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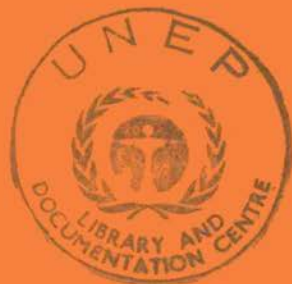
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«TRAINING ACTIVITIES ON FOOD CONTAMINATION CONTROL
AND MONITORING WITH SPECIAL REFERENCE TO MYCOTOXINS»

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**URGENT PROBLEMS
OF THE NUTRITION SCIENCE**



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Attention to the problem of nutrition has been constantly growing on the part of various population groups and on the part of researchers, state governmental organs and international organizations.

This is due to the fact that already at present there is considerable deficiency of food products in general and protein containing ones, in particular. About 60% of world population, predominantly located in developing countries of South-Eastern Asia, Africa and Latin America receive qualitatively inadequate nutrition as a result of insufficient consumption of proteins of animal origin, 15% of the population suffer from malnutrition due to decreased total protein content and calories in their diets. Malignant malnutrition disease is common among children as a result of chronic malnutrition.

The nutrition problem in view of its particular importance is included into 10 major global problems, put forward by the UN for the humanity in general, along with such problems as environmental protection, energy supply and some others.

The rapid growth of the world population has put the problem of providing a corresponding rate increase in our production of food resources and foodstuffs into the top rank among those determining the progress of world civilization. It is assumed that by the year 2000 the population of our planet will exceed 6 billion people. Sufficient provision of this population with food demands, according to some experts, almost a two-fold increase of the present day productivity of agriculture.

Science has established three functions of food.

The first function consists in providing the organism with energy. Adequate nutrition envisages an approximate balance of incoming energy and its consumption by metabolic processes. Energy consumption in human organism is due, first, to basic metabolism (amount of energy necessary for the maintenance of life under condition of complete rest, for example, during sleep in comfort setting), second, to the specific dynamic effect of food (energy consumption in the process of food digestion) and, finally, to activity.

The second function of food consists in providing the organism with plastic substances which include first of all proteins, to a lesser degree, mineral substances, fats, and to a still lesser degree, carbohydrates. Some cells and intracellular components are constantly destroyed to be substituted by others. Chemical substances coming part of food products represent the building material for the creation of new cells and intracellular components.

Finally, the third function of food consists in providing the organism with biologically active substances necessary for regulation of metabolism. Enzymes and the majority of hormones which are regulators of chemical processes taking place in the organism are synthesized by the organism itself. However, some co-enzymes without which the corresponding enzymes are inactive as well as some hormones can be synthesized by the human organism only from special precursors present in food. These precursors are vitamins.

Recently, it has also been found that some peptide hormones are formed in the human digestive tract in the process of digestion of several food proteins. For example, it has been established that during digestion of milk casein peptide hormones of morphine-like effect are formed, which are absorbed to blood and exert an influence on the brain activity.

Comparatively recent data suggest the existence of still another (fourth) function of nutrition, consisting in the development of immunity, both non-specific and specific. First of all, it has been found that the degree of the immune response depends on the quality of food, particularly on a sufficient content of full-value proteins and vitamins in it. In this case nutrition is associated with non-specific immunity. Later it was found that some chemical substances contained in foodstuffs are not decomposed in the digestion tract or are only partially decomposed. Such undecomposed, large protein or polypeptide molecules can penetrate through the intestine wall into blood and, being foreign for the organism, induce the specific immune response. A similar effect could be exerted by foreign substances of low molecular weight which pass through the intestine wall and bind to organism proteins thus transforming the latter into antigens.

Nutrition should meet the requirements of all the above-mentioned functions.

The amount of chemical substances spent by an adult human organism should be equal to that consumed with foodstuffs. However, in the course of metabolism some substances could be transformed into others. The majority of substances can be synthesized within the organism while some represent a kind of ini-

tial stock: they cannot be synthesized and must be consumed with food. All food substances can therefore be divided into non-essential and essential. Essential food substances include essential amino acids (valine, isoleucine, leucine, lysine, methionine, threonine, tryptophane and phenylalanine), essential fatty acids (linoleic, linolenic, arachidonic acids), vitamins and mineral substances.

