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Part 1

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Lecture I

HYGIENE AS THE SCIENCE AND AREA OF PRACTICAL ACTIVITIES

1. INTRODUCTION

The purpose of medicine is restoration, preservation and strengthening of human health. This purpose is achieved by the two methods: the first — treatment of human diseases, the second — prevention of diseases and premature aging of an organism, i.e. prophylactics. According to this two directions in medicine were formed: medical and preventive.

The source of medical direction is therapy, the source of preventive direction is hygiene. The word «hygiene» originates from the name of ancient Greek goddess of health Hygiea — daughter of doctoring god Aesculapius. Hygiene is a science of human health.

Apart from the term «hygiene» which means «radiant in health» there exists the term «sanitary» (originating from the Latin «Sanitas», or health, which denotes the practical part of hygiene). Now, both therapy and hygiene are divided into the number of medical (therapy) and preventive (hygiene) scientific disciplines and the areas of practical activities united by the common goal but with various methods of its reaching.

The structure of preventive direction includes general hygiene, social hygiene, municipal hygiene, hygiene of labor, hygiene of a nutrition, radiation hygiene, naval hygiene, hygiene of physical culture and sports, sanitary toxicology, sanitary microbiology, parasitology and, finally, important enough preventive discipline — epidemiology of infectious diseases.

Thus, the modern hygiene represents the unique direction in medicine. It includes the number of preventive scientific disciplines and areas of practical activities of doctors. Similar to medicine, hygiene is founded on the theoretical base of philosophy, exact (physics, chemistry, mathematics) and biological (general biology, normal and pathological physiology) sciences.

2. HYGIENE AS THE MEDICAL SCIENCE OF THE PREVENTIVE ORIENTATION

2.1. Purpose, subject, object and method of hygiene

The purpose of hygiene as of science is protection and boosting of public and personal health by improvement of natural and social environment consisting of the concrete working conditions, life and behaviour of the man. By contemporary representations (the Charter of the World Health Organization), health means not only the absence of diseases but also the maximal physical, mental and social well-being allowing the person to most effectively carry out the public and labour functions. Hence, the health of a man is a biosocial concept at the leading part of a social.

The subject of hygiene is studying of laws of interaction of factors of natural and social environment and an organism of a person, research of cause-and-effect relations within system «environment – human health» as the majority of cases of health disorder, diseases and early ageing of the organism is the result of interaction of the person with unfavorable influence of the environment.

The basic objects of survey in hygiene are a healthy person (social group, population, the population of a region) and the environment. By origin, environmental factors are divided into natural, industrial and domestic. By their nature environmental factors are divided into physical (climate, microclimate in rooms, atmospheric electricity, noise, vibration, ionizing and non-ionizing irradiation, and others), chemical (chemical compound of atmospheric air at homes and business premises), biological (microorganisms, plants, mushrooms, insects, animals and products of their life activity) and social (conditions of accommodation and rest of people, nutrition, water supply).

The method of hygiene differs in specific preventive orientation consisting in prevention or reducing of harmful factors impact and the application of useful factors of the natural and social environment for the achievement of the purpose – preservation and boosting of public health.

Specificity of the hygiene method consists not only in its orientation on elimination of negative environmental influence on the person but also in the way of it realizes this orientation: not by direct influence on the person (treatment) but through regulation of a complex of scientifically grounded legal, administrative, technical, economic and other measures.

In hygiene the following concrete methods of research are applied:

1. The method of hygienic inspection of an object in which people live or work. This method consists of natural research of working conditions, life and rest, in comparison of the revealed conditions with hygienic specifications and in the development of recommendations on elimination of the revealed sanitary infringements.

2. The instrumental-laboratory method which played a big role in transformation of hygiene into scientific discipline. The significant number of partial techniques for research of physical, chemical, biological factors of environment, and also functional shifts giving understanding of the influence of these factors on an organism is used.

3. The sanitary-statistical method allowing to assess the level of public health in any collective, group of population in connection with influence of factors of natural and social environment by three basic groups of parameters:

- Sanitary-demographic parameters describing reproduction of the population (birth rate, death rate, reasons of death, average life duration, final results of reproduction);

- Parameters of morbidity and disability (initial applications for medical assistance, hospitalization, disability);

- Parameters of physical development (growth, body mass, functional parameters).

4. The experimental method used in scientific research for hygienic normalization, including laboratory and natural research.

Summing up, modern hygiene can be determined as a complex of medical preventive scientific disciplines and areas of practical activities of doctors aimed at preservation and boosting of human health by means of prevention of illnesses and premature aging.

2.2. Hygiene as fundamental science

Regarding practice, sciences can be divided into fundamental and applied. The word «fundamental» (of Latin «fundamentus» — «basis») has two meanings: the basic, main and substantial, deep.

As possible meanings of this word the Webster's Dictionary tells: «theory or principle underlying something» and «something basic for scientific and technological progress».

Considering all this, hygiene can be qualified as an equivalent fundamental and applied since it both has to ground healthy conditions of life and work and is a scientific basis for sanitary practice, and its developed scientific recommendations have direct practical introduction.

2.3. Laws of hygiene

For the first time the fundamental preventive science with a centuries-old history whose subject of studying is a system «healthy person — environment», has formulated its laws.

So, the *first law* of hygiene determines that affection of health of people caused by physical, chemical, biological or social factors, can arise only at presence of three conditions: a source of harm (danger) of the environment, mechanism of its transfer and susceptibility of an organism.

The *second law* of hygiene reflects negative ecological influence of the human activity on the environment which occurs regardless his will and consciousness. Without taking into account corresponding sanitary-and-hygienic requirements there is a progressive environmental pollution and biosphere on the whole.

The *third law* of hygiene — the law of negative influence of the extreme natural phenomena (volcanic activity, geochemical anomalies, flashes on the Sun, earthquakes, cyclonic and anticyclonic activity, etc.) on the environment.

The *fourth law* of hygiene establishes positive influence of human society on the environment. Its observance at introduction of non-polluting technologies promotes augmentation of conditions which improve quality of human life.

The *fifth law* of hygiene characterizes negative influence of the polluted environment on human health. Action of this law is in certain dependence on the concrete display of requirements of the second and third laws. So, in the result

of long pollution at unskilled land tenure of some agrocoenosis in the Gomel area with pesticides and nitrates combined with the high radioactive background and presence of polymetals in soil of the region there were created conditions for occurrence of xenobiotic syndrome among pregnant women and the newborns, expressed in anemia, hypoxia, jaundice and microsymptoms of the central nervous system affection.

The sixth law of hygiene — positive influence of the natural environment on the human health which should not be limited but strengthened (ecologically clean and good-quality food, drinking water, atmospheric air, natural insolation, UV (ultraviolet) radiation of the Sun, etc.).

These are scientific bases of hygiene, its 6 laws.

2.4. Differentiation of hygiene as subject matter

Sections of hygienic science are hygiene of labor, municipal hygiene, hygiene of children and teenagers, hygiene of nutrition, radiation hygiene, military hygiene with reference to investigated objects: industrial enterprises, living places, children's and school establishments, cafes and restaurants, enterprises of food industry, objects of military machinery.

Doctors-hygienists conduct the routine and precautionary sanitary-and-hygienic control over condition of the environment, conditions of life and work of the population.

Practical implementation of specifications and recommendations developed by hygienic science is carried out as sanitary measures. For example, hygienic standards of microclimate, maximum concentration limit of dust and toxic substances in air, airproofing of the equipment, mount of ventilation in workshops, applications of individual means protection, etc. Hygienic norms of water consumption and quality of water demand carrying out of the number of sanitary measures at choosing of water supply point, systems of water purification and disinfecting, development of a quality monitoring over efficiency of water treatment, etc. All these actions are surveyed by sanitary inspection.

3. THE HISTORY OF THE HYGIENE DEVELOPMENT. LINK OF HYGIENE WITH THERAPEUTIC MEDICINE

From ancient times hygiene possessed monopoly to studying of factors of the environment and their influence on the human health. Ancient Greeks believed that mythical doctor Aesculapius had two daughters — Panacea and Hygiea. The first daughter performed the role of treatment of ill people, the second one prevented illnesses in healthy people by elimination of harmful factors of inhabitancy, application of useful ones and formation of healthy way of life on this basis. This formation was first based upon empirical supervision over results of people's interaction with the environmental natural and social environment and was expressed as traditions, laws and religious rules. Later they were summarized

in the first scientific manuscripts belonging to the well-known doctor of antiquity Hippocrates (460–377 B.C.) such as «About water, air and districts» where he wrote, that disease is the result of the life contradicting to the nature, therefore the doctor, to execute the duties, should observe carefully how a person relates to food, drink and everything surrounding him. Since the 9th century, there was a University in Italy (Salerno) in which ideas of Hippocrates and Roman doctor Galen were widespread. In the East an outstanding role in the development of medicine and studying of influence of the environment on health was played by the well-known scientist Abu-Ali ibn-Sina known in Europe as Avicenna. He developed many hygienic rules about the structure and treatment of homes, clothes, correct nutrition, child care, etc. He for the first time specified an opportunity of spreading of a disease through soil and water. 15th and 16th centuries were marked by the development of a capitalist industry which was followed by development of sciences and arts including modern natural sciences.

Medicine in general and hygiene in particular, overcoming religious, scholastic representations about the reasons of illness take the natural-science way of development. Environment and life conditions of people are admitted to be leading in occurrence and development of illnesses. Doctor and Astronomer Fracastoro reports of supervision over ways of distribution of infections and writes the treatise «Of infectious illnesses» (1546), Doctor Rammatsini — «Treatise about the illnesses caused by trades of people» (1700).

The further progress in science, public life and culture put forward new problems before hygienic science and practice. Their decision demanded scientifically grounded positions based on accurate research of factors of the environment and experiment. The first large papers corresponding these requirements were manual in hygiene by Michel Levis published in 1844 in Paris, and the manual in experimental hygiene of an English doctor Parx published in 1854 in London. Experimental direction received further development in work and practical activities of the outstanding scientist - hygienist Max Pettenkofer (1818–1901) and the school of hygienists created by him.

In Russia, as well as in other countries, the beginning of empiric knowledge of connection between conditions of life and health arose long ago — in Kiev and Novgorod Rus (Russia). They were reflected in «Domostroi» — the treatise about life of prosperous Russian family. Later a number of decrees about protection of an environment and health of the population, in particular, about supervision of a sanitary condition of cities (1737), about sanitary conditions at cloth factories («Rules», 1741), about the obligatory notice is issued in case of infectious illnesses («the Order to governors and voevodes», 1743).

The history of domestic medicine testifies to deep understanding of problems of hygiene by outstanding Russian clinical physicians.

One of founders of Russian therapeutic school M. J. Mudrov (1776–1831), being the professor of therapy of medical faculty in Moscow University, on

June, 3 1809 has made the well-known assembly speech under the name «the Word about advantage and subjects of military hygiene, or sciences to keep health of military men». In this speech are contained the ideas which have not lost the value today. He spoke: «In regiments and especially in fleet it is much easier to protect than to recover the lost of health». And further: «Satisfied and healthy soldiers essence are brave, in works are tireless, and, hence, are invincible».

N. I. Pirogov's words are widely known: «I believe in hygiene. The future belongs to medicine precautionary». S. P. Botkin as chairman of the Society of Russian doctors considered necessary that «deep idea of improvement of sanitary conditions was more and more popularized », that an idea about «... Improvement, about sewage disposal, the water drain of our cities — these centers of disease-breeder — it was made more and more possible». The professor of therapeutic clinic G. A. Zaharjin in 1873 in assembly speech in Moskow University has told: «Is victorious to argue with an illness of mass can only hygiene. Clearly therefore, that hygienic data more useful for everyone, than knowledge of illnesses and their treatment». Professor G. A. Zaharjin emphasized: «The more mature the practical doctor, the more he understands power of hygiene and relative weakness of treatment, therapy..., the successes of therapy are possible only under a condition of observance of hygiene».

The cradle of the first faculty of hygiene in Russia was the Medical-and-surgical academy where it has been organized in 1871 by professor Alexey Petrovich Dobroslavin (1842–1889). Day of perusal of the first lecture by A. P. Dobroslavin — on November, 19 1871 — is considered date of the basis of hygiene faculty. It has been named faculty of the general, military-overland and sea hygiene. The founder of domestic hygiene A. P. Dobroslavin is the pupil of the academy who have received improvement at well-known chemists N. N. Zimin, A. P. Borodin, A Vjurts, L. Peblj, at physiologists N. M. Jakubovich and A. Rollet, at hygienists M. Pettenkofer and R. Fojt.

A. P. Dobroslavin has written the first original textbooks in Russian, has based first hygienic magazine «Health» and a hygienic society. A. P. Dobroslavin has enriched hygiene with valuable experimental researches and practical recommendations in the field of nutrition hygiene, military hygiene and in other areas of hygiene.

One of founders of domestic scientific hygiene by right is considered professor Feodor Fedorovich Erisman (1842–1915). The Swiss by origin F. F. Erisman most effectively worked in Moscow where in 1882 has based hygiene faculty in Moskow University, in 1879–1885 together with doctors A. V. Pogozhev and E. V. Dementjev has carried out detailed studying a sanitary condition of factories in the Moscow's provinces which results are published in 10 volumes.

F. F. Erisman is also the author of three-volume «Manual in Hygiene», «Professional Hygiene or Hygiene of intellectual and physical work». His sights

at essence of the hygiene, stated in the introductory lecture published in «the Course of Hygiene» in 1887, have not lost the urgency today. F. F. Erisman counted hygiene a science about public health: «Deprive the hygiene of its public character..., declare, that hygiene not is a science about public health, and that it should be engaged only by studying of private questions in walls of laboratory, — in front of you there will be only illusion of a science pro which and to work doesn't worth».

4. THE CONCEPT OF HYGIENIC DIAGNOSTICS AT THE CONTEMPORARY STAGE

Concept «diagnostics» (recognition) usually connect with clinical, i. e. medical medicine. Obviously, this concept can be distributed and on other natural phenomena and societies, including factors of an environment. It was marked in the works by the founder of hygiene in Russia A. P. Dobroslavin which called on doctors to diagnose «sanitary illnesses» of societies, to form hygienic mentality under which he understood skill to diagnose and eliminate these illnesses. He counted a technique of recognition, studying and an estimation of environmental conditions identical those at definition and recognition of conditions of the person during diagnostics of illness.

Contemporary hygienic diagnostics represents system of thinking and the actions which are having for an object research of conditions of the natural and social environment, health of the person (population) and an establishment of interrelation between a condition of environment and health. It appears from this, that hygienic diagnostics has three objects of research — environment, health and connection between them. Now while the most investigated is the first object — an environment, it is worse — the second and very little — the third.

In the methodological and methodical relation hygienic diagnostics significantly differs from diagnostics clinical.

Objects hygienic preozological diagnostics is the healthy person (population), environment and their interrelation. Object of clinical (nozologic) diagnostics — the sick person and it is rather fragmentary, only in the familiarization plan, – conditions of his life and work. A subject of clinical diagnostics is illness, its size; a subject hygienic preozological diagnostics — health, its size.

Hygienic preozological diagnostics can begin with studying or, anyway, from an estimation of the available data on the natural person natural and social environment and then to pass to the person (population). Clinical diagnostics begins directly with the patient who already has both complaints, and symptoms. They should be coordinated in the logic circuit and to compare with existing one in textbooks, manuals and model of illness developed as a result of experience. The knowledge of environment plays a supporting role here, it directly for diagnostics is not necessary almost because the result of action of environment is available, and moreover in manifest form.

An ultimate goal of hygienic prenosological diagnostics is the establishment of a level, sizes of health, of clinical ones — definition of illness and its size. It appears from this, that at realization hygienic prenosological diagnostics the condition of adaptable reserves of an organism, and then functions and structures which in general can be not broken, especially structure first of all should be estimated. At clinical diagnostics on the contrary and more often infringements of structure, function and less often — conditions of adaptable reserves are revealed.

THE CONCLUSION

Finishing introduction lecture about a place and value of hygiene in system of medical sciences, it is necessary to emphasize, that hygiene — a science is preventive. Now we are at that stage of development of a medical science when there is a question of revision of a preventive direction of all our public health services and its deeper introduction in medical practice. Therefore today with special the urgency perceives A. I. Nesterova's words: «the preventive medicine is a medicine etyologic, pathogenetic and social in the same time; is a medicine of scientific and active multilateral influence both on the sick person, and on the environment».

In all civilized countries the preventive direction of medicine is conventional and the most effective. Attempts to introduce in our country the system of prophylactic medical examination of the population as method of preventive maintenance of appreciable did not give effect. Among the reasons of failure, alongside with absence of structures and the mechanisms, allowing to develop preventive maintenance, it is necessary to note disinterest in carrying out of this work of practical doctors, bad preparation of students in medical institutes on this section of work.

The main task of preventive maintenance in present conditions should be counted not revealing of early attributes of diseases, and improvement of a health state surveyed and application of such methods of influence on the person which prevent occurrence and development of diseases.

Lecture II
METHODICAL BASES OF HYGIENE
INTRODUCTION

On the first lecture we studied the aim, subject, object of hygiene. Today we'll dwell in detail upon methodological bases of hygiene.

Under methodology, set of investigation technique used in hygiene is understood, and as method — the way of investigation or method of phenomena comprehension.

The methodological basis of hygiene is the fixed positions describing mutual relations of a human organism and the environment which assumes detection of cause-and-effect laws of interrelation between the environment and human health.

**1. THE CONCEPT OF RISK FACTORS AS THE SCIENTIFIC
BASIS OF MODERN REPRESENTATIONS ABOUT
PROPHYLAXIS OF DISEASES**

The concept of health assumes understanding of risk factors — states promoting appearance and development of diseases. To the number of those determining health, or main risk factors, they refer: factors of unhealthy way of life, environmental pollution, genetic risk, defects of the organization of public health care services, medical aid, etc. Risk factors can be both primary, or external: dependent on social and economic, political, environment; and secondary, or internal: dependent on the specific features of an individual determined first of all by its genotype, sex, age, and also pathological conditions promoting appearance and development of diseases.

The negative tendencies are typical for the situation with the health of the population. The number of patients with risk factors increases which makes especially actual the solution of problems of primary prophylaxis and its scientific basis — sanology.

The solution of problems of preventive medicine is promoted by the concept of risk factors representing methodological base for search of answers to practical questions of prophylaxis.

Formation of the concept «risk» is connected in medicine with reflection of relative, probabilistic laws in vital activity of an organism in interaction with outer world. It is known that for any event to appear, certain reasons and conditions exist. Depending on a concrete interaction, the event either comes or does not come. Formation of such unity of reasons and conditions reflects actions of probabilistic laws. Probability is a measure which gives the qualitative characteristic of an opportunity of occurrence of the phenomenon or realization of result. The probability varies from 0 when event never comes within the certain system of relations, to 1 when it comes inevitably.

For comparison of different probabilities of appearance of any condition depending on these or those conditions the method of risk assessment is used. In

the basis of risk assessment lays a comparison of chance of event appearance within certain time interval under certain condition with the chance of its appearance within the same time interval under other condition.

The value of risk provides an opportunity of prediction, forecasting of event. Procedure of the forecast is based on the use of risk factors. The risk factor is, first of all, an attribute which is so closely associated with the occurrence of a phenomenon that can be used for its prediction. The role of a risk factor is played both by external conditions and internal features of an organism.

Why and with what purpose the concept of a «risk factor» arose? Its formation is connected, first of all, with the necessity of prediction. In the event when public health services deal with treatment of illnesses and do not predict diseases, the given category is not necessary. Really, to treat, it is enough to know the existing position, negative reasons valid at present. However, to achieve an appropriate effect in struggle against diseases, it is not enough to be oriented only to the available medical situation. Also, it is necessary to be able to look into the future in order of its forecasting and purposeful correction.

Thus one important feature was found out in the practical plan. It was found out, that for forecasting in some cases it is not necessary to know all reasons of the phenomena. Was to find out connection between them enough, to prove that it not casual, has steady character, sufficient force and takes the priority of illness. Moreover, appeared, that is possible to influence occurrence of illnesses in the future, not having exact theoretical description of their etiologic factors. Often by empirical selection of different variants it was possible to grope such ways of influence which warned appearance in the future of the undesirable phenomena. The practice stimulated of the theory, its development. As classical example it was the cholera warning of spreading in the last century in London. It was long before opening of cholera vibrio. It has been made on the basis of I. Snou's supervision which has shown necessity to isolate one city's source of water supply. In this case the use of water from the given source was a risk factor of a cholera spreading as associated with disease so that could be used as the indicator for its forecasting. By analogy the any property which is capable to predict disease or to prompt ways of struggle against it, it's understood by the person as a risk factor.

In what way risk factors descend detachment, their borders and quantitative criteria?

First, the assumption of risk factors arises at revealing the direct correlation between an attribute the investigated phenomenon.

As an example — direct dependence between a level of cholesterol and development of myocardial ischemia.

Second, such connection should be consecutive in time. For this purpose frequency of occurrence of new cases of disease for the certain period of time should be high. In one-stage research it is impossible to prove, that the observable sign is a risk factor.

The third — is stability, repeatability of the revealed connection in identical conditions. The impossibility of recurrence in the same situation or repeatability in different conditions forces to think of presence of other laws.

The fourth — the sign is considered a risk factor while its connection with disease appears as independent.

Summarizing the stated criteria it is possible to assume the following brief definition of a risk factor. The risk factor is a sign which is independently connected to probability of appearance of event so that can be used for its forecasting. The risk factor of disease is the sign previous to disease, having with it independent, steady, probable connection which has practical value as a minimum for its forecasting.

Unfortunately, parameters of health which are used in our public health services, basically do not include parameters of risk. Spreading among the population of the increased levels the arterial blood pressure is not taken into account, smoking, hypercholesterol in blood, etc. as is done in a number of the countries, for example in USA.

At the same time, the concept of risk factors has allowed is differentiated to approach to an estimation of health quantity, an opportunity of forecasting and the prevention of diseases.

2. THE GROUPING OF RISK FACTORS

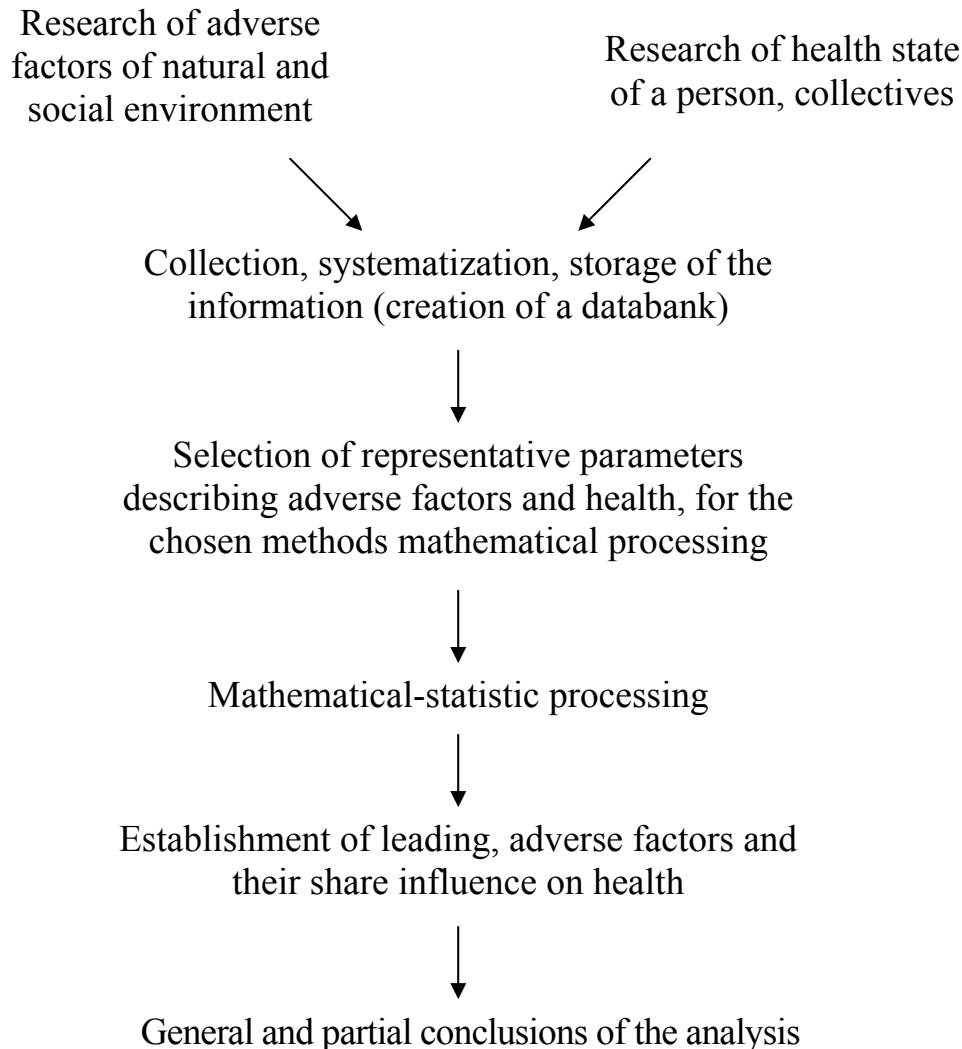
According to the international formula of health, the basic part of risk factors concerns to conditions of life, i.e. to the social and economic sphere, determining a way of life. To this group of risk factors it is necessary to relate smoking, an unbalanced nutrition, hypodynamia, bad material conditions of life, substance abuse, abusing medicines, fragility of family, loneliness, a low level of culture, excessively a high level of urbanization. As scientists consider, on a share of these factors 49–53% forming a health state are allocated. 18–20% health depends on a heredity, i. e. predisposition to hereditary illnesses. 18–20% depends on an environment: impurities of air, ground, water by carcinogen and others pollutants, the sharp changes of the atmospheric phenomena increased heliocosmic, magnetic and other radiations. And only in 8–10% health depends on public health services, i.e. directly from medicine activity.

