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PHYSIOLOGICAL BASIS OF RATIONAL NUTRITION AND DAILY INTAKE OF NUTRIENTS

Kamolova Lobar Yagmurovna

Email: Kamolova.lobar@bsmi.uz https://orcid.org/0009-0006-8315-2924

Bukhara State Medical Institute named after Abu Ali ibn Sina, Uzbekistan, Bukhara, st. A. Navoi. 1

Tel: +998 (65) 223-00-50 e-mail: info@bsmi.uz

Resume: Nutrition is the process of intake, digestion, absorption and assimilation by the body of nutrients necessary to build and renew tissues, as well as to replenish the energy costs of the body. Food consists of complex compounds of plant or animal origin (proteins, fats and carbohydrates), from which, after their enzymatic hydrolysis, nutrients (nutrients) are extracted: amino acids, fatty acids, monosaccharides and glycerol, as well as vitamins and mineral salts. The first ancient theory of nutrition was created by Aristotle and Galen. According to this theory, the body is nourished by blood, which is continuously formed in the gastrointestinal tract from food substances as a result of an unknown process similar to fermentation. In the liver, the blood is purified and nourishes all parts of the body. Based on this theory, all diseases should be treated by bloodletting, and bloodletting becomes the main method of healing for several centuries.

Keywords: nutrition, proteins, carbohydrates, theory of adequate nutrition, dietary fiber.

The second - the theory of balanced nutrition was formed in the late XIX - early XX centuries.

A special role in the development of this theory belongs to I.P. Pavlov, who created the doctrine of the physiology of the digestive system (for these studies, I.P. Pavlov, the first among Russian scientists, was awarded the Nobel Prize (1904)). Digestion was considered at that time as a process of enzymatic decomposition of food into elements, some of which were included in the composition of the body (proper nutrients), the other part - ballast substances - was discarded as unnecessary to the body.

The theory of balanced nutrition considers food intake as a way to maintain the constancy of the molecular composition in the body, where energy and plastic costs are compensated by new food intake. In this case, the flow of incoming substances must be well balanced with their consumption. This theory made it possible to establish a set of vital nutrients and determine the quantitative needs of the body for proteins, fats and carbohydrates, salts and vitamins. Based on this theory, nutrition can be adapted to the physiological characteristics of the body (age, gender), physical activity, climatic conditions, etc. Recommendations were made for a balanced diet for children and adults, taking into account their work activities. During the existence of the theory of balanced nutrition, the norms for the consumption of nutrients have been repeatedly revised.

The concept of ideal nutrition was associated with the theory of balanced nutrition: the more accurately the consumption and its replenishment were taken into account, the more ideal the nutrition was considered. However, a balanced approach to the problem of nutrition has led to the fact that only those components of food that are absorbed by the body - these are

nutrients - began to be considered valuable and useful, and the rest of the food was considered as ballast, which is better to get rid of. However, the idea of monomeric and ballast-free power has not stood the test of time. The use of refined products of cereal plants, a decrease in the share of plant foods in the diet, an increase in the consumption of refined foodstuffs were factors that contributed to the development of diseases. There were metabolic disorders, which became one of the reasons for the development of such diseases as diabetes mellitus, cardiovascular diseases, atherosclerosis. These diseases are the result not only of excessive consumption of fats or carbohydrates, but also of insufficient plant fiber in the diet.

Currently, it is believed that a balanced nutrition is characterized by the optimal correspondence of the quantity and ratio of all food components to the physiological needs of the body (A.A. Pokrovsky).

The food taken, taking into account its digestibility, should replenish energy costs (basal metabolism, specific dynamic action of food, work performed). The caloric value of fats is 9.3 kcal/g (37 kJ/g), proteins and carbohydrates 4.1 kcal/g (17 kJ/g). As sources of energy, proteins, fats and carbohydrates are interchangeable and, in accordance with their caloric value (the rule of isodynamics), this can be used for a short time. But each of them performs plastic functions. With a prolonged replacement, for example, of proteins with fats and carbohydrates, the metabolism of proteins will certainly be disturbed. The diet should be balanced proteins, fats and carbohydrates. The average ratio of their mass is 1: 1.2: 4, the energy value is 15: 30: 55%. This ratio satisfies the energy and plastic needs of the body, compensates for the consumption of proteins, fats and carbohydrates. An imbalance in nutrients will lead to metabolic disorders and related diseases.