The theory of balanced nutrition which was broadly and thoroughly elaborated in our country by A.A. Pokrovsky, Academician of the USSR Academy of Medical Sciences, consists in the establishment of a close linkage of nutrition with metabolic processes. A particular role in the process is played by essential factors of nutrition.

The science of nutrition, nutritionology, is concerned with quantitative regularities of metabolism reactions: how much of every substance is consumed and formed in the process of vital activity.

This quantitative principle allows to elaborate physiological norms for needs of the human organism in nutritive substances and, thus, norms of consumption in foodstuffs.

In the Soviet Union first scientific norms of nutrient substance requirements were formulated in the thirties. Revision of these norms was carried out in 1951 when they were approved by the USSR Ministry of Health for the first time, while until recently we have been using the norms established in 1968.

The concept of rational nutrition is placed as basis of new "Norms of Physiological Requirements in Nutrient Substances and Energy for Various Population Groups of the USSR" which ha-

ve been developed by a large group of medical establishments of our country under the guidance of the Institute of Nutrition of the USSR Academy of Medical Sciences and approved by the USSR Ministry of Health in March, 1982.

The physiological norms of nutrition are the final outcome of all studies broadly carried out in the world and first of all in the Soviet Union in the field of physiology, biochemistry and hygiene of nutrition. They are based on the results of detailed study of energy losses as well as indices of protein, fat, carbohydrate, vitamin and mineral metabolisms among various population groups in different geographical zones. These norms determine the requirements of the human organism in energy, total amount of protein including animal proteins, total amount of fat including vegetable oil, vitamins and mineral substances depending on sex, age, character of occupation and household conditions, physiological state and climate environment.

The previous norms which were approved in 1968 and were quite useful during that time in the organization of rational nutrition of various population groups, are presently outdated and demand a wide variety of modifications owing to the changed character of working activity, intensified processes of acceleration in the child age, shifts in age-sex structure of the population, development of new methodological techniques in the science of nutrition and also with changes in some other conditions influencing the requirements in nutrient substances.

These changes concern values of energy losses for various groups of population and the content of a most important component of food protein, basic energy-supplying factors, fats and

carbohydrates, as well as several vitamins and mineral substances.

The study of energy losses by representatives of major occupations has been carried out by a number of research institutions under the guidance of the Institute of Nutrition, USSR Academy of Medical Sciences, in various areas of the country. These studies showed that daily energy losses of both rural and urban populations constantly decrease.

At the same time the attained level of labour mechanization and organization of household conditions cannot ensure complete elimination of physically intensive and hard labour. In this connection there emerged a necessity of introducing differentiation in the new norms for adult ablebodied population according to the following groups:

- I group - workers of predominantly intellectual labour;
- II group - workers of physical labour demanding no considerable energy losses;
- III group- workers of mechanized labour;
- IV group - workers of moderately mechanized labour;
- V group - workers engaged in hard manual labour.

Each of the groups is differentiated into three age subgroups: 18-29, 30-39, 40-59. The requirement for the energetic value of food within the groups varies with age and sex:

I group - 2200-2800 kcal; II group - 2350-3000kcal; III group - 2500-3200 kcal; IV group - 2900-3700 kcal; V group - 3900-4300 kcal (this group does not include women).

For children and youngsters (up to 17 years) the energy value of food is differentiated into 10 groups. For youngsters studying in vocational training colleges the requirement in

nutrients and energy is to be increased by 10-15%. Differentiation depending on sex is introduced beginning with 11 years of age.

Due to the increasing life-span and changing age structure the number of individuals of older contingents of the population (over 60 years) constantly grows. This part of the population is divided into two groups: 60-74 years and 75 years and older. This division by age is in agreement with the international one. The energetic value of food for this group is 2000-2300 kcal for men, and 1800-2100 kcal for women. In view of the fact that this group also includes individuals on pension which continue working, the norm in nutrients for the latter category should be increased.

A major issue in scientific motivation of nutrition norms concerns certain requirements in protein. Studies have shown that the value of optimum physiological norm for protein should be approximately 1,5 times that required to maintain nitrogen balance. This protein norm should be correlated to a certain degree with energy requirements; the requirement in essential amino acids is provided for by a sufficient amount of animal protein.

In view of the above, the requirement in protein in the new norms constitutes on the average approximately 85 grams per capita, with the differentiation by individual groups. Thus, for group I the protein quota constitutes 13% of all nutrients in the diet (by calories), groups II and III, 12%, for groups, IV and V, 11%. A high biological value of nutrition is ensured according to data of fundamental studies, by an approximately 1:1 ratio of animal and vegetable proteins.