To number of this group of risk factors it is necessary to relate inefficiencies of preventive actions, poor quality and inopportuneness of medical aid.

So, health of the population depends on a complex various on the character, an orientation and force of factors. Its studying is complicated that these factors cooperate with each other, vary in time, their influence on levels of parameters of health is not identical in various regions of Republic.

Connection of risk factors with human health will be considered in all sections of the general hygiene. With reference to each section of hygiene factors can be the common (microbiological in hygiene of nutrition, water supply, etc.) or specific (the radiation factor).

3. THE ALGORITHM OF HYGIENIC PRE-NOZOLOGICAL DIAGNOSTICS



The primary goal of hygienic diagnostics is the establishment of the reasons of health change of the person (population) on the basis of definition of various factors and detection of their sources. Professional work of people in concrete social and medical-and-geographical conditions is taken into account. For preservation and strengthening of health population the doctor carries out hygienic diagnostics with the aid of determined algorithm (see below).

Thus, hygienic diagnostics is multistage process. It includes first of all research of potentially harmful factors and a state of people health. Qualitative gathering of the information demands from the doctor of deep hygienic, physiological, clinical knowledge and skills of work with the medical documentation.

4. HYGIENIC STANDARDIZATION OF INFLUENCE ON THE HUMAN ORGANISM THE ENVIRONMENTAL FACTORS

The hygiene establishes character of action of factors on the human organism, defines borders of their negative and positive influence, in other words hygienic norms, and also develops offers on elimination or decrease of action harmful and using of valuable factors.

Hygienic standardization is the big and difficult social - biological problem providing health, workability and even the future existence of people. It is carried out in various branches of hygiene (in municipal, military, radiation, hygiene of a nutrition, etc.) differently, however the basic methodological approaches and theoretical principles of standardization, are the general.

Hygienic standardization as process it is based on carrying out of hygienic diagnostics. Its results are the initial material for a substantiation safe for health of fluctuations limits of values of an environment factors. The establishment of hygienic norms is carried out on a basis scientifically — proved relationships of cause and effect between the standardized factors and health parameters.

Hence, the health is the basic criterion of correctness of a choice of the specification. Thus the concept of threshold of the normalized factor actions, calculation of assurance factor and a clinical-statistical method of check guarantee the specification (a principle of a feedback) is used.

Hygienic standardization is carried out in the research establishments, capable to carry out pre-nozological hygienic diagnostics with use of the modern mathematical device.

5. PRINCIPLES OF HYGIENIC STANDARDIZATION

Now bases of hygienic standardization are developed and formulated by N. F. Koshelev, P. V. Ramzaev and V. P. Mihajlov as universal, the theory of the hygienic standardization basing five interconnected principles.

To number of main principles of hygienic standardization (Koshelev N. F., 1979) concern: **guarantee, complexity, differentiation, social-biological balance, dynamism.**

Guarantee assumes that hygienic standardization and any norm should guarantee first of all preservation of health, including genetic and reproductive function of the person, and in some cases – lives of people. Not smaller interest for hygiene is represented with positive factors, presence and which action is necessary for existence of the man, and their fluctuations and variability are the basic condition of training adaptive mechanisms, strengthening of health and even perfection of the man as representative of a biological kind. These factors also are subject to hygienic standardization in connection with that their efficiency duty has quite often enough strictly outlined borders.

The second general principle of hygienic standardization is complexity. The initial stage of development of this principle was studying the combined

action of factors of one nature, for example, several chemical substances. Now complexity of standardization assumes the account of action on an organism whenever possible all major environment factors including social.

The third principle — differentiation. Hygienic norms should have certain social applicability. Depending on a social situation, for the same factor quantitative values can be established some, namely: optimal, allowable, maximum permissible, extremely tolerable.

1 level — optimal, guaranteeing at influence of negative factors preservation of health and work ability at unlimited time of action.

2 — allowable, describing preservation of health and work ability on condition of unitary, repeated or continuous action of negative factors during the certain interval of time, for example, the working day.

3 — it is maximal or maximal permissible at which some reduction of work ability and temporary deterioration of a health state is supposed.

4 — maximal or extremely tolerable. It is a level admitting decrease of work ability, failure and deterioration of health.

5 — the level of a survival, is provided for application in unusual cases a wartime.

Certainly, it would be desirable that hygienic norms in all cases guaranteed a maximum of health. However social practice shows that quite often the society is not capable to execute this requirement. For this reason in all areas of hygiene the differentiated norms operate: these are various norms of water supply, accommodation, etc.

It is rather remarkable that infringement of a principle differentiation can result to return results as economic expenses of a society for such maintenance can weaken protection against action of other harmful factors or to decrease economic well-being so, that harm for health will be more than advantage for which expected at an establishment of such norms.

Here **fourth principle** of hygienic norms – a principle of social – biological equation starts to operate. It can be presented in the following: hygienic norms should be such that benefit for health from observance of the specification (A) and benefit of a product of manufacture to which the specification concerns (B), in the sum as much as possible exceeded the sum of damage to the health rendered by manufacture by a residual denaturalization of environment (C) and damage to health, connected with expenses for observance of the specification, reducing an opportunity of satisfaction of other needs of a society (D). $(A+B) - (C+D) = \max$

In other words, this principle demands reasonable weighing of benefit and harm and acceptance of the specification only in the event that the first will be more than the second. **The established norms not always steady.** In connection with changes of environmental factors and parameters of health population they can change. Besides, modern scientific researches quite often deny the previous conclusions about safe levels of this or that factor. As an example it is possible

to result a history of change of the specification of a irradiation doze of the population from 50 up to 0,5 sZv per year on a measure of knowledge accumulation in the field of radiobiology.

At revision of the specification the parameters indicating on remote, earlier not established, consequences of influence of the factor are conducting. Here it is possible to relate life expectancy, death rate, physical inability, premature biological ageing and others.

Thus, a principle of guarantee, complexity and differentiation, social-biological equation, dynamism of specification are the general for various branches of hygiene and the majority of environment factors. They allow to formulate definition of hygienic norm of positive and negative factors of an environment.

6. THE CONCEPT OF PRIMARY PROPHYLAXIS OF POPULATION DISEASES

PROPHYLAXIS is a general method in activity of people, the public, the states, directed on the prevention of the undesirable phenomena, offences, illnesses, failures, fires, etc.

Prophylaxis of illnesses is a component of health protection and is reached by means of the prevention and an establishment of risk factors of diseases, traumas, poisonings and other infringements of a health state, and also by increase of its stability to adverse influence of an environment.

It is obvious, that only medical measures it is impossible to warn illnesses.

The concept represents uniform system of views at the prevention of diseases and other infringements of a health state.

In the concept of initial prophylaxis of diseases allocate three its kinds: primary, secondary, and tertiary.

Primary prophylaxis has the purpose the prevention of any diseases, a trauma, poisonings and other pathological conditions.

Secondary prophylaxis is directed on the prevention of complications of available illness, transition to the chronic form, tertiary – on the prevention of disablement and death rates. Last two kinds of prophylaxis concern to a field of activity of a treatment-and-prophylactic direction of medicine.

Preventive measures are undertaken at various levels: individual (personal), public (family, work collective, department, etc.), state (republican), interstate (in region of the states or on a global level). In the prevention of appearance of diseases – to primary prophylaxis – the leading role belongs to social and economic measures: working conditions, a life, rest, to maintenance of the population with foodstuffs and water, a condition of an environment and others. Medical measures assume carrying out of hygienic education, sanitary-and-epidemiologic supervision, immunization and others antiepidemic actions. The big value in preventive maintenance of diseases individual measures of

prophylaxis — have a healthy way of life of the person: a correct mode of work and rest, physical activity, a balanced diet, refusal from harmful habits.

For functioning system of prophylaxis the following tasks are solved.

1. Studying and estimation:
 - a) level of health and physical development of the population.
 - b) level and structure of diseases, a traumatism and accidents, disablement, physical inabilities, death rates.
 - c) influence on health of working conditions, life, environmental factors.
2. Development of principles, criteria, norms and rules of a healthy way of life, safe working conditions, a life, rest, municipal and personal hygiene.
3. Sanitary-and-epidemiologic supervision of the environmental natural, industrial, medical-social environment, conditions of a life and rest.
4. Training and education of the medical staff in a direction of a hygienic mentality.
5. Hygienic [education](#) and teaching of the population.

The structure of primary – preventive activity assumes a high level of vocational training of medical structure in questions of a preventive direction of medicine. Thus the concept acts as the integrating factor during training.

THE CONCLUSION

Until recently the primary goal of hygiene was studying factors of the environment influencing a health state of the population with the subsequent elimination, or reduction of their negative action. Now before a preventive direction of medicine there was a problem of the estimation and forecasting of a state of population health at influence of environment factors. Thus, value of research pre-nozological health states of practically healthy people in conditions of their interaction with an inhabitancy grows. Paramount value gets not treatment of illness or improvement of a bad state of health, and preservation and strengthening of it. A methodological basis of the decision of this task is, as you see, the concept of risk factors on the basis of which primary prophylaxis should be organized.

Lecture III

AIR IS THE MAIN COMPONENT OF ATMOSPHERE. THE CLIMATE, WEATHER

Atmosphere it's external gas covering. This one consists of nitrogen, oxygen, dioxide of carbon, ozone. The state of the atmosphere influences on physical, chemical and biological processes on Earth surfaces, in hydrosphere, lithosphere. The greatest value have: oxygen for breath and mineralizations of dead organic substance; dioxide of carbon — for photosynthesis; ozone — for screening of earth surface from hard gamma rays of UV radiations, nitrogen, water vapour were formed due to volcanic activity and evaporations.

Definition of the concept of air, the air environment — it's a complex combination of meteorological factors with physical and chemical components, and also biological, chemical, physical anthropogenous pollution. The layer of air in height 50–100m is named surface.

The air environment has a property of self-purification. If the opportunity for self-purification are less than anthropogenous pollution, then the air structure changes to the worse for the human health. Natural forces become etiologically damaging factors. Air environment self-purification is enabled by sunlight, green plants, water reservoirs, movement of air mass.

Priority movement of air mass in relation to the sides of the world during a year cycle is called "wind rose". There are also intermediate directions of the wind. The wind rose is used when designing houses and public buildings, industrial enterprises, medical establishments, preschool and educational establishments. Air should leave the industrial enterprises zone from the leeward side off buildings, and living houses and public buildings should locate at the windward side. For Gomel and all territory of Belarus a primary wind direction in a year cycle from the west, less often — from a southwest and northwest, even less often from the east. Air mass from northern oceans, the seas bring to us a cold, dryness and pure ringing air. From the west there comes warm, damp, foggy polluted air with atmospheric precipitations; from the east-cold, polluted (from the industrial enterprises); from the south-hot, dry, dusty.

Atmospheric air absorbs all emissions from the man, transport, industrial enterprises. There is intensive saturation of air by vapor, aerosols, ultraviolet, phytoncides, microorganisms, oxygen, chemical substances, albuminous components, physical factors. All this mass gets to respiratory ways, settles on a skin, clothes, soil, green plantings, on subjects, food. With food it gets in a gastrointestinal tract. Force of response (reactance) of the organism depends on contact time and quantity of this substance, summation their actions.

Climate is a long-term weather tendencies within the geographical latitude and the longitude of the given district, relief, character of spreading surface of soil.

Weather is a condition of the physical phenomena in the atmosphere for the given moment. Weather varies with seasons, months. Weather induces fluctuations in morbidity of people with these or those illnesses.

The autumn-spring period is characterized catarrhal, virus diseases, tonsillitis, flus, bronchites, aggravations of ulcer processes, cardiovascular dystonias, crises. The summer period promotes growth of gastrointestinal infections, dysfunctions, alimentary and non-alimentary poisonings, overheating, solar and heatstrokes, solar burns. Winter is characterized by overcoolings, freezing, chilblain.

Our health depends on weather, but at a healthy life way, the account of all these factors it is possible to be the whole year healthy, efficient. For catarrhal diseases prevention use a method of hardening through cold and thermal receptors, physical and chemical thermoregulation, a corresponding diet and using of protective properties of clothes, footwear. For gastrointestinal illnesses prevention necessary personal and public hygiene, observance of food preparation technology, terms of realization and food storage; a reasonable rational drinking regimen.

Water of open spaces, deserts, mountains, steppes, large forests, mines promote formation of original air which are used with the medical purpose in bioclimatology. For goal of treatment by a climate it is necessary to take into account physiological processes of adaptation and acclimatization, the testimony and contra- testimony. At illnesses of respiratory ways steppe open spaces, coniferous files, mountain air, hydrochloric mines are good. The diseases of cardiovascular system need hardwood, water open spaces.

At a homogeneous climate adaptation occurs without serious consequences, at a contrast climate (north - south) occurs acclimatization in three phases. Acute climate change at purpose bioclimatology is not recommended as far as can come to aggravation of illness, more rapid of attacks with a lethal outcome.

Acclimatization is a complex social and biological process of active adaptation to new climatic conditions, a special case of adaptation.

Acclimatization has three phases: 1) initial phase of the physiological strain which lasts for 7–10 days and is characterized by the strain of thermal regulation of the basic and working energy metabolism; 2) phase of reorganization of the dynamic stereotype, it can proceed on two ways. In the first one, favorably proceeding (this may be promoted by social-hygienic actions), the second phase smoothly passes into the third one. Adverse current of the second phase generates marked dysadaptation meteoroneurosis, meteorological arthralgia, acute attacks of chronichal diseases. However, with relevant treatment-and-prophylactic and hygienic actions in both cases it is possible to enter the third phase: 3) the phase of stable acclimatization. It is characterized by stability of metabolic processes, absence of nutrition disorders, normal working ability, usual morbidity level, etc.

The fastest change of the weather situation with sharp change of meteorological factors parameters within a day is observed during passage of front, i. e. a boundary layer between the two different by structure air masses.

There are warm, cold, and occlusion fronts. At occlusion the cold front overlaps the warm making weather changes less rapid. Passage of front and change of air masses more frequently combine with formation of one of the basic types of the synoptic condition of the atmosphere — cyclone or anticyclone.

Cyclone is the zone of the lowered pressure with its decrease from periphery to the center. Weather within cyclone is changeable, with big shifts in pressure and temperature, increased air humidity, precipitations and reduction of the electricity gradient. Anticyclone — zone of increased pressure with its increase from periphery to the center. Weather condition in the established anticyclone is mainly stable, dry, without essential precipitations and with big pressure and temperatures shifts.

In summer the anticyclone brings warm and even hot weather, short-term, sometimes strong rains with thunder-storms, brings clear, frosty weather or cold, cloudy, with snowfalls in winter. Therefore connection of a high pressure with good weather (that is specified in traditional barometers) is not obligatory. Anticyclones provide steady, but not necessary pleasant and clear weather. Cyclones and anticyclones replace each other.

The climate and weather have many-sided hygienic value. Healthy people with good advanced adaptive mechanisms as a rule are «meteorological stable», even at acute changes of weather. Together with it a part of people, in particular patients, elderly, «meteorolability», so among patients with hypertonic illness meteorological sensible are 50–80%. At meteorological sensible people abrupt weather changes cause meteorological reactions of various expressiveness, down to dangerous for life. Therefore the important value has a medical estimation and weather forecast.

2. HYGIENIC VALUE OF GAS STRUCTURE OF PURE AIR. POLLUTION SOURCES, HYGIENIC STANDARDIZATION

Clean air is used as nature forces for health strengthening. For the specification take a chemical compound of an atmosphere on a sea level at barometric pressure one atmosphere or 760 mm mercury. This air contains 20,94% — O₂; 78,06% — N₂; 0,03–0,04% — CO₂, inert gases-argon — 0,76%; variable quantity of water vapor, in small amounts — hydrogen, helium, neon.

In oxidizing processes in human organism in a rest condition it is spent about 350 ml O₂/min., and at work can reach 4500–5000 ml O₂/mines. Carbonic gas does not collect in open space, and with water, rain, snow, by vapor water is washed off in soil, rivers, lakes, the seas, oceans, forming carbonic salts, and CO₂ is absorbed by plants also.

Through contents CO₂ in the closed premises it is possible to judge air pollution by products of human vital activity and efficiency of ventilation of premises. At concentration CO₂ more than 0,07% in the closed premises arise unpleasant sensations, bad health state (air heavy, stuffy). CO₂ is supposed up to

0,1 %. At concentration CO₂ 1% comes a short wind, heavy breath, cough, heat in breasts, headaches, a tachycardia, increase the blood pressure. Pathogenic microorganisms in the open atmosphere practically cannot exist. Under influence of ultra-violet and infra-red beams they perish.

CO₂ it is necessary for regulation of the respiratory center. Deficiency in CO₂ or its surplus are injuring factors for the organism. CO₂ holds PH blood on neutral position, at deficiency CO₂ there is shift PH in the acid side, surplus CO₂ — shift PH in the alkaline side. Flying products of the metabolism excrete by glandulae sudoriferae, have a unpleasant smell is a sweat smell, products of its decomposition, and also sebaceous glands — skin bacon, products of its decomposition. Through glandulae sudoriferae gases of blood (connections of the ammonia, flying salts of fat acids, connections skatole, indole) are evolved also. All these connections change physical and chemical properties of air. The adult in one hour exhales 22,6 CO₂ liters. Children and teenagers breathe out liter CO₂/hour approximately so much, how many years old to him, 10-year — 10l, 18-years — 18l, etc.

At change blood PH the homeostasis is broken, there are painful symptoms. In the closed premises the number of motes, droplets increases (conversation, cough, sneezing), grows number of heavy ions. If air are clean, fresh the number of heavy ions does not exceed 1–2 in cm³ of air. In polluted (stuffy) air their number grows up to 300 in cm³. Simultaneously with it the number of easy ions is reduced. Motes appear from books, papers, folders, magazines, from the person of a particle epithelium, hair, clothes. In a paper-book dust the book tick who promotes occurrence of bronchites, asthmatic bronchites, cough settles.

The toxic dust renders to poisoning influence. Microorganisms, as a rule, settle on motes. In the closed household premises air becomes soiled from use of household chemical goods, electric and gas cookers. Through motes with microorganisms air — drop infections are distributed quinsy, a flu, respiratory virus infections, etc. If the premise is well aired in it mainly there are easy ions are an electric condition of air (pure air after a thunder-storm). At presence even invisible motes, easy ions of them as though will neutralize, settle on them and turn to heavy ions. For maintenance of cleanliness of air is used aeroionization (Chizhevsky lamp).

The sanitary-and-hygienic norms of ventilation volume are easy, frequency rates of air exchange in a premise through natural or compulsory system of ventilation is developed.

Environmental pollution is any entering into the ecological system of not typical alive or lifeless components resulting in structural and physical-and-chemical changes, changes in energy direction or destruction of the ecosystem.

Anthropogenous pollutants share on material (dust, gases, slags, ashes), physical or power (electromagnetic fields, noise, vibration). Material pollutants are subdivided on mechanical, chemical, biological. To mechanical the dust,

aerosols, firm particles in water, ground concern. Chemical are gaseous, liquid, firm chemical compounds and elements. They enter chemical reactions with elements of the environment and form acids, alkalis, dioxides, etc. Biological pollutants are all kinds of microorganisms: mushrooms, bacteria, blue-green seaweed, etc.

Influence on the man both direct, and indirect is expressed in deterioration of his physical and moral state, deterioration of demographic parameters at disease and death rate, birth rate of children with pathologies.

The greatest contribution to pollution bring thermal power station: SO₂, NO, CO, firm particles, fluorine compositions. By kinds of fuel strong pollutants share on material (dust, gases, slags, ashes), physical or power (electromagnetic fields, noise, vibration). To mechanical the dust, aerosols, firm particles in water, soil concern. Coal, brown coal, black oil; the purest kind of fuel — natural gas. The following pollutants share on material (dust, gases, slags, ashes), physical or power (electromagnetic fields, noise, vibration). This are the iron and steel industry, black and color; mechanical engineering, manufacture of building materials.

Bacterial pollution include bacteria, spores, fungi, viruses, helminth eggs, etc. are on a surface of motes. Bacteria basically saprophyte, pathogenic in atmospheric air meet seldom, and at the closed premises there are as saprophyte, and pathogenic microbes. Air — drop infections — at sneezing, cough of a droplet of a saliva, slime can scatter in air up to 5–6 m, at strong sneezing up to 11 meters. The more finely motes and droplets, the further they are distributed and can there are in a suspension some hours. Droplets dry up, the weight of a mote decreases, and it is in air even longer. At sneezing about 40000 drops are formed and even completely healthy person excretes thus 10–20 thousand microbes. Pathogenic microbes become the reason of infectious diseases - measles, whooping cough, flu, diphtheria, scarlet fever, meningitis, chicken pox, natural smallpox, tuberculosis, pyogenic infections, the Siberian ulcer.

Primary prophylaxis of intrahospital infections are the ventilation, the damp cleaning, natural illumination, UV irradiation. During 10–15 minutes the beams of UV-lamp clears air from microbes on 70–80%. It is possible to turn in during 30–40 min. every 2–3 hours. Disinfection reduces pollution by microflora on 90%, there is a disinfecting.

The hygienic science allows entering of various chemical substances in the natural, household and industrial environment; not excepting their entering to the human organism. However, quantitatively this entering is limited to a limit at which harmful chemical substances are indifferent for the human organism and for environment. In this connection there were concepts of maximum concentration limit, MCL.

For a hygienic estimation of structure and air pollution in premises, hostels, children's, treatment-and-prophylactic establishments are used hygienic

standards (maximum concentration limit, MLL) the harmful substances in air, and at the estimation of air environment of industrial premises — is the special hygienic standards (maximum concentration limit, MLL) harmful substances in air of working zone. The given hygienic standards have a number of the basic distinctions incorporated in a basis of their definitions.

MCL, MLL can be recognized such concentration of substances in air which at daily continuous influence for a long time on human organism do not render direct or harmful indirect or adverse influence, do not reduce his workability and mood.

For air of a working zone, according to Sanitary Rules & Norms № 11-6-2002 RB «Hygienic classification of working conditions» the following definition of MCL, MLL is given.

Maximum concentration/level limit (MCL, MLL) are levels and concentrations of harmful production factors, which at daily (except for weekends) work but no more than 40 hrs a week, during all working experience, should not cause diseases or disorders of health state, detected with modern research methods, during work or in the remote life periods of the present and future generations. Observance of hygienic specifications does not exclude affection of the health state in highly-sensitive people. Hygienic specifications are based upon 8-hours working day.

MCL, MLL of the atmospheric pollution in CIS and Belarus are established in two parameters: maximum single (for 30 minutes) and daily average (for 24 hrs.). The latter are the basic; their purpose — don't allow suppose adverse influence as a result of continuous resorbitive action. Maximum single dozes are set in addition to daily average for substances possessing smell or irritating action and able to cause acute poisoning.

The state sanitary specifications are widely used in precautionary sanitary supervision at designing, choice of technological process; at the planning and building of the occupied places; at sanitary examination of toxicity of polymeric products; at a choice of means of man-to-man defence, etc. They are used during realization of sanitary inspection and form the legal basis of estimation of impurity of objects of the environmental natural environment (air, drinking water sources, soil, food stuffs) and the social environment, and also estimating of improving actions efficiency. Qualitative and quantitative definition of substances in objects of environment is carried out with the help of the wide spectrum of modern chemical and physical research methods with application photoelectrocalorimeter, fluorometer, spectrograph, chromatograph and other devices.

At human organism simultaneously influence numerous various factors of the air environment in places of dwelling. To one factors the organism has a wide range of the adaptation and endurance, and to others has the adaptation in a narrow range, with disruption of adaptation.

3. ATMOSPHERIC PRESSURE AND HUMAN HEALTH

Air surrounding globe has the certain weight. Thus 1 litre of air at near 0° on a sea level weighs 1,294.

