МИНИСТЕРСТВО ЗДРАВООХРАНЕНИЯ РЕСПУБЛИКИ БЕЛАРУСЬ
БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ МЕДИЦИНСКИЙ УНИВЕРСИТЕТ
КАФЕДРА ОБЩЕЙ ГИГИЕНЫ

Я. Н. Борисевич, Н. В. Рябова

ОБЩАЯ ГИГИЕНА

GENERAL HYGIENE

Учебно-методическое пособие

2-е издание

Минск БГМУ 2013

УДК 613(811.111)-054.6 (075.8)
ББК 51.20 (81.2 Англ-923)
Б82

Рекомендовано Научно-методическим советом университета
в качестве учебно-методического пособия 31.10.2012 г., протокол № 2

Р е ц е н з е н т ы: канд. мед. наук, доц. зав. отделом гигиены питания ГУ «Республиканский научно-практический центр гигены», В. Г. Цыганков; канд. мед. наук, доц. декан медико-профилактического факультета Белорусского государственного медицинского университета А. Р. Аветисов.

Борисевич, Я. Н.

Б82 Общая гигиена = General hygiene : учеб.-метод. пособие / Я. Н. Борисевич, Н. В. Рябова. 2-е изд. – Минск : БГМУ, 2013. – 72 с.

ISBN 978-985-528-844-3.

Изложены основные материалы по общей гигиене. Рассматриваются вопросы влияния профилактики неблагоприятного воздействия на здоровье человека питьевой воды, почвы, физические и химические свойства воздушной среды, условий размещения, производственных факторов, фактического питания. Первое издание вышло в 2012 году.

Предназначено для иностранных студентов обучающихся на английском языке.

УДК 613(811.111)-054.6 (075.8)
ББК 51.20 (81.2 Англ-923)

ISBN 978-985-528-844-3

THE PURPOSE, TASKS, OBJECT AND METHODS OF HYGIENE. ENVIRONMENT: NATURAL AND SOCIAL ELEMENTS. PRENOSOLOGICAL HYGIENIC DIAGNOSIS

First attested in English in 1670s, the latinisation of the Greek — hugieinē technē, meaning «(art) of health», (hugieinos), «good for the health, healthy», in turn from (hugiēs), «healthful, sound, salutary, wholesome». In ancient Greek religion, Hygeia was the personification of health.

Edmund Parks said: «**HYGIENE** is the art of preserving health; that is, of obtaining the most perfect action of body and mind, during as long a period as is consistent with the laws of life. In other words, it aims at rendering growth more perfect, decay less rapid, life more vigorous, death more remote».

Hygiene is a branch of preventive medicine which studies laws of influence of environments on human health and develops the preventive actions directed on the prevention of diseases and strengthening of health of the population, the prevention of presenilation and prolongation of active longevity.

Hygiene is a scientific basis of preventive medicine.

Sanitary is the set of the practical actions directed on realization of requirements of hygiene.

General hygiene is independent hygienic discipline which includes following branches: social hygiene, municipal hygiene, hygiene of labor, hygiene of nutrition, hygiene of children and adolescences, hygiene of hospitals, naval hygiene, aviation hygiene, hygiene of railway and a sailing charter, hygiene of physical culture and sports, space hygiene etc.

The hygiene **purpose** is protection and **boosting** of personal and public health.

The **tasks** of general hygiene are:

1. Studying of factors of environment which influence health of the person
2. Studying of laws of interaction of factors of natural and social an environment and an organism of a person
3. The Scientific substantiation, working out and introduction of hygienic specifications, rules and actions.
4. Forecasting of a hygienic situation for the nearest and remote

Subjects (object) of hygiene are:

– The condition of health of healthy people on individual, group, population levels.

– The condition of environment.

Methods of hygienic researches can be divided to two basic groups:

– The methods of studying hygienic condition of environment

– Methods of an estimation of reaction of an organism on influence of the environmental factors.

Methods of hygienic researches:

- hygienic inspection and the description
- hygienic experiment *in vivo* and *in vitro* (toxicological and biological);
- laboratory methods: physical, chemical, bacteriological methods;
- the clinical methods (physiological, biochemical etc.);
- the sociological and sanitary-statistical methods;
- the method of hygienic examination.

Environment

Environment is an inhabitancy (including natural), the social environment and the environment of labor activity of the person.

Inhabitancy is a complex of interconnected abiotic and biotic factors which influence an organism outside and define its activity.

Distinguish still such **concepts** of an environment:

- not changed natural environment;
- the changed natural or polluted environment;
- artificial (the environment created by the person for time maintenance of the ability to live in it is artificial the created closed spaces).

The industrial environment is the part of environment including climatic conditions and the professional factors (physical, chemical, biological and social), which influence the person in the course of labor activity.

The social environment is a part of environment which defines public, material and spiritual conditions of its formation, existence and activity.

The social environment includes habitation, the life, a family, formation, culture and so forth.

Properties of elements are the factors of environment.

Health of the person is a condition of full physical, psychological and social well-being, and not just absence of illnesses and physical defects.

There are 3 levels of health: individual, group, population.

Criteria of an estimation of health

Individual level:

- Absence or presence of chronic diseases.
- Physical and psychological development.
- The condition of the basic organs and systems of human body.
- Resistibility of an organism to unfavorable influences of environment.

Group level:

- Demographic indicators (death rate, birth rate).
- Indicators of physical development of the population (anthropometrical indicators, functional indicators).
- Disease Indicators.
- Physical inability Indicators.

Population level:

- Deduction of a total national product on public health services.
- Availability of the primary sanitary-medical help.
- Coverage of the population by medical aid.
- Level of immunization of the population.
- A nourishment condition, including nourishment of children.
- Level of children's death rate.
- Forthcoming life expectancy.
- Hygienic literacy of the population.

Prenosological hygienic diagnostics

The purpose of prenosological hygienic diagnostics is Interrelation establishment between factors of environment and human health. And also, it is an estimation of a condition of adaptable systems of the person.

Difference from clinical diagnostics:

Hygienic diagnostics begins with studying and environment estimation.

The estimation of a state of health is made on population level, instead of at individual level, as at clinical diagnostics more often.

Object prenosological hygienic diagnostics is the healthy person, but object clinical diagnostics is the sick person.

Methods early prenosological diagnostics

Preventive maintenance (prophylactic) is a system of the prevention of diseases and elimination of risk factors. It includes medical, sanitary-engineering, hygienic and social and economic actions. There are individual and public preventive maintenance.

Consider 3 steps of preventive maintenance.

The first step of preventive maintenance is a system of measures of the prevention of diseases under the influence of risk factors (vaccination, a rational mode of work and rest, a balanced diet, physical activity, improvement of environment, etc.).

The second step of preventive maintenance is the diagnostics and treatment of the diseases, the prevention of development of complications, chronization of diseases and disablement. The most effective method of secondary preventive maintenance is prophylactic medical examination.

The third step of preventive maintenance is a complex of actions for rehabilitation of the serious patients. The third step of preventive maintenance provides social, labor, psychological and medical rehabilitation.

Test questions:

1. Define the following concepts: health, sanitation and general hygiene.
2. What is the purpose and tasks of hygiene?
3. List the main methods of hygienic research and expand their essence.

HYGIENIC CHARACTERISTICS OF WATER SOURCES

The human body contains anywhere from 55 % to 78 % water depending on body size. To function properly, the body requires between one and seven liters of water per day to avoid dehydration; the precise amount depends on the level of activity, temperature, humidity, and other factors. Most of this is ingested through foods or beverages other than drinking straight water. It is not clear how much water intake is needed by healthy people, though most advocates agree that 6–7 glasses of water (approximately 2 liters) daily is the minimum to maintain proper hydration. Medical literature favors a lower consumption, typically 1 liter of water for an average male, excluding extra requirements due to fluid loss from exercise or warm weather. For those who have healthy kidneys, it is rather difficult to drink too much water, but (especially in warm humid weather and while exercising) it is dangerous to drink too little. People can drink far more water than necessary while exercising, however, putting them at risk of water intoxication (hyperhydration), which can be fatal. The popular claim that «a person should consume eight glasses of water per day» seems to have no real basis in science. Similar misconceptions concerning the effect of water on weight loss and constipation have also been dispelled.