Special studies performed at the Institute of Nutrition of the USSR Academy of Medical Sciences have shown that an optimum quota of animal protein for adult population constitutes 85%. For children and youngsters this quota is higher.

In assessing the requirements in fat the necessity of complete provision of the organism with full-value fat substances containing polyunsaturated fatty acids as well as fat-soluble vitamins is taken into account.

Besides, a study of actual nutrition both in our country and in developed countries leads to the conclusion that the percentage of fat in the diet exceeds that recommended, equal to 30% of all diet nutrients (by calories), and in a number of cases exceeds 40%. This is explained by traditional habits, dependence of food taste on fat content, and correlation between fat and protein content in products of animal origin.

Studies performed at the Institute of Nutrition of the USSR Academy of Medical Sciences showed that optimal provision of human organism with fats as energy carrier on the one hand, and essential fatty acids and vitamins, on the other, is attained when the fat content in the diet equals 33% (by calories). In this connection the new norm of fat requirements is on the average 33% of all nutrients in the diet with the differentiation by zones: for southern zones, 27-28%, for northern zones, 38-40%.

Of the total fat content, 30% should fall on the part of vegetable fats, containing essential polyunsaturated fatty acids and fat-soluble vitamins. Linoleic acid norms within the limits of 4-6% (by calories) represent an important innovation which permits identification of biological value of a diet of any

fat composition.

The carbohydrate requirements in the new norms were somewhat decreased.

A comparative ratio of two basic sources of carbohydrates, starch and sugars is of a considerable interest. At present, the percentage of sugar in food in industrialized countries is extremely high and has a tendency to increase, which is due to better taste of sugar and growth of material well-being of the population. At the same time, elaboration of a rational food pattern suggests the presence of sufficient amounts of products containing starch because starch is more valuable from the physiological point of view. In this connection there is a question about a possible differentiation of norms of carbohydrates by their basic sources, starch and sugars. This question, however, cannot be regarded as finally solved although the consumption of sugars and pastry products should evidently be reduced.

An important part of the problem of rating nutrient substance is the assessment of requirements in vitamins as essential factors of nutrition.

The necessity to determine the need in vitamins is due first of all to the fact that satisfaction of the organism needs in vitamins is largely provided by foodstuffs.

Recent investigations performed in our country and abroad established broad distribution of hypovitaminosis conditions in large groups of the population particularly in pregnant women and feeding mothers, students, elderly people in developed countries (including the USSR). The reasons for this lie both in nonobservance of nutrition rules by the population and in changes of diet structures. This is connected with an increased

of refined, highly caloric and also canned or durably stored products, deprived of vitamins or having low vitamin content. Hence the necessity of correction of vitamin supply (elaboration of diets with maximal use of natural foodstuffs carriers of vitamins, vitaminization of food products, use of vitamin preparations) and an establishment of necessary norms of vitamin consumption.

The requirements in some vitamins are connected with the energetic value of a food diet. Studies carried out in the Institute of Nutrition of the USSR Academy of Medical Sciences, as well as new data presented in tables of chemical composition of foodstuffs elaborated and published by the Institute of Nutrition, permitted to update the consumption norms for vitamins B₂, A and D and also established for the first time in our country the consumption norms for three other vitamins, folacin, vitamins B₁₂ and E.

Consumption norms for four mineral substances - calcium, phosphorus, magnesium and iron have been also established.

The use by the population of our country of new, more differentiated and decreased nutrition norms is of extremely great significance for the improvement of health status of the population because it represents an alternative to the frequently observed overnutrition, characterized by excessive weight and obesity which in turn exert a considerably negative influence on the metabolism, decrease the life-span and represent a risk factor for the appearance of cardio-vascular diseases, diabetes, cholelithiasis and several other pathological conditions.

The frequent occurrence of overnutrition diseases in economically developed countries represents today a peculiar paradox.

The outcomes of excessive consumption of some foodstuffs are characterized by manifested specificity. Thus, an excess of purines leads to the appearance of metabolic arthritis and gout, vitamin D, to intensified processes of calcification. Excessive use of glucose and saccharose considerably aggravates the course of diabetes, excess of proteins, the syndrome of renal insufficiency, etc.