All life on the ground surface developed in conditions of this pressure, therefore we feel it only at significant fluctuations, for example during ducking or climb to mountain. With conditions of the raised atmospheric pressure the man faces at diving and pneumatic work, at a bookmark of the bases of various constructions, at tunneling, mines (shafts), construction of the underground, bridges, dams.

Atmospheric pressure is more in areas below than a sea level and lower in high mountains. On the man body surface air presses with force about 16T as the body surface is equal about 1,6m². It is one counterbalanced by pressure in cells and organism tissues.

At increase of pressure pulse and breath become slower, the bradipnoe, there are signs of narcotic action of nitrogen, excitation, ambiguity of ideas, deterioration of orientation, coordination. Dissolution of gases in the organism is increased. At 1 Atm blood contains 1,2% of nitrogen, at 2 Atm — 3,9 %. From blood nitrogen passes in the tissue and is dissolved in lipid, lipoid. The sharp change of pressure lead to nitrogen boiling (air-bladders which have not time to exude through lungs — gas embolicm, blood-vessel occlusion by air-bladders of nitrogen — consequences — a paralysis, death). At immersing pressure grows by 10m on 1 Atm. On depth 20 m pressure approximately 2 atmospheres. There are symptoms underwater, deep because of shortage O₂, hypoxemia and hypoxia tissues, cells. The man loses orientation of space and time, there can come destruction because of other direction of rise or emersion. Superfluous air pressure (over usual atmospheric) in the working chamber of caisson can make up to 4 atmospheres. At pressure of 10 atmospheres is possible loss of consciousness.

At professional work at divers arises caisson illness or decompression illness. If gas embolism there is in vessels of the central nervous system how consequence of the ischemia — local infringement of blood circulation, can come to ischemic paralysis — infringement of impellent function, speech. At gas embolism coronary vessels or in vessels of the vital centers of a brain, lungs arteries there can come to death. Preventive maintenance of caisson illnesses consists in protection by time — standardization of stay duration in conditions of the raised pressure. At first signs of disease the man is located in a special box (recompression chamber) in which raise pressure up to primary level. Approximately through 30 min – 1 hour the painful phenomena disappear, then slowly and little by little pressure is reduced.

In caissons there should be a temperature of air in limits 17–22⁰C. At caisson works should be medical survey, and then during a week — the medical control. At employment of divers rules also are observed: the current medical

control, observance of norms and rules on depth of subsea. The diver has telecommunication with service of ground for informs the coordinates about health state. At vessels occlusion of the lower extremities lead to a chronic professional disease of caisson workers and divers. It is shown by symptoms of infringement of local blood circulation: snap of lower extremities, chilliness, cyanosis, puffiness, painful sensations, infringements of movement.

High-altitude illness begins about 2000 m (flights by plane, campaigns in mountains) — the flying on 10000 m lead to insufficient receipt of oxygen in blood — hypoxemia — weariness, apathy, drowsiness, muscular weakness, dizziness, a nausea, vomiting, increase of breath, a bleeding from a nose, ears, intestines. At pressure 1 Atm oxygen is active, has certain partial pressure which provides saturation of blood by oxygen — oxygenation. The above there is a district above sea level, it is less partial oxygen pressure, the less its saturation in air and in blood. It is reduced oxygenation and as indemnification of the given damaging factor — is developed more Er and hemoglobin (170–160 g/l) is higher. On a sea level at 1 Atm — 120–140 g/l. With decrease of oxygen partial pressure appear symptoms of pathological reaction and a pathological condition — mountain or high-altitude illness. The critical zone of a threshold for life and death is located above 6000 m. Without special equipment to be at such height it is impossible. Up to height the zone of full indemnification for the account erythropoiesis is considered of 3000 m, the number of erythrocytes considerably grows and compensates respiratory function. At height more than 3000 m up to 6000 m in the beginning go decrease of compensation, and then comes decompensation and significant infringements in organism functions.

Preventive maintenance of high-altitude illness consists in training in pressures chamber, high-altitude flights, mountain ascensions, application of oxygen devices and in maintenance with special clothes. In modern conditions use isolating, compensative survival suits. In survival suits pressure in underclosing space is automatically supported. Cabins of flying devices are pressurized, in them the temperature, humidity, pressure of air and maintenance O_2 is automatically supported also. At increase of atmospheric pressure till 750mm hg saturation O_2 are higher grows, meteodependent people feel discomfort. At decrease of atmospheric pressure (sometimes up to 725 mm Hg) parcial pressure O_2 is reduced, health state becomes worse almost at everybody.

At significant and fast pressure difference in the organism can arises high-altitude decompression frustration (DF) and high-altitude decompression disease (HDD). In a basis of pathogenesis DF and HDD three kinds of processes lay:

- Difficulty of pressure smoothing in natural body cavities which results to high-altitude meteorism, to aerosinusitis, aerootitises, HDD;
- Formation of free gas fraction in organism wicking lead to high-altitude decompression illness;
- Transformation with occurrence high-altitude tissues emphysema.

High-altitude meteorism is caused by expansion of gases in gastrointestinal tract, and also an output of gases dissolved in intestinal contents at rise of man on height. Thus substantial growth of volume of gases causes mechanical and reflex influence on an organism on type visceral-and-visceral reflexes, causing changes breath, pulse, blood pressure, etc.

Aerootitises, aerosinusites, aerodontites are consequence of differences of barometric pressure in cavities of middle ear, additional sinuses of nose, carious teeth. Cause occurrence of feeling stuffiness in nose, pains of various intensity.

Explosive decompression is characterized by fast and significant pressure difference, it occurs at sudden depressurization cabins of the plane. Than there will be a size of pressure difference more and its duration is shorter, consequences explosive decompression, acute (explosive decompression disease) will be especially expressed.

4. MEDICAL-AND-CLIMATIC DIVISION INTO DISTRICTS OF BELARUS. MEDICAL WEATHER FORECAST AND METEOPROPHYLAXIS

In medical practice division of a climate on «sparing» and «irritating» is applied. Sparing it is accepted to name a warm climate with small amplitudes of temperature, with rather small yearly, monthly, daily fluctuations of other meteorological elements, with minimal requirements to adaptable physiological mechanisms. The wood climate of the middle latitudes as in RB, Southern coast of Crimea is «sparing». The «irritating» climate is characterized by the expressed daily and seasonal amplitude of meteorological elements; it requires increased adaptive mechanisms. The cold climate of the North is such; high-mountainous; a hot climate of steppe areas and deserts. In Belarus are selected northern, central and southern medical-climatic zones.

Northern zone occupies of Belarus lake area, and northern part of the Minsk height, is characterized by a cold and damp climate. Duration of solar light in one year consist 1735–1800 H. The annual sum of solar radiation 86,5–92,8 kcal/cm², and the sum of active temperatures 1900–2150 degree. Opportunities for solar isolation for the population are limited here, biologically active solar radiation (BASR) — 234–240 days; in Verhnedvinsk — 200 days, in Vitebsk — 190 days. In this zone the most long period of cooling of the people organism (with negative air temperatures) — 76–82 days and ultra-violet starvation — 96–103 days (november — february). In east part of this zone are established: area of the raised storm activity (Ushachi, lake Lukomorie, Vitebsk) with loss of deposits. At carrying out of salvage operations participation of the medical personnel is required here.

The Central medical-climatic zone of Belarus includes Orsha-and-Mogilyov and Central-Berezinskaya plains, lowland Nemanskaja. In comparison with northern zone, it differs more moderate parameters of the cold period and

high warm. Duration of solar light 1800–1900 hour, the sum of solar radiation of 90,5–96,1 kcal/cm² and the sum of active temperatures 2150–2400 hailstones. The period of possible biological active solar radiation — 240–252 days; actual in Mogilyov — 210 days, Minsk — 202, Grodno — 209 days. The period of cooling of an people organism 56–73 days, and ultra-violet starvation — 81–95 days. In east part of this zone areas with often blizzards and ice are allocated. Here at high density of highways the greatest probability of road and transport incidents during winter time.

The Southern medical-climatic zone occupies Poleskaya and lowlands Pridneprovskaja, is characterized by a warm climate, higher temperatures of the years (summer) and winter periods. Duration of solar light 1800–1950hrs., the annual sum of solar radiation 90,0–97,4 kcal/cm², the sum of active temperatures 2400–2530 hailstones. The period of possible biological active solar radiation from 253 till 270 days; actual in Gomel — 212 days, Lelchici — 220, Brest — 224 days. The period of cooling and overcooling of people (50–74 days) and ultra-violet starvation (67–80 days) are the least in comparison with other zones of Belarus. The zone differs the raised storm activity, the extensive areas of years (summer) and autumn high waters, spring floods of the rivers (the Pripyat, the Bug, their inflows).

Medical weather forecast is the special form of the scientifically-valid assumption of character of a forthcoming condition heliogeographical and meteorological factors. It is made on the basis of the analysis of development of large-scale atmospheric forecasts, with the purpose of preventive maintenance of aggravations meteodependent diseases. Such forecast is necessary not only to treatment-and-prophylactic establishments, but also for all agriculture, industrial and for transport agencies. If in the first case the forecast can warn pathological syndromes, an aggravation of illnesses and to increase efficiency of treatment, patients rehabilitation in the second — to warn and lower quantity of accidents on manufacture, accidents on transport. Medical weather forecasts make for 24 hours. and longer terms (48–72 hrs) On the basis of the analysis of the space aerosynoptic, meteorological processes, current dynamics of the basic meteoelements. Medical weather forecast should be informed in due time to attending physicians and nurses for corresponding preventive maintenance.

Meteoprophylaxis it's a complex of the medical actions directed on the prevention of development or mitigation of meteopathic reactions:

1. Acquaintance of doctors with principles of medical weather forecast and allocation of adverse classes (types) of weathers.
2. Definition and an estimation of patients with allocation of meteolabil groups: with psycho-and-emotional changes; the increased irritability; amplification of attacks of a stenocardia; asthmatic attacks; hypertension strokes.
3. Scheduled meteoprophylaxis.
4. Urgent meteoprophylaxis.

All variety of measures of medical preventive maintenance can be reduced to three groups:

a) Increase of nonspecific organism stability, especial hardening during adverse seasons of year; preventive by UVR; rationalization of nutrition and vitaminization; the rational organization of work, life and rest;

б) Sparing actions include: confinement to bed or other sparing mode; carry of scheduled operations or tiresome medical-and-diagnostic procedures; a direction of outpatients in dispensaries; to change of a climate during an adverse season of year (use of holiday); transfer of risk patients in special chambers with an artificial microclimate (biothrones), etc.

в) Scheduled 10–15 day time preventive courses of treatment at adverse monthly weather forecast and urgent, on the basis of the operative information on weather the nearest days. Thus nonspecific means, medicines, physiotherapeutic procedures are used.

THE CONCLUSION

Hygiene of atmospheric air, the air environment, climate, weather play extremely important role in prophylaxis of pre-nozological conditions and aggravations of many illnesses. Sources of pollution create in it the raised concentration of xenobiotics, rendering to negative influence on people health, especially among the children and old age. The doctor of the general practice should know the chemical compound of air a vein of environment should not differ essentially from those in clean atmosphere. The functional condition of human organism depends on change of weather, especially at change climatogeographic conditions connected to acute difference of atmospheric pressure and contrast change of weather. Decrease of adverse action of climatic factors is reached by improvement of an inhabitancy; use of rational clothes; realization of some sanitary-and-hygienic actions; the account of medical weather forecast and meteoprophylaxis.

The environment can be healthy, comfortable and unhealthy-pathogenic, harmful, painful. The extreme environment causes irreversible changes in health state, lethal outcomes. As criteria of environmental quality are used standards of cleanliness and comfort. These standards are established as maximum concentration limit (MLC). Maximal limit concentration for chemical, bacteriological pollutants, maximal limit level (MLL) — for physical influences, noisy and electromagnetic pollution.

Measures of improvement of environmental quality: architectural — planning; engineering-and-organizational both technological, ecological and legal. In real human conditions take place multifactorial, combined action. For atmospheric air of the occupied places in RB are established 56 factors of its combined action. Ecological passports of the enterprises are introduced; certification of technological processes and workplaces is carried out; ecological examination of natural-economic objects also. Criteria of an estimation of examinations are certificated; ecological audit is conformity to legal certificates and norms; updating of social-and-hygienic aspect of development of system «Human–Biosphere».

Lecture IV

HYGIENIC CHARACTERISTIC OF PHYSICAL FACTORS OF AIR

INTRODUCTION

Physical factors usually name properties of air (the workspace of the closed premises) as physical system and processes arising in it.

Hence, the major task of hygiene is the scientific substantiation of actions for optimization of the air in settlements and in the closed premises, and also the prevention of its adverse effect.

1. HYGIENIC CHARACTERISTIC OF PHYSICAL FACTORS OF AIR

1.1. Classification of physical factors

In the hygiene of air physical factors are traditionally divided into three basic groups: microclimatic, mechanical-and-acoustic and electromagnetic.

Microclimate, i. e. condition of meteorological elements indoors, is determined by its temperature, humidity, speed of air movement and pressure; besides, for formation of a microclimate the temperature of surrounding surfaces and intensity of thermal emission from these surfaces is essential. To microclimatic parameters they also refer estimated functions of its basic elements (for example, average radiating temperature, effective temperature, resulting temperature, etc.).

The group of mechanical-and-acoustic factors includes the basic kinds of acoustic noise (constant, interrupted and pulse), fluctuations of air pressure and generated acoustic pulses, vibrations and shock acceleration.

Electromagnetic factors include illumination, ultra-violet radiation, non-ionizing radiation (super-high-frequency, ultra-high-frequency, high-frequency, and also very low-frequency, super-low-frequency and laser radiation), electrostatic and magnetic-and-static fields, air-ionization and ionizing radiation.

1.2. Physical factors as components of environment, providing vital activity of man

Similar to medications which, depending on the dosage, may cause therapeutic or toxic action, majority of environmental physical factors have adverse effect on the human when achieved definite levels. However, a certain intensity of these or those factors as of environmental components is necessary for normal vital activity of a man.

The graphic evidence of it are microclimatic factors. Sizes of each of microclimate components by their action on the organism are interconnected and mutually conditioned.

2. PHYSICAL PROPERTIES OF AIR. METEOROLOGICAL FACTORS

Physical state of air is characterized by the temperature, humidity and speed of air movement, barometric (air) pressure and also by air ionization and atmospheric electricity. The human organism is influenced by a complex of meteorological factors a set of which forms climate and weather.

The hygienic assessment of meteorological factors consist both of their complex influence on the human organism and their separate influence.

For example, reduction of atmospheric pressure in 10–12 mm Hg results in increase of oxygen consumption due to respiratory function and blood circulation. The increased volume of negative aeroions causes increase of oxygen of inhaled air and the basic metabolism. The most important meteorological factors are solar radiation, as the main climate-forming element, and the air temperature first of all determining thermal state of the human organism.

2.1. Solar radiation

The sun is an energy source, heat and light on globe.

The solar energy heats up a surface of the Earth, causes evaporation of a moisture, formation of air currents and the changes of weather connected to these phenomena and a climate in the given region.

Solar energy, which surface has temperature 6000°C , represents electromagnetic fluctuations, spreading with a speed of 3.10580 km/s.

The sunlight has three sub-ranges: ultra-violet beams (10–400 nanometers), visible light (400–760 nanometers) and infra-red beams (760–3400 nanometers), ratio of which in the general solar radiation by total energy makes 7,46 and 47% respectively.

The sunlight, being a source of life in the Earth, renders direct influence on a thermal condition of human organism, function of the visual analyzer, on a vitamin exchange and nonspecific resistency of an organism.

The biological importance of ultra-violet, infra-red radiation and visible light various.

Ultra-violet radiation. Intensity of the ultra-violet radiation reaching earth surface, depends on height of Sun standing.

If height of a solstice above horizon less than 25° the most active biological ultra-violet radiation does not reach a earth surface.

For the man ultra-violet beams with wave-length from 200 up to 400 nanometers have the greatest hygienic value. By character of biological action they are divided into 3 zones: A — with wave-length from 400 to 320 nanometers, B — 320–280 nanometers, and C — 280–200 nanometers.

Zone A — sunburn or fluorescent zone. Ultra-violet beams of this zone cause melanin formation in the skin — the specific pigment causing darkening of the skin.

Zone B, or erythematous zone of ultra-violet radiation. Beams of this zone cause skin erythema and also promote formation of vitamin D. Biological role of

vitamin D, as known, is in absorption of calcium and phosphorus in the gastrointestinal tract and calcium phosphate deposition in a bone tissue.

Zone C, or bactericidal. Ultra-violet beams of this zone cause death of microorganisms, due to which are used for disinfecting of water, air and surface of subjects. The greatest bactericidal effect is marked at ultra-violet beams wave-length about 265 nm (used in medicine).

UVR of zone C causes effect at a level of protein of cells nuclei and differs in high bactericidal activity. Radiation of this range practically is absent in the solar beams reaching earth as it is absorbed by atmosphere. Therefore to its reception in conditions of the Earth apply artificial sources — bactericidal lamps.

Beams of this range are desirable «impurity» to UVR sources intended for an irradiation of the man. Presence of them should not exceed 5% from all stream.

Middle wave radiation (area) cooperates mainly with molecules of protoplasm fibers of cells. It is considered thus, that protein of protoplasm carry out function of additional filters, protecting nucleus protein of cells from damage. The superficial layer of a skin is characterized by low factor of permeability for UV-beams. Nevertheless UV-beams of a zone B are capable to penetrate into a skin deep into 1 mm.

Long-wave beams have ability most deeply to penetrate into proteins of coverlet. Despite of this, long time was considered, that beams of area A are biologically inactive and consequently their biological effect is less investigated. Now it is established, that beams of this part of a solar spectrum in the big doses differ high ability to stimulate formation of melanin at participation melanostimulative hormone, renders tonic action on condition CNS, adrenal glands, cardiovascular system, etc.

Character of reaction of an organism on UVR is defined also by intensity of influence and regimen of irradiation. Changing frequency rate, duration and intensity of beam influence it is possible to receive opposite effects. To features of biological influence UVR it is necessary to attribute long (up to 3 weeks) the period of aftereffect. For the characteristic of skin sensitivity to UVR the threshold of erythematous sensitivity, or minimal erythematous doze (MED) is used. MED is the minimal quantity of UVR causing erythema. MED is expressed in joules per 1m². Its value, depending on individual features of the surveyed people, varies from 60 to 600 J/m² at influence of UVR with wave-length of 297,6 nanometers. But since the opportunity of precise measurement of specific capacity of separate monochromatic beams of a source is not always available, in medical practice MED is frequently expressed in minutes. It is taken into account that at constant spectral structure, capacity and distance of a source from the irradiated surface the quantity of coming energy is proportional to the duration of irradiation.

As erythema from UVR it is considered as the undesirable phenomenon connected to overdose and destruction of structural skin formations at use UVR with the preventive purpose it is recommended to apply in suberythema doses.

Prophylaxis ultra-violet overirradiation is provided with use of rational clothes and light-defensive glasses. For protection of a skin from solar burns it is possible to use various ointments, elementary of them consist from following components: vaseline — 10,0; zinc oxide — 3,0; salol — 1,0. The important role in maintenance of organism stability to ultra-violet beams overirradiation play the organization of a balanced diet consisting in increase of reception of protein, vitamins, mineral substances and polynonsaturated fat acids since they are strenuously spent by organism at synthesis of melanin.

Overirradiation by the ultra-violet beams can promote an aggravation of some chronic diseases, in particular, tuberculosis, rheumatism, nephritis, a stomach ulcer and a duodenal gut, it is especial at people of average and senior age groups. It is known also, that the excessive irradiation beams can provoke a skin cancer.

Infra-red radiation. Infra-red radiation represents the electromagnetic fluctuations rendering basically thermal action. Their sources are all bodies with temperature of the man in natural and industrial conditions.

The thermal effect of infra-red radiation depends on power and a spectrum (lengths of waves) of radiations. If local action of the radiant heat having power of irradiation 0,3–0,6 kw/m², man stands indefinitely long time, power 1,6–2,1 kw/m², it is possible to stand an irradiation only during 20–30 sec, and it is more than 3,5 kw/m² within several seconds.

The short-wave part of infra-red radiation (up to 1400 nanometers) will penetrate on depth of proteins up to 3 cm and causes their uniform warming up.

The long-wave part of infra-red radiation (1400–1300 nanometers) is late basically in the top of epidermis and causes fast rise in temperature of skin and to erythema. Specific reaction of an organism in reply to an infra-red component of solar radiation is thermal (solar) impact. Victims register the headache, excitation, in heavy cases — convulsions, and loss of consciousness are marked rise of body temperature up to 40–42⁰C. The reason of it is accumulation of heat in an organism owing to what there is a frustration of its functions. Heatstrokes frequently come to lethal end.

2.2. Temperature of air

The temperature of air is the basic meteorological parameter describing a thermal condition of the air environment. The air temperature is expressed in degrees of scale Celsius (⁰C). The temperature of air depends on a degree of heating by solar beams of underlayer of ground or water which transfer heat to air.

The minimal temperature of air within day is marked before sunrise, and maximal — at 13–15h.

The difference between the greatest and least air temperatures for a day refers to as daily amplitude. This parameter has also the certain hygienic value for characteristic of climat-and-geography areas. So, the greatest daily amplitude of air temperature is marked in depth of continents (for example, in desert — up to 60⁰C), the minimal — as approaching to the seas and oceans.

The difference between air temperatures of the warmest and coldest months of year refers to as annual range.

For the man living in moderate latitude, comfortable air temperature from 20 till 25⁰C is considered.

2.3. Humidity of air

Source of formation of water vapour, determining humidity of atmospheric air, are the rivers, lakes, the seas and oceans, and also soil and a vegetative cover.

Distinguish humidity absolute (more precisely – aqueous tension), maximal and relative.

Aqueous tension in air (*e*) is the moisture content expressed in terms of atmospheric pressure (kPa, millibar, mm of mercury), absolute humidity (*a*) — concentration water vapour in air (g/m³).

The maximal humidity (*E*) is an aqueous tension in a condition of saturation by them of air (kPa, Mb, mm mercury or g/m³).

Temperature at which water pairs in air reach saturation, i.e. humidity becomes maximal and starts to be condensed, refers to as a dew-point.

Relative humidity (*r*) represents the relation of actual elasticity water vapor in air (or absolute humidity) to the greatest possible humidity of air at the given temperature and is expressed in percentage:

$$r = \frac{e}{E} \times 100 (\%)$$

Deficiency of saturation of air by moisture (*d*) is a difference between the maximal humidity (*E*) and actual elasticity of pair (*e*):

$$d = E - e$$

It is established, that at temperatures 18-20⁰C and speeds of air movement 0,1–0,3 km/s the optimal for an organism is relative humidity from 40 up to 60%. At high temperature and relative humidity feedback of heat is at a loss due to evaporation, thus there can come to organism overheating accompanying with deterioration of health state and decrease of workability. The combination of high air temperature and low relative humidity causes dryness of mucous membranes and occurrence of skin microcracks. The combination of low temperature and high humidity of air causes strengthening of heat irradiation and promotes development of overcooling of an organism. Hence, high humidity of air at high and low temperatures it is necessary to regard as adverse factor of an environment since it promotes development, both supercooling, and superheating.

2.4. Movement of air

Atmospheric air is in a condition of constant movement.

The reason of this phenomenon - different air pressure in various areas of a land and the sea, caused by in turn distinction of thermal balance in these regions. The air movement is characterized by speed (km/s) and a wind direction determined by the sides of horizon, where from it blows: northern, southern, east, western. Any geographical area is characterised the certain repeatability of winds — a wind rose.

Hygienic value of air movement is defined first of all strengthens heat irradiation effect by convection. If temperatures of air is high then its movement increases heat irradiation from a body surface and warns thus superheating of an organism, if one low — promotes supercooling of an organism.

2.5. Atmospheric pressure

The mass of air press down on the land equal on a sea level at temperature 0°C 1,033 kg/cm². This pressure corresponds to pressure of mercury mercury column in height of 760 mm and is named normal.

Atmospheric pressure is measured in hectopascal (hPa). It is necessary to tell, that 760 mm mercury are equal 1000 hPa (1 mm mercury is equal 1,33 hPa).

Daily fluctuations of atmospheric pressure are usually within limit 5–8 hPa, seasonal — no more than 40 hPa and does not render to essential influence on an organism of the healthy man. However elderly and sick people whose functionalities of the organism in particular suffering hypertonic illnesses are reduced are very sensitive to differences of atmospheric pressure that connected respective alterations partial pressure of oxygen.

With rise on height atmospheric pressure is reduced on the average on 110–120 hPa. The fast rise on height more than 2500 m appeal the phenomena high-altitude, or the mountain illness, connected with sharp atmospheric pressure decline. It is typical of it weakness, drowse, dizziness, a short breath, cyanosis of mucous membranes. Increase of stay duration at height give rise adaptation to depressed partial pressure of oxygen in inhaled air, the specific symptoms fade away.

