of tissues, the more reduced amount of P is needed to maintain the nitrogen balance.

When an essential amino acid is missing from the food, the organism catabolizes its own P until an enough amount of the respective amino acid is released. Thus a negative nitrogen balance is generated.

Conventionally, the biological value of P is noted from 100 to 0 (zero). For eggs, the biological value of P is considered 100, because 100g of egg proteins can replace 100g of P from the human body. Biological value of animal proteins varies between 80 -100 and the value of those vegetable between 60-70. The proteins having a reduced biological value are also called incomplete/partial proteins and they are represented by: *gelatin*, from whose composition is missing Tryptophan, the *zeine* of corn, which does not contain lysine and tryptophan. The rats fed exclusively with zeine die in about 17 days. When to zeine, tryptophan is added, the animals survive and when is also administrated the lysine, the growth of animals is resumed.

A high biological value has the animal proteins like: proteins contained in eggs, dairy products, liver, muscles, and fish. Ground nuts, potatoes, soy bean and some cereals contain good quality proteins. The greatest part of vegetables includes proteins with a reduced biological value. Simultaneous intake of two or more inferior quality proteins increases their biological value, due to the reciprocal completion of the deficient amino acids. Fish, milk, rich in lysine increase much biological value of vegetable proteins.

The recommended daily intake of proteins is 1g/kg/day or 12 -13% of total energy intake. Some European developed countries sustain that the minimum physiological amount of P able to maintain the nitrogen balance is 0,8g/kg/day. It is indicated that 30-50 % of P to be animal proteins. In pregnant women, women who nurse, children and teenagers, the protein intake should be 14% of total calorie intake, namely 1,2- 1,5 g/hk/day to 2 g/kg/day.

The greatest proportion of P provides from vegetables, especially bread, potatoes and farinaceous products. Exclusive nutrition with cereals, deficient in tryptophan, causes the illness of children after the weaning. The disease is characterized by stopping of growth, anemia, fat degeneration of liver; mental retardation and it is called kwashiorkor.

During the starvation period, P are mobilized from liver, spleen, muscles and to a low extent from brain and myocardium. Amino acids released by tissues are used for the synthesis of hormones, enzymes and for maintaining the normal structure of vital organs. The loss of P becomes critical when the body weight is reduced with 25%. In a normal person such a lowering occurs after 2 months of starvation. Treatment of obesity, which may be realized by exclusive ingestion of water and vitamins, induces a daily loss weight of 1kg/day within the first 10 days. During the next days the lowering of weight is limited to 0, 3 kg/day.

The P excess does not bring any benefit to health for a normal person.

### **Daily intake of lipids**

Lipids (L) are alimentary components with a very high energy value, which are found both in animal products (meat, fish, eggs, butter, dairy products) and in seeds of some plants. Fatty acids provided by breaking down of L can be directly used by skeletal and myocardium muscles and by the most of cells. Red blood cells and neurons, in normal conditions of alimentation do not use fatty acids.

Going from the observation that L can be synthesized from glucides, it has been considered that the ingestion of L is not compulsory. Removal of L from the diet of the experience animals induces disturbances as follows: cutaneous exudative and degenerative lesions, retardation of growth, renal lesions and sterility. The growth of such animals can be reestablished by ingestion of linoleic acid, the other

disturbances may be removed by supplementation of food with linolenic and arachidonic acid. The free fatty acids are polyunsaturated and they can not be synthesized in organism, therefore they are named *essential fatty acids* (EFA). Although the symptoms induced by the lack of essential amino acids have not been noted in human being, it is supposed that a minimum intake of such fatty acids is indispensable for children.

EFA have importance in *prostaglandins synthesis*. Prostaglandins, which are formed from arachidonic acid, are unsaturated fatty acids, with 20 carbon atoms, which contain a cyclopentanic nucleus. The action of different types of prostaglandins is extremely varied, sometimes antagonistic/opposed. There are some prostaglandins which inhibit the aggregation of platelets, while others activate them, some of them have antilytic effect and others lytic effect. It has been demonstrated that certain types of prostaglandins induce hypotension, relax bronchial muscles, reduce gastric secretion and contract the uterine muscles.

EFA are also necessary for synthesis of phospholipids (PL), which take part of the structure of membrane (cell and mitochondrial membrane)

A high content of EFA possess the vegetable oils. EFA are missing from artificial hydrogenated vegetable oil, for increase their consistence.

Foods of animal origin are unmissed of fats. About a half of alimentary lipids are visible, for instance in: butter, lard, oil, but the rest are distributed under the form of invisible drops in meat, cheese, seeds.

The cholesterol ingested together with the animal foods (eggs, milk, and meat) represents 750mg/day. Endogenous production of cholesterol, which takes place in liver, is about 1g/day. Blood cholesterol concentration depends not only by the endogenous synthesis but also by lipids from food. Saturated fatty acids increase the blood cholesterol level and the unsaturated fatty acids decrease it. Increase of blood cholesterol concentration above 220mg% predisposes to atherosclerosis, myocardial infarction, cerebra-vascular accidents/stroke.

Proportion of L in diet must be between 25-35% of total daily calorie intake. When the energetic needs of organism are greater, more lipids can be included in nutrition. A diet which contains fewer lipids, but a normal amount of EFA has not negative effects. People need about 1g /day of polyunsaturated fatty acids.

### **Daily intake of glucides**

The cheapest source of alimentary energy is represented by the glucides (G). Foods contain glucides under the form of monosaccharides, with 5 or 6 carbon atoms (pentose and hexose) or polysaccharides. Pentoses and hexoses can be free or combined in foods.

Glucose represents the only free monosaccharides, which can be detected even in blood of a person during starvation. Some fruits and grapes contain slight trace of glucose.