An original recommendation for water intake in 1945 by the Food and Nutrition Board of the National Research Council read: «An ordinary standard for diverse persons is 1 milliliter for each calorie of food. Most of this quantity is contained in prepared foods.» The latest dietary reference intake report by the United States National Research Council in general recommended (including food sources): 2.7 liters of water total for women and 3.7 liters for men. Specifically, pregnant and breastfeeding women need additional fluids to stay hydrated. According to the Institute of Medicine—who recommend that, on average, women consume 2.2 liters and men 3.0 liters—this is recommended to be 2.4 liters (10 cups) for pregnant women and 3 liters (12 cups) for breastfeeding women since an especially large amount of fluid is lost during nursing. Also noted is that normally, about 20 % of water intake comes from food, while the rest comes from drinking water and beverages (caffeinated included). Water is excreted from the body in multiple forms; through urine and faeces, through sweating, and by exhalation of water vapor in the breath. With physical exertion and heat exposure, water loss will increase and daily fluid needs may increase as well. Over 10 % of world population do not receive enough amount of purified water.

Water is essential to maintain the cleanliness of body, housing, public buildings, streets, squares, organizations heating and sewage disposal, woodlots. Need water for washing dishes, kitchen utensils, fresh vegetables, fruits and berries, cooking food.

The lack of not just fresh water, but pure water becomes a real threat for the future because of water sources pollution with domestic, industrial and agricultural sewage.

For their needs person uses basically only fresh water from surface water, groundwater and atmospheric sources.

The Antarctic ice sheet, contains 61% of all fresh water on Earth. **Surface sources** (ground water) can be divided into natural and artificial. Natural open sources include rivers, lakes and ponds, man-made — reservoirs, canals. In the water, open-source contains a large amount of flora and fauna. Given saprobity aquatity reservoirs are divided into poly-, mezo- and oligosaprobic.

Polysaprobic zone is characterized by strong water pollution, lack of oxygen, presence of recovery and the absence of oxidation processes, a high content of protein substances. In polysaprobic zone small number of flora and fauna, aquatic flowering plants and fish are absent, is characterized by the predominance of one the most stable to the conditions of the form. For polysaprobic zone is characterized by the presence of hundreds of thousands and millions of microorganisms in 1 cm^3.

Mezosaprobic zone occupies an intermediate position between the poly- and oligosaprobic.

Oligosaprobic zone is characterized by almost pure water, which lacks recovery processes, organic matter is completely mineralized, there is a lot of oxygen. The number of bacteria does not exceed 1000/cm^3, flora and fauna are very diverse, intensive development of various algae, and there are mollusks, crustaceans, insects, many flowering plants and fish.

Underground springs are formed mainly by precipitation or filtration of water of open water. They include soil, groundwater and interstratal water.

Soil water lie close to the earth's surface in the first aquifer, have no protection in the form of impermeable layers, so their composition is subject to abrupt changes. Most groundwater is stored in the spring.

Ground water accumulates on the first watertight rock and has no impermeable layer on top. The composition of groundwater is subject to large fluctuations depending on the season. These waters are colorless, transparent, and characterized by good taste. Groundwater depth varies from two to several tens of meters. Ground water used for drinking water supply in rural areas with decentralized water supply.

Interstratal water enclosed between two impermeable rocks. Feeding them is happening in the places of the surface aquifer. Interstratal water has stable physical properties, chemical and microbial composition. Interstratal water are divided into free-flow and pressure, or artesian. Artesian water moving under pressure and can gush.

Precipitation formed as a result of condensation of water vapor of the atmosphere and fall to the ground as rain and snow. They contain small amounts of calcium, magnesium and other chemicals, and very soft. Since the atmosphere is heavily polluted industrial cities of various acids, salts, alkalis, soot, dust and microorganisms, precipitation also become contaminated and unfit for drinking.

Water is characterized by: organoleptic, microbiological factors, chemical composition.

By organoleptic factors include water smell, taste, color, turbidity, temperature.

The chemical composition of water before, except hydrogen and oxygen, sodium, calcium, magnesium, carbon, sulfur, nitrogen, zinc, lead, molybdenum, arsenic, fluorine, iodine, chlorides, sulfates, carbonates and other chemical elements and compounds. In natural water also contains sand particles, radioactive materials (uranium, thorium, radium, polonium, radon, toron), washed from the rocks.

Biological components of water are microorganisms, including bacteria, fungi, protozoa, algae and multicellular plants and animals. As a result, economic activity in the water may appear pollutants.

However, water may play a negative role, being one of the ways of transmission of infectious diseases, a risk factor for excessive or insufficient salt content, the cause of several diseases of noninfectious origin of the presence of pollutants.

To water to meet the following **hygiene requirements:** it should be colorless, transparent, have no odor, has a pleasant refreshing taste, have a natural chemical composition. Water also should not contain toxic chemicals and radioactive materials, pathogens, protozoa cysts and helminthes eggs.

Organoleptic properties are very important indicators of hygienic quality of drinking water, since they not only rise to the appearance of water, but also may point to its pollution. Also murky, opaque, died in any color, warm and has an unpleasant smell and taste of water causes a negative feeling, negative impact on water-drinking schedule, inhibits secretory activity of the stomach and water-salt metabolism, leading to a denial of water consumption.

Hygienic **significance of water chemistry.**

The most important chemical components of water are chlorides, sulfates and sulfites, phosphates, carbonates and hydrocarbons, iodine, iron, zinc, molybdenum, manganese, cobalt, fluorine, sodium, potassium, calcium, magnesium, hydrogen, oxygen, etc. Besides them, the water may be the origin of the soil organic matter and inorganic impurities.

Depending on the quantity **of mineral salts** distinguish freshwater (up to 1 g/dm^3), brackish (1–2.5 g/dm^3) salt (above 2.5 g/dm^3 mineral) water. High total salinity of drinking water in constant use leads to indigestion, poor appetite, the appearance of weakness, disability, aggravation of chronic diseases of the gastrointestinal tract. Highly mineralized water causes dehydration, violates the acid-alkaline balance, leads to a weakening of the heart and death.

Hygienic importance of biological factors of water

Water contains a large number of photo-autotrophic and chemosynthetic bacteria, heterotrophic bacteria, unicellular algae, fungi and protozoa, and multicellular coelenterates, worms, mollusks, arthropods, fish and plants. Auto-

trophic organisms absorb carbon dioxide and oxygen enriched water, heterotrophs involved in the processes of self-purification.

Improving water quality

To improve the quality of water cleaning, disinfection, and special processing techniques used. Water purification is carried out mechanically (settling), physical (filtration) and chemical (coagulation) methods.

Settling on the waterworks carried out in special landfill horizontal and vertical type for 2–8 hours.

Filtering — a more complete release of water from suspended particles in a special finely porous material (slow and fast filters, quartz-anthracite filters, etc.)

Coagulation is addition to water coagulant. As a coagulant often use aluminum sulfate, chloride and sulphate of iron. In the process of coagulation form hydroxides, which adsorb contaminants and rapidly precipitate in the form of flakes, releasing water from the suspended particles are not removed by settling and filtration.

Methods of **disinfection of** water:

- chemical (reagent) method;
- physical (non-reagent) method.

Chemical methods are based on adding to the water of chemicals that cause the death of microorganisms (chlorine and its compounds, ozone, iodine, potassium permanganate, silver, etc.). One of the most reliable and proven method is to chlorinate with chlorine gas, bleach, sodium hypochlorite, calcium hypochlorite, chlorine dioxide.

Physical methods in contrast to the chemical do not affect the composition and properties of water, do not affect its organoleptic properties, have a broad bactericidal action. These include boiling, UV radiation, the use of pulsed electric discharge, ultra sound, ionizing radiation.

Test questions:

1. Drinking water sources, classification and characteristics.
2. General requirements for drinking water quality.
3. Methods for improving the quality of drinking water.

SOIL AND ITS HYGIENIC IMPORTANCE

Soil is a natural self-regulating biological system, representing the top layer of the lithosphere, which has fertile. Soil fertility, i. e., the ability to provide plant food and water, allowing it to participate in the reproduction of the biomass. Soil fertility depends on the availability of nutrients, air, water and thermal regimes of the area, as well as farming, agrochemical and drainage impacts.

The main factors of soil formation — climate and topography, parent material, vegetation and fauna, as well as human economic activity.

MECHANICAL COMPOSITION AND STRUCTURE OF SOIL

The composition of the soil consists of four major components:
- mineral (50–60 % of total);
- organic matter (10 %);
- air (15–25 %);
- water (25–35 %).