2.6. Air ionization and an atmospheric electricity

The air always contains the certain quantity of the ionized atoms and molecules of gas (aeroions) or particulate pollutant in the form of a fog, a cmoke or a dust (aerodispersion), charged by a positive or negative electricity. To ion-generative factors concern: space beams, radioactive substances, the ultra-violet radiation, an open flame and the heated up surfaces (thermal ionization), an atmospheric electricity. Dispersion of water at sea surf, falls and the mountain rivers is accompanied by the expressed atmospheric air ionization also. Under the action of all these factors occurs detaching electrons from molecules, thus the molecule residues get a positive charge. The ions existing in air as the

independent residues of gas molecules or attached to group of neutral molecules of oxygen, nitrogen, carbonic gas, ozone, refers to easy, and connected with particles of a fog, a smoke or a dust — heavy. From hygienic exponents of air ionization it is usually analyzed the following: the contents of different ions, weight of particles, unipolarity coefficient (ratio of number positive to number of negative ions) and pollution factor (ratio of total quantities of heavy metals and easy ions of the same sign).

In ground atmospheric air the quantity of the easy, positively charged ions, as a rule, always is more, than negative. In this connection the factor of unipolarity reaches 1,3 thousand pairs easy ions in 1 cm³. Air of sea coast at surf contains up to 5–40 thousand easy ions in 1 cm³.

3. THE MICROCLIMATE OF PREMISES AND ITS HYGIENIC ESTIMATION

Health and workability of the man in many respects depends on conditions of a microclimate of internal premises.

The microclimate of premises is the physical air condition composed of four elements — temperature, humidity, speed of air movement, the radiant heat, determining human heat sensation.

Elements of a microclimate can be among themselves in various combinations and essentially define three condition kinds of the person such as superheating, thermal comfort and supercooling.

The hygienic microclimate estimation taken separately meteorological parameters (t, humidity, mobility of air and radiant heat) not always gives full idea about possible thermal influence of an environment on human organism as they, as a rule, influence not separately, and together. It is known also that the identical subjective perception of the environment can be observed at various combinations of separate meteorological parameters. Therefore, for hygienic estimation of microclimate, estimation of physical conditions of thermal exchange and thermal loading on the man complex parameters were proposed. The theoretical grounding of them lie in different degree specifications of the basic equation of thermal balance.

In the basic equation of thermal balance the primary factors influencing thermal exchange of the man are taken into account:

$$Q = M \pm C \pm R \pm E, \quad \text{where:}$$

Q — thermal loading on the organism; M — metabolic heat, composing 67–75% of energy expenses level, C — convecting thermal exchange between the organism and the environment, E — organism heat emission with evaporated sweat.

4. PRINCIPLES OF HYGIENIC STANDARTIZATION OF MICROCLIMATE OF PREMISES

At an establishment of hygienic specifications of premises microclimate are issued that it should provide thermal comfort for the man. In case of normal microclimatic conditions about 10% of people (on average) feel thermal discomfort. It is explained by individual distinctions in intensity of exchange processes, thickness of a hypodermic fatty layer, national and social features, etc. The microclimate is considered favorable if the number of subjective values «comfort» or «normally» makes more than 75%, and uncomfortable — less than 25%. For hygienic standartization of a microclimate of premises it is necessary to take into account the following:

- Conditions of people activity (destination of premises);
- Seasonal distinction of microclimate parameters (the separate for warm and cold periods of year);
- Necessity of creation of a narrow diapason of normalized microclimate parameters.

It is necessary besides to prove the separate components of a microclimate creating in complex sensation of thermal comfort at the person. The thermal comfort is the meteorological conditions of environment promoting an optimum level of physiological functions, including thermal regulator, at subjective sensation of comfort. Apparently the leading role is played with the subjective factor.

It is impossible to establish uniform hygienic specifications of microclimate parameters of various premises as it is impossible to require identical hygienic requirements, for example, to a microclimate of premises.

The majority of researchers considers, that border of intellectual workability deterioration is the temperature in premises 28–30⁰C, is above which the number of erroneous reactions of operators grows. So at temperature of air 27–31⁰C the number of mistakes at work with the Morse alphabet increases till 50%, at 36⁰C it becomes more then in six times. At temperature 40⁰C and relative humidity 70–80% pace of brainwork is reduced twice, concentration of attention with increase of quantity of mistakes in 5–6 times sharply reduced, further rise of air temperature lead to disturbance of movements coordination. Physical workability in conditions of high air temperatures is reduced later.

THE CONCLUSION

The air environment plays an exceptional role in prophylaxis of pre-nozological conditions and many illnesses of the man.

The doctor should know that on man health influence a microclimate of premises which is characterized by such parameters, as air temperature of residential zone, horizontal and vertical temperature gradients, absolute and relative humidity, temperature of an internal surface of walling, radiating temperature. The named parameters provide a thermal condition of an organism, influencing on his many physiological systems. For this reason on basis of numerous researches are established optimal parameters of microclimatic conditions at which observance risk of occurrence of the diseases connected to a microclimate to be reduced to a minimum.

Lecture V

HYGIENIC BASES OF OPTIMAL NUTRITION. CLASSIFICATION OF THE NUTRITION STATUS. THE BASIC LAWS OF NUTRITION

At composition of a high-grade diet it is necessary to take into account, that approximately 40% of ration should be animal origin products, food volume should give feeling of satiation. This feeling is connected to stay of food in a stomach. In this respect the best advantage the meat food has. Fried food are more nourishing, than one cooked. At culinary processing it is necessary to keep a maximum of values of foodstuff, especial vitamins and microelements. There is digestion adaptation to food, therefore sharp changes are inexpedient. Spices, bitterness in food have the certain value. A diet is necessary to distribute in regular intervals both in volume, and in caloric value. Great one-stage food volume is badly acquired, it is better to divide a day time diet into 4–5 times. Time of food consumption depends on a habits, and distribution daily ration from a profession, operating time, etc. Protein's food are recommend to eat till 14–15 o'clock since this one accelerates a metabolism, stimulate nervous system, raises a vitality. The first dishes contain extractive substances of meat and vegetables, they serve as chemical activators of secretion.

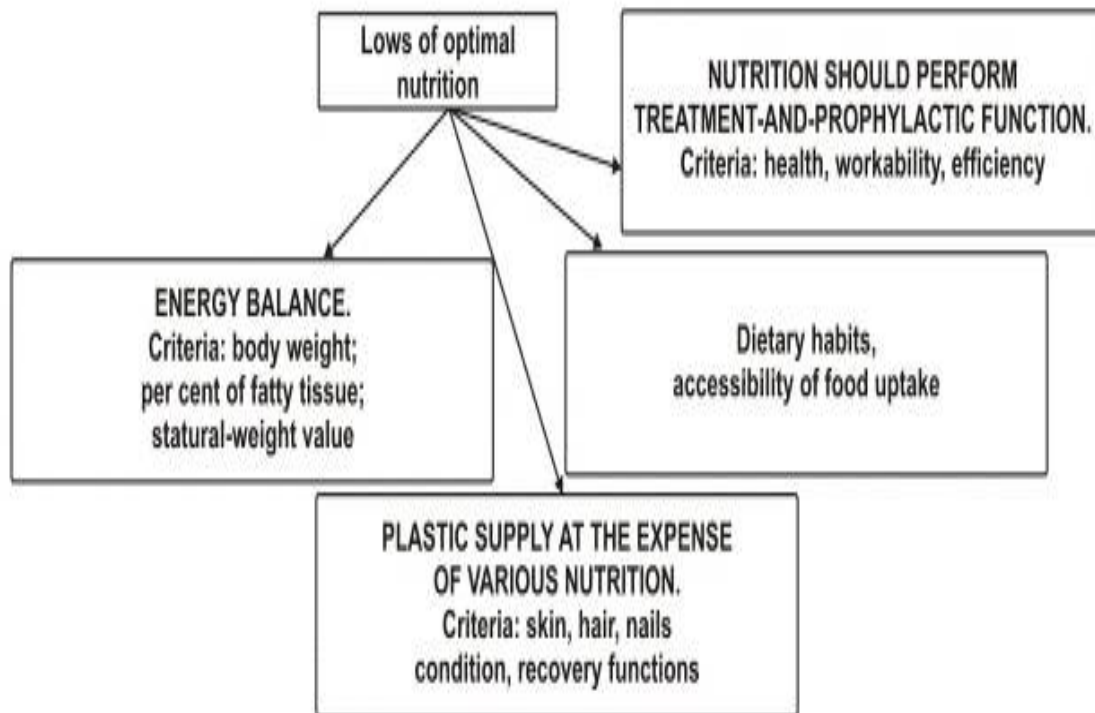
Milk and vegetative food fast passes through a stomach and gives short-term saturation (200 g milk stay in a stomach 1–2 hours, 200 g bread — 2.5 hours; cooked rice, cabbage, potato — 3–4 hours; 200 g meat — 4–5 hours; fat, smoked meat — 6–7 hours. Cream, sour cream, fat cottage cheese — till 7–8 hours; 2 hard-boiled eggs — 2.5 hours. The usual dinner stays in a stomach 4–5 hours. The animal food is assimilated on 95 %, vegetative — on 80 %, sour cream — on 80–90 %. Assimilation of vegetative food — is less due to cellulose. Fat pork, mutton, duck, goose are digested difficultly. The fresh fish is assimilated good, the egg is assimilated easily too and good. Gastric secretion is decreased at milk, bread intake, and is braked by fat food. From string beans and peas mashed potatoes is better to prepare, porridges are assimilated better if they are cooked on milk. On digestion and assimilation of food influences conditions of consumption, the important role belongs conditioned-reflex to secretion of juice and salivation, temperature of food. The temperature must not be higher than 60–65°C. After of nutrition should be impossible to start at once work, is necessary the interval 1–1,5 hours. The dinner should begin with the soup, the second dish: in the beginning to eat meat to reduce acidity of gastric juice.

The balanced diet is based on the theory of the balanced and adequate nutrition and consist of five laws of a nutrition.

The first law — observance of balance between energy entering with food (caloric content of food) and energy expenses of an organism.

For measurement of food caloricity are used a unit of measurements — a calorie, the international — joule (Jl), 1 cal = 4,184 Jl.

The second law — it is necessary to follow the rule of equation between proteins, fats, carbohydrates, vitamins, mineral and ballast substances. Norms of physiological needs for food substances and energy for different groups of the population are developed.



For definition of an optimal nutrition is necessary to calculate factor of physical activity (FPA):

$$\frac{\text{Total energy expenses}}{\text{Basic metabolism}}$$

At easy work average FPA is equal 1,4; at average — 1,6, at hard work — 2,5.

The third law dictates a rule — the variety.

The fourth law — observance of eatig [dietary] pattern — regularity and optimal food distribution within day.

The fifth law — to keep to age needs and motion activity, the nutrition will carry out a preventive orientation in this case.

In recommendations the ratio is offered: for preschool children 1 : 1 : 3, for school children 1 : 1 : 4; 1 : 1,2 : 4,6 (1 : 1,1 : 4,7).

Eating [dietary] pattern is multiplicity of food consumption, quantitative distribution during day, intervals between food consumption. At 4 multiple nutrition: a breakfast — 25%; a lunch — 35%; a dinner — 15%, a supper — 25%.

There are physiological norms for 9 groups of the children's population, 6 groups of preschool and school age. For adult population — 5 groups for men and 4 groups for women.

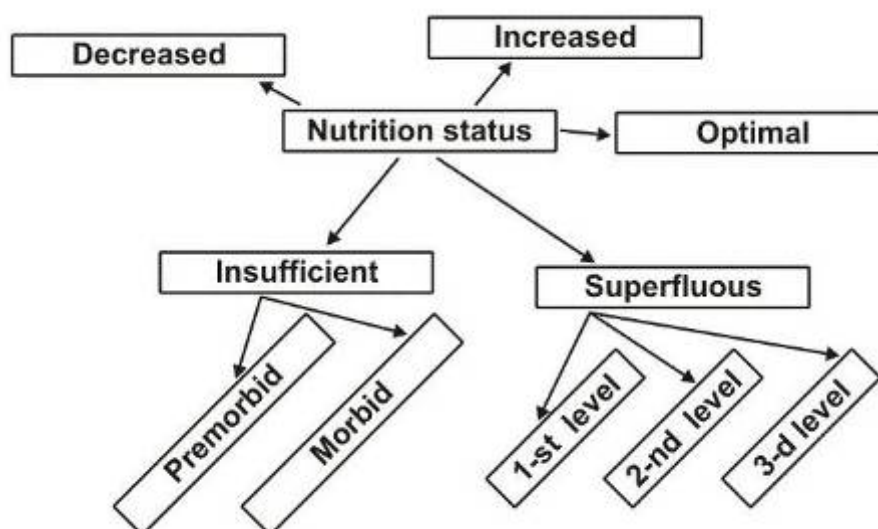
CLASSIFICATION OF THE NUTRITION STATUS (NS)

The analysis of the literary data shows, that the basic parameters of a nutrition reflecting a body structure condition, functional and adaptable opportunities of an organism, inherently characterize a health level of the person and a population as a whole. Existing classification of the NS requires correction in connection with that it is practically impossible to differentiate the usual and optimal status. Moreover, on available classification the superfluous status is considered as a condition of adiposity of a various degree, the intermediate condition between the superfluous and usual NS is not allocated.

It is established, that on a level of physical readiness, a condition of functional and adaptable opportunities of an organism exert essential influence the body structure, in particular fat content. The optimal results of relative physical workability, the maximal oxygen consumption, performance of physical exercises is registered among young men with the contents of a fatty component in organism from 9 up to 18%.

Results of research of immune resistance of organism show, that at persons with the fat contents in a body less than 12% are considerably reduced bactericidal activity of blood serum and increased lysozyme level. At the men having the superfluous nutrition status (fat contents more than 18%) are reduced the content beta-lysine and increased the lysozyme level in blood. At higher fat quantity in organism (over 21%) bactericidal activity of blood whey, a compliment level and beta-lysine in blood is authentically reduced in comparison with persons with the fatty component from 12 up to 18%.

Classification of the nutrition status



In the offered classification the following basic levels of the NS are allocated: optimal, lowered, raised, insufficient and superfluous. *To the usual nutrition status is necessary to concern persons with the fat contents in a body 12–18% or having IBM within the limits of 20,0–25,0 kg /m².* At that functional

and adaptable opportunities of an organism provide usual conditions of vital activity. Such nutrition status takes place among the most young people accepting an adequate diet.

The decreased status is characterized by fat quantity in a body 9–12% or IBM from 18,5 up to 20,0 kg/m². It can be caused by the constitutional and adaptable features of the organism, an inadequate nutrition, physical and nervous-and-emotional loadings. At that takes place preservation of functional adaptable organism opportunities or their insignificant reduction at inadequate nutrition.

People concern to the increased nutrition status with a fatty component of body from 18 up to 21% (IBM — 25,0–27,5 kg/m²). Such status is formed as a result of consumption of diets, at which energy expenses of organism less then consumption. At persons with such nutrition status is not marked essential changes of functional and adaptable opportunities though their some reduction takes place.

The insufficient nutrition status arises at quantitative or qualitative inadequacy of nutrition, and also at reduction or full impossibility of nutrients assimilation. Therefore the body structure, functional both adaptable reserves and opportunities of organism can be broken. Persons with such nutrition status (fat content in organism less than 9%, IBM — not less than 18,5 kg/m²) are subject for medical inspection and treatment. The insufficient nutrition status is subdivided on pre-morbid (latent) and morbid.

Pre-morbid status is characterized by occurrence of microsymptoms of nutrient's insufficiency, deterioration of functions of the basic physical systems, decrease of the general resistency and adaptable processes even in usual conditions of vital activity. Morbid or the painful status is characterized not only functional and structural infringements, but development distinct syndrome of nutrient insufficiency.

For the healthy person starvation heavily as reserves of the basic substances are insignificant. So, free amino acids are spent during several hours, carbohydrates till 13 hours, fats — till 27 days. At starvation the organism is reconstructed on an expenditure of own reserves; functions of a liver, hemopoietic systems, CNS are broken. Avitaminosis is dangerous at this time also.

The raised need for vitamins and microelements arises at pregnancy, lactation, in extreme situations, at presence of parasites in intestines, some bacteria. The unbalanced ratio of vitamins in food promotes hypervitaminosis. Presence in food of so-called «antivitamins» reduces or completely liquidates corresponding vitamins. For example, ascorbinaza destroys an ascorbic acid, thiaminaza — thiamine, avidin — biotin, etc.

THE ILLNESSES CONNECTED TO NUTRITION INSUFFICIENCY

Alimentary insufficiency essentially reduces organism ability to synthesize antibodies, phagocytic activity micro-and-macrophages, nonspecific resistency to bacterial toxins, one is the reason of abatement of inflammatory reaction,

slows down of wound repair, changes intestinal microflora. Sensitivity to deficiency of food substances is more than younger organism and than more intensive growth. Long term nutrition limitation results in radical changes in cells down to the dystrophy phenomena.

Protein-calorie deficiency (PCD) occur as **Quashiorecor** and alimentary marasm. Quashiorecor happens at 2–3 years children. The main reason of ones is unbalanced nutrition, especial in animal proteins. Insufficient of protein entry results in occurrence of hypostases, water — diarrheal syndrome — as consequence of disorder of enzymes synthesis by pancreas, the muscular hypotonia, psychomotor disorders (apathy, inertness, etc.), changeable symptoms — skin depigmentation («snake leather», anemia, crescents-shaped face form, dermatosis, splenomegaly and hepatomegaly, etc.).

Alimentary marasm (cachexy) is deficiency as proteins and energy of food. May be observed a lag in physical developmental. At marasm the form and color of hair does not change, skin depigmentation does not happen, there are no hypostases, mental disorder are less expressed than at Quashiorecor.

This condition can develop in all age groups, but occur at children of the first year more often. The reasons are social-and-economic factors, the early termination of breast feeding (ablactation) without adequate artificial feeding.

QUALITY MONITORING OVER PROTEINS IN ORGANISM

The widespread means of the proteins control by calculation of their maintenance in dishes and periodic weighing products. The protein maintenance expects using the table of a chemical compounds of products.

Quantitative protein detection in diets objectively characterizes completeness of food issue. However is not taken into account thus actual protein assimilated by the man. It can be determined by a method of nitrogen definition excreted with urine.

Except for the general nitrogen is defined protein nutrition factor (PNF).

$$\text{PNF} = \frac{\text{N urea}}{\text{N general}} \times 100\%$$

At protein deficiency the share of urea nitrogen is decreased. The essence of reaction consists in use of metabolits nitrogen including urea for synthesis of amino-acids and the basic nitrogens and, finally, protein.

The least protein quantity at which PNF reaches 90%, corresponds to an adequate level of its consumption, the compensated consumption level of protein — 70–89%, low or insufficient — $\text{PNF} < 70\%$.

Advantage of this method its exsanguinity, availability for mass inspections. PNF can be used for an estimation of a diet and the control over it, in clinic — for the characteristic of disease severity, efficiency of treatment.

For an estimation of supply organism by protein can be other biochemical parameters are used also: the maintenance of the general protein, free amino-acids in whey of blood, excretion with urine of ammonia, creatinine, etc.

HYPO-AND AVITAMINOUS STATES

The reasons:

1. Alimentary insufficiency of vitamins:
 - The low maintenance of vitamins in a diet;
 - Destruction of vitamins owing to technological products processing, their wrong storage and irrational cooking processing;
 - Action of the antivitamin factors contained in products;
 - Presence at products of vitamins in little-digestible form;
 - Diet disbalance and optimal ratio between vitamins and other substances;
 - Food distortions, religious interdictions;
 - Anorexia.
2. Depression of the normal intestinal microflora, producing vitamins:
 - Illnesses of intestinal tract;
 - Irrational chemotherapy.
3. Infringement of vitamins assimilation:
 - Infringement of vitamins absorption in a gastrointestinal tract;
 - Presence of pathogenic intestinal microflora, parasites;
 - Hereditary anomalies;
 - Anti-vitamin action of medicines.
4. The raised needs for vitamins:
 - 1 — special physiological states of organism;
 - 2 — climatic conditions;
 - 3 — intensive physical activity;
 - 4 — stress;
 - 5 — infectious status;
 - 6 — harmful production factors;
 - 7 — internal diseases.

Hypovitaminosis A — frequently arise as specific eyes defeats at preschool age children. This is progressing conjunctiva and corneas of eyes (xerophthalmia), defeat infringement of twilight vision («night-blindness») and colour perception; may be observed hyperkeratosis, the raised susceptibility to infectious diseases, etc.

Insufficiency of vitamins D (rachitis) is more often at children, at adults seldom and is shown as an osteoporosis and osteomalacia.

Hypovitaminosis E occurs seldom, are considered a risk factor of an atherosclerosis and its complications — IDH and stenocardias. Insufficiency of tocopherol plays the important role in occurrence of various diseases of a liver and bilious ways.

Thiamine (B₁) deficiency occurs at consumption food with the big densities of refined carbohydrates. The hot climate, heavy physical work, endocrine diseases, poisonings with heavy metals, alcoholism promote its

development. Clinical symptoms are a headache, undue fatiguability, sleep disturbance, depression, muscular asthenia, pains and syndromes in musculus gastrocnemius (illness Beri-beri), at an avitaminosis — peripheral polyneuritis.

Riboflavin (B₂) hypovitaminosis lead to changes of a mouth mucous membrane, a skin, eyes, characteristic angular stomatitis with cracks in mouth corners, vertical cracks of mucous lips (cheilosis), seborrheic eczema.

At ariboflavinosis «geographical language», conjunctivitis, disturbance of light and color sensitivity. This can arise at absence of milk and dairy products in a diet.

Pyridoxine (B₆) insufficiency occurs seldom, at the chronic diseases IT, hereditary defects of pyridoxine-dependent enzymes, at persons inclined to alkoholizm. Disturbance of the central nervous system, defeats of skin and mucous may be observed.

Avitaminosis B₁₂ arises at the vegetarians, pregnant: irritability, loss of appetite, disturbance of intestine motility.

Deficiency of folic acid (B₉) is the most widespread form. Is connected with bad intestinal food assimilate. The high maintenance of a folic acid: in liver, vegetables, beans, yeast. This one present at the older persons, pregnant and nursing mothers more often. Pregnant are special group of risk B₉ hypovitaminosis — promotes occurrence teratogenic effects and can result in disturbance of mental development of newborns.

The illnesses caused by deficiency or disbalance of microelements are named microelementosis. Hypomicroelementosis can have exo- and endogenous origin. Exo- is met at 20% of the population of biogeochemical provinces. To endogenous — concern to hypomicroelementosis, caused by hereditary or congenital diseases. Secondary endogenous this one arises at infectious diseases, diseases of a gastrointestinal tract, CNS. It's divided into mono-and polyhypomicroelementosis.

The control over vitamin provision includes:

- The analysis of apportion of foodstuff;
- The control of rules storage of products, technology of food preparation;
- The analysis of foodstuff and ready dishes;
- Clinical and biochemical methods of researches;
- Methods of functional diagnostics;
- Revealing of microsytptoms of vitamin insufficiency.

Vitamin C is least steady, in an organism of the human is not synthesized, in an open atmosphere - quickly collapses. A method of functional diagnostics is definition of durability of skin capillaries, definition of time dark adaptations.

The calculation method consists in studying a consumable complex by the person according to official documents (in menus, cumulative list) with the subsequent calculation under tables of a chemical compound of maintenance foodstuff in them vit. A and C.

The biographical-polling method is simple, accessible, does not demand the special equipment, can be used at the analysis both groups, and an individual nutrition.

The weight method consists in weighing of all products and dishes consumed in day. This method is laborious but let to realize a full quantitative estimation of an actual nutrition.

Complex studying of a health state includes generally clinical inspection of disease estimation, studying of immunological status and anthropometrical parameters, is the important approach to an estimation of organism provision by vitamins.

Generally clinical and somatoscopy inspection is directed on revealing of possible microsymptoms. Studying of disease includes the account of the general number of cases with temporal disability, structures disease, calculation of collective health index. The deviation of anthropometrical parameters of physical development also can indicate vitamins deficiency in nutrition.

Physiological methods include investigation of vascular permeability, an estimation of time dark adaptation (for an estimation vit. A adequacy). **Biochemical methods** are based on definition of the maintenance of vitamins and metabolism products in blood, urine, leukocytes, etc. About adequacy of vit.C in organism judge by quantity of the ascorbic acid egest with urine (mg/hour or daily), under the relation of quantity of urine ascorbic acid to egest general nitrogen quantity (in norm — 0,21–0,33), under the maintenance in blood serum and leukocytes (norm 0,7–1,2 in 100 ml).