According to the world statistics, a major overnutrition diseases is obesity. Mechanization and automation, developed networks of urban transportation facilities and many other types of household and communal services have contributed to the apparent and constant decrease of human energetic losses. We have to speak more frequently about insufficient physical efforts and excessive nutrition as major causes of health disorders.

Voluminous epidemiological studies carried out in various regions of the country under the guidance of the Institute of Nutrition of the USSR Academy of Medical Sciences identified the fact that excessive bodyweight and its extreme obesity, are very common (particularly in women). Prevention and treatment of obesity becomes a social problem.

An analysis of nutrition of individuals living in various geographical zones of the Soviet Union supports the conception of energetic unbalance as a major cause of obesity development. This notion includes, on the one hand, increased energetic value of food, and on the other, aggravated hypokinesia resulting in imbalance between required and consumed energy. Not only overnutrition, due largely to consumption of animal fat and carbohydrates, but also wrong eating habits such as con-

sumption of a major part of food in the evening is pointed out.

The theory of balanced nutrition on the basis of which low-calorie (reduced) diets, though balanced in all essential factors and containing an adequate amount of protein, should represent the scientific ground for modern principles of preventing and treating obesity.

In the development of obesity a considerable role is played by excessive consumption of carbohydrates and fats. Of carbohydrates the most dangerous is sugar which not only represents the so-called "futile calories" because it doesn't contain any essential nutritive substances necessary for the human organism, but also leads to the development of other two diseases; dental caries and diabetes mellitus. Sugar production and consumption in the whole world and particularly in highly developed countries grow constantly and considerably increased during the last 5 decades.

In many countries of the world including the Soviet Union considerable attention is attached to the development and production of pastry with reduced sugar content.

Uric acid is the final metabolic product of nucleic acids which contain purine bases. It is poorly soluble and can be sedimented in joints and some other organs and tissues, resulting in the appearance of a typical disease of improper nutrition, gout. The study of character of nutrition of gout patients carried out by the Institute of Nutrition, the USSR Academy of Medical Sciences, showed that such patients consumed too much of animal origin products: fish, eggs, meat. The treatment and particularly prevention of this disease therefore consists in limiting consumption of these products and also of leguminosae - carriers of a considerable amount of nucleic acids,

The cause of appearance and development of atherosclerosis should not be considered as finally resolved. An important role, however, is known to be played by the pattern of nutrition and in particular, by quality and quantity of fat in the diet. Atherosclerotic patients typically have a considerable impairment of fat metabolism, manifested as a higher content of total lipids, cholesterol and several other lipid components in the serum. Excess of animal fat leads both to the appearance and intensification of the above impairments. If the amount of fat is not higher than 30-35% (by calories), of which no less than 30% is represented by vegetative oils, one can hardly expect lipid metabolic unbalance. If the content of fat, mostly animal fat, increases to 40% and over, there exists a threat of appearance of the risk factor of atherosclerosis development.

It is now well known that a risk factor for hypertension is excessive consumption of sodium chloride. Some amount of salt (up to 5-6 grams) should be added to food, however, an extremely high content of it can considerably damage the health status.

Food allergy occupies an important place among diseases directly associated with nutrition.

Allergy is hyperreactivity or hypersensitivity to a certain substance, allergen, as a result of previous contact with this substance. When foreign cells or molecules (antigens) appear in blood they direct formation of antibodies against them. These antibodies at the next appearance of the antigen react with it and inactivate it. This is the essence of reactions of

development and manifestation of specific immunity which are vital for protecting the organism from undesirable effects of environmental factors. However, in a number of cases when antigens appear in blood for the first time, peculiar, so-called reaginic antibodies, may be formed not only in the serum but also at the surface of a number of quite reactive cells of both blood and of some tissues. When these antibodies react with antigens appearing in blood for the second time they cause changes in structure and metabolism in such cells and induce formation in the latter of biologically active substances which are secreted into blood and lead to the development of a clinical allergy. Antigens inducing allergic reaction were given the name of allergens.

Antigens and allergens can appear in human blood through different ways. One of such ways which turned out to be of great significance is through the digestion tract. Foodstuffs containing various foreign proteins and other compounds are attacked in the gastro-intestinal tract by digestive enzymes which decompose complex chemical compounds into smaller ones and the latter are absorbed by the lymph and blood. It was found, however, that a fraction of protein molecules can penetrate the lymph and blood only in a partially decomposed or completely intact form. It has been argued that penetration of foreign protein molecules from intestines into the lymph and blood of man and animals is biologically advantageous because it results in the development of corresponding antibodies and stronger immunity to various foreign proteins. However, as it happens rather frequently this biological advantage also has its negative sides in the form of a possible development of alimentary

allergy.