In disaccharides, glucose combined with fructose forms saccharose, and glucose bound to galactose forms lactose.

A derivate of hexose, present in composition of rowan tree is the sorbitol. It can be also produced artificially, leaving from glucose. From digestive tract it is absorbed 90%. Sorbitol is used in diabetic people nutrition, because it has 60% of sugar sweetness. It does not change glycaemia and is metabolized in the same way as glucidic substances.

Disaccharides are represented by: saccharose, maltose and lactose.

Rafinose, present in molasses is a trisaccharide resulted by combination of glucose with fructose and galactose.

Among polysaccharides: starch, glycogen and cellulose are consumed.

*Starch* is deposited into the granules of some seeds or into the roots of some plants. It is presented under the form of two polymers: amylose and amylopectin. Amylose represents 15- 20% of total starch molecule. It is made up of long unramified chains of hundreds units of glucose. The major component of starch, amylopectin has the glucose chain ramified. Starch granules are insoluble in water.

The animal equivalent of starch is *glycogen*, made up of ramified chains of 3000- 6000 molecules of glucose. Animal liver and Mollusca are the richest source of glycogen.

An other vegetable polysaccharide which takes part to the structure of the plants framework is *cellulose*. The molecule of cellulose includes 3000 or more glucose unit, bound between them in other way than in starch... Digestive enzymes can not digest it. Indigestible mass of cellulose increases the peristaltic. There are findings that a diet rich in cellulose decreases the incidence of colon cancer.

In daily intake 65% of glucides must be consumed as polysaccharides, which provide to the organism vitamins and minerals and the rest of 35% as oligosaccharides. About 50 -60% of energy intake must be covered by glucides. Reduced consumption of glucides or their insufficient metabolism (in diabetes mellitus) induces a rapid burning of lipids and accumulation of ketone bodies into the organism. For preventing the ketosis is necessary a minimum of 5g of glucides for each 100kcal ingested. In conditions of a nutrition rich in fats or during the starvation, preventing of unpleasant effects of ketosis may be realized by ingestion of 50 – 100 g glucides/day.

## **Vitamins (V)**

Vitamins are organic substances, with an extremely varied structure, which can not be synthesized in organism. They have an essential role in maintaining the state of health and growth.

A normal diet usually provides an enough amount of vitamins (V). Needs of V increase in parallel to the person volume, physical activity, during the fever or some diseases and growth period. An extra amount of vitamins is necessary when a high consumption of glucides occurs and during the pregnancy, nursing, growth.

Little amount of vitamin D is stored in all cells. Vitamins A and D are also stored in liver. When the two V are absent in daily food, the hepatic deposit of vitamin A is enough for 6 months and 2 months for vitamin D. Hydro soluble V are to a little extent stored, so that the vitamin B deficiency appears in a few days.

During the culinary preparation or preserving the food, vitamins C, B and D are rapidly destroyed.

An appropriate supply with vitamin C needs the presence in daily diet of fresh fruits and vegetables. For preventing the destroying of V existing in meat, the meat is necessary to be prepared grilled or roasted. The two culinary methods break down /degrade the vitamins of superficial layer and let unaltered the vitamins of central portion of meat. When the muscle is prepared by boiling is recommended to be introduced into salted boiling water, which forms a shell of coagulated proteins at the surface, which impedes the diffusion of vitamins and minerals into the solution.

Grinding or refining of cereals cause great losses of vitamin B. This is the reason for what, lately, the cereal products are enriched with vitamins B<sub>1</sub>, B<sub>2</sub>, PP and even iron (Fe). Improvement of margarine from nutritive point of view is performed by adding of vitamin A, and of milk by adding of vitamin D. Due to the toxicity of the abuse of vitamins, it is recommended that the products that contain more than 10000UI vitamin A or 400UI vitamin D/dose to be administrated only to the physician prescription.

Hypervitaminosis A is manifested by headache, loss of appetite, hepatosplenomegaly, irritability, dermatitis, loss of hair, bones ache, and hyperostosis.

Acute intoxication was described for the first time in the arctic explorers, who ate bear liver, very rich in vitamin A and they presented headache, diarrhea, and dizziness.

Excess of vitamin D induces loss of weight, calcification of soft tissues and finally renal failure. Mega doses of vitamin B<sub>6</sub> may produce peripheral neuropathy.

There are antivitamins in some foods, for instance many species of raw fish contain tiaminase, which splits vitamin B<sub>1</sub> (thiamin).

Avidine of white (of the egg glair) fixes biotin. Artificial antivitamins are used for therapeutic purposes. For instance coumarins, presented in altered trefoil, with an antivitamin K action are used in thrombosis treatment, because they reduce the coagulability of blood. Isoniazid an antagonist of phosphate pyrodoxal (active form of vitamin B<sub>6</sub>) is used in treatment of tuberculosis, because it impedes the development of Koch's bacillus. Antibacterial effect of sulphamids is explained by preventing the action of p-amino benzoic acid, an essential substance for germs growth.

## **Minerals**

Although minerals represent only a little part of body weight, they perform an important role in the economy of organism. The absence of some minerals from foods generates disturbances. Thus lack of iron induces a hypochromic anemia, lack of copper generates anemia and neuropathy, lack of iodine induces goiter. For maintaining of well being Cu, Mg, Mn and Zn are indispensable in nutrition.

Calcium and phosphorus are provided especially by dairy products. Very important are Na, K, but it is very difficult to prepare a meal without these two minerals. Diet without salt is well tolerated, due to the fact it induces an intensification of Na preserving mechanism.

## **Water**

Daily intake of water is compulsory because water forms the environment of cells. Together with the continuous loss of water, elimination of waste products takes place.