THE ILLNESSES CONNECTED TO OVERNUTRITION

The superfluous status (fat in an organism — more than 21%, IBM — more than 27,5 kg/m²) is characterized by corresponding infringements of body structure, decrease of functional and adaptable opportunities an organism depending on a degree of adiposity. This status is formed as a result of consumption of diets which energy value considerably exceeds energy expenses of an organism. The family of superfluous nutrition illnesses consists of an atherosclerosis, cholelithiasis, fatness, podagra, metabolism polyarthritis, renal insufficiency, diabetes, etc.

Cardinal symptoms of a superfluous nutrition:

- hypercholesterolemia,;
- hyperglycemia;
- azotemia;
- hyperuresis.

A superfluous nutrition in the first months and years of life promotes formation of fatty cells depot and is a risk factor of accumulation of a significant amount of fat. Appear especially resistant to treatment hypercellular form of adiposity. All cases of adiposity are considered as manifestation of energy

disbalance in view of nutrition character and growing hypokinesia. The first degree of adiposity is characterized by superfluous body weight up to 30% from normative level. The second degree of adiposity — more than 50% of surplus of body weight from normative level.

It is considered that a principal cause of adiposity is overeating. However it more likely consequence than the reason. An original cause is frustration of regulating function of homeostasis mechanism supervising entry and a energy expense and their reserves in an organism. Under action of the external or internal reasons this regulating function can be broken. To external one concerns are hypodynamia, family and national habits, alcohol consumption.

To internal factors it is necessary to relate age changes of metabolism, diseases of CNS, endocrine diseases.

Now it is conventional, that adiposity is dangerous for health. Any separately taken illness cannot attribute all additional death rate among people, suffering by adiposity, however adiposity raises risk of a diabetes at the adults, the raised blood pressure and aggravates the tendency to the increased lipid level in blood. The heavy form of adiposity ($ИМТ > 35$) is connected to hypertonic illness, chronic intimate insufficiency, sudden death from a heart attack of a myocardium and insult. Recently carried out researches have shown importance of distribution of body fat. The risk of diseases occurrence is higher at distribution of fat in the field of a stomach than total than at its distribution on hips and in the field of a pelvis.

The overwhelming majority of epidemiological researches show positive connection between fats consumption and a degree of adiposity among the population. A diet rich the fats usually stimulate overeating. Consuming food, containing more fat, the person receives more energy, than at the use of food with the high maintenance of carbohydrates and the low fat maintenance. The fat food causes smaller satiation feeling than food rich carbohydrates from equal caloric content. 1g of fat contains 9 kcal of energy, whereas 1g of carbohydrates — 4 kcal. Products rich carbohydrates are more volumetric, therefore with them it is more difficult to use as much than energy, how many with fat products.

Ischemic cardiomyopathy is one of the important problems in the majority of the advanced countries. At ischemic cardiomyopathy the arteries supplying with blood heart are narrowed owing to an atherosclerosis — illnesses at which during many decades under inferior envelope of artery is formed atherosclerotic «plaque». Later this plaque can break. It causes to number of the processes directed on restoration of integrity of a vessel therefore the blood clot or a thrombus is formed. The quantity and type of the fat contained in a diet can influence both process of an atherosclerosis and on process of a blood clot. The fat included into food everywhere admits as one of fundamental external risk factors which action is shown through blood cholesterol and other physiological and biochemical functions. For reduction

of risk ischemic cardiomyopathy is important not reduce of total fat but type of consumed fat, i. e. replacement of the saturated fatty acids by nonsaturated. For example, oils (soya, corn, sunflower), rich polynonsaturated linoleic acid, provide lipoprotein structure, optimum for reduction of risk ischemic cardiomyopathy. Recommendations concerning to nutrition cannot be the most effective way of ischemic cardiomyopathy reduction-risk among the population. Alternative variant of strategy is change of fat structure of acids in fatty products of mass consumption.

Depending on the mechanism of occurrence all kinds of adiposity divide on metabolic and regulation. Metabolic are genetically caused or got, regulation — due to disorders of the central mechanism. To illnesses of a superfluous nutrition concern hypervitaminosis. Overdose of vitamin A is characterized by dizziness, a headache, vomiting, disorder of sight, muscular spasms. Overdose of vitamin D amazes nervous system, organs of blood circulation, kidney. Develops premature skeleton and skull ossification, hypercalcemia, arterial calcinosis, parenchymatous organs calcinosis.

Biogeochemical provinces determine mineral structure of soil, water and plants and undirectly illnesses of microelements insufficiency — fluorosis — enamel spottiness — superfluous fluorine intake, at insufficient intake of fluorine teeth caries develops.

What we consume, that what we are sick; illnesses are a mirror of the nutrition status.

CONCLUSION

The nutrition defines duration and quality of human life. Mistakes in structure of nutrition become one of the reasons of many heavy diseases, including the most widespread cardiovascular diseases and a cancer. Hygienic measures of prophylaxis alimentary depending diseases are based on modern knowledge of essence of metabolism processes and maintenance of a homeostasis.

Thus, studying of the nutrition status represents system of consistently spent researches, including some stages:

- Studying of actual nutrition;
- Studying influence of various environment factors on organism status;
- Collect of the people having various deviations in a nutrition status or risk group;
- Groups of the risk subject to more profound inspection;
- An establishment of the reasons of nutrition status disorder;
- Measures of infringements elimination, improvement of the nutrition status;
- Nutrition and a health status.

Lecture VI

QUESTIONS OF NUTRITION IN THE TREATMENT-AND-PROPHYLACTIC INSTITUTIONS. A DIETARY NUTRITION

INTRODUCTION

Provision by foodstuff does not solve a problem of their correct consumption and achievement of the basic purpose of nutrition-preventive and medical effect.

The basic directions of practical activities of the Republican Center of Hygiene in the field of nutrition are following:

1. Study of fundamental bases of nutrition influencing on formation, development and functioning of physiological and biochemical functions and processes: adaptogenic, antioxidant, protective, genomic, xenobiotics neutralization.

2. Monitoring of actual nutrition on adequacy to physiological needs in view of a health state of different groups of the population, equation of a diet.

3. A hygienic substantiation of diets of separate groups of the population: for children — «the Collection of compoundings of dishes»; «the Card file of dishes» in view of deviations in their health; a preventive nutrition of workers in view of their working conditions, weight and intensity of work; the treatment-and-prophylactic nutrition of a sick directed on recovery with clinical researches.

4. Control of food stuffs safety according to quality specifications at enterprises and the trade, accompanying components (container, packing, the equipment, technology) contacting to foodstuff: heavy metals, chlorine-containing pesticides, mycotoxines, nitroamines, polyaromatic hydrocarbons, hormones, antibiotics, monomers of polymeric materials, etc. Must be obligatory sanitary-and-hygienic examination of foodstuff.

Food — the major substratum of an environment rendering constant and very essential influence on vital activity as healthy both sick organism. Cellulose and pectin sorb salts of heavy metals and radionuclids, strengthening of intestines peristalsis, accelerate their mechanical removing from the organism.

Fresh crude vegetable products (for example: cabbage, beet, pumpkin, carrots) — the most valuable food for the human. They are ideally balanced in acids and alkalis, contain vitamins and biologically active substances, the recommended consumption — up to 400g per day. Their thermal processing reduces product's value.

Macro- and micronutrients should not be a subject of «food body building». In gastrointestinal tract are shown their synergetic and antagonistic interactions, so, zinc increases cadmium intestinal absorption. Antagonistic effects are established for: iron — manganese; zinc — copper; calcium — iron;

calcium — manganese, etc. Enrichment of products by calciferol, consumption of vitamin medicines and enthusiasm for sunburn promotes deficiency of vitamins A, E, B₁, C and bioflavonoids.

For Belarus is actual search of effective treatment-and-prophylactic medicines and foodstuff for normalization of the functional-and-metabolic organism status in conditions of complex man-caused, ionizing and non-ionizing radiations, noisy and vibrating influence. The way of creation of similar treatment-and-prophylactic diets on a basis of vegetable derivatives bioflavonoids is perspective. They can become a basis of preventive medicine. Bioflavonoids (about 4000) have multiform biological activity: P-vitamin activity strengthens capillaries; they render detoxic action, anti-oxidant, cardioprotective, spasmolytic, anti-inflammatory, choleric, radioprotective, antiallergic, hepatoprotective, diuretic, anticancerogenic and other influences.

A dietary (medical) nutrition is directed on increase of treatment efficiency and prophylaxis of repeated hospitalization. The dietetics, diet-therapy is treatment by nutrition (who well nourish — well treats).

Questions of nutrition should be considered in a complex: health, profilaxis, treatment in view of a sex, age, organism status, stressful situations, working, social, ecological and industrial conditions.

THE BASIC PRINCIPLES OF A DIETARY NUTRITION

A dietary nutrition is organized according to the general principles of the balanced (rational) nutrition in view of disorder of metabolic processes. Modern tactics of dietetic therapy issue from the following main principles.

1. Equation of nutrition and its full value taking into account of needs of the sick organism. Live ability of an organism is possible, if it receives with food the certain amount of proteins, fats, carbohydrates and others vitally important substances. Decrease of proteins in a diet is especially inadmissible, as at acute diseases (pneumonia, stomach ulcer, enterocolitis, traumas, operations) is observed infringement of albuminous metabolism, decrease of albuminous supply of the organism.

The quantity of fats in a dietary nutrition is a little limited at patients by chronic colitis, a chronic gastritis with lowered secretory stomach function, cardiovascular diseases. Dietary dishes are prepared on the cow oil. The vegetable oil containing valuable for organism unsaturated fat acids and phosphatides also should be included into a diet.

The maintenance of carbohydrates at patients with functional diarrhea, a chronic gastritis and a stomach ulcer should be within the limits of usual norm, and at patients with malnutrition — increases. At the chronic intestine diseases with amplification of fermentative processes the quantity of carbohydrates are decreased.

Assimilation of vitamins at stomach diseases and especially intestines is broken, and patients require their raised quantity. The control over the

maintenance of vitamins at culinary processing of products and for food vitaminization is necessary.

Table salt in a diet are decreased at a chronic gastritis with the raises secretion, a stomach and duodenum ulcer, at diseases of cardiovascular system and organs of urogenital system.

Quite often in a diet of the sick person it is required to change usual balance of food and biologically active substances to result in a necessary optimal ratio a chemical compounds of a diet with fermental systems. For example, at kidneys disease in a diet the quantity of proteins is decreased, at adiposity are increased proteins and reduced carbohydrates, at diabetes are reduced quantity of carbohydrates, especial fast-absorb.

2. Taking into account of features of biochemical and physiological processes of transformation and assimilation of food substances by the sick person. For example at atherosclerosis is prescribed to limit easily digestible carbohydrates, total animal fat can depending on features of metabolism infringements.

Enrichment of a diet by essential nutritional factors is stimulated synthesis of enzymes in regenerative processes. At hepatitis, for example, a diet is enriched with lipotropic substances: the proteins containing amino acid methionine, choline, lecithin, vitamins B₆ and B₁₂.

For normalization of biochemical processes in an organism change a diet (frequency rate, quantity of food intake). Most frequently this method will be applied after operations on organs of gastrointestinal tract, etc.

3. Mechanical and chemical sparing diet of diseased organ. At mechanical sparing is limited in diet products rich cellulose and difficult assimilable: black bread, cabbage, radish, kidney beans, beans. Are applied methods of processing of the products improving food digestion and assimilation: products are crushed, wipe, knead, shaken up. Vegetative products are soften, reduced the contents in them rough cellulose. Vegetables are boiled or baked, wipe and use as puree, roll, baked puddings. Meat is used of average fatness, low-fat, carefully crushed. For preparation of soups are used well sodden soft groats: pearl-barley, semolina, oatmeal. The second dishes are necessary to prepare by porous, air, light.

The principle of chemical sparing is achieved by exception of products rich extractive substances, restriction of the dishes stimulating secretory and motor functions of gastrointestinal tract. Are excluded strong broths, rich soups, fried dishes with formation of the crust, the concentrated sauces, pickles, pancakes, fresh bread and spices (mustard, pepper, vinegar). Taste of dietary dishes improves due to use of some seasonings and spices (vanillin, vanilla — citric acid, cinnamon, greens). It is widely applied boiling at which extractive substances pass in bouillon and broth. The food should not be hot or cold as can render irritating temperature influence on mucous membranes of a mouth, an

oesophagus and a stomach. The temperature of the first dishes should be no more than 60°, the second — no more than 55°, cold — is not lower 15°.

4. Limitation in nutrition (quantitative and qualitative), down to partial or complete starvation. Regime of partial starvation (are limited intake of some food (dairy, cottage cheese, apple etc.), are used at treatment of cardiovascular diseases, alimentary adiposity. Complete starvation for the limited term is shown at some acute diseases: uraemia, intoxications, acute inflammatory processes in gastrointestinal tract.

Dietetic therapy in all cases should promote the best action of medicines. So, at therapy by anabolic steroids it is necessary to increase the maintenance of proteins in a diet (anabolic effect raises).

It is necessary to consider the food not only as an energy and plastic substances source, but also as a pharmacological complex. Therefore dietetic therapy is an obligatory element of modern complex therapy which in one cases renders conducting therapeutic action, in others — promotes achievement of effective influence of other medicinal methods. Correctly organized nutrition provides an organism by food substances necessary for life and recovery of the patient.

Indications for increase of proteins in a diet are the extreme emaciation, condition after operation or acute diseases: colitis, enterocolitis, stomach ulcer, and also other illnesses accompanying hypoproteinemia. At all this pathology the maintenance of proteins in a diet should increase up to 150–160g in day. Half of them should consist of proteins of animal origin.

Restriction of proteins is shown at function sparing of kidneys at nephritis, hypertonic illness, and also at urolithic diathesis. However, it is necessary to remember, that limitation of protein of below physiological norm is allowable only at short date.

At dietetic therapy is recommended to take into account also the general action of various products and dishes on the organism, on a metabolism and local their influence on organs of digestion.

Properties of products and the dishes taken into account in dietetic therapy — «Dietary pharmacology»:

1. **Quickly evacuated from a stomach:** milk, lactic products, an egg lightly-boiled, fruit, berries, mashed potatoes, dishes from ground meat and a fish (a cutlet steam, quenelles , rolls, quenelles), porridges from ground groats, macaroni products, white yesterday's bread.

2. **Slowly assimilating:** a salty fish, fresh (warm) bread, refractory fats (beef, mutton, pork), fat meat and a fish, geese, duck, fried meat, legumes.

3. **Render expressed secretagogue action:** extractive substances of meat, a fish, mushrooms (broth from them), cheese, spices (mustard, horse-radish, pepper), vegetable gains and juices, cabbage, cucumbers, smoking, pickles, fried meat.

Have weak secretagogue action: dairy products, cooked vegetables and fruit, boiled meat, carrots, green peas, fats.

4. **Render eccoprotic action:** prunes, honey, vegetable oil, cold vegetable juices, sweet drinks (water with honey), compotes, kefir, cold aerated mineral waters, vegetables and fruit (except for having astringent taste), bread from coarse grinding, legumes.

Slow down intestinal peristalsis: hot dishes, rice and a cream of wheat, flour dishes (pies, pancakes, noodles), lightly-boiled egg, strong tea, cocoa, chocolate, bilberry and broth from it (have the expressed fixing action), fresh bread (it is especial from a flour of a thin grinding), cottage cheese.

5. **Have choloretic action:** vegetable oil (especially olive, sunflower), vegetables rich vegetative cellulose, the tomatoes, a grated radish with vegetable oil, beet.

6. **Contain much cellulose:** foliferous green, legumes, bread from a flour of a rough grinding, bran wheaten, groats - buckwheat, pearl-barley, peeled barley, millet, white cabbage, dried fruits, green peas, horse-radish.

Contain a little cellulose: macaroni products, bakery, products from flour of the maximum (supreme) and first grade, rice, semolina, pumpkin porridges, potato, cauliflower, berries.

7. **Cause meteorism:** legumes, fresh bread (rye), white cabbage, whole milk.

8. **Promote shift in acid-alkaline balance to the sour side:** meat, fish, bird, bread, flour products, groats, legumes, cowberry, nuts, almonds.

Promote shift in acid-alkaline balance to the alkaline side: vegetables, fruit, berries (except for a cowberry), dairy products, not sour cottage cheese, mushrooms.

9. **Stimulate nervous system:** meat and fish gains, cheese (especially at night), cocoa, coffee, chocolate, strong tea, spices.

10. **Products rich oxalic acids:** sorrel, spinach, cauliflower, rhubarb, cocoa, tea, chocolate.

11. **Products rich of purines:** sardines in oil, sprats, herring, fish, meat, internal organs, lentil, beans, spinach, cauliflower, rich broths.

12. **Products rich of holins:** eggs, liver, legumes, cabbage.

PHYSIOLOGICAL-AND-HYGIENIC CHARACTERISTIC OF BASIC DIETS

In 1922 M. I. Pevzner developed the basic diets for the different groups of illnesses.

Dietary nutrition at M. I. Pevzner's system includes 15 basic diets. The chemical compound and caloric content of diets are submitted in the table. Diets № 0, 0b, 0c, 1a, 1b, 4, 5a, 5, 8 concern to strict diets (without right of choice). Being unbalanced in structure and food value they are appointed at short date.

The first diets (1a, 1b, 1) provide mainly, mechanical sparing of sick organs, therefore are appointed at diseases of a stomach and a duodenal gut. They provide sparing baro-, chemo- and thermoreceptors of stomach, fast food evacuation. The food stuffs unduly stimulating stomach secretion are excluded from a diet.

During an exacerbation are limited the food stuffs slowly evacuated from a stomach and containing a lot of cellulose. The diet includes products poorly stimulating secretory stomach activity.

The diet № 1a includes 4–5 glasses of milk, soups dairy or mucous (from groats or wheaten bran) with oil, soft-boiled egg or steam omelette, kissels and jelly berry, fruit (not sour), and dairy. Once a day liquid dairy porridges, a soufflé from cooked meat or a fish are resolved.

Period of this diet is considered as the first stage of treatment. At favorable current of disease in 7–10 days the patient is transferred on more loading regimen — a diet № 1b for the same term. At that are added white crackers (75–100g), the meat and fish dishes increases up to 2–3 times in the day, prograded porridges are given 2 times in day. Nutrition on diets № 1a and 1b is better to organize six times the amount.

The primary goal of dietetic therapy at diseases of the broken intestine functions is maximal recovery organs involved in pathological process.

The diet №4 is appointed at enterocolitis promoting normalization motor and secretory functions of intestine, to weakening of fermentative processes.

Diets №5 and 5a are appointed at acute hepatitis of any aetiology. This diet high-grade, but with some fat limitation (up to 70g). The basic kidney diet in Pevzner is a diet №7. In this diet half the quantity of proteins and not less than 1/3 is consist of proteins of animal origin. Fats in relation to quantity of proteins are in a physiological ratio, the quantity of carbohydrates is a little bit increased. Table salt is not given neither for preparation of food, nor for a table, the vegetables are selected with the least maintenance of chloride sodium.

The diet № 10 is the basic medical diet at cardiovascular diseases (myocardial ischemia, essential hypertension, cardiac infarction). It promotes normalization of metabolism processes in an organism, improves a functional condition of heart, kidneys, has good diuretic action. With the help of a diet may actively influence on the basic atherosclerosis mechanisms.

It is necessary to know that animal fats, especially emulsified, raise coagulating blood properties, vegetative one operate in opposite direction. Cellular environments contained in vegetative products (dietary fibres), raise motor function of intestine and strengthen cholesterol removing from the organism, positively influence on lipid metabolism.

Dietotherapy renders essential influence on a condition of blood circulation and myocardium function. This action is caused by limitation in a diet of table salt (ions of sodium) and inclusions in it of products rich salts potassium, vitamins (especially groups B). Essential value has a diet regimen. Rare food intake increase hyperlipidemia, break tolerance to carbohydrates and promote increase of body weight. Distribution of regimen within day should be uniform, amount of food intakes — 5–6 times in day.

The diet № 9 is applied at allergic conditions when any kinds of a metabolism suffer and infringements of a carbohydrate-and-fatty metabolism are most expressed. The given diet is recommended also at diabetes.

From the menu is excluded sugar and sweets, limit the maintenance of table salt and the general caloric content, mainly due to protein and fat.

The diet №8 is appointed at superfluous body weight, for reduction of hypererethism of the food center.

It's typical for a diet:

— Sharp limitation of caloric content (50–60% of need for persons with normal body weight) due to restriction of carbohydrates;

— The physiological maintenance in a diet of proteins and restriction of fats. Significant reduction in a diet of fats expediently since fats have expressed lipolytic action, reduce lipogenesis (fats formation) from carbohydrates, create feeling of satiety;

— Restriction of table salt up to 5–7 g;

— Exception of products and the dishes stimulating appetite (meat, mushroom, fish broths, alcohol, sharp, salty and fried dishes; spices, smoked products);

— Inclusion volumetric products, vegetables and fruit poor by carbohydrates (cabbage, cucumbers, tomatoes, apples), with the purpose of creation of satiety feeling;

— Presence in a diet of sea products containing a plenty of essential aminoacids and iodine;

All products are given not crushed, mainly in the cooked, baked or crude kind. Quantity of food intakes consist of 4–5 times.

The chemical compound and caloric content are determined by «due» body weight of the patient. In view of it are allocated three variants of a diet № 8.

Variants	Maximal normal body weight, kg	Protein, gr	Fats, gr	Carbohydrates, gr	Calories, kkal
A	Till 60	95	75	120	1400
B	61–70	110	80	130	1500
C	More 70	125	85	140	1650

Zero diets are appointed after operations on digestion organs and contain a minimal food quantity.

The diet consist of liquid dishes: juice, tea with sugar, liquid kissel, a weak broth with butter, rice broth with cream, vitamin drinks. Fruit drinks, juices and vitamin drinks are necessary to give guardedly, taking into account an opportunity of peristalsis amplification and diarrhea. Milk, vegetables, meat, fish, bread, crackers, porridges, cocoa, chocolate are forbidden.

The food is accepted 7 times in day, according to the necessity — in each 2–2,5 hours round the clock.

The diet № 11 is appointed at lung tuberculosis to persons with the lowered nutrition status, to convalescents after infectious diseases, operations and traumas, at anemia. They are intended for stimulation of assimilation processes

and regeneration in a sick organism and characterized by a variety in assortment. Caloric content of food, animal proteins, lipotropic substances, vitamins and calcium are increased.

The diet № 15 provides a high-grade nutrition. It is characterized by a high-grade set of food stuffs with the raised maintenance of vitamins and exception of difficult transferable fat products. It is appointed at absence of indications for special diets. Culinary processing at diets № 11 and 15 is usual, various.

DIET № 1

Prescription: acute condition of stomach ulcer in partial recovery stage; a chronic gastritis with the conserved and raised secretion during acute condition.

The characteristic: moderate mechanical and thermal sparing of a stomach mucous membrane and a duodenum; food cooked and mainly in prograded kind. Food intake 5–6 times per day, ration weight nearby 3 kg, table salt — till 8–10 gr.

Assortment of products and dishes: yesterday's white and grey bread, crackers white, biscuit. Soups: dairy, prograded, groats and vegetable (except for cabbage). Steam cutlets (meat, fish), the hen and a fish should be cooked or steam. Vegetable puree, porridges and puddings should be prograded, cooked or steam; soft-boiled eggs or a steam omelette. Sweet grades of berries and fruit, juices from them, sugar, honey, jam, baked apples, kissel, mousse, jelly. Whole milk, cream, fresh sour cream, fresh low-fat cottage cheese. Tea and cocoa rather weak, with milk. Butter — unsalted and vegetative.

Are limited: rough vegetative cellulose, bouillons.

Are excluded: spices, coffee, mushrooms.

DIET № 1a

Prescription: stomach and duodenum ulcer, the first 8–10 days of exacerbation; a acute gastritis and chronic gastritis exacerbation, the first 1–2 days.

The characteristic: mechanical and thermal sparing of stomach and duodenum mucous membrane; all food should be in fluid and semi-fluid kind. Food intake — 6–7 times per day, ration weight nearby 2,5 kg, table salt up to 8 gr.

Assortment of products and dishes: soups dairy and mucous from groats and wheat middlings with the butter, prograded vegetables (carrots, beet) and puree from the boiled down lean meat and fish. Porridges are liquid, prograded, dairy, soft-boiled eggs, steam omelette, whole milk. A souffle must be prepared from green cottage cheese. Are recommended dogrose decoction, rather weak tea. Butter and olive oil are added in a dish.

Are excluded: vegetative cellulose, bouillons, mushrooms, bread and bakery products, lactic acid products, spices, snacks, coffee, cocoa.

DIET № 1B

Prescription: exacerbation of a stomach and duodenum ulcer, 10–20 days of disease; acute gastritis 2–3-d days.

The characteristic: more moderate in comparison with a diet № 1a mechanical, chemical and thermal sparing a stomach and a duodenum mucous membrane; all food in semifluid and pureeform kind. Food intake — 6–7 times per day, ration weight up to 2,5–3 kg, table salt — 8–10 gr.