In the Institute of Nutrition of the USSR Academy of Medical Sciences an experimental model for the study of food allergy development has been elaborated. An active anaphylactic shock by means of intravenous administration of various food allergens into guinea pigs after feeding with the same allergens has been induced. Whole egg albumin, pasteurized cow milk, bovine serum albumin and some other food proteins were used as allergens. Because intravenous injection of allergens without a prior feeding to animals fails to induce any reactions, the appearance of allergens in the digestion tract results in their penetration into blood and in the formation of reaginic antibodies towards them. The latter are the prerequisite of a rapid development of anaphylactic shock, an extreme form of allergy, which takes place at reappearance of the allergen in blood. It is interesting to note that the vigour of anaphylactic shock in the animals varied with different food allergens.

To develop scientifically motivated methods of diagnosis, prevention and treatment of food allergy it is necessary to obtain and study highly-purified individual allergens from foodstuffs. The knowledge of physicochemical properties of such antigens is extremely important for the study of allergic reaction mechanism. A detailed analysis of the chemical composition of allergens can help in the identification of the parts of their molecules responsible for the effect the so-called allergic determinants. The correlation between the structure of a chemical compound and its function represents the central problem both for molecular biology and, with regard to allergenicity of foodstuffs it can be presented in the form of a question:

what makes this or that food component an allergen? At present, this question has no clear answer though it has been rather well established that the overwhelming majority of food allergens are proteins and glycoproteins, the content of the carbohydrate moiety in the latter being subject to considerable variation.

While for highly developed countries of Europe and Northern America, overnutrition and the resulting excessive body-weight and obesity is characteristic of the majority of population, for poorly developed countries of Asia, Africa and Latin America the problem is quantitative and qualitative insufficiency of nutrition.

As a result of insufficient amount of protein particularly in combination with a low energetic value of it, processes of regeneration and synthesis of proteins are impaired, which results in a considerable weakening of the organism resistance to various harmful effects.

Studies carried out on Leningrad inhabitants during its blockade by Nazi troops permitted to determine the lowest limit of caloricity and protein content which would allow maintenance of life at a minimum level, just to ensure vital functions fulfilment and maximum economy of the vital forces. This limit corresponded to an average of 1000 kcal per day the protein content being 25 g. Naturally, living under such conditions presented a number of difficulties in view of a sharp loss of ability to work, physical and mental weakness, and reduced resistance of the organism. A caloricity and protein contents below the above mentioned limits resulted in a rapid progress of dystrophic changes ending in death.

A study performed on young healthy volunteers receiving

a daily diet of 1000 kcal and 25 g of protein showed a development of primary dystrophic changes in their organisms in the course of 2-3 weeks.

Children are characterized by particularly great vulnerability to insufficiency of nutrients because, in view of their growth, a more intensive metabolic process is typical of them. In children protein insufficiency can induce considerable impairments in the brain activity. There is scientific evidence that children who suffered from acute protein insufficiency during their first three years of life (period of intensive brain formation) were irreversibly underdeveloped intellectually. The infantile disease, kwashiorkor, caused by a gross insufficiency of protein in food has been quite common in several developing countries.

A comparatively common phenomenon in highly developed countries including the Soviet Union is undernutrition of young girls trying to maintain or improve their slim figure. This frequently results in dystrophic changes while in some cases a medical effort is needed to save the lives of these girls.

Decreased consumption of vegetables and fruits by various groups of the population can result in insufficient intake of not only vitamins but also of several mineral substances because the bulk of them is received from vegetables and fruits. Vegetables and fruits also represent basic carriers of the so-called "food fibers" which are cellular membranes composed of cellulose and hemicellulose which are not digested by enzymes. The food fibers were found to enhance the motor system of the digestive tract, which is quite significant for the prevention of diarrheas. On the other hand, there is evidence that the content

of fibers in the human diet is inversely correlated with the colon cancer. It was assumed therefore that food fibers are capable of absorbing carcinogenes and other toxic compounds which appear in the digestive tract and discharge them from the organism with feces.