Value them differently, not only in different soils, but also in various horizons of the same soil, and is constantly changing due to land uptake of atmospheric precipitation, sometimes irrigation and groundwater, as well as the flow of moisture - soil runoff, evaporation, sucking plant roots and other.

Table 1

Mechanical composition of soil

Particle size, mm	The name of the faction
> 3	Stones
1–3	gravel
1–0,5	coarse sand
0,5–0,25	mean
0,25–0,05	Small
0,05–0,01	Dust is a major
0,01–0,005	average
0,005–0,001	Small
0,001–0,0005	Coarse silt
0,0005–0,0001	slender silt
< 0,0001	Colloids

SOIL CLASSIFICATION

Unified international classification of soils has not yet been developed.
Distinguish the following types of soil:
- stony;
- sandy (more than 80 % sand);
- sandy-loamy;
- clay (60 % clay);
- loam;

– lime (50 % lime);
– chalk (more than 50 % of chalk);
– saline;
– black earth (more than 20 % of humus);
– peat;
– various combinations of them.

PHYSICAL PROPERTIES OF SOIL

Solid particles in situ do not fill the entire volume of soil mass, the rest was time — the gaps of various sizes and shapes. Total pore volume is called the *porosity* of the soil. Depend on the porosity of the soil water properties (permeability, water-lifting capacity, moisture content) and soil density.

The liquid part, i. e., soil solution is an active component of the soil, carrying out the transfer of substances within it, removal and supply plants with water and dissolved nutrient elements. *Water permeability* (filtration capacity) is the ability of soil to absorb and pass water. This property is important for the formation of soil water and the formation of its reserves. *Capillarity* is the ability of soil to raise the water through the capillaries of the deeper layers to the surface. The more small pores in the soil, the more she capillary and the higher it rises on the water, which can cause damp basements and ground floors of buildings.

Water-holding capacity is the amount of moisture, which can keep the soil by adsorption and capillary forces. It is the greater, the smaller the pore size and the greater their total volume. The hygienic value of this property is that the high moisture content contributes to soil moisture, reduces air and water permeability, and impairs self-purification processes.

The gaseous portion or soil air fills the pores not occupied by water. The number and composition of soil air, which consists of N_2, O_2, CO_2, volatile organic compounds, etc., are not constant and determined by the nature of the set occurring in soil chemical, biochemical, and biological processes. *Air permeability* — the ability of soil to pass air. High breathability is favorable hygienic properties. Exempt from the water pore space is filled with air. These phenomena are determined by air and soil water regime.

Soil temperature — affects the surface air temperature, the thermal regime of the 1 floor and basement, as well as the processes of self-purification and activity of soil microorganisms. The soil temperature depends on the geographic location of the area, relief (better warmed up the southern slopes), albedo (dark soil absorbs more solar energy), soil moisture (preferably heated dry).

Chemical properties of soil

On the ***chemical composition*** of mineral components of soil consists of sand and silt (quartz form) SiO_2 with the addition of silicates ($Al_4(SiO_4)_3$, $Fe_4(SiO_4)_3$, Fe_2SiO_4) and clay minerals (silicates and crystalline compounds

aluminum hydroxide)).The mineralogical composition of the solid part of the soil largely determines its fertility. The composition of minerals include: Si, Al, Fe, K, N, Mg, Ca, P, S; much less contained trace elements *:* Cu, Mo, I, B, F, Pb and *others.* The vast majority of elements are in oxidized form.

Organic particles contained little, and only the peat soil is almost entirely composed of them. Organic matter in soils formed from the remains of plants and animals. Important role in the expansion are saprophytes.

In the process of self-purification of soil is crucial phenomenon ***of humification.*** As a result of a complex interplay of chemical reactions, mesophilic and thermophilic microorganisms form complex amorphous organic matter of weight — ***humus*** — a dark brown or black. It is composed of humins, carbohydrates, fats, organic acids, phenolic compounds, carboxylic acids, esters of fatty acids. Humus improves soil properties, increasing its ability to retain water and dissolved minerals.

Under the influence of physical factors (sun drying), a significant portion of pathogens are killed under the influence of chemicals (oxygen of the air and soil), the oxidation of organic substances (fats and carbohydrates) to carbon dioxide and water, and nitrogen compounds are decomposed into amino acids and the oxidation of nitrifying. At the same time play important role bacteria of the genera Nitrosomonas and Nitrobacter, which form the minerals absorbed by plants. Some chemical elements (nitrogen, phosphorus, sulfur) take part in the process of moving from the expansion of organic compounds in inorganic. So-called process ***mineralization*** of the substance occurs.

Chemical contamination of the soil — to change the chemical composition of the soil, arising directly or indirectly impacted by the factors of land use (industrial, agricultural, municipal), causing a reduction in the quality and the potential threats to public health.

Biogeochemical provinces — are different in size are the territories of the Earth at different levels of concentration of chemical elements. And as a consequence — the appropriate level of concentration in the organisms and the appearance of responses of biological reactions on the part of the human body. Effect of various chemical elements on the body is most pronounced at sharply pronounced excess or deficiency in the soil of individual chemical elements, which leads to various forms of metabolic diseases and the emergence of endemic diseases, which may end with the death of the organism.

Such endemic are known — with a large content of strontium in the soil (chondrodystrophy), boron (boric enteritis), fluoride (fluorosis), calcium (brittle bones), cobalt (hypo-and vitamin deficiency, vitamin $B_{12)}$. With a lack of iodine is developing endemic goiter, etc.

Currently, only the natural soil of endemic regions, there were artificial biogeochemical regions and provinces. Their appearance is connected with the arrival in the soil of industrial emissions (smoke emissions from factories, wastewater discharges and solid waste).

In recent years, a greater urgency the problem of soil pollution by pesticides, non-normalized doses of mineral fertilizers and plant growth stimulants acquired. Chemical compounds (poisonous in nature) penetrating into the soil each time in large amounts accumulate in it and change over time, its physical and chemical structure and acidity. They also kill micro-organisms are actively involved in the process of soil, earthworms, loosening soil and many other organisms, whose existence is crucial to soil fertility.

Epidemiological importance of soil

In a pure soil inhabit small infections. Pathogens enter the soil from the secretions of humans and animals, with sewage treatment and prevention facilities, etc. In a pure soil, they usually die quickly. However, in soil heavily polluted with organic substances and contains chemicals that are broken self-purification processes.

Mold can be a factor in the transfer:

– diseases caused by spore-forming organisms (tetanus, botulism, gangrene);

– zoonotic infections (anthrax, brucellosis, glanders);

– soil-transmitted helminth (ascariasis, trichuriasis) and biohelmintosis (enterobiasis, teniasis, teniarinhoz);

– intestinal infections (dysentery, typhoid fever and salmonellosis);

– particularly dangerous infections (plague, cholera);

– dust infections (tuberculosis);

– viral infection (polio, hepatitis A).

Health number — the ratio of soil protein (organic matter) of nitrogen to total organic nitrogen of soil. Evaluation is performed in accordance with tab. 2.

Table 2

Evaluation of the purity of the soil with health number

Characteristics of Soil	Health number
permissible	0.98 and over
moderately hazardous	From 0.85 to 0.98
dangerous	From 0.70 to 0.85
extremely dangerous	Less than 0.70

When selecting a first examine the soil areas at risk the public health impact, which include preschool and school institutions, health facilities, residential area, the zones of sanitary protection of reservoirs, water supply, land occupied by growing crops, recreational areas etc.

Test questions:

1. Soil: definition, texture, classification.
2. Hygienic significance of physical and chemical properties of soil.
3. Biogeochemical provinces, natural and artificial.
4. Epidemiological importance of the soil.

HYGIENIC CHARACTERISTICS OF THE PHYSICAL FACTORS OF AIR

Properties of atmospheric air:

1. Physical:

– temperature;
– humidity;
– movement of air;
– pressure;
– solar radiation (electromagnetic radiations);
– atmospheric electricity (air ionisation, electric field, a geomagnetic field);
– natural radioactivity.

2. Chemical:

– normal gas structure (oxygen, nitrogen, carbonic gas, inert gases — argon, water steams, ozone);
– harmful gaseous impurity (natural and anthropogenic origin).

3. Biological the content in air of open places and the closed premises of various microflora — bacteria, viruses, spores of mold fungi, yeast, actinomycete, cysts of the elementary, seaweed, disputes of lichens, mosses, ferns, pollen of plants.