Overeating, excessive consumption of animal fats or food sugar and confectionery products with reduced energy consumption will cause obesity and related diseases (arterial hypertension, atherosclerosis, diabetes mellitus, caries). In the daily diet, products of animal and vegetable origin should be balanced. Proteins should be balanced with regard to their usefulness, fats should be balanced with regard to their saturation, carbohydrates should contain more polysaccharides and few simple sugars. Of great importance is a sufficient amount of vitamins, mineral salts in food, correlated with their consumption.

In terms of a balanced diet, it is impossible to explain the traditional diets of different human populations. For example, a rational diet based on the theory of balanced nutrition and suitable for Europeans cannot be used for the nutrition of northern peoples, whose diet is dominated by meat, fish and fats. However, such a diet does not lead to metabolic disorders in these peoples. At the same time, some Negro tribes eat exclusively plant foods, the protein content of which is much lower than the protein minimum. The physiological needs for mineral salts are just as different among different peoples.

The theory of adequate nutrition arose in the middle of the last century (A.M. Ugolev). For the first time, nutrition is considered from the standpoint of the evolution of the digestive system, since the main processes of food hydrolysis and nutrient transport have common patterns in different animal species.

The theory of adequate nutrition does not deny that nutrition compensates for the plastic and energy costs of the body for basic metabolism, external work, growth, i.e. she does not deny the main provisions of the theory of balanced nutrition, on the contrary, she considers them vital and puts forward new provisions:

1. the necessary components of food are not only nutrients, but also ballast substances (dietary fiber),

2. there is an endoecology of the host organism, represented by the intestinal microflora, with which the host organism maintains complex symbiotic relationships,

3. The balance of nutrients in the body is achieved as a result of enzymatic breakdown of food structures due to cavitary, parietal, membrane and intracellular digestion, as well as due to the synthesis of new substances, including essential ones, carried out by the bacterial flora of the intestine (secondary nutrients).

Adequate nutrition is not just a balanced diet, but nutrition corresponding to: 1) the nature of the metabolism in the body and 2) the features of the digestive system formed in the process of evolution. From this it follows that the nature of nutrition is determined by the evolutionary characteristics of metabolism. Metabolism, in turn, depends on environmental factors and, above all, on the ambient temperature. From here, the diet of the northern peoples becomes clear. To maintain their body temperature, they need much more energy than the inhabitants of the middle and especially southern latitudes, so their diet is dominated by proteins and fats with an extremely low carbohydrate content. In the process of evolution of these peoples, a special, protein-lipid variant of metabolism has developed, which does not lead to the development of metabolic diseases. This is due to the fact that with an increase in fat intake, a lot of fat-soluble vitamins (A, D, E) enter the body, which are antioxidants and reduce the damaging effect of excess lipids and their peroxidation products on cell membranes.

The chemical nature of nutrients must correspond to the enzymatic spectrum of the digestive system, and the mechanical properties of food must correspond to the way of nutrition.

It is known that many people suffer from milk intolerance (intolerance). This is due to the fact that lactose (milk sugar) cannot be hydrolyzed by the intestinal enzyme lactase due to its deficiency. With lactase deficiency, you should eat foods with a low content of this disaccharide - kefir, sour milk, cheese.

The author of the theory of adequate nutrition considers an organism that hydrolyzes nutrients as a superorganism with its own endoecology formed by the intestinal microflora and the enteral environment.

There is a close relationship and interchange between the host organism and symbionts.

Dietary fibers (ballast substances) are evolutionarily an important component of food. They are represented mainly by polysaccharides of plant origin, but they may contain proteins, fats and trace elements. Dietary fibers include cellulose, hemicellulose, pectin, lignin, wax, etc. Dietary fibers stimulate intestinal motility, affect the rate of absorption of nutrients, ions, the exchange of bile acids, cholesterol; have the ability to adsorb toxic substances, affect the habitat of the intestinal microflora and are a source of nutrition for it.

Dietary fibers introduced into the diet have a preventive and therapeutic effect on diseases such as hemorrhoids, constipation, chronic pancreatitis, etc. Thus, in addition to proteins, fats and carbohydrates, vegetable fiber must be included in the diet.