Assortment of products and dishes: dishes and products of a diet №1a, and also white and thinly cut and not toast crackers — 75–100gr., 1–2 times day — meat or fish quenelles or meat-balls; prograted vegetable puree; kissels, jelly from sweet grades of berries and fruit, the juices diluted half-and-half with water and sugar, sugar, honey.

DIET № 2

Prescription: a chronic gastritis with secretory insufficiency; acute gastritis, enteritis, colitis during the period reconvalescence as transition to a balanced diet.

The characteristic: mechanically sparing, but promoting increase of gastric secretion. Food are cooked, baked, fried without breading. Table salt — up to 15 gr in day.

Assortment of products and dishes: yesterday's white bread, not rich crackers, 1–2 times in a week — not rich pies. Soups must be from groats and vegetables with meat and fish broth. A low-fat beef, the hen are cooked, stewed, steam, baked, roasted without breading and galantine. A fish low-fat by a piece or in chopped kind, boiled, steam, jellied. A herring — soaked, chopped. Vegetables: a potato (is limited), beet, carrots in a prograted kind, boiled, stewed, baked; tomatoes are raw. Compotes, kissels, jelly, mousses, from mature fresh and dry fruit and berries (except for melons and apricots), the fruit and vegetable juices, baked apples, fruit candy, sugar. Whole milk is used at good tolerance. Acidophilus milk, kefir, cottage cheese fresh not sour, row and baked; cheese not spike and grated; sour cream is added in dishes. Sauces are meat, fish, sour cream and on vegetable broth. Are used: bay leaf, cinnamon, vanilli; tea, coffee, cocoa on water with milk; butter and oil; lightly-boiled eggs, fried omelette.

Are excluded: legumes and mushrooms.

DIET № 3

Prescription: chronic diseases of intestines with prevalence of constipations, unsharp aggravation period and the period of remission.

The characteristic: increase in a diet of products, rich vegetative cellulose and the products strengthening intestine motor function. Table salt — 12–15 gr per day.

Assortment of products and dishes: bread wheaten from a meal, black bread — at good tolerance. Soups — with the skim broth or vegetable broth with vegetables. Meat and a fish should be cooked, baked, sometimes — cut. Vegetables (especially deciduous) and fruit — crude, in large quantities (prunes, fig), sweet dishes, compotes, juices. Porridges — crumbly (buckwheat, pearl-barley), cottage cheese and cheesecakes, one-day kefir, hard-boiled eggs. Butter and olive oil add to dishes.

Are excluded: turnip, a radish, garlic, mushrooms.

DIET № 4

Prescription: acute enterocolitis, chronic colitis aggravation, the profuse diarrhea period and strongly pronounced dyspepsia.

The characteristic: chemically, mechanically and thermally sparing intestines. Food intake — 5–6 times in day. All dishes are prepared on a pair, prograded. Table salt — 8–10 gr. in day. Duration of a diet — 5–7 days.

Assortment of products and dishes: crackers from white bread. Soups with the skim meat broth, broths from groats with egg flakes, the semolina, frayed rice. Meat is low-fat in the cut kind, cooked or steam. A bird and a fish low-fat in a natural kind or cut, cooked or steam. Porridges and puddings from frayed groats with water or the skim broth. Juices — from fruit and berries, broth of a dogrose, a bilberry. Tea, cocoa on water, jelly, kissels. Eggs - at good tolerance — no more than 2 pieces in day, soft-boiled or steam omelette. Butter — 4%-s' — 250 gr.

Are limited: sugar up to 40 gr, cream.

Are excluded: milk, vegetative cellulose, spices, snack, a pickles, a smoked product, legumes.

DIET № 7

This table is destined to patients with kidney's diseases. The main requirement here — liquid, table salt, proteins limitation, especially an animal origin. Every possible spicy and «acute» substances are forbidden.

To patients give: vegetarian and fruit soups, kissels, compotes, berries, fruit, sweet dishes, butter, flour dishes, various vegetative proteins, cottage cheese, cooked meat and fish.

However: at different conditions of the patient and various secretory system diseases the diet is altered. For example, at various hypostases is limited drink and completely excluded table salt; proteins excluded at uraemia, including vegetative (legumes products, bread, porridges, etc.), at nephrosis, when in urine the big maintenance of proteins, is destined with so-called «days of limited intake of food» with almost full exception of the basic products (proteins, fats, carbohydrates), basically at first 1–3 days. During starvation is entered in organism necessary liquid quantity — a physiological solution — hypodermically or intravenously; at acute current of illness — usually is limited drink, at chronic — quite often is destined plentiful drink (but only not irritating kidneys and urinary tracts), mainly milk, mineral water, cranberry and cowberry fruit drink, extract bearberries, cowberry, a bilberry, birch kidneys, etc.). In heavy cases the patient is destined only sugar days, when give only 120–200gr sugar in day.

THE CONCLUSION

One of leading factors of health and many diseases prophylaxis is nutrition, its quantitative and qualitative side. In structure of nutrition of all groups of the population there were significant changes that dictates necessity of the constant

control, creation of monitoring system of nutrition for acceptance of measures at the state level for its optimization. There is actual problem of balanced nutrition in microelement structure, in particular selenium. It is one of components of antioxidant protection, it has radioprotective properties that is very important in our region, in republic. Worsening population health is dictated necessity of development of the normative documentation regulating the maintenance micronutrients in nutrition, vitamins, mineral substances. Special demands are made to marks and packing of the enriched foodstuff for the medical - improving, preventive purposes. Now in Belarus 9 hygienic specifications in nutrition are developed, present the system of automatic action «NUTRITION», the control system of databases MS Access is advanced. The given system allows to calculate of food value of grocery sets, dishes, diets on parameters - proteins, fats, carbohydrates, mineral substances and vitamins, energy value for different population groups in view of a sex, age, profession, disease. The individual should takes care of the nutrition also.

Lecture VII

HYGIENE OF WATER AND ECONOMIC DRINKING WATER SUPPLY.

THE WATER AS THE HEALTH FACTOR.

WATER RESOURCES ON THE EARTH

INTRODUCTION

Water is one of the most widespread natural compositions. The total amount of water consists of 1,5 billion km³, 93,9% — in the seas and oceans. The big maintenance of salts (till 35 g/l) makes this water unsuitable for the economic — drinking purposes. Fresh water makes less than 6% of all water resources. The most part of world reserves of fresh water are contained in glaciers. Really for the drinking purposes 0,2–0,35% of all water of the Earth are used. More than 2 billion people need in good-quality water.

The reasons:

1) Irregularity of distribution (so, in the CIS 80% of fresh water is concentrated on the Far East, in Siberia, the European North where 33% of the population live only).

- Development of cities.
- Unlimited consumption of underground waters (for example, Mexico falls annually on 14sm from pumping out of underground water).

• Increase of water consumption.

2) Decrease of water quality as a result of pollution by microorganisms and chemical substances, a problem of «water hungry».

Reduction of «water hungry»:

- Preservation of natural waters quality, its effective clearing.

- Rational use.
- Development and use of accumulation reserve of fresh water in underground water-bearing horizons.
- Use of glaciers.
- Demineralization of the seas.

HYGIENIC VALUE OF DRINKING WATER AND RATIONAL WATER SUPPLY

The problem of water supply infringes interests of the big number of people. This feature follows from that role which water play in human physiology.

As is known, the human body consists of 65% of water. The organism even in conditions of the starvation, not satisfied thirst at absence of physical loading loses some of water which is formed in result of continual oxidizing processes.

Rather small water deficiency in the organism results in considerable health infringements. In experiment with animals it is shown, that water loss of 20–22% results in their death. All this speaks that processes of digestion, synthesis of living substance in organism and all metabolic reactions take place only in the water environment.

Despite of extremely big physiological role of water, water expenses for the drinking purposes is insignificant. In conditions of a temperate climate at absence of physical loading, the man loses (hence, and uses) 1,5 litres of water per day. On a consumption level of drinking water influences natural (temperature and humidity of air, isolation, wind) and social (working conditions) factors. So, during physical average work in the temperate climate it is necessary 4 litres, at the same work in a hot climate — 5 litres of water per day. In unusual cases (at work in conditions of desert or in hot shops) the water need for man can raise up 11 litres per day.

However hygienic value of water it's not only physiological role of one. A great deal it necessary for the sanitary and economic-and-domestic purposes. Water commercially promotes to development of hygienic skills (body care, keeping in cleanliness of household goods, etc.).

The sanitary condition of treatment-and-prophylactic establishments depend on quantity of consumed water. The rational centralized water supply is the important condition for prevention of hospital (nosocomial) infections.

Water of drinking quality is necessary for creation of a due sanitary-engineering conditions at the enterprises of the food industry and catering with the purpose of the prevention food toxicoinfections and intoxications. Commercially water is used for carrying out of improving and sports actions (swimming pools), and hydrotherapeutics also.

It is necessary to emphasize, that for water consumption with the purpose of prophylaxis of infectious diseases and improvements of sanitary conditions of population's life is necessary the drinking water of corresponding quality.

In the basis of norms of water consumption are put:

- a) Physiological need;
- b) Body hygiene;
- c) Preparation of food;
- d) Cleanliness of dwelling;
- e) Water discharge in public institutions;
- f) For sprinkling.

In the countryside at use of water from water-folding columns norm of water consumption are 30–50 liters per day, and in city — up 400–500 liters per day.

For example, in Minsk for 1 person is spent more 700 liters, in Rome — 1000 liters (it is a lot of fountains, reservoirs) — is emphasized aesthetic value of water as hail growing factor.

The water quantity which necessary for one inhabitant in day depends on a climate of place, a cultural level of the population, a degree of the accomplishment of city and the housing stock. On average in Republic Belarus water consumption makes more than 200 liters per day. In some cities development of a waterpipe allows to provide enough high norms of water consumption (till 400 liters per day).

2. EPIDEMIOLOGICAL VALUE OF WATER

The centralized water supply allows to lift a level of sanitary culture of the population, promotes reduction of disease only at uninterrupted submission of enough of water of the certain quality. Infringement of those or other sanitary rules as at the organization of water supply, and during of use a waterpipe lead to sanitary trouble down to accidents.

The most mass and with heavy consequences of infringement of public health are connected to the opportunity of carry with water of pathogenes of intestinal infectious diseases. The opportunity of transfer through water of cholera, typhoid fever, salmonellosis, dysentery, brucellosis, a virus hepatitis and others is proved.

In water of water supply sources frequently find out viruses of a poliomyelitis, various adenovirus and enterovirus.

Accordinly to the data the WHO annually in the world because of poor quality of drinking water dies about 5 million people. The infectious disease of the population connected to water supply reaches 500 million cases per year.

It has given the basis to name a problem of water supply hygiene by a problem N 1, i.e. supply by good-quality water in adequately.

In order that distribution of infectious diseases through water would became real, simultaneous presence of three conditions is necessary.

The first condition — aetiological agent of disease should get in water of a source of water supply. At modern development of canalization of the occupied places, presence infectious patients and healthy bacteria carrier this condition constantly is present.

The second condition — pathogenic microorganisms should keep viability in the water during enough long time. The reality of this condition is determined by ability of preservation of a microbe as biological kind. Practical supervision and experimental data testify about opportunity of their long existence outside of human organism, for example, in the water.

The third condition — aetiological agents of infectious diseases should get with drinking water in human organism. This condition can be realized at breakdown in process of water-preparation technology at station of water treating or the first operation of a water supply system.

Protozoan invasions, i.e. the diseases caused by elementary, which meet basically in a hot climate of the Asia and Africa countries. Among the protozoan invasions are amebiasis or amoebic dysentery, balantidiasis, lambliosis, accompanying by diarrhea at receipt of the elementary with drinking water and their penetration into mucous membrane of large intestine. Children are lamblia carriers in collectives can be found up to 30–40%.

Many helminthiasis — *opisthorchosis*, *diphyllobothriasis*, *ascariasis*, etc. can be transferred through water. The factor of transfer of opisthorchosis and diphyllobothriasis is the fish, molluscs, fresh-water shellfish Cyclopes. Ascariasis is possible at drink of the water containing eggs of it's heminth.

Schistosomiasis dermatitis (itch of bather) meets everywhere, especial among children. The basic owner, where schistosomiasis reach a sexual maturity, are domestic and wild ducks, the intermediate owner is the fresh-water mollusc. Larvas of schistosomiasis take root into human epidermis in process of bathing, cause a strong itch, puffiness and appearance of skin rash. Duration of disease are from several hours till 2 weeks.

Dracunculosis (guinea worm) occurs in the countries of Africa, in India (at drink or bathing). The intermediate owner is a fresh-water shellfish-Cyclops. Larvas through a skin take root and migrate into lymphatic system in subcutaneous fat. The length of individuals can grow till 120 sm, the parasite is in the human organism till 14 months.

Filariasis is inoculable helminthiasis, transmitted through stings of malarial and not malarial mosquitoes. They are distributed in Africa, Asia, Australia and S.America. The number of patients in the world reaches 100 million people. Filarias parasitize in lymphatic system, blood vessels and internal organs. Cause a fever, puffiness, stagnation of lymph, legs elephantiasis, a sepsis.

In some cases at bathing in unsanitary conditions it is possible to catch mycosis diseases.

In water there can be Oligochaeta worms, flat Ciliated molluscs, Crustacea. They are found out to the unaided eye, get from ground, subsoil waters, with a dust, are transferred by germs. Their appearance is connected to thinness in water-supply network.

Value all this conditions very important for correct tactics of the doctor at development of preventive actions and the control over their realization.

3. THE CHEMICAL COMPOSITION OF WATER AND IT'S INFLUENCE ON POPULATION HEALTH

All chemical compounds incoming into human organism from environment divided on essential and non-essential (toxic) substances.

The chemical compound of organisms is connected to a chemical compound of an earth's crust. On the basis of Vernadskii's doctrine acad. A.P.Vinogradov has created the doctrine about biogeochemical provinces. As result of deficiency or surplus of one or another element is developed endemic diseases. In the organism macroelements appreciably comes with water, for microelements it is not the basic way of receiving. In total in human organism was determined more than 80 chemical elements which can be subdivided on macro-, micro- and ultramicroelements. Macroelements — they are C, O, H, N, Ca, Mg. Micro — Fe, J, F, Cu, Mn, etc. Ultramicroelements — indium, gold, tellurium, niobium.

In the nature water never meets chemically pure composition. Having properties of universal solvent, it constantly has a plenty of various elements and compositions, the structure and which ratio is determined by conditions of water formation, structure of water-bearing horizons. The big influence on structure of natural waters, both superficial, and underground, renders their man-caused pollution.

When we speak about water as about the reason of diseases not infectious nature, we have in view influence on human of chemical impurity man-caused or anthropogenous factors.

The limit of a mineralization of drinking water (the dry rest) 1000 mg/l has been established on the basis of organoleptic sign. The basic part of the dry rest of fresh water consist of chlorides and sulfates. These salts have the expressed salt or bitter taste that is limited one in water up to level of a threshold of sensation: 350 mg /l for chlorides and 500 mg/l for sulfates.

It is established, that by the lower limit of a mineralization at which the homeostasis of the organism is supported by adaptive reactions, the dry rest is 100 mg/l, the optimal level of a mineralization of drinking water is 200–400 mg/l. Thus the minimal contents of calcium should be not less than 25 mg/l, magnesium — 10 mg /l.

The water rigidity caused by the total contents of calcium and magnesium, was considered usually in economic-and-domestic aspect (scale formation, the raised expenses of washing-up liquids, bad cooking meat and vegetables, etc.). There is a direct high correlation of water rigidity with the contents in it, except for calcium and magnesium, more then 12 elements from anions lines. However already for a long time there were assumptions about etiologic role of the salts causing of water rigidity in development of urolithic illness (*urolithiasis*).

In last years was come out with a suggestion, that water with the low content of salts of rigidity promotes development of cardiovascular diseases.

Until recently presence, concentration and a ratio of nitrates and nitrites in water of sources were regarded only as parameters of a sanitary condition of the reservoir, testifying about a degree and prescription of its pollution by organic substances. In 1945 2 cases of cyanosis at younger children, which ended fatally have been described. Cyanosis was accompanied by presence in blood of the raised quantities of methemoglobin. It was connected with the high maintenance of nitrates in the well water used for dilution of children's nutritious mixes. Further this disease received the name water-nitrate methemoglobinemia. Easy forms of toxic methemoglobinemia are shown by weakness, pallor, easily fatiguability, and at insufficient awareness can be estimated as other reasons. As is known nitrates do not promote methemoglobin formation. Their harmful action is shown when in result dyspepsia, a dysbacteriosis in intestines they are restored in nitrites. Nitrites absorption results in increase of the methemoglobin content in blood. Younger children have the insufficiency of the specific enzymes working in return transformation methemoglobin into hemoglobin. Diseases occur at pregnant, at patients with a stomach ulcer and malignant cancer, i.e. at the weakened persons with metabolism disorders. Nitrates can turn to nitrites which incorporate with amines and amides, entering with food. In result are formed nitrosamines with the marked cancerogenic properties. Nitrosamines render also to toxic action in a liver, and some from them have mutagen and teratogenic properties. For example, in Chinese province Fuyn the highest death rate from a cancer of a stomach has revealed. Was established that in this area the content of nitrates and nitrites in drinking water and vegetables was higher than in areas of low risk. The hygienic norm for nitrates is 45 mg/l.

In water are revealed about 65 microelements contained in tissues of animals and plants in concentration corresponding to thousand shares of percent and less. Hygienic value of microelements is determined by their biological role as they not only participate in a mineral metabolism, but also essentially influence on the general metabolism as catalysts of biochemical processes. Now biological value for animals and plants near 20 microelements is proved.

It is necessary to take into account and aesthetic influence adverse organoleptic properties of water, importance for secretion of gastric juice.

Dental fluorosis develops at the superfluous contents of fluorine in water. Fluorine is postponed in teeth as calcium fluoride («black spots»). Dental fluorosis form at children's age during 2–3,5 years. At the contents of fluorine more than 6 mg /l are amazed dentine also. Consequences are next: osteoporosis, fragility of bones.

Daily need of iodine — 100–200 mkg, 2/3 of one comes with food, 20 mkg — with water (indirect parameter of provision in the given district). At deficiency synthesis of enzyme thyroxin is broken, which lead to diffusive increase of thyroid gland, it's hyperfunction, in heavy cases — to cretinism.

Urovszkaya illness or Kashin-Bek illness is endemic deforming osteoarthritis (widely-spread in Transbaikal, in permafrost regions), is described by Kashin in 1856 and doctor Bek. It is connected to use of local sources with soft water of a marsh origin characterized by calcium sufficiency.

4. HYGIENIC REQUIREMENTS TO POTABLE WATER QUALITY

Standardization of water quality has the big history. Criteria of water safety for health varied with expansion of medical and biological knowledge. Also hygienic requirements to water accordingly varied. There are four stages in histories of hygienic standardization of potable water quality.

The first stage of standardization of water quality concerns to the antiquity when quality determined by sense organs.

Organoleptic method of the water estimation as single accessible at that time dominated within many centuries. However the general, only qualitative definition organoleptic properties of water did not give to its estimation a necessary degree of objectivity.

Making the second stage is connected to opening M. Lomonosov and Lavoisier quantitative and qualitative analysis in chemistry. The results of chemical analyses expressed by a measure and weight, attracted with the concreteness since could be used as scale for comparison of water from different sources. The big attention was given definition of the general water mineralization, content of chlorides and sulfates, water rigidity. The choice of methods is determined by their availability. In due course are begun to determine the content of organic composition and products of their decomposition (ammonia, nitrites, nitrates).

The third stage was characterized by primary studying of bacterial structure of water and hygienic standardization of water quality. Special value had discovery of Robert Koch. Participating in 1891 in liquidation of big cholera epidemic in Hamburg — Alton, Koch has established not only the fact of absence of diseases in Alton, but also has connected it with clearing river's water. Water researches have shown that water Alton's waterpipe contained no more than 100 saprophytes in one ml. And in water of the Hamburg's waterpipe was much more microbes. On this basis Koch made conclusion, that water in which is no more than 100 saprophytes in 1 ml, does not contain pathogenic microbes (in this case — cholera vibriion). It is the first example when the hygienic specification has been offered as a consequence of study of influence on human organism. Further the method of definition of *Escherichia coli*-titre has been introduced into practice of an estimation of clearing efficiency.

The *Escherichia coli* being the obligatory and constant inhabitant of human intestines is in close connection with group of pathogenic microorganisms — activators of intestinal infections. So its detection in water in the greater measure testifies to presence of epidemic danger. This method of definition of

Escherichia coli in water easily and safely for laboratory diagnostics. In 1914 in the USA have been published the first quality standard of drinking water — general number of colonies and Esherihia Coli titre.

The third stage of development of hygienic standardization can be named critical. Since this time the problem of water hygiene has got a physiology-hygienic direction.

At the fourth stage of new knowledge accumulation necessity of standard revision has appeared with the purpose of its development.

Quality of drinking water

In praesenti are guided by normative standard SanR&N 10-124 Republic Btelarus 99 «Drinking water».

Water should be safe in the epidemic and radiating relation, harmlessly in a chemical compound, and should have favorable organic properties.

If it were detected bacteriophages or coliformed bacteria in water their test repeatedly. If in repeated test their more than 2 general coliformed bacteria and coliphages in 100 ml, tests of water are investigated with pathogenic group and intestinal viruses.

It is standardized 6 organoleptic attributes of disutility, 20 sanitary-and-toxicological, maintenance of the harmful chemical substances entering and formed in water during its processing in system of water supply (chlorine, ozone, etc.), at maintenance of the harmful non-organic and organic chemical substances entering as a result of economic human activities. To last group refer more than 1200 chemical compounds.

Quality of drinking water should correspond to hygienic norms before its entering in a distributive network, and in points of water pumping of an external and internal water supply system also.

Safety of drinking water in the epidemic relation is defined by absence in it of pathogenic bacteria, viruses and the elementary microorganisms, in accordance with norms in microbiological and parasitologic parameters.

5. THE HYGIENIC CHARACTERISTIC OF SOURCES OF WATER SUPPLY

One of the main principle questions of drinking water hygiene is the choice of a water source. This choice is carried out by technical and economic comparison of variants of water supply sources which can be atmospheric, underground and superficial.

Atmospheric waters rather weak mineralized, very soft, contain few organic substances and are free from pathogenic bacteria. Further method of water gathering and storage influence on water quality.

Underground water suitable for the purposes of drinking water supply are deposited on depth no more than 250–300 m. Next conditions of water bedding are differed: upgrade water, underground waters and middle waters considerably distinguished from each other by hygienic characteristics.

The underground waters deposited most close to earth surface are named upgrade waters. Upgrade water easily becomes dirty owing to superficial bedding, absence of a waterproof roof and small volume, as a rule, in the sanitary relation it is unreliable and cannot be considered as a good source of water supply.

Subsoil waters are the waters of the first from a surface of the ground constantly existing water-bearing horizon. They have not waterproof layers as protection; the feed area of subsoil waters coincides with area of their distribution.

Subsoil waters are characterized by rather changeable regimen which entirely depends on hydrometeorological factors, frequencies of loss and an abundance of precipitations. Thereof there are significant seasonal fluctuations of a standing level, chemical and bacterial structure of subsoil waters. The water reserves are replenished due to infiltration of atmospheric precipitation or nature river's water of a high level. In process infiltration water is released from organic and bacterial pollution; thus improve it organoleptic properties also. Subsoil waters are used mainly in countryside at the organization of well water supply.

Middle waters are deposited between waterproof layers and depending on bedding conditions can be pressure or non-pressure. Middle waters differ from underground by low temperature (5–12°), structure stability. Usually they are transparent, colorless, devoid a smell and any smack.

Due to a long filtration and waterproof roof protecting middle waters from pollution, in it is almost absent microorganisms, and this one can be used for drink. Middle waters are extracted with the help of deep tube well and less often mineshaft.

Constant and big discharge of water supply source (from 1 up to 200 m) and high qualities of water allow to consider middle horizons as the best source of water supply for small and average waterpipes, majority of which give water to the population without any clearing.

Springs. Underground waters can independently rise on a ground surface. In that case they carry the name of springs. From them are formed *keys or streamlets*.

Superficial waters flow down on natural slope to more lowered places, forming flowing and landlocked reservoirs: *streamlets, rivers, flowing and landlocked lakes*. Open reservoirs are provided for not only atmospheric but partially underground waters.

Open reservoirs are subject to pollution from the outside, therefore with the epidemiological point of view all open reservoirs are potentially dangerous. Water reservoirs near settlements are especially dirty due to discharge of sewage.

If necessary to use an open reservoir for water supply it is necessary to prefer, first, large and flowing reservoirs, second, protecting reservoir from pollution by household and industrial sewage and, thirdly, it is necessary to disinfect water safely.