4. Mechanical (presence of firm particles — dust, ash, gaseous aerosols).

Weather — a set of physical properties of the atmospheric ground surface layer (or set of meteorological indicators) with in a short interval of time (hours, days).

Climate of the specified district is a long term naturally repeating mode of weather.

Weather is a changeable phenomenon, while climate is statistically steady.

Weather is a set of meteorological indicators (temperature, humidity, speed and a direction of movement of air, atmospheric pressure, atmosphere transparency, character of overcast, presence of precipitations). Hence, weather is a complex physiological stimulus.

Microclimate is a set of physical air properties (or meteorological indicators) in small territories (a glade in the wood) or in premises (an inhabited apartment, a classroom, a medical office, etc.)

Heat exchange is a set ***of chemical thermoregulation*** mechanisms (a generation of the thermal energy caused by nutrients oxidation processes) and ***physical thermoregulation*** (excretion of heat from an organism).

Physical thermoregulation: in normal conditions (temperature 18 °C) a person loses via skin about 85 % of heat and 15 % is spent for food heating, extracting air, water evaporation in lungs. Out of 85 % of heat from a skin surface approximately 45 % is a radiation way **emissions (radiation)** takes place in the

presence of objects with a temperature lower, than a temperature of skin surface; approximately 30 % is at the expense of **conduction** (direct heat losses during contact with surrounding objects) **or convection (**heat donation from skin surface to contacting air layers during their movement); approximately 10 % is at the account **evaporation of sweat** from a body surface.

Air temperature — a degree of its heating, expressed in centigrade.

Under the influence of high temperature the following symptoms are:

– considerable amount of tooth stone;

– inflammatory processes of gums and periodontal fabrics (catarrhal stomatites, infringements of salivation, heavy forms gingivitis and periodontitis);

– injuries of uncarious origin (cracks and enamel destruction, pathological erasability with prevalence of anterior teeth).

Prevention of overheating:

1. In normal conditions:

– tempering to the influence of heats (a bath, a sauna, but not at the expense of long stay on the sun);

– rational clothes and footwear;

– maintenance of microclimate optimum conditions (natural and artificial ventilation, air-conditioning);

– balanced diet (a diet, drinking mode);

– rational mode of work and rest.

2. At working conditions in hot shops:

– improvement of the surrounding industrial environment (application of technologies excluding heating and thermal processing of metal);

– remote control of hot processes, use of heat-shielding screens, ventilation;

– use of rest rooms with the radiation cooling;

– rational drinking mode (the use of salty soda water);

– treatment diet (rich in proteins and vitamins).

Prevention of overcooling:

– tempering an organism;

– rational clothes and footwear;

– balanced diet and drink;

– optimum microclimate in inhabited and working premises;

– move (muscular activity).

Fig. 1. Mercury thermometer

Air temperature measured by thermometers (measured and fixing). These include alcohol, mercury (fig. 1), electrical thermometers and maximum, minimum thermometers.

To define a temperature mode of premises it is necessary to take air temperature in the following points: in the centre and at the external and internal

walls at the distance of 10 cm from them and at the level of 0.1–1.5 m from the floor. The obtained data are transferred to the minutes and analyzed on vertical and horizontal lines.

The average temperature of a premise is calculated taking into account three values of measurements in various points of the horizontal line at the height of 1.5 m:

– fluctuations on the vertical line within the norm of 2–3 °C;

– fluctuations horizontal line within the norm of 2–3 °C;

– average temperature in premises in winter is 20–22 °C, in summer 21–25 °C;

– daily fluctuations in heating: in case of central heating — 2–3 °C, in case of stove heating — 4–6 °C.

Types of humidity:

1. **Absolute air humidity** is the mass of water vapour in 1 m^3 of air (mmHg).

2. **Maximal humidity** is the mass of water vapour required to saturate 1 m^3 of air at a defined temperature (mmHg).

3. **Relative humidity** is the ratio of absolute humidity to the maximal humidity, expressed as a percentage, or percentage of air saturation with water vapour at a time of observation.

Optimum air humidity within 40–60 %, admissible — 30–70 % is considered.

Saturation deficit is difference between maximal and absolute humidity.

Physiological humidity deficit is difference between maximal humidity at 37 °C (body temperature) and absolute humidity at the time of observation.

Humidity is measured with August and Assmann psychrometers (fig. 2, 3) and hygrometer (fig. 4).

Fig. 2. August psychrometer

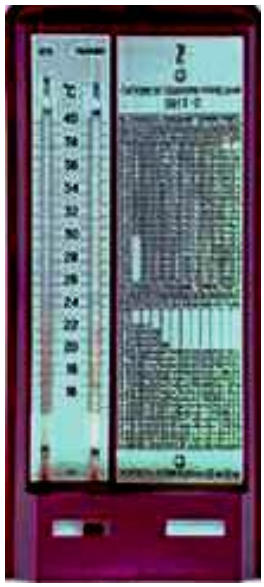

Fig. 3. Assmann psychrometer

Combined instrument TKA-PKM/20 (fig. 5) is designed to measure the relative humidity (RH, %) and temperature (T, °C).

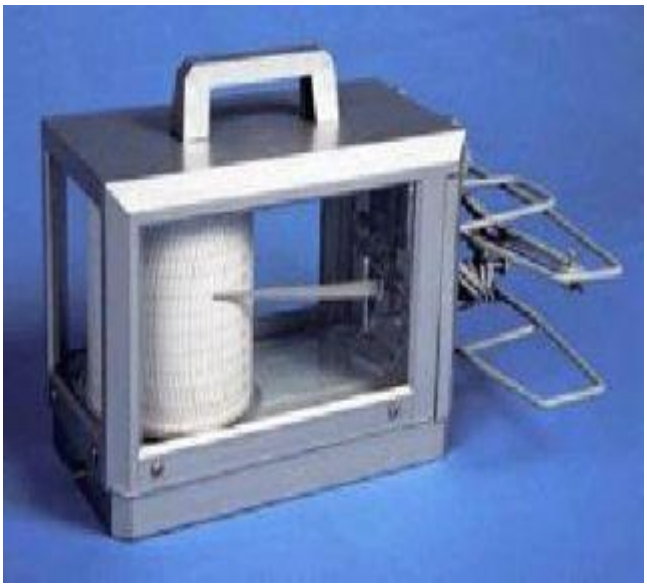

Fig. 4. Hygrometer

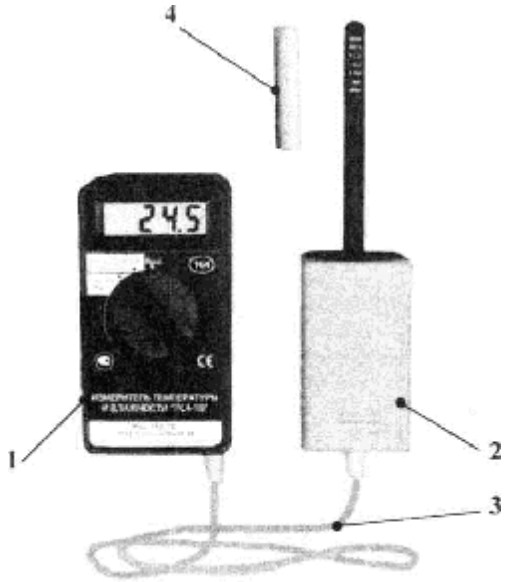

Fig. 5. Combined instrument TKA-PKM/20

Assessment of Air Humidity with the help of psychrometers:

1) By means of an August stationary psychrometer

Water is filled in the tank of a damp psychrometer thermometer (the thermometer lawn is rinsed with plenty of water); then the psychrometer is suspended on a support at a measurement point. In 7–10 min it is possible to take the readings of the dry and damp thermometer.

We can calculate absolute and relative humidity according to the formulas:

$$K = f - a\,(t_1 - t_2)\,B,$$

where K — absolute humidity; f — the maximum humidity at of the damp thermometer; a — psychometric factor 0.0011; t_1 — temperature of the dry thermometer; t_2 — temperature of the damp thermometer; B — barometric pressure in mm Hg.

$$R = \frac{K}{F}\,100\,\%,$$

where R — relative humidity; F — the maximum humidity of the dry thermometer.

The relative humidity is calculated in accordance with psychometric tables.