Along with the theory of balanced nutrition, other concepts of nutrition appear, which are actively promoted and become fashionable for some time. For example, the concept of separate nutrition recommends taking food substances - proteins, fats, plant foods - separately from each other. This idea has no scientific justification, because. it is known that mixed food is absorbed

better, various food components have the properties of mutually reinforcing the effects of secretion, motility and absorption. Recently, the idea of strict vegetarianism has been promoted in Siberia. The geographical position of Siberia with a sharp continental climate and long winter requires an increase in the amount of proteins and fats in the diet, at least to maintain temperature homeostasis. Any recommendations for dietary changes should be scientifically based and supported by long-term practice.

Physiological basis of rational nutrition and daily intake of nutrients

To ensure a complete and balanced diet, the following principles must be observed:

1. The calorie content of the daily diet of a particular person should correspond to his energy costs.

1.1. The distribution of daily caloric content between fractional meals, taking into account its digestibility.

2. Balanced in quantity and quality content of proteins, fats and carbohydrates.

3. Sufficient content of vitamins, salts, trace elements and water in food.

4. The diet should contain dietary fiber.

Daily energy costs are presented in the Energy Exchange section (Tables 3 and 4). The distribution of calories per day depends on the number of meals. With a 3-time meal, the daily ration for energy value is distributed as follows: breakfast - 25-30%, lunch - 45-50%, dinner - 20-25%. It is considered more rational to have 5 meals a day with the introduction of a second breakfast and an afternoon snack. In this case, the distribution is as follows: first breakfast - 25% of daily calories, second breakfast - 10-15%, lunch - 35%, afternoon snack - 25%, dinner - 10%. The interval between meals should not exceed 5-6 hours. The period of time between dinner and going to bed should be at least 3-4 hours. In a rational diet, it is equally important to eat at the same time (conditioned reflexes are developed that activate the secretion of the glands, the motor activity of the gastrointestinal tract).

As already indicated, the quantitative ratio of proteins, fats and carbohydrates should be 1: 1.2: 4.

Squirrels. The biological value of animal proteins is greater than vegetable proteins. Among vegetable products, soybeans, beans, peas are distinguished by a high content of essential amino acids. Proteins of buckwheat and oatmeal are approaching full-fledged amino acids. The digestibility of meat, fish proteins is 93-95%, milk, eggs - 90-98%, protein digestibility averages 83-85%. The daily requirement of an adult for protein is 80-90 g (at least 0.8-1 gram of protein per 1 kg of body weight). 55-60% of this norm should be proteins of animal origin. Approximately 15% of the body's energy needs are provided by food proteins.

Lipids enter the body as part of animal and plant foods. Unsaturated fatty acids are found in all dietary fats, especially in vegetable oils. Vegetable oils also contain essential fatty acids. Butter is digested by 95%, fish oil by almost 100%, beef oil by 80-84%, mutton fat has the lowest digestibility - 70-80%, digestibility of vegetable oil (sunflower) - 86-90%. The average lipid requirement for an adult is 80-100g/day. Of this amount, vegetable oils should be at least 30%. A significant reduction in fat intake can lead to a deficiency of fat-soluble vitamins, a

decrease in the synthesis of steroid hormones. A growing organism is especially sensitive to lipid deficiency.

The specified norms of daily requirements for nutrients for the adult population and children are given in the textbook "Human Physiology" (edited by Pokrovsky V.M., 2003)

Carbohydrates in food are contained in the form of polysaccharides (starch, glycogen), simple sugars (sucrose, lactose), monosaccharides (glucose, fructose). Vegetable starch (vegetables, fruits) is the main polysaccharide used in nutrition. Glycogen is found in the liver of animals (15-20%) and less in meat (1-2%). The process of hydrolysis of starch in the digestive tract occurs gradually, and therefore its intake with food does not cause a sharp rise in monosaccharides in the blood. Disaccharides are absorbed quickly. Sucrose (food sugar), used in all confectionery and jams. Excessive consumption of sugar leads to a sharp increase in blood glucose levels, tension of the secretory functions of pancreatic β-cells; Part of the glucose is converted into fat and leads to an increase in fat depot. Glucose in its natural form is found in berries and fruits, the main source of fructose is honey. The average requirement for carbohydrates is 350-450 g/day. Of this amount, polysaccharides should account for 70-75%, no more than 15-20% - simple sugars and about 10% - dietary fiber (ballast substances).

Dietary fiber is found in bread containing rye and wheat bran, in all vegetables and fruits. In addition to dietary fiber, rye bread, vegetables and fruits contain many vitamins and microelements. Ballast substances in the diet should be at least 30-40 g / day. Daily salt requirements are listed in the Metabolism section.