The possibilities of adaptation of the human organism to decreased intake of essential substances with food is rather limited. Naturally, the basic processes of metabolism taking place in the human organism should not be subject to considerable changes. The absence of a component received with food causes metabolic impairments manifested in the appearance of various diseases. From a certain point of view diseases of food insufficiency which result from the characteristic metabolic impairments can be considered as a peculiar, though non physiological adaptation of the organism to changed, unfavorable conditions, since instead of termination of metabolism which would result in death, the organism continues living and functioning under extremely complicated and unfavourable conditions (the condition of disease). Usually, a prolonged absence of essential components in food results in death. When their content in foodstuffs is insufficient there can be no death, although the organism functioning is impaired. For example, there is an opinion that small height and decreased bodyweight in several peoples of South-Eastern Asia and Africa result from hereditarily established adaptation to protein-caloric insufficiency.

Annually the world population increases by 70 million people while the natural resources remain at the same level, From year to year the inflow of solar energy to the Earth surface remains constant and in the final analysis foodstuffs are

nothing but processed energy of the sun. The pigment chlorophyll present in vegetative cells possesses the property of synthesizing glucose from carbon dioxide and water, using the energy of light i.e. the sun energy. Glucose in its turn represents primary energetic material for subsequent biosynthetic processes in plants. Unfortunately, the factor utilization of the sun energy to create consumable parts of plants for man and animals is very low due to the fact that evolution favored not the species which could serve as food for animals but, on the contrary, those which were unable to serve this purpose due to various reasons. It is true that in the process of artificial selection man has grown and multiplied plants that yielded maximum crop from a unit of territory, however, this, particularly at early stages, has been done on an empirical basis without considering the biological value of vegetable products of food. Unfortunately, proteins of all vegetable products are imperfect because they contain from two to four essential amino acids in insufficient quantity. For example, bread and most of groats contain insufficient amount of lysine and threonone while leguminosae have little methionone.

Animal proteins (e.g. from meat, fish, milk, eggs, etc.) are full-value proteins because they contain all essential amino acids in adequate amount. It is true that their amino acid composition differs from that of an "ideal" food protein, i.e. protein with ideal balance of all the amino acids. In nature there exists no ideal product of food which could meet all the requirements of man in nutrients. Breast milk is the only exception, however, only for infants.

In practice man utilizes a mixture of proteins of animal and vegetative origins as food, doing it empirically (according to the appetite) and trying to adapt the mixture maximally to the ideal protein. Studies have shown that the biological value of food proteins consumed by the population of our country constituted on the average 70% of the biological value of the ideal protein.

In the synthesis of meat, milk, eggs and other products of animal origin the sun energy utilization factor decreases additionally 5-10 times in comparison with the same factor in the production of vegetative origin products, because animals possess no capacity of direct utilization of sun energy and use it indirectly, by eating plants.

The extremely low sun energy utilization factor for the production of foodstuffs poses before the science of nutrition a very important problem of radical increase of this factor for the creation of a larger number of full-value foodstuffs from a unit of territory. In such cases a serious task consists in a purposeful selection of consumed plants for the growing of species with a highest protein content and an increase of its biological value. For cereals it means selection of species with a higher content of lysine, for leguminosae, those with a higher content of methionine.

Another problem which is being solved at present is obtaining consumable isolates or protein concentrates from various sources and first of all from food production residues. Full-value proteins from dairy products residues: casein, caseinate, etc. have been already obtained and introduced into practical use. The same is true of soybean protein isolates which are admixed to meat products (without an apparent deterioration of

their quality); work is on the way to obtain protein isolates from oilseeds and first of all from sunflower and cotton grist. Considerable expectations are connected with obtaining proteins of microbial origin, first of all those of yeast, because the rate of synthesis of these proteins is extremely high and various non-food sources such as methanol, ethanol, paraffins, natural gas, etc. could serve as substrates for the biomass growth.

All new sources of food protein (isolates, concentrates, etc.) created in various laboratories of the world, and also those obtained in experimental production, should be subject to special medico-biological tests to prove their safety and usefulness for the human organism. As a result of scientific efforts both in our country and abroad there has been a rather well elaborated scientific programme of medico-biological studies allowing to obtain reliable information about safety and biological value of new sources of food protein of various origins. In accordance with the latest scientific achievements the new sources of food protein should meet a number of requirements the adequacy of which is tested with a well established range of instrumental techniques of analysis.