Further we are to find *deficiency of saturation*:

$$\text{physical: } D_{physic.} = F_{t\ premises} - K$$

$$\text{physiological: } D_{physiol.} = F_{t\ body} - K;$$

Dew-point temperature — we equate the obtained value of absolute humidity to maximum and find the required temperature in the table.

2) With the help of the Assmann aspiration psyhrometer

Absolute humidity is calculated according to the following formula:

$$K = f – 0.5(t_1 — t_2)B/755.$$

Relative humidity is calculated with the help of psychometric tables too.

Wind speed of movement influences on:

– organism heat exchange (increase of heat loss);

– mechanical work (more than 20 m/sec) on body movement in space — increase of energy consumption and metabolism; deterioration of movement coordination;

– processes of external breath (a normal process of breathing is broken);

– thermal state of health (a moderate wind of 1–2 m/sec in hot days invigorates);

– psychological state — mental excitement or depression;

– wind over 0.5 m/sec can lead to violation of heat exchange processes, catarrhal and infectious diseases.

Air mobility is described by:

– **Direction** is the air move in open atmosphere.

– **Wind rose** is based on continuous observations over the wind direction.

– **Speed** is the distance, which air mass makes per unit of time (m/sec).

Wind direction is determined by anemorumbometer and weather vane (fig. 6, 7).

Fig. 6. Anemorumbometer

Fig. 7. Weather vane

Fig. 8. Cup anemometer

Fig. 9. Vane anemometer

Also for measuring air mobility using hot-wire anemometer (fig. 10).

Small air mobility is measured by katathermometer (cylindrical and spherical) (fig. 11).

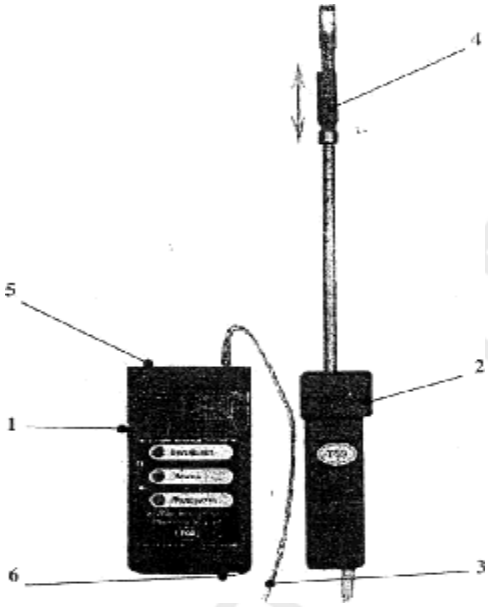

Fig. 10. Hot-wire anemometer

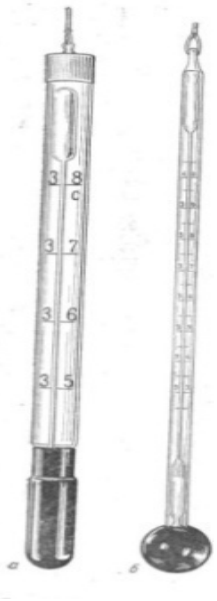

Fig. 11. Katathermometer cylindrical and spherical

Definition of Air Movement Speed with the Help of a Katathermometer

The principle of work:

A **katathermometer** is heated up to a certain temperature (above air temperature), and then in case of cooling under the influence of temperature and air movement the device will lose certain quantity of heat at a certain level of

temperature. Knowing the amount of cooling and the air temperature, we may calculate the air movement speed according to the empirical formulas and tables.

Work course:

A spherical katathermometer is placed in a vessel with hot water at the temperature of 65–70 °C until the painted spirit fills half of the top tank. After that the katathermometer is wiped dry rag and hanged up on a support in a place where it is necessary to define air movement speed. Further by means of a stop watch time we define the time in seconds for which the column has fallen from T_1 to T_2. It is possible to take intervals from 40–33 °C, from 39–34 °C, from 38–35 °C, i. e. such an interval, a partial value of which from division of the sum T_1 and T_2 should be equal to 36.5 °C. The test is repeated 2–3 times and the average indexes are calculated. Further on their basis we calculate the amount of cooling H. The ***cylindrical*** **katathermometer** amount of cooling and the spherical **katathermometer** are calculated with an interval of 38–35 °C applying following formulas.

$$H = F/a,$$

where F — the device factor, a constant showing the quantity of heat, lost from 1 sm^2 of the device surface during its cooling from 38 to 35 °C, $mcal/sm^2$; is a time of cooling of the device, sec.

In case we use 40–33 °C and 39–34 °C intervals on a ***spherical*** **katathermometer** a cooling value is calculated according to the following formula:

$$H = \frac{\Phi(T_1 - T_2)}{a}$$

$$\Phi = F/3.$$

The value of factor **F** is indicated on the back surface of every katathermometer.

To calculate air speed movement of less than 1m/sec we apply the following formula:

$$V = \left(\frac{H/Q - 0.2}{0.4}\right)^2.$$

To calculate speeds of more than 1m/sec we use the below formula:

$$V = \left(\frac{H/Q - 0.13}{0.47}\right)^2,$$

where Q is a difference between an average body temperature 36.5° and surrounding air temperature. $Q = T^0_{body} - T^0_{air.}$

0.2; 0.4; 0.13; 0.47 — are the empirical factors.

It is also possible to define air speed movement with the help of the table, after calculating H/Q prior to that.

The value of the air speed of movement in premises should be within the frames of 0.1 — 0.25 m/s.

Influence of the low pressure:

As a result of partial oxygen pressure decrease we observe:

– the increase of pulse and breath rate due to lack of oxygen;
– vision problems;
– breathlessness weakness come;
– problems with coordination of movements and functions of sense organs;
– meteorism (the expansion of gases in the food channel, high standing of a diaphragm, restriction of breath depth, the difficulty of blood inflow to the right auricle etc.

The effects of high atmospheric pressure:

– difficulty of breathing (exhalation);
– squeezing and pain in ears;
– slow pulse, breath, and heart rate;
– stomach squeezing, diaphragm lowering;
– hyperhidrosis;

Atmospheric pressure is measured by a barometer or aneroid barometer (fig. 12). For continuous recording of fluctuations in atmospheric pressure using barograph (fig. 13) are used.

Fig. 12. Aneroid barometer

Fig. 13. Barograph

Normal atmospheric pressure variations within the limits of:

760 ± 20 mmHg, or

1013 ± 26.5 hPa

Methods of complex estimation of meteofactors influence on heat exchange:

– katathermometry;
– effective temperatures;

– equivalent effective temperature;
– resultant temperatures.

Katathermometry:

Value of air cooling ability «H» is calculated using katathermometer cooling time. Optimal values of H at rest is 5.5–7 mcalcm²/sec.

Effective temperatures (ET):

– allow to assess complex effects of temperature, humidity and air mobility on human organism;

– standardised air temperature is determined with a help of nomogram based on levels of humidity and air mobility.

Equivalent effective temperature (EET):

– Conventional temperature shows the effect of heat feeling which depends on simultaneous action of a certain ratio of temperature, humidity and air mobility on human organism.

– Values of EET, at which 50 % of people feel good, are called comfort zone. At rest levels of comfort zone vary between 17.2 to 21.7 °C.

– Values of EET, at which 100 % of people feel good, are called comfort line. Comfort line values are between 18.1–18.9 °C.

Resultant temperatures (RT):

Resultant temperatures take into account complex effects of: temperature, humidity, air mobility, radiant energy. Values are detected with nomogram.

At the present time to assess the combined effect of meteorological factors are used index measuring heat stress environment (heat stress environment - INDEX) (fig. 14).

Fig.14. Measuring heat stress index

Test questions:

1. Properties of atmospheric air.
2. What is the weather, the climate, the microclimate?
3. Heat exchange with the environment.
4. Air temperature and its hygienic importance.
5. Humidity, its kinds. Hygienic humidity value.
6. The hygienic value of air mobility.
7. Atmospheric pressure and its hygienic importance.
8. Hygienic evaluation of the complex influence of meteorological factors on the human body: methods and their comparative characteristics.

HYGIENIC ESTIMATION OF SOLAR RADIATION AND CONDITIONS WITH LIGHT

Solar beams have an effect on an organism all parts of the spectrum. Depending on length of a wave the solar spectrum shares on three parts: ultra-violet, visible and infra-red. The greatest influence on fabrics renders the ultra-violet radiation which length of a wave makes 10–400 nanometers.