All-Union State Standard provides at a choice of water supply sources first of all pressure head, middle-artesian waters. At impossibility of their use should find others in the following order: a) middle pressure waters, including spring; b) subsoil waters; c) open reservoirs.

Sources of reservoirs pollution

1. Household economic-and-faecal sewage. Sewage of infectious hospitals is most dangerous in the epidemic relation. In them also contains SAM (surface-active material).

2. Industrial drains. Exist more than 140 kinds of technological processes, each of which defines specific structure of sewage. Toxic substances, radionuclids, pesticides, salts of heavy metals (water — mollusca — fish — man, water — plant — animal — man) get to water.

3. The air environment in large cities (acid rains, etc.)

4. Navigation (problem of the Baltic, the Black and Mediterranean seas). In a reservoir the crude sewage, combustive-lubricating materials get.

5. In an emergency at the enterprises.

6. Sewage of an agricultural production:

- Fertilizer, pesticides;
- Liquid waste products of animal husbandry industries and food production.

7. Dumps.

Aral Sea — with 1970 up to 1980 there were big changes of catastrophic drying and loss of fish value. The man has created man-caused ecosystem, huge region of an artificial irrigation. The area of the sea decreased almost half and more than twice in water volume. Concentration of salts has grown from 10‰ till 14‰. The forage reserve for fishes was lost.

Sarezskoe lake, Aral Sea Sea (Central Asia) are sources fresh, cleanest water. This one has arisen as a result of accident. The piece of mountain has failed to a valley and has partitioned off channel of river Murghab (1911). It's lake of goaf type. Now it's deepest and young lake in Central Asia.

6. SANITARY PROTECTION OF SOURCES OF WATER SUPPLY

All sources share on 3 classes. The higher the class, the more especially effective water purification is required.

With the purpose of protection of water supply sources from pollution are organized zones of sanitary protection (ZSP) in which present three subzones.

First zone of underground and superficial sources of water supply and water constructions is established with a view of exception of an opportunity of casual or deliberate pollution of water source and allocate in places of water-intake and water supply constructions. Water intake of underground waters should settle down, as a rule, outside of territory of the industrial enterprises and

living zone. First zone is established on distance not less than 30 m from a water intake at use of the protected underground waters; if used not enough protected underground waters — on distance not less than 50 m. At use of group of underground water intake the border of the first zone should be on distance not less than 30 m and 50 m, accordingly, from end holes (or mineshafts).

The border of second zone is defined by hydrodynamical calculations from conditions that if outside in water-pump horizon will arrive microbic/notstable/pollution they it is not achieved water-intake. For effective protection of underground source of water supply against microbic pollution it is necessary the estimated time of promotion of pollution with underground waters from borders of the second zone up to water-intake was sufficient for loss of viability and virulence of pathogenic microorganisms, i.e. for effective self-purification.

The border of third zone is defined by hydrodynamical calculations at condition that if from outside in water-pump horizon chemical (stable) pollution will arrive, they or don't achieve a water-intake, moving with underground waters outside of area of a feed, or reach a water-intake, but not earlier then estimated time.

The scheme of water supply defines by the mutual, technologically coordinated arrangement of constructions of water supply system and the order of water delivery from a source to consumption. The choice of the scheme depends on a source of water supply, requirements to quantity and water quality, reliability and survivability of water supply system, from relief and other features.

Drinking water in all cases should be safe in the epidemic relation, harmlessly from a chemical compounds and has favorable organoleptic properties, i.e. should satisfy to hygienic requirements of normative documents.

7. METHODS OF IMPROVEMENT OF DRINKING WATER QUALITY

The basic methods of improvement of drinking water quality are clarification, decolouration and disinfecting. Clarification and decolouration of water are reached with the help of coagulation, sedimentation and a filtration.

For disinfection of water are applied chemical (chlorination, ozonization) and physical (boiling, UV irradiation) methods.

For **sedimentation** are applied horizontal and vertical precipitation tank. Clarification depends on speed of water movement and densities of particles. The more slowly water flow, and the more hardly the particles, the more easy they fall on a bottom (about 1m up to 1mm in sek.). Speed in horizontal sediment bowls — 2–4 mm/s, in vertical — 1 mm/s, time of passage — 4–8 hours.

Lack is a slowness and increase in volume of precipitation tank for time lengthening of sedimentation.

Coagulation of water — the weighed substances form flakes and drop out in a deposit. Coagulant has a charge opposite to a charge of colloid particles. Sulfate of aluminium is used for this. After coagulation are used precipitation.

Water goes in the down part, is distributed and rises with small speed upwards, passing through coagulant layer in a zone of clarification — the filter.

The filtration is passage of water through fine-pored material (filters of slow speed, contact clarifiers). Efficiency — 95% in detention of suspensions. Consist of sand, lower — gravel. In filters of new type water passes through coarse-grained layers, and then — through sand. Speed of a filtration 4–5 m/hour.

Disinfection.

One of the most widespread disinfection method is chlorination.

To chlorination of water are applied gaseous chlorine, chloride lime, dioxide of chlorine, hydrochloride of calcium, chloramines. Chlorine-containing tablets are applied to disinfecting individual stocks of water: pantothenatecide, aquasept, etc.

There are some ways of water chlorination:

1. Chlorination by normal dozes (the doze of chlorine is established on size chlorine absorptivity and sanitary norm of residual chlorine).

2. Chlorination with ammoniation (in water simultaneously are entered chlorine and ammonia for chloramines formation).

3. Hyperchlorination (the doze of chlorine considerably exceeds water chlorine absorptivity (quantity of active chlorine which is spent during chlorination 1 liter waters during 30 min. for oxidation of the organic substances, easily oxidized inorganic substances and connection with protoplasm of bacteria). For maintenance of reliability of disinfecting it is necessary that after end of process of chlorination in water residual chlorine in the following quantities contained: 0,3–0,5 mg/l of free residual chlorine (in the form of hypochlorous acids) at normal chlorination and 0,6–1,0 mg/l of the connected chlorine (in the form of chloramines) at chlorination with ammoniation. The necessary doze of chlorine at chlorination by normal dozes is determined in each case by carrying out of test chlorination, with the account chlorine absorptivity of water. Minimal time of chlorine contact with water at chlorination by normal dozes makes in the summer not less than 30 min; time of contact increases up to 1 hour in the winter at low temperature.

This one consists of stages:

a) managements of the equipment for liquid chlorine and plant for dissolution;

b) dosages of chlorine;

c) mixture with water;

d) contact to water.

Plant consists of 3 tanks (1 — ready solution chloride lime, 2 — for receiving a working solution; 3 — dozer).

Double chlorination (before sedimentation and after the filter).

Ammoniation – at once ammonia is entered in water, and then — chlorine in the ratio 1 : 4. Advantages are longer disinfecting action, prevention of smells and test of chlorine.

Superchlorination is chlorination by superfluous doses of chlorine.

Ozonization is applied in France, Switzerland, England, the USA, Kiev, Moscow. Advantages of this method:

- High Speed;
- Ozone has not taste and smell;
- Small dependence from t° , pH and other properties of water;
- Ozone is made on a place.

Special devices — ozonizers, consist of 2 electrodes with an air layer between them (2–3 mm), used for as discharge space. Ozone is received from air.

Disinfecting by UV-beams:

- Speed;
- Absence of a smell and test.

Lacks: the test control over maintenance is excluded, complexity of technical service. UV-lamps are allocated above a water stream or into the water. It is applied on small waterpipes.

8. THE CONCLUSION

The doctor of the general practice should remember that 80% from all diseases in the world are connected to unsatisfactory quality of drinking water. The basic preventive actions are standardization of drinking water quality, use of modern systems of water treating and methods of disinfecting alternative to chlorination, application of various means of additional cleaning of water. Now in world practice of drinking water supply are widely applied water in bottles, household filters to additional cleaning water, work which one is based on sorbtion effect, that allows to improve physical and organoleptic water properties.

Lecture VIII

HYGIENE OF HOSPITAL-BUILDING.

PROPHYLAXIS OF INTRAHOSPITAL INFECTIONS

INTRODUCTION

Hospital hygiene develops hygienic norms and requirements to accommodation, allocation and sanitary-and-engineering maintenance of patient care institution (PCI) with the purpose of creation of optimal stay conditions for patients, effective carrying out of medical process and favorable working conditions for medical personnel.

It is known, that the hospitalization success of patients depends on many factors. We shall consider a role of hygienic optimization of the hospital environment.

1. Optimal hygienic conditions first of all are necessary for the medical process and for recovery of patients. The patient, placed in a hospital, except for medical aid, requires a careful and skilful care, light, warm, enough spacious, it is good insulated and the ventilated ward, convenient (sometimes functional) bed; silence, quiet conditions, etc.

2. Hygienic conditions are the important precondition of the prevention of a hospital infection. Struggle against a hospital infection is actual not only for infectious, children's, surgical, maternity, but also for all other branches. Last years in hospitals is marked growth of hospital diseases, in particular due to a staphylococcal infection which even have named «a plague of 20-th century». So, in the USA a hospital infection is sick 6,3 per cent of all patients in hospitals. At the same time it is established, that a basis of the prevention of a hospital infection is the rational device, the equipment and the maintenance of hospitals.

3. Hygienic conditions are the integral element of a treatment-and-guarding regimen in which basis lays actions, supplying with the patient full somatic and mental comfort.

4. Hygiene of hospitals should provide healthy working conditions of all personnel. The medical personnel can be exposed to influence of some professional harmful conditions. The neuropsychic (psychological) pressure, muscle tension, night work, chemical agents concern to them.

Taking into account the increased value of hospital hygiene, in hospitals of some the countries was introduced the new post «the hospital hygienist». The primary goals of its activity: 1) improvement of hygienic conditions in hospital, 2) the regular control over a sanitary condition of a hospital, 3) creation of minimal risk of a hospital infection. Creation of hygienic conditions depends on system of hospital construction, properties of the ground area and the location of hospital in settlement, internal emplacement of hospital buildings, a sanitary-engineering accomplishment, the equipment and the sanitary maintenance.

2. THE HYGIENIC CHARACTERISTIC OF SYSTEMS OF HOSPITAL CONSTRUCTION

Hygiene of hospital is stated by the example of the basic medical institution — hospitals of the general type. Hospital of the general type includes:

- 1) Reception;
- 2) Hospital with a therapeutic and surgical structure, and also obstetric-gynecologic, children's, infectious, anesthesiology-and-reanimations, radiological and others;
- 3) Polyclinic;
- 4) Medical-and-diagnostic divisions: subdivision of functional diagnostics, radiologic investigation, physiotherapy, physiotherapy exercises;
- 5) Pathologoanatomic subdivision with a morgue;

6) Auxiliary services: food establishment, a laundry with sterilizer room, the central sterilizing subdivision, workshops for repair of medical technics, garages, a vegetable storehouse, etc.;

7) Administrative part: office, medical archive, library, etc.

Reciprocal accommodation all listed divisions in hospital buildings depends on architectural — composite structure of hospital (system of hospital construction).

There are the following types of hospital building:

- Decentralized system of construction;
- Centralized;
- Mixed;
- Centralized-and-block.

At decentralized system of construction the hospital establishment consists of separate rather small buildings in which are placed various on a structure medical subdivisions. The majority of pre-revolutionary hospitals are constructed on this system.

At the centralized system the hospital is placed in one many-storeyed building. Each of the named systems of hospital construction has merits and demerits. For example, merits of decentralized hospitals are good isolation of subdivisions among themselves and from polyclinic that facilitates an opportunity of rest creation and warns a hospital infection. In view of small number of stores buildings is facilitated the opportunity of patients stay on air.

At the centralized system construction is reduced the price, duplication of premises and expensive equipment in each building is excluded, ways of movement of patients and the personnel both to diagnostic and physiotherapeutic studies are shorten, becomes simpler the delivery of ready food from kitchen in wards. At this system is facilitated the device and operation of regimen sanitary technical equipment (central heating, artificial ventilation, air conditioning), the mechanization of auxiliary operations, the centralized submission of medical gases (oxygen, nitric oxide).

However isolation of some groups of patients, the organization and realization of a medical - guarding and sanitary regimen, using a hospital garden in this building is difficulty. The mixed system of hospital construction allows to use the positive sides decentralized and the centralized hospitals and to reduce to a minimum their defects.

At the mixed type of building in the main housing are placed the specialized not infectious subdivisions, laboratory, medical-and-diagnostic subdivisions. Except for the main corpus, is built some smaller buildings in which locate polyclinic, infectious, maternity, children's and radiological subdivision. In separate buildings are placed also the pathoanatomical subdivision and auxiliary services. This system of hospital construction was widely applied earlier. Now apply on-line-block system more often, at which the

hospital consist of several corpusis (therapeutic, surgical, etc.), blocked in a single whole. In this building the positive sides of the centralized system of construction are better used.

The on-line-block system of construction allows to unit functionally similar divisions. For example, creation of a uniform operational complex with 6–8 and more operational rooms, central sterilizing, uniform X-ray subdivisions with 6–8 X-ray [radiological] apparatus.

3. HYGIENIC REQUIREMENTS TO ACCOMMODATION AND LAY-OUT OF PCI

The opportunity of creation of hygienic comfort depends on place and other features of a hospital site. Therefore for PCI are allocated the ground areas, optimal in the natural conditions, located on raised dry district, whenever possible with the southern slope, well aired and rich by vegetation.

The territory of hospital should be distant from sources of noise (railways, air stations, the main city highways) and air pollution, ground and water (dumps, fields of sewage disposal, massacre, burial ground of cattle.

Between the industrial enterprises and hospital sanitary-protective zones are established width from 50 up to 1000 m depending on a degree of occupational hazard. The site should settle down from windward (side) (in view of a wind rose) concerning the industrial enterprises and other sources of air pollution. Not casually the specialized hospitals (for example, tubercular, psychiatric hospitals or the rehabilitation centers), are under construction on suburb or even outside of settlement, for which a favorable environment are the additional treatment factor.

The most convenient for accommodation of a hospital complex is the site of the rectangular form with a ratio of the sides 1:2 or 2:3. The long axis of a hospital building should be located in a direction from the east to the west that allows to provide optimum southern orientation of wards for patients.

The site should be connected to served area or settlement by convenient local ways.

At contemporary construction systems of hospitals it is required not less than 100–150 m² territory counting upon one bed.

Before construction make the general plan of a site of hospital. For creation of optimum sanitary and medical guarding regimens and psychological comfort by development of the general plan a site divide to a functional attribute into the following zones: 1) medical buildings — not infectious, infectious; 2) landscape gardening; 3) polyclinics; 4) pathoanatomical subdivision; 5) economic, etc.

Hospital buildings should be simple, but beautiful architecture, the light, surrounded green plantings. They should be removed from borders of a site not less than on 30 m. Break between facades of the next medical building should be not less than 2,5 heights of an opposite building; between end faces there is enough distance — 15 m. Infectious subdivision is located in depth of a site.

Building of a polyclinic must be separately from medical building — in distance 30–50 m. The entrance in a polyclinic zone should be separate. In an isolated place, not outstanding from windows of hospital buildings, is located pathoanatomical subdivision with a mortuary. At periphery of a site is organized 15-meter green planting protective zones from noise, dust and strong wind.

The correct lay-out provides presence a minimum of two entrances on territory of hospital: in medical and economic zones. Last ones can be used as an entrance to the pathoanatomical building.

The density of building on hospital site should be within the limits of 12–15%. The area of green zone and lawns occupies not less than 60% of territory, and the others 20–25% — an economic court yard, driveways, tracks.

4. HYGIENIC REQUIREMENTS TO ARCHITECTURAL DECISIONS OF THE BASIC DIVISIONS OF A HOSPITAL

Rational positional allocation the basic hospital divisions should promote realization of medical process, simplification of work of the medical personnel, the prevention of intrahospital infection, creation of optimal hygienic conditions.

The central reception is intended for patients reception, their survey, specification of the diagnosis and subdivision in which treatment will be carried out. It is placed in the largest medical housing, near to the transport lift. Convenient connection with reanimation, radiological and surgical subdivisions is desirable. From antiepidemic reasons infectious patients, parturient woman and children are accepted directly in the subdivisions having for it casualty wards.

At reception are placed wards for patients with the indeterminate diagnosis. The bed quantity in them should be 10% from number of the patients incoming within day.

The specialized subdivisions and sections.

The hospital consists of the specialized subdivisions, each of which intends for patients with homogeneous diseases.

The specialized subdivision is the major functional element of hospital. At capacity more than 30 beds it arranges from sections and the rooms located between them, the common for all subdivision.

The structure section includes the following rooms:

a) For stay of patients: wards, rooms of the day time stay, a glazed verandah,

b) Medical-and-auxiliary: doctor's consulting room, procedural, a post of the nurse, dressing room - in subdivisions of a surgical structure;

c) Economic: buffet, dining room, linen, rooms of the nurse — mistress and the senior nurse;

d) A lavatory: bathing, a washstand, toilets for patients and personnel, a sanitary room;

e) Ward corridor connecting listed rooms.

All hospital rooms should have natural illumination. Artificial illumination is supposed in wards lavatories, hygienic bathing, preoperative room, warehouse.

The basic room of section is the ward. Now the common wards for adult patients are projected no more than 4 beds; thus in each section there should be two wards per 1 bed and not less than 2 wards per 2 beds. Beds should be located in parallel a wall with windows, but no more than in three lines. Thus the distance from a bed up to external walls should be not less than 0,9 m, the long sides line worth — not less than 0,8 m. Depth of wards at natural illumination on the one part should be no more than 6m.

The post of the on duty nurse is projected as the glazed cabin by the area 4 m² available from northern side of a corridor a little bit outstanding to corridor to provide good supervision over entrance in wards. The arrangement of a post in the center of section (around of a post are grouped one and 2 beds wards for seriously ill patients) reduces the relocation time of the medical nurse (15–18 m up to distant ward) and to improves her work.

In hospital construction expediently partial bilateral building of corridors with the device of light break in the extent not less than 40% of its length now is recognized. The corridor width necessary for free movement and turn of a stretcher, wheelchairs and beds should be not less than 2,4 m.

Procedural room serves in section for carrying out of some physiotherapeutic procedures, massage, injections.

Food intake by patients in a dining room renders the big psychological influence on them. Translocation of patients in a dining room is perceived by them as a critical stage from illness to recovery. A dining room it is possible to arrange one for subdivision (two sections), having it nearby buffet. The quantity of places in dining rooms is accepted with equal 80% of bed quantity in subdivisions: postnatal, physiotherapeutic, dermatovenereologic, tubercular, psychiatric and recovery treatment and not less than 60% — in other subdivisions. In buffet is warmed up and distributed food on portions, and also washed dishware.

The lavatory consists from wash-room, a bath, toilets, a sanitary room. The sanitary room serves as a room where are made washing, sterilization bedpan, storage of a material for the analysis, disassembly and time storage of dirty linen, washing of oilcloths, storage of subjects of cleaning.

Therapeutic subdivision is the basic structural division of multiple-discipline hospital. For carrying out of medical actions in the majority of therapeutic subdivisions it is provided only procedural rooms. Therefore section of these subdivisions consists of a set of identical rooms.

Now in structure of subdivision of a therapeutic structure highly specialized subdivisions are allocated: cardiologic, gastroenterologic, nephrologic, heamatologic, pulmonologic, etc. where new methods of diagnostics and treatment of patients with use of the difficult medical equipment

are widely applied. Therefore in the specialized subdivisions of a therapeutic structure additional rooms for carrying out of special researches and medical procedures are provided.

Surgical subdivision.

The requirements to designing of surgical subdivision (general type or specialized) are common:

1. Presence of convenient connection with the operational block and diagnostic subdivisions.

2. Presence of corresponding number dressing and procedural rooms.

3. The organization of conditions for postoperative stay of patients in the specially equipped wards, including for carrying out of a long narcosis with reanimation or the medical purpose.

4. Exception of an opportunity of contact of postoperative («pure») patients and so-called «purulent» patients at which have appeared postoperative complications.

Section of subdivision of the common surgery in few differs from section of therapeutic subdivision. In addition in all surgical subdivisions it is projected dressing rooms.

For patients with suppuration processes (phlegmons, abscesses, extensive purulent wounds) are allocated purulent subdivisions or sections and special operational. All other patients are placed in pure subdivisions or sections.

The main feature of subdivision of the common surgery is presence of the operational block, and in large hospitals — operational subdivisions.

The operational block represents important structural unit of surgical subdivision. The operational block is never through-passage. The operational block, as a rule, should have two not through-passage subdivisions: septic and aseptic.

Into structure of the operational block included: operational, preoperative, sterilizing, narcotic and other rooms.

Operational it is necessary to project at the rate of 1 operational table per 30 beds of surgical structure. The height operational, as against all other rooms of a hospital, should be not less than 3,5 m. Width of operational room is not less than 5m and corridors in the operational block is not less than 2,8 m.

Preoperative it is intended for carrying out of last preparation of the surgeon and other medical personnel before operation. From preoperative the surgeon should have an opportunity to observe narcotic and operational where prepare for operation of the patient.

Narcotic is the room for last preparation of the patient for operation. It is also a workplace of the anaesthesiologist which conducts a narcosis during operation.

Sterilizing in the operational block settles down between two operational and serves for sterilization of the surgical tool.

In immediate proximity to the operational block wards for postoperative stay of patients are placed. The bed quantity in postoperative wards is established at the

rate of 2 beds per 1 operational. The area in postoperative wards increases up to 13 m per bed, that allows to place the special equipment for a care of patients.

Infectious subdivision.

Patients come in infectious subdivision not only for treatment, but also for isolation. Therefore the opportunity of distribution of intrahospital infections should be excluded in correctly organized infectious subdivision.

The infectious subdivision is more rational to allocate in detached building. The internal lay-out and a sanitary regimen of this subdivision have a number of the features directed on the prevention of intrahospital infections. For reception of patients it is provided viewing boxes by the area 16 m². In subdivision by capacity from 30 up to 60 beds should be 2 boxes, from 60 up to 100 beds — 3 boxes, more than 100 beds — 3% from total beds.

For the personnel in a reception of the infectious building of division it is provided sanitary inspection room.

The lay-out even small infectious subdivision should allow to divide it on a little bit independent sections, the patients intended for hospitalization with different infections. Each section should have the important role of «bactericidal locks». The sluice has two densely closed doors and if one is open — another is closed, that protect carry out of a drop infection. For greater reliability the sluice can be equipped with a bactericidal lamp. The section should have the lavatory.

The following distinctive feature of infectious subdivisions is that for improvement of isolation of patients in ward are arranged mainly one- and 2-beds (a maximum 4-beds). All wards are equipped with wash-stands. In children's hospitals for prevention of drop infection distribution are obtained blimped wards. In similar wards it is possible to place only sick with one certain infection, for example, a scarlet fever or diphtheria. The entrance in ward has a sluice.

For individual hospitalization of patients are applied 1-bed wards with a sluice, semiboxes and boxes. Semibox consists of ward, a sluice and a lavatory. Essential defect of semibox is that patients come in it through corridor. Thus it is possible semination of corridor air by pathogenic microflora which from here can spread into wards.

Completely guarantees against the intrahospital infection, transmitted by the drop way, only individual box. It consists of street tambour, a lavatory, actually wards and a sluice. The patient come to box through tambour directly from street (if subdivision on 2-nd floor — from gallery). The personnel enter from corridor through a sluice. In a wall which separates box from a corridor, made the glazed windows for supervision over patients. Washing and disinfection of utensils is spended in box. The area of box is 22 m². In box are placed first of all patients with the obscure diagnosis or with the mixed infection. The similar lay-out and strict observance of a sanitary regimen allow to reduce till a minimum and even completely to liquidate intrahospital infections in children's infectious subdivisions.

Boxes can be projected also on 2 beds by the area 27 m².

Semibox consists of the same rooms as box, but has no external entrance (exit) with tambour. Patients and the medical personnel enter to semibox through a sluice from a hospital corridor. In the section consisting from semiboxes, there can be patients only with identical infectious diseases.

Construction of infectious subdivisions with boxes cost much more expensively, but there are facilitates maneuvering by infectious beds and promotes full liquidation of intrahospital infections.

Polyclinic.

Polyclinics should be placed in detached building, adjoining to a hospital in common places of accommodation for a hospital and a polyclinic of medical-diagnostic subdivisions.

About 40% of all rooms are therapeutic and 20% are surgical subdivisions of a polyclinic. Quantity of visits to polyclinic in the greatest shift it is necessary to accept equal 60% of the total quantity of visits to a polyclinic in day.

The approach of patients to the building should be independent of entrance to a hospital.

The basic rooms of a polyclinic are medical, medical-and-diagnostic studies, waiting room for patients, registry, vestibule with checkroom.

Doctor's rooms should be oriented on the north. The area of a room of the therapist, the neuropathologist, the psychiatrist, the teenage doctor is 12 m². The area of specialized rooms (the surgeon, the phthisiatrician, specialist in skin and venereologic diseases, urologist, traumatologist) should have not less 18 m². The ophthalmologist room should have length not less 5 m for definition of visual acuity.