An extremely important task in the above mentioned direction is accumulation of new food proteins adequately tested and suitable for human consumption, with the aim to combine them and create mixtures maximally adapted to the ideal protein mixture, i.e. the one containing all amino acids in the amounts corresponding to human organism requirements. To resolve this task computerized technology capable of extremely complex mathematical calculations is needed. At the Institute of Nutri-

tion of the USSR Academy of Medical Sciences this work has been started and has already yielded a number of positive results.

The Agricultural Programme of the USSR envisages constant and accelerated production of full-value foodstuffs for the population of the Soviet Union. At the same time a total provision of the population with food is greatly dependent on elimination of losses in the process of production and consumption of foodstuffs.

In recently terminated scientific studies carried out by a large number of technological and nutrition institutes under the guidance of the Institute of Nutrition it has been established that traditional, evolved during decades, technological processing of foodstuffs both in household and, particularly, in enterprises of public nutrition occasionally results in a considerable decrease of their nutritive and biological value due to destruction of a greater part of protein, fat, carbohydrates and vitamins. Particularly unfavourable are commonly utilized processes of roasting as well as heating with fat for a relatively long period of time. Under these conditions, i.e. at a high processing temperature, intensive formation of the so-called melanoidins (from the Greek "melanos" which means "black"), takes place resulting from a chemical reaction between proteins and carbohydrates. Melanoidins are practically not decomposed in the digestive tract and are not assimilated by the human organism. Besides, there is evidence on their toxicity for animals and man. The studies also showed that thermal treatment of foodstuffs at a high temperature irreversibly damages a considerable percentage of amino acids. First of all this concerns lysine, methionine, trypt-

tophane, arginine and histidine.

Cooking of food can induce adverse changes on the part of fat. For example during roasting an intensive oxidation of fats takes place with the formation of hydroperoxides, epoxides, aldehydes, ketones, carbonyl compounds. Fritter cooking with the use of vegetative oil results in the appearance of darkly stained compounds - melanophosphatides which add unpleasant taste and smell to the product. Many compounds formed during fat oxidation in the course of thermal treatment possess a considerable toxic effect.

Vitamins coming part of foodstuffs are very sensitive to cooking. Vitamin C, contained in small quantities in vegetables and fruits is subject to particularly easy decomposition. Decomposition of group B vitamins (thiamine, riboflavin, pyridoxine, folic acid, niacin) present in considerable amounts in flour, groats, milk, is directly related to the temperature and duration of exposure to high temperature.

In view of the fact that the existing traditional technology of food cooking results in considerable losses of valuable nutrients, the G.V.Plekhanov Moscow Institute of National Economy in collaboration with the Institute of Nutrition of the USSR Academy of Medical Sciences have developed a new protocol of cooking aimed at preserving the nutritive and biological values of food for rational dietetic nutrition. The basic principle of the new pattern is the use of most gentle thermal treatment of foodstuffs. It completely excludes roasting and long-term heating with fat and considerably decreases the duration of such processes as boiling, stewing, baking. The proposed technology does not include thermal treatment of fat at

all. Fruits, vegetables and dairy products are used mainly in the intact form.

The new pattern of cooking differs from the traditional one in making use of recent achievements of the science of nutrition in the fields of physiology, biochemistry and hygiene of nutrition, and also in the chemistry of food products. At the same time it maintains the sources of national Russian cooking.

The new technology maximally maintains nutritive and biological value of all foodstuffs. For example, vegetables and fruits contain phytoncides, pigments, aromatic compounds, including ester oils, biostimulants, vitamins, hormones, antibiotics, etc. Many of these are decomposed when excessive thermal treatment is applied. Thus, according to many investigators, boiling alone results in the elimination of antimutagenic activity of such vegetables as cabbage, eggplants, sweet pepper. The new technology preserves biologically active substances in vegetables and fruits.

Thus, the new technology is aimed at a more rational and adequate nutrition both at home and in the system of public nutrition by making everything possible to preserve valuable nutrient substances in products. It can be particularly helpful for physicians and dietologists in the organization of treatment nutrition.

At present, the Institute of Nutrition of the USSR Academy of Medical Sciences in collaboration with the G.V. Plekhanov Moscow Institute of National Economy implement measures on a large-scale testing and introduction of new technological patterns of food processing into a system of both public and treatment nutrition.