To the characteristic of biological action of ultra-violet radiation distinguish its three areas: the first area with length of a wave from 400 to 320 nanometers possesses poorly expressed biological action, the second with a length of a wave from 320 to 280 nanometers — antirachitic action on a skin, the third with length of a wave 280 nanometers and more low has destroying an effect on cells of tissue. This radiation does not reach a terrestrial surface owing to what the life on the Earth is possible. Dust, gases, steams in atmosphere influence on ultra-violet radiation. Therefore all resorts, sanatoria, rest houses are under construction far from the big cities and the industrial enterprises.

Ultra-violet radiation has antirachitic action on a human body. It is thus epidermis and the pigment melanin is formed — the skin gets a brown shade (sunburn).

Ultra-violet radiation of the Sun possesses also bactericidal action.

Influence of visible radiation of the Sun (length of a wave of 400–760 nanometers) is carried out basically through the visual analyzer. Invisible infra-red radiation with length of a wave 760–2500 nanometers has mainly deep thermal an effect therefore at a long irradiation there are burns and the general overheating.

The Sunlight makes active enzymes, influences various kinds of a metabolism in an organism. At children deprived of influence of a sunlight, the rickets develops. At adults fragility of bones which at crises slowly grow together is observed, a teeth easily collapses. This condition is called «as light starvation» which is often observed at miners, the people living in the north. For the prevention of such infringements it is recommended to be irradiated regularly with ultra-violet beams in special fotarijah, to take vitamins of group D.

Thus, the sunlight represents the powerful preventive and medical factor promoting improvement of environment, perniciously operating on microorganisms. Operating on an organism through the visual analyzer, a sunlight renders influence on physiological processes in an organism, changing a metabolism, the general tone, a dream rhythm etc.

Kinds of lighting: natural (top, sides and combined), artificial (general, local, combined), natural and artificial together.

Natural lighting depends on:

- latitude;
- time of a year and of a day;
- windows location;

– darkening from buildings and green plants located nearby;

– windows condition — sizes of windows openings, their construction, quality and cleanness of window glass;

– internal factors of the premise — internal planning, wall, floor and ceiling paint, colour of furniture.

Features of internal planning affecting the lighting:

– Top margin of window should be at a distance of 20–30 cm from the ceiling, because in this case light gets deeper in the premise.

– Height of window-sill should be 0.75–0.9 m.

– Depth of the premise — not more than 6 m.

– Optimal premise height — 3.2–3.5 m.

– Wall paint of wards looking south direction should be of cold colours (mint, light blue), smoothening the sunshine;

– Wall paint of wards looking north should be of warm colours (yellow, orange), replacing the absence of direct sun light.

Orientation of windows. Windows in the operational, wound dressing change, procedure, resuscitation rooms should look north, north-west or north-east, as this prevents dazzle from sun shine.

Insolation regimen of premises.

There are 3 regimens of insolation in temperate climatic zone which are determined by:

1. Orientation of windows by the sides of horizon.
2. Duration of insolation in hours.
3. Percentage of insolated floor area.
4. Amount of heat received through the window with solar radiation.

Types of insolation regimens:

1. Maximal — recommended for paediatric, trauma wards, and wards for convalescents.

South-east or south-west orientation;

Insolation time — 5–6 h;

Insolating floor area — 80 %;

Heat amount > 500 kcal/m^2.

2. Moderate — for medical, infection, surgical wards.

South or east orientation;

Insolation time — 3–5 h;

Insolating floor area — 40–60 %;

Heat amount = 500 kcal/m^2 .

3. Minimal — for operational theatres, intensive care units, burn, oncological, neurological wards.

North-west or north-east orientation;

Insolation time < 3 h;

Insolating floor area < 30 %;

Heat amount < 500 kcal/m^2.

Methods of natural lighting assessment:

1. Direct methods — by measuring of absolute and relative illumination with light-meter (luxmeter). Calculate of the coefficient of natural light (CNL).

2. Indirect methods:

– Light coefficient (ratio of glazed area to floor area);

– Location coefficient (ratio of distance from external to internal wall to the distance from upper window margin to the floor). Hygienic requirement — not more than 2.5;

– Light angle;

– Aperture angle.

Norms of natural light in some kinds of premises are in the table 3.

Table 3

Norms of natural light in some kinds of premises

Kind of premises	CNL, %	Light coefficient, LC	Light angle	Aperture angle
Operational rooms, patrimonial wards, laboratories	Not less 2.5	1 : 4–1 : 5	27	5
Educational premises, procedural rooms, boxes and insulators, dressings	1.25–1.5	1 : 4–1 : 5	27	5
Hospital wards, offices of doctors	1,0	1 : 6–1 : 7	27	5
Living rooms, registry	0,5	1 : 8– 1 : 10	27	5

For assessment of **artificial lighting** is used method «Watt». Computational method, «Watts», definition of artificial illumination is based on counting the total power of all the lamps in the room and identify specific power lamps (P, W/m^2).

$$E = P \cdot Et/10K,$$

where E is measured illuminance lux, P is power density, W/m^2; Et is illumination with power density 10 W/m^2 is depends on the power of incandescent lamps and the nature of the luminous flux (tab. 4 — for incandescence lamps; for fluorescent lamps, Et = 150 lux); K — factor of safety for both residential and public buildings is equal to 1.3.

Table 4

Size of the minimum horizontal light (lux) at specific capacity 10 W/m^2 (incandescence lamps)

Lamp voltage, W	Value of light exposure, lux (network voltage is 220 V)	
	Direct light	Reflected light
75	36	23
100	42	26
150	46	29
200	50	31
300	55	35
500	61	38

The formula is suitable for lamps of equal power. For lamps of different power, lighting calculation is done separately for each group of lamps. The results are summarized.

Norms of natural light in some kinds of premises are in the tabl. 5.

Table 5

Norms of artificial light of some educational, treatment-and-prophylactic premises, and houses

Premises	Optimum light of working surfaces at the general light, lux	
	Luminescent lamps	lamps of incandescence
Classrooms, auditoriums	400	200
Patrimonial, reanimation room, dressing rooms	500	250
Doctors offices (surgeons, accoucheurs-gynecologists, pediatrists, specialists in infection disease, specialists in skin and venereal diseases, stomatologists)	500	250
Offices of doctors who do not examine the patients	300	150
Living rooms	100	50
Kitchens	100	50

Test questions:

1. Hygienic importance of solar radiation.
2. Types of insolation regimens.
3. Methods of natural and artificial lighting assessment.

HYGIENIC CHARACTERISTICS OF CHEMICAL COMPOSITION OF AIR ENVIRONMENT

STRUCTURE OF ATMOSPHERIC AIR AND ITS HYGIENIC VALUE

Atmospheric air represents a mix of gases in parities.

N_2 — 78.08 %; O_2 — 20.93 %; Argon, other inert gases — 0.94 %; CO_2 — 0.03–0.04 %; water steams — 0.42 %.

Except the specified gases in air the certain quantity of a dust and microorganisms always contains.

At breath in lungs there is a gas exchange: in alveoluses the part of oxygen from air passes in blood, and from blood the part of carbonic gas is allocated in alveolar air. Thus in exhaled air contains oxygen and in 100 times more in comparison with inhaled carbonic acids much less.

Oxygen is the basic component of air. At its participation in a human body and animals all oxidising processes proceed. The person in a rest condition consumes about 350 ml of oxygen; at heavy physical activity oxygen consumption increases.

Fluctuations of the maintenance of oxygen in atmospheric air are insignificant. Its suppliers are plants which absorb carbonic acid, acquiring thus carbon, and the released oxygen is allocated in atmosphere. An oxygen source is also photochemical decomposition of water steams in an upper atmosphere under the influence of ultra-violet radiation of the Sun. Therefore practically the oxygen maintenance in atmospheric air remains almost constant in spite of the fact that it is spent for breath of the person and animals, burning and oxidation processes.

At low concentration of oxygen in air (submarines, refuges etc.) when oxygen is superseded by other gases and its level considerably decreases (4–5 %), is marked the expressed oxygen insufficiency promoting decrease of working capacity and accompanied by cough, sensation of heat in a breast, a headache, tachycardia, a hypertensia, etc.

Carbonic gas — colourless gas without a smell, in 1,5 times is heavier than air, enters into its structure. Concentration of carbonic gas (0,04 %) in atmosphere is almost always constant, as its surplus is absorbed by plants. oksida carbon in atmospheric air it is a lot of suppliers: it is allocated at fuel burning, at the expense of ability to live of the person and animals, from soil. However even in air of badly ventilated public buildings maintenance carbonic gas usually does not exceed 1 %. Maximum permissible concentration of carbonic gas in air of the closed premises makes 0,1 %.