The polyclinic subdivision for children is completely isolated from subdivision for adults. Intake of children is carried out through the filter in which nurse asks parents about a child condition, examines a skin and mucous membranes, takes temperature. Children with the raised temperature, with attributes of acute infectious disease direct from the filter to box which has a separate exit at street.

5. PROPHYLAXIS OF INTRAHOSPITAL INFECTIONS

The term «intra-hospital infection» designates various infectious diseases with which patients fall ill in connection with treatment in hospitals or the persons who were fallen ill in connection with activity of physician.

Are allocated three groups of intra-hospital infections: a) ambulatory infection; b) infection arising owing to preventive actions; c) hospital infection.

Properly hospital infection is infectious diseases which arise in time or after hospitalization. So-called **accompanying infections** concern to this group (a mastitis at parturient woman, a sepsis at newborns, a pneumonia at measles), **superinfections** (for example, a sick by scarlet fever falls ill with a salmonellosis, the patient with a hepatitis — a dysentery, etc.), **cross infections**, when there

contagion of patients from each other. Frequently is met an infection arising at activation of own flora (for example, at the patient with virus disease of the upper airways the pneumonia can develop, after operative intervention — a tetanus, a gas gangrene, etc.).

The hospital is closely connected to an environment — from here their mutual influence. Are possible the latent cases, when the person, suffering disease come in a hospital, being in the incubatory period concerning other disease, or, on the contrary, leaves in the incubatory period of the disease, got in a hospital. The infection can be carried out by the personnel, in that way are observed flashes in families.

Sources of intrahospital infections are various. It is the infectious patients, who have arrived in a hospital with the mixed infection, the somatic patients, who have not sustained terms of quarantine; pathogenic staphylococcus carriers, carriers of intestinal infections.

The reasons of distribution of intrahospital infections also are various, that complicates struggle against them. On the one hand, this change of an inhabitancy and properties of microorganisms, presence in the hospital environment more virulent strains, occurrence of strains, resistant to antibiotics and action various disinfecting means, with another introduction in surgical practice of more and more difficult operative interventions, wide, frequently irrational and unsystematic application of antibiotics; infringement of a sanitary-and-hygienic regimen in hospitals and other medical institutions, an overload of wards, faults in work of ventilation, etc.

Special value has thus infringement of aseptic rules. Training of «feeling of prophylaxis» at doctors and paramedical personnel is very important. Absence of a preventive orientation in the organization of work of a hospital results in oblivion of necessity of careful and pedantic performance of aseptic instructions.

Activators of intrahospital infections are various. It's first of all air drop infections — flu, scarlet fever, measles, chicken pox, etc. Respiratory viruses play a role in occurrence of pneumonias. Then follow by value staphylococcal infections.

Last years serum hepatitis have raised in worldwide. More often it is registered in hospitals and subdivisions for chronic patients with big incubatory period since the hepatitis has time to be shown as intrahospital infection only under condition of long (months, years) stay of patients in a hospital.

Most vulnerable contingent are the newborns, prematurely born children, puerpera, patients with leucosis, diabetes and the persons receiving corticosteroids, is especial immunosuppressive, therapy.

Struggle with hospital infections is difficult, since activators, as a rule, widely circulate in the intrahospital environment, have high stability to external influence, and mechanisms of transfer are rather various. As reliable methods of specific preventive maintenance of intrahospital infections are absent, carrying out of nonspecific actions is required.

To nonspecific actions for preventive maintenance of intrahospital infections concern: architectural-and-planning, sanitary-engineering, sanitary-and-antiepydemic, disinfecting-and-sterilizing. Architectural-and-planning actions are directed on the prevention of distribution of the activator by section isolation from operational blocks. Efficiency of sanitary-and-hygienic actions is provided with performance of all requirements, sanitary culture of patients and the personnel, correct statement of the bacteriological control, revealing among the personnel and patients of the pathogenic bacteria carriers and sanitation of these persons.

The second necessary part of preventive maintenance of intrahospital infections are the specific actions directed on increase of organism stability of patients to intrahospital infections. Effective specific preventive maintenance provides the actions directed on prevention of development of disease at people in case of their contamination. Its purpose is creation of immunity in limits of incubation period. For example, with a view of sanitary preventive maintenance of pyoinflammatory diseases at parturient woman and newborns should be carried out active immunization of pregnant by cleared staphylococcal anatoxin.

Depending on character of used means emergency prophylaxis can be subdivided on specific and the general: for specific are apply chemicals of the directed action (staphylococcal adsorbed anatoxin, antistaphylococcal hyperimmune plasma, antistaphylococcal gamma-globulin, bacteriophage), for general — antibiotics of wide spectrum action, strengthening means and others.

Lecture IX

ACTUAL HYGIENIC ASPECTS OF PROTECTION AND STRENGTHENING OF CHILDREN AND ADOLESCENTS HEALTH

INTRODUCTION

Dynamics of a children's health state in Belarus is characterized by increase in functional disorders and chronic diseases. The technology of complex social-and-hygienic monitoring of children's population health in Belarus is developed. Analysis of health state is used in view of quantitative integral estimations in marks of day regimen parameters of the schoolchildren in concrete conditions of training.

In structure of diseases the first place is occupied with illnesses of respiratory system, nervous system, sense organs and the third place — digestive system. The life style and the family status have an important role and the importance social component of the pupils.

Educational conditions of training should correspond to functional capabilities of the pupil.

Morphofunctional deviations registered at 60% children are connected with the musculoskeletal system, and as consequence — bearing disorder, foot flattening. They are caused by low motion activity, disorder of rest regimen. Only 1/3 population are engaged in their health and family health.

There are certification of educational establishments, are planned to enter into schools staffs doctors, physical training to make by more health-improving form.

Transition to subject training (4–5 classes) is accompanied fragile of stereotypes, differentiations in training, formation of the new collectives, falling on critical pubertal period. These years are connected to intensive growth and development of pupil organism, their socialization.

Are distinguished the following components of health: somatic, mental, spiritual, intellectual, moral, social, emotional, personal. Criteria of estimation are acts and behaviour, a self-estimation, self-education, life-style.

For teachers it is a level of an academic load, a condition of physical-improving work, a condition of extracurricular educational work, the psychological help to pupil, preventive work in health life-style.

For estimation of the quantitative health characteristic is entered the health index. The health index is a number of the revealed body system deviations to the common number of children.

Allocation of children and adolescents hygiene in independent discipline is caused by original conditions of education and the training, not conterminous with professional and public life of adults. The significant contribution to children and adolescents hygiene has brought F.F.Erisman: in law of growth and their development; in estimated parameters of physical development; about the reasons of occurrence of short-sightedness; has developed hygienic specifications on light exposure, on the sizes of school desks and their design (Erisman's school desk); on prophylaxis of fatigue — requirements to the timetable of lessons.

Profession of a physician in the field of children and adolescents hygiene is based on sanitary rules and norms, governmental decrees, certificates, laws and has the state character. However, the role of family and the person also is great and conclusive.

1. THE SUBJECT, GOALS AND OBJECTIVES OF CHILDREN AND ADOLESCENTS MEDICINE

Medicine of children and adolescents is a science about laws of growth and development of human organism into phylogenesis and ontogenesis; definition of a share of its basic components in this process; about methods and ways of hygienic regulation of generation health at a simultaneous combination of all complex of actions to teaching and educational process in preschool, general educational establishments, average special educational institutions.

School hygiene studies influence of the educational loading also, the forced pose at reading and writing, school furniture and conditions on growth, development, health state of pupils in different age groups and a health level.

The medicine of children and adolescents covers wide aspect of questions: sanitary-and-hygienic accomodation conditions of children and adolescents,

quality of nutrition, protective clothes and footwear, intensity of training and education process, improvement and treatment. The system of state actions should be combined with public and not less important individual actions.

Subject of studying is teaching and educational process. **Object** of studying is children's and adolescent's organism.

The goal of studying is perfection of teaching and educational system, assistance to harmonious development of children and adolescents.

There are three basic medical, sanitary-and-hygienic problems at modern school: bearing, vision, organization of nutrition.

Hygiene of children and adolescents is closely connected to psychology-and-pedagogical sciences, pediatrics, social hygiene, epidemiology, physical training and sports.

The primary goal of children and adolescent hygiene, school hygiene is development of the hygienic actions directed on the illnesses prevention, creation of comfortable conditions for growth and development of all functional systems of a growing organism, strengthening of mental and physical health, preventive maintenance of deformation of the musculoskeletal system, visual impairment, increase of the general workability and progress.

The growing organism in the anatomophysiological features and functionalities considerably differs from the adult. Children are more sensitive to adverse environment influences, including industrial conditions. Their health in many respects is defined by correctness of a work and rest combination, color and light, air movement, ventilation, illumination, the forced pose at school desk, a working table.

Obligatory criteria of educational establishments include ten blocks:

1. A sanitary condition of establishment territory.
2. A sanitary-engineering condition of a building and its engineering accomplishment.
3. A set of the area and the equipment of rooms.
4. A light and thermal regimen.
5. Conditions and the organization of teaching and educational process.
6. Conditions and the organization of physical training.
7. A sanitary condition of eating establishment.
8. Food organization.
9. Sanitary-antiepidemic regimen.
10. The organization of medical help.

The medical personal card which is filled for persons from 3 till 17 years is authorized also. This card contains data of medical survey, questioning of parents and certification of establishment and is a source of the information on a health state of children and adolescents, social and biological risk factors in family and educational establishment.

2. COMPLEX ESTIMATION OF A HEALTH STATE OF CHILDREN AND ADOLESCENTS. HEALTH'S GROUPS

The health state is determined by growth and functional development. Growth and development is a change of anatomic and morphological parameters, i.e. length and body weight, proportions of body parts, the cross sizes and volumetric, changes in physiological systems, tissues and organs — i. e. a functional direction in age aspect. Growth and development are interconnected, depend from each other; from environmental conditions; hygiene social; school; hygiene of nutrition; work and rest; physical training and sport. The periods of amplification of growth are replaced by the periods of amplification of development, differentiation of tissues and systems and on the contrary. It is so-called heterochronia is diversity two phases of unitary process, harmonicity of this one depends on external and internal factors.

Hygienic aspects of children and adolescents health begin with preventive medicine at a stage of planning of pregnancy and delivery, the whole complex of protection actions of motherhood and the childhood. These are female consultations, maternity hospitals, social protection — antenatal and maternity leave, transference in safe and easy work, encouragements and compensations for the early registration in antenatal clinic. Are carried out genetic consultation, supervision, the control over intra-uterine development, recommendations of the health life style of the woman, her nutrition, movements, the rest. In an organism of mother is formed the third circle of blood circulation of an embryo and a fetus, first of all the best and worse acts it, a priority of new life.

All illnesses by children's legs are entered into adult life. The level and quality of health depends on many well controlled factors both genetically determined, and external nature forces, life-style and the help of preventive medicine. All interconnected complex of physical, mental and moral health is formed not only by the environmental biological-and-social factors, but also by the person.

Health is the best blessing. Scientific and technical process reduces a share of physical work and increases its intensity, intellectual and mental loading, reduces moving activity. There are three «whales» of physical, mental and moral health — a nutrition, movement, protection. The nutrition is becoming more refined, high-calorific, poor or deprived by biologically active substances more and more. Deficiency of sleep increase neurotic and asthenoneurotic conditions. Motoric «starvation» increases deformations of the locomotor system.

Health is integrated parameter which is formed from the following components: somatic, physical, emotional, personal, moral, intellectual, spiritual, mental, social.

For an estimation of children and adolescents health necessary to use four criteria as a minimum, namely:

1) presence or absence of chronic diseases at the moment of examination;

2) level of the achieved physical both psychological development and a degree of its harmonicity;

3) level of functioning of the organism basic systems;

4) degree of resistibility of an organism to adverse influences.

From the hygienic point of view of the greatest attention deserves the estimation the health state based on set of all four attributes.

According to the suggested scheme children and adolescents, depending on set of health parameters, are subdivided into five groups.

The first group are persons who do not have the chronic diseases, sick seldom for the supervision period, having normal, according to age physical and psychological development (health without deviations (rejections)).

The second group is children and adolescents not suffering chronic diseases make, but the having functional and morphological deviations (rejections) frequently sick — 4 times per year and more, or have long one disease — more than 25 days (healthy, with functional deviations (rejections) and the reduced resistance).

The third group is the persons having chronic diseases or with a congenital pathology in a condition of compensation, with rare and not hardly current aggravations of chronic disease, without the expressed infringement of the general health state (condition of compensation).

The fourth group is persons with chronic diseases, congenital anomalies of development in a compensation condition, with infringements of the general condition and health state after an aggravation, with the long period convalescence after acute intercurrent diseases (condition of subcompensation).

The fifth group includes persons with heavy diseases in a condition decompensation, with considerably reduced functionalities (patients in decompensation condition). As a rule, such patients do not attend children's and adolescence establishments of the common structure and by mass surveys cannot be involve.

Children and the adolescents are referred to different health groups, require the differentiated approach by development of a complex of treatment-and-prophylactic actions. For the persons who are included in the first health group is organized educational, work and sport activity without any limits according to existing programs of teaching and educational process. The pediatricist or the adolescence therapist study in usual terms carries out their routine inspection. Children and the adolescents entering into the second health group (group of risk), demand more steadfast attention of doctors. The matter is that the given contingent requires a complex of improving actions which duly carrying out has the greatest efficiency in the prevention of chronic pathology development at children's and adolescence age. Hygienic recommendations for increase of organism resistance by nonspecific means have special value: optimal impellent activity, hardening by factors of the nature, a rational day regimen, additional vitaminization of food stuffs.

Children and the adolescents referred to the third, fourth and fifth health groups are subject to dispensary supervision at doctors of different specialists according to existing methodical recommendations on prophylactic medical examination of the children's population.

Patients receive the necessary medical and preventive help caused by presence of this or that pathology form and reduction of compensation. In children's and hardening establishments for them is created the sparing day regimen, is prolonged duration of rest and night sleep, is limited the volume and intensity of physical loadings, etc. If necessary, patients with chronic diseases or with congenital developmental aperiodicities are directed to special children's and adolescents establishments, where treatment and education is carried out purposefully in view of features of pathology.

In Belarus the purposeful program for preservation of pupils health is carried out.

3. HYGIENIC ASPECTS OF AGE PERIODIZATION

Biological factors of growth and child development are defined by the nature in the organism, and social conditions correct them. Irregularity of growth and development are known in hygiene as the periods «stretching», «rounding».

«Stretching» takes place during puberty, it is replaced by «rounding» within youth and the growth ending till 18–20 years. «Disgusting duckling» turn in «fine swans», stately, relief young people with more coordinated and sedate movements.

All stages of embryo maturing, a fetus, the person is divided for some age chronological, passport periods. Processes of growth, development and functionalities of an organism during these age periods are identical. Each age period finishes the certain qualitative and quantitative stage of accumulation and achievement of readiness for the certain activity, realization. Age periodization integrates children and adolescents under the biological and social status: to education, study, intellectual and physical loading, nutrition, formation of all kinds of health.

The first prenatal period is so important, that it is subdivided on days, weeks, months. Only 40 weeks (10 lunar months):

- embryonic — till 8 weeks;
- transitive — till 16 weeks;
- fetal — till 40 weeks.

The second period, postnatal includes:

1. The neonatal period - till 10 days;
2. Breast — till 1 year;
3. Early children's, prepreschool — till 3 years;
4. The first childhood, preschool — 3–5 years.

School age is subdivided on:

1. The second childhood, younger school age — 6–11 years;
2. Adolescent age, average school — 12–15 years;
3. Youthful, senior school age — 16–18 years.

Age periodization is necessary for a substantiation of health protection system and development of physical, mental and moral opportunities of children and adolescents, their training and education. The calendar, chronological, passport age not always corresponds to their biological maturity, the difference can make limit 5 years. The reasons of developmental lag of an individual retardation can be factors of nutrition, movements, social and ecological one. The accelerated development can be both in ontogenesis, and in relation to the last generations. If acceleration of biological development goes in relation to the last centuries are used the term-acceleration. If acceleration goes in relation to homogeneous group its designate «secular trend». In XX century parameters of acceleration in all age groups were fixed. So, the newborns weight has increased on 100–300 gr, body length — on 1,5 sm. Doubling of weight occurs not to 6 months, and to 4–5 month. Change of a dairy teeth comes to the end on one year earlier and etc.

There are some hypotheses of the given phenomenon:

1. Physical and chemical hypotheses according to which it is considered, that children regimen are exposed to more intensive influence of solar, radioactive and electromagnetic radiation.
2. Alimentary-nutritive hypothesis — improvement of nutrition, increase in consumption of fats, proteins, vitamins, especially B₆ and B₁₂, which stimulate growth and development.
3. Successes of medicine, development of a preventive direction in pediatrics.
4. Change of social and religious factors, deleting of borders between the nations and the states, the interethnic marriages. All this, undoubtedly, affects change of a heredity and acceleration of growth and development.
5. A hypothesis of urbanization — increase in irritating influence of an environment, rate of city life at nervous system, and also cinema, radio, TV, video, computer, the Internet, etc.

Process of acceleration has both positive, and the negative sides. Mental functions and physical qualities not always go in harmony, began more dispersion in the data in the same age groups of children, adolescents. This dispersion rather big — on some exponents — sigmas. According to this one diseases of respiratory, blood circulation, digestion system among children, adolescents grow, became more deformation of the musculoskeleton system, grow up death rate and a birth rate of defective intellectually and physically children. Begin more allergic, autoimmune diseases, rheumatism, etc. All this form new goals — about terms of the beginning of school education, about lessons duration, studies at school, about growth of children and the sizes of the educational equipment, clothes, footwear, etc.

At children of younger school age the bone system differ by insufficient hardness because of prevalence in its structure of organic substances in relation to mineral — calcium, phosphorus, magnesium. Changing of the skeleton form can be connected to it at static loadings, at wrong positions of a body standing, sitting, at the long forced poses. Process of ossification of hands comes to end by 10–13 years that it is necessary to take into account at loadings on hand — the writing, physical loadings (expression, emphasises, hang, etc.).

The growth of bone system passes ahead of development of muscular mass. The muscular mass starts to develop strenuously approximately from 10–11 years (rounding off). But the increase in muscular weight and its force goes not simultaneously. Muscles of a trunk (backs, a shoulder, a hip) grow faster, than development of fine muscular groups, for example hands and feet. It is complicated with performance of the certain physical exercises, is registered bad coordination and stability. By virtue of it for children more approaches dynamic work and not so long (for 10–15 minutes).

Development of motility is closely connected to development CNS. In this age group coordination mechanisms in a bark of a brain are insufficiently advanced. During this period is marked instability of nervous processes, prevalence of processes of excitation over braking processes. Therefore it is necessary to dose out emotionality of classes. Instability of attention, fast approach of exhaustion which the child does not notice by virtue of the emotionality speaks also. All this is necessary for taking into account at the organization both intellectual, and physical work, strictly to normalize duration, character and size of loadings, it is necessary to provide switchings and micropauses.

In average school age the bone system has already same structure, as well as at adult people, but process of its growth, development, differentiation proceeds. Ossification of a backbone and an attachment of costal arches is not completed yet, danger by deformation of a chest and a back therefore is kept at the big statical loadings, wrong planting and a raising, carrying of weights - bags. As a result of often pressure at a chest at a support about a school desk is possible the curvature and chest forms with the subsequent infringement of normal activity of lungs function, heart, a gullet, large vessels. Incomplete ossification and basin bones adhesion can result in their displacement at jumps from height, at rigid landing (broad jumps, high jump, for example). And further these displacement are fixed adhesion and the form of a basin varies, that can affect genital function at girls. Taking into account these features it is necessary for incompleteness of ossification to build the plan of a lesson of physical training, to give attention for bearing, correct statement feet, to correct planting, etc. to promote strengthening of a bone tissue and formation of correct bearing.

The muscular mass is characterized both strengthening of growth, and a gain of muscular force, especial at boys. Children's ability to performance of exercises with effort, resistance raises; time of continuation of the work

increases, there is perfect a coordination of movements also, stability increases. But to overload with such exercises does not follow yet, it is better to apply high-speed, dynamic with switching on statics. At this age the period of sexual development, maturing begins also. In an initial stage excitability of nervous system, instability of mental sphere prevails, therefore badly there is an adaptation to physical loadings and the regenerative period is delayed or it pass undulation. In this connection in this age group the individual approach is necessary, is especial at the beginning of sports lessons. Correctly picked up dosage of physical exercises on structure, force, time will promote normalization of the aggravated reactions, instability of the pshyho-and-emotional environment, the best adaptation and functional systems of an organism, in particular blood circulations, breath, digestion.

At the senior school age formation of bone and muscular systems comes to the end, marked strengthened growth of a body length, weight addition significant, the greatest gain of hand force, attachment. Accuracy and coordination of movements in general and fine movements in particular is improved. Parameters of physical development come nearer to those of adult people. At this age any specialization in sports is accessible.

Growth and functional development of a brain, differentiation of its functions comes to the end. There are possible more thin and difficult movements, acceptance of fast decisions at the moment of game, are balanced processes of excitation and braking, and consequently, inclusion in work and restoration.

Except for especial bone-muscular and nervous systems it is necessary to take into account features and all other functional systems, including tactile sensitivity, cardio-respiratory system, metabolism, etc.

4. THE ORGANIZATION OF MEDICAL EXAMINATIONS OF CHILDREN AND ADOLESCENTS. DEFINITION OF A DEGREE OF READINESS FOR SCHOOL EDUCATION

The children and adolescents health state depends on the organization of their medical maintenance. Form of medical help basically is concentrated in hands of the local pediatrist (in conditions of a polyclinic, at home), chargeable the preventive help (in conditions kindergarten, schools) doctors working in children's establishments.

Medical examinations of 5 age children has special value for preparation of the child for school, allow not only to reveal in due transient deviations in their health condition, but also to carry out maximal full improvement.

The program of an elementary education, application of an active method as a whole corresponds to age opportunities of the six-year child. At the same time some first-graders badly adapt for school conditions. It occurs at completely normal intelligence many children, have no sufficient functional readiness for school. As

have shown special researches, «not ready» to school there are children with lag of biological age, with some diseases or functional deviations, with developmental lag psychophysiological functions most connected to educational activity.

The majority children who are not having sufficient functional readiness for school education, do not cope with requirements of the school program and the school schedule. Unavailability of children to school is adversely reflected in their workability, progress and health state.

So, according to data of Institute of hygiene and preventive health care among children more than 50% this one, which went to school, hadn't «school» maturity and during training in the first class have worsened a health condition both due to functional deviations, and due to deterioration of current or occurrence of new chronic diseases.

Therefore there is a necessity of careful duly diagnostics of a readiness degree of each child for entry to school. Such diagnostics is based on results of versatile medical research and the special researches determining a level of development of «school-necessary» functions.

All children who goes to school is necessary in September–October of the year previous to entry, are subject to the first in-depth examination. The in-depth medical examination (prophylactic medical examination) is carried out in kindergarten or a children's polyclinic by pediatricist, otolaryngologist, ophthalmologist, neuropsychiatrist, surgeon–orthopedist, stomatologist. In the same terms by the doctor of children's preschool establishment or a children's polyclinic it is carried out psychophysiological examination of all children. Results of the first in-depth medical and psychophysiological children examination fix in a medical card of child's development.

To children having deviations in health state is appointed the complex of medical and improving measures. To preschool children, at whom are revealed lag in development of school-necessary functions (a motility, speech), is appointed a complex of exercises on their correction. Medical and improving actions are carried out by doctors of a children's polyclinic. Elimination of articulation defects are carried out by the doctor-logopedist.

Exercises for motility development (drawing, modelling, games with fine designers, etc.) can be made by kindergarten tutors or parents. The local pediatricist or the doctor of preschool establishment controls performance of the appointed measures.

The repeated children's examination including psychophysical inspection, is carried out in April–May by the same experts, as at the first examination.

The final decision of child readiness for school education fix in medical card. Children having deviations in a health state, lagging in biological development and not reached a school maturity are considered not ready to training. The conclusion about readiness for school education is fixed in a medical card of child development. There are medical contraindications for entry in school of six-year children.

As a school maturity understand such level of development of some physiological systems or even separate functions which provides performance by pupils of all school requirements without health damage and normal development.

Research of parameters of some functions at children in comparison to progress, workability, fatigue, educational activity and dynamics of a health state in the first class has allowed to select psychophysiological criteria on which it is indirectly possible to judge a functional readiness of children to study at school.

MEDICAL CRITERIA

- Level of biological development.
- Health state at the moment of examination.
- Acute diseases during previous year.

PSYCHOPHYSIOLOGICAL CRITERIA

(THE ESTIMATION OF THE PHYSICAL MATURITY)

- Results of the Kern – Irasek's test (synthetic and analytical brain function);
- Quality of pronunciation;
- The motor-metric test.

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