The quantitative content of vitamins should not be less than the need for them.

Nutrition of newborns and children of the early postnatal period

Currently, various breast milk substitutes (nutrient mixtures), often prepared on the basis of cow's milk, are widely used. From the standpoint of the theory of adequate nutrition, such a replacement is not only undesirable, but also dangerous, especially in the first days after birth. This is due to the fact that intracellular and membrane digestion is dominant during this period, abdominal digestion is poorly developed. Intracellular digestion of the endocytic type is carried out either with the breakdown of polymers by lysosomal enzymes, or by transport through the enterocyte in the form of vesicles without change. The last method is the selective transport of various antibodies (-globulins) of the mother's colostrum by the epithelium of the jejunum. On the membrane of enterocytes there is a specific receptor site, which, when touched by the corresponding globulin, deepens into the cell, and then laces off. Apparently, the receptor center protects such a vesicle from lysosomal enzymes. However, immature enterocytes of newborns can "make mistakes" and capture nonspecific macromolecules, including antigens. Therefore, when replacing breast milk with any other or nutrient mixtures, foreign antigens may enter the internal environment of newborns.

In the first 2-3 days of lactation, the mammary gland secretes colostrum and only after 2-3 weeks the milk becomes stable and is called mature. Colostrum is a thick secret containing 9-12% protein, 4-5% fat. It contains a lot of mineral salts, vitamins, neutrophils. The calorie content of colostrum is 2 times more than that of mature milk. Colostrum provides optimal adaptation to the extrauterine life conditions of newborns. Natural feeding from the first days of life creates local passive immunological protection of the child's gastrointestinal tract, and the

endocytic type of transport in the intestine ensures the entry into the internal environment of not only various antibodies, but also hormones, especially corticosteroids.

Mature milk retains high nutritional qualities, and its components are well digested and absorbed. Milk proteins - caseinogen (its molecule is 3 times smaller than the cow's milk caseinogen molecule), lactoalbumins, lactoglobulins contain 17 amino acids, including essential ones. Breast milk contains more lactose than other sugars. Part of the lactose is broken down in the small intestine and absorbed, while the other part enters the large intestine, acidifying its environment, which is necessary for the development of lactic acid and other beneficial bacteria. There is much less lactase in cow's milk, it is completely hydrolyzed and absorbed in the small intestine, therefore, when a child is fed cow's milk, pathogenic microflora and putrefactive processes develop intensively in the large intestine. The child's body is exposed to intoxication, and this can lead to a violation of physical and even intellectual development. Among the emulsified fats, breast milk contains polyunsaturated fatty acids (linoleic, oleic, arachidonic), which improve the absorption of proteins, vitamins, and increase the body's resistance.

Mineral salts (Ca2+, Na+, K+) are contained in the optimal ratio for the development of the body and do not disturb the water-salt homeostasis. There are many vitamins in milk, vitamin D3 and its metabolites increase the absorption of calcium in the intestine. In addition to nutrients, milk contains enzymes: lipase, amylase, esterase, hydrolase - the activity of which increases in the child's stomach (autolytic type of hydrolysis). Milk contains biologically active substances - lysozyme, lactoferon, antistaphylococcal and bifidogenic factors, growth factor. The qualitative composition of milk depends on the nutritional conditions of the mother. With poor nutrition, there is little protein in milk, which can be a cause of death in newborns. Premature babies need more protein, calcium, phosphorus, sodium. It should be borne in mind that although the mammary gland has a selective barrier to drugs, compounds such as nicotine, alcohol, caffeine, some sleeping pills and drugs pass into milk and adversely affect the health of the child. Allergy to breast milk is extremely rare, although there may be a small amount of antigens in breast milk, but there are IgA, IgE antibodies against them in milk. Allergic diseases in children who are on artificial nutrition are a very common phenomenon. Thus, mother's milk is an adequate, natural food for newborns and young infants.

From 5-6 months, breast milk can no longer satisfy all the needs of a growing body, so the child begins to feed. Complementary foods stimulate the digestive tract and prepare it for the transition to the common table. They begin to give new food from small portions instead of one breastfeeding, after a while a second complementary food is introduced, etc. By 12-14 months, a baby can be weaned if their digestive system is able to digest mixed but easily digestible foods. Improper nutrition can lead to digestive disorders, metabolic disorders, slow growth and general development, the consequences of which may persist in an adult.

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