Carbonic gas — the activator of the respiratory centre. Increase and breath deepening are observed at its concentration in air, equal 2–3 %. In considerable quantities carbonic gas causes narcotic action and death. Signs of a poisoning with carbonic acid (it is angry a mucous membrane of respiratory

ways, cough, sensation of heat in a breast, a headache, the tachycardia, the raised arterial pressure, working capacity decrease) appear, if its concentration in air makes 4–5 %, at 10–12 % loss of consciousness and death are observed.

The poisoning can be observed in the closed or hermetically sealed premises (mines, submarines), and also in places, where probably intensive decomposition of organic substances: sewer pipes, barmy tubs on breweries, deep wells, silage holes etc.

Hygienic value of carbonic gas consists that under its maintenance judge cleanliness of air of inhabited and public premises. At a congestion of people in badly ventilated premises concentration of carbonic gas can exceed 0,1 %. Air thus gets an unpleasant smell and can cause infringement of a functional condition of an organism. In parallel accumulation CO_2 in air the maintenance of other products of ability to live of the person increases, its temperature and humidity raise. Arising thus the unpleasant state of health and the painful phenomena at people are caused by infringement of thermoregulation at the expense of rise in temperature and humidity of air, instead of as a result of toxic action CO_2.

Nitrogen and other gases. Nitrogen is the basic component of atmospheric air. In an organism it is in the dissolved condition in blood, in a fabric liquid, but in physiological reactions of participation does not accept.

Hygienic value of other gases (inert) in air is insignificant, as they do not participate in reactions and do not render adverse influence on the person.

The basic sources of atmospheric air pollution:

– transport (more than 70 % of pollution amount) — carbon oxide, nitrogen oxides, 3,4-benzapiren, soot;

– fuel burning (coal, mineral oil, peat, fire wood, straw) — flying ashes, soot, 3,4-benzapiren, polychlorinated dioxides and biphenyls;

– the enterprises of the chemical and petrochemical industry — compounds of chlorine, fluorine, hydrogen sulphide, oxides nitrogen, heavy metals, etc.;

– the enterprises of black and nonferrous industry- iron, lead, chrome, oxides sulfurs, oxides carbon compounds;

– large cattle-breeding complexes — ammonia, formaldehyde, etc.

The effect of air pollutants on health and sanitary life style:

– They add smell to air and cause the undesirable reflex reactions (breath delay, reduction of breath depth, nausea and headache).

– They irritate mucous membranes of eyes and the upper respiratory tract, reduce their protective properties, suppress the function of ciliated epithelium, cause inflammatory phenomena (conjunctivitis, bronchitis, anemia, quinsy, pneumonia).

– Cause dental fluorosis and bronchial asthma.

– Affect mucous membrane of oral cavity (stomatites, leukoplakia and cheilitis).

– Cause diseases tooth hard tissues (caries).

– Lead to oncological diseases of lungs (3,4-benzapiren).

– Reduce intensity of solar radiation, reduce natural light, lead to formation of overcast, fogs, fall of the acid rains, making negative impact on vegetation.

Monitoring is a long supervision over a condition of the air environment on republic territories, and also the analysis of the reasons and sources of pollution of atmosphere.

During monitoring substances can be determined:

– carbon oxide,
– sulphur dioxide,
– dioxide of nitrogen, etc. nitrogen oxides,
– dust,
– phenol,
– hydrogen sulphide,
– ammonia,
– formaldehyde, etc. specific hydrocarbons.

Maximum permissible concentration (MPC) — is the amount of harmful substance in air (mg/m^3), which at daily respiration cannot cause any pathological changes or the diseases in humans, their children.

Test questions:

1. Structure of atmospheric air and its hygienic value
2. The basic sources of atmospheric air pollution
3. The effect of air pollutants on health and sanitary life style
4. What is monitoring

HYGIENIC ESTIMATION OF VENTILATION

Types of ventilation:

1. Natural ventilation;
2. Artificial ventilation.

Natural ventilation is performed due to temperature gradient between outside and inside air and impact of wind force.

Natural ventilation is divided into:

1. Ventilation with unorganised air exchange;
2. Ventilation with organised air exchange.

Ventilation with unorganised air exchange performed by infiltration through pores in building materials of walls, tiny gaps in windows and doors; as a result of pressure gradient between indoor and outdoor air, depends on weather conditions.

*Artificial ventilation***:**

1. General ventilation — air exchange takes place in a whole premise.
2. Local ventilation — delivery or removal of air takes place within the limited part of the premise (exhaust hood).

Depending on the purpose of general ventilation is: – inlet – exhaust – supply and exhaust.

The basic sources of air pollutions of premises

1. The external sources:

– are defined by the chemical content of air toxic substances in premises;

– getting inside with wind loading(capacity), the difference of temperatures and concentration, natural and artificial ventilation;

2. The internal:

– polymeric used in construction;
– products of the human organism vital activity — anthropotoxins;
– household processes (gas burning, smoking);
– microbal pollution.

Intensity of emanation of flying substances depends on temperature, humidity, operation time, and concentration of them depends on frequency rate of air exchange. Even in small concentration these chemical substances can become the reason of a sensibilisation of an organism.

The air environment of not ventilated premises worsens proportionally to number of people and time of their stay in a premise. In a rest condition the adult person excretes on the average 22.6 liter/hour.

The maintenance CO_2 in air of the closed premises has sanitary significance, being an indirect indicator of cleanliness of air. When level CO_2 raises, others of properties of air worsen: the temperature, humidity, dust, the maintenance of microorganisms, number of heavy ions raises, there are anthropotox-

ins. To such change of properties of air there corresponds maintenance **CO_2 *of equal 0.1 %*** and consequently, the given concentration is considered ***maximum permissible for air of the closed premises.***

The major action for preservation of cleanliness of air in premises is ventilation.

Ventilation — the adjustable air exchange which is carried out for creation in premises of the favorable air environment.

Ventilation is characterised ***by ventilation volume and frequency rate of air exchange***. Cleanliness of air of the closed premises is caused by maintenance for each person *of necessary volume of air — **an air cube*** and its regular change with external air. ***Ventilation volume is*** quantity of necessary ventilating air on one person in hour, for maintenance of an air cube. The ventilation volume depends on a premise cubic capacity, quantity of people and a kind of work, carried out in this premise.

In inhabited, public premises and hospital chambers *the norm of an air cube makes **25–27 m^3**, ventilation volume **37.7m^3**, frequency rate of air exchange makes 1,5 times in hour*

In this case, the ventilation task is support of maintenance CO_2 in air of the closed premise less ***than 0, 1 % (1 ‰) in*** **private and public premises, 0.07 % or 0.7 *‰* in hospital rooms.**

Frequency rate of air exchange — is the number which shows, how many times it is necessary to replace air in a premise within an hour (equal to a premise volume) to maintain the concentration of carbonic gas at the sanitary level.

Air cube — the premise volume ($м^3$),which is necessary for one person (not less than 25–30 m^3), to maintain of the concentration of carbonic gas at the sanitary level.

A. Calculation of ventilation volume:

$$L = \frac{C \cdot N}{P_1 - P_2},$$

where L — ventilation volume, m^3; C is quantity CO_2 exhaled by the person at o'clock (22.6); N is number of people indoors; P_1 is as much as possible admissible maintenance CO_2 in a premise (0.1 % = 1 ‰= 1 l/m^3); P_2 is maintenance CO_2 in atmospheric air (0.04 % = 0.4 ‰ = 0.4 l/m^3).

Frequency rate of air exchange in 1 hour K = L/V.

where L is ventilation volume, m^3 ; V is a premise cubic capacity, m^3.

Example: At sanitary-and-hygienic inspection of the air environment in chamber (a cubic capacity 69.7 m^3) where there are 4 patients, maintenance CO_2 has made 0.12 %. Define necessary both actual volume of ventilation and frequency rate of air exchange.

The decision:

1. $L_{\text{necessary volume of ventilation}} = \frac{ПN}{P - P_1} = \frac{22.6 \cdot 4}{1 - 0.4} = 150{,}6\ m^3.$

Frequency rate of air exchange necessary $K = \frac{150.6}{69.7} = 2.16$ times.

2. $L_{\text{actual volume of ventilation}} = \frac{ПN}{P - P_1} = \frac{22.6 \cdot 4}{1.2 - 0.4} = 113\ m^3.$

Frequency rate of air exchange actual $K = \frac{113}{69.7} = 1.62$ times

The conclusion: actual frequency rate of air exchange (1.62 times in 1) are considerable below necessary frequency rate of air exchange (2.16 times in 1), therefore, ventilation is not effective.

B. ***Calculation of ventilation volume and frequency rate of air exchange at natural ventilation***.

Frequency rate of air exchange at natural ventilation can be calculated under the formula:

$$K = \frac{ABC}{V},$$

where A is the area ventilating apertures (window leaf), m^2; B is speed of movement of air in a ventilating aperture, m/sec; C — airing time, sec; V is a premise cubic capacity, m^3;

Example: a cubic capacity of chamber 60 m^3, there are three person in it, airing occurs at the expense of a window leaf which open on 10 mines each hour. Speed of movement of air in a ventilating aperture — 1 m/s, the window leaf area — 0.15 m^2. Calculate frequency rate of air exchange.

The decision:

Frequency rate of air exchange: $K = \frac{0.15 \cdot 1 \cdot 600}{60} = 1.5$ times.

The necessary volume of ventilation and frequency rate of air exchange is defined:

$L = \frac{22.6 \cdot 3}{1 - 0.4} = 113\ m^3$ $\qquad$ $K = \frac{113}{60} = 1.9$ times

The conclusion: Actual frequency rate of air exchange below necessary frequency rate of air exchange, is recommended to increase time of airing of chamber to 15 mines each hour.

C. ***Estimation of artificial ventilation on inflow and an extract.***

The main criterion of an estimation of artificial ventilation is frequency rate on inflow and an extract. It is usually familiar «+» designate frequency rate of air exchange on inflow and a sign «–» on an extract.

For example: + 4 – 3

Prevalence of inflow over an extract is provided in premises where cleanliness of air has special value (operational, patrimonial etc.), in chambers for patients with infectious or purulent diseases the extract should prevail over inflow.

Test questions:

1. Types of ventilation.
2. Hygienic characteristics of air pollution indoors.
3. Indicators characterizing ventilation: air cube, the volume of ventilation air exchange.

OCCUPATIONAL HYGIENE

Occupational hygiene — the section of preventive medicine studying(investigating) influence on a human body of labour process and factors of the industrial environment, for the purpose of a scientific substantiation of specifications and means of preventive maintenance of occupational diseases and other adverse consequences of influences of working conditions on working.

The **purpose**: preservation of health and working capacity of the person.

The **tasks** of occupational hygiene:

1. Working out of hygienic specifications, sanitary rules on the industrial enterprises.

2. Sanitary inspection of projecting, building and working industrial, agricultural objects and other appointment.

3. Studying of features of technological processes for the purpose of revealing professional harms, an estimation of their influence on a human body and working out of measures on their decrease and elimination.

4. Working out of recommendations about the rational organization of labor processes and workplaces, work and rest mode.

5. Estimation of efficiency of used health-improvement actions.

Working conditions — set of factors of labor process and the industrial environment in which the activity of the person is realized.

Dangerous production factor is the factor of environment, labor process which can cause an acute disease or sudden sharp deterioration of a state of health or even death**.**

Safe working conditions — conditions at which influence on working harmful and dangerous production factors is excluded or their levels do not exceed hygienic specifications.

All harmful production factors divide on groups:

– Physical factors: temperature, humidity, speed of movement of air, thermal radiation, electrostatic fields, industrial noise, vibration etc.

– Chemical factors including substances of the biological nature (antibiotics, vitamins, hormones, enzymes, albuminous preparations), received by chemical synthesis.

– Biological factors — microorganisms-producers, live cages (cells) and spores, pathogenic microorganisms.

Factors of labor process: workload, tension of work.

Workload — description of the working process reflecting its load on muscular-skeletal system and systems, providing its performance (cardiovascular, respiratory).

Tension of work — description of working process reflecting the load on central nervous system, senses and emotional sphere.

Hygienic rules of working conditions (MPC, MPL) are maximum permissible concentration (levels) of harmful production factors which at daily

(except the days off) work, but no more than 40 hours a week, during the working should not cause diseases or deviations in a state of health, detected by modern methods, in the course of work or in the remote terms of a life of the present and the subsequent generations.

Professional disease — the disease caused by the influence of harmful working conditions.

Professional poisoning — the sharp or chronic intoxication caused by the harmful chemical factor in conditions of production.

Sharp professional poisoning is the disease which has arisen after unitary(single) influence of harmful substance on a worker.

Chronic professional poisoning — the disease developing after regular, long influence of small concentration or doses of harmful substance.

Group professional disease — disease at which simultaneously two and more persons was ill .

Preventive medical inspections — inspections of the persons who can be exposed to influence of dangerous, harmful substances and adverse factors.

Medical inspections are divided on preliminary and periodic.

Preliminary medical inspections are spent at receipt for work. They allow to revealing people who on a state of health cannot be admitted for work in the conditions of this manufacture. Doctors take part in there– the therapist, the neurologist, the ophthalmologist, specialist in skin and venereal diseases.

Periodic medical inspections allow to revealing professional diseases at early stages or deviation in a state of health, which influence risk action of the professional harms. A physician is the basic person who spends periodic medical inspections. The physician assigns of other doctors.

The classification of the **professional harm factors** which influence on the medical personnel:

1. The mechanical;
2. The chemical;
3. The physical;
4. The biological;
5. The psychogenic.

The mechanical factors are: the compelled (forced) position of a body or pressure (stress) of separate organs and systems. Long static muscular pressure is accompanied tonic and tetonic reductions of muscles. At long standing in the basal limbs a stagnation of blood is observed, the shin volume increases almost by one centimeter, and the foot area — almost on 5 % that conducts to development dilatation of the basal limbs and a thrombophlebitis, and stagnation of blood in the field of a pelvis conducts to development hemorrhoids.

The chemical factors:

– Medical drugs.
– The disinfecting, chemical means.

– Narcotic substances, especially substances of inhalation way of introduction to an organism.

– Organic solvents, acids and alkalis.

The physical factors:

– X-ray radiation.

– Radionuclides.

– Ultrasound.

– Ultra-violet radiation.

– Laser (coherent) radiation.

– Electric currents and fields.

– Elevated pressure.

– Aerosols.

– Noise of devices and devices.

The biological factors :

– Pathogenic microorganisms and viruses.

– Antibiotics and biostimulators.

– Vaccines and serums.

The psychogenic factors:

– Syndrome of chronic fatigue (a chronic virus Epstein-Barr) (SCF).

– Syndrome of emotional burning out (SEB).

Specific symptoms of SCF which are characteristic for medical workers:

– Irritability (it is directed not only on patients, but also on friends).

– Reduction of time of reception of patients already to the middle of the working day.

– The use in oral and written speech the world of fatigue.

– At performance of work which connects with official registration of papers, use of internal speech (the internal talk of phrases).

Syndrome of emotional burning out (SEB) is a kind of professional disease of the persons working in system the person — the person. The term characterizes a psychological condition of the healthy people who are in intensive and close dialogue with clients (patients) in emotionally overloaded atmosphere at rendering of the professional help.

The basic symptoms of SEB:

1. Fatigue (after the active professional work), not passing after a night sleep, a holiday.

2. The personal dispassionateness (irritation to colleagues, the managers, the person cannot be involved in another's problems to empathize).

3. The sensation of loss of efficiency of achievements, decrease of the self-estimation of the person.

The prevention of harmful effect of professional factors on the health of the medical personals:

1. The creation of optimum microclimatic conditions, prevention of the maintenance of air pollutions on workplaces.

2. Vocational counseling in medical high schools at final stages of preparation of the future experts and professional selection of employees taking into account psychophysiological features on medical specialities to which the most strict demands (for branch of hyperbaric oxygenation, surgeons).

3. Optimization of a mode of work and rest of doctors and the average personnel. It is necessary to forbid planned operative works to surgeons and anesthesiologists in day after night or daily watching, more uniform distribution of these works during the working week.

4. Speciality change if there is a risk of professional disease. The work of physicians-women in pregnancy is changed too, especially, if they work in surgery, traumatology, obstetrics and gynecology.

5. Preliminary and periodic medical inspections (is not rarer than 1 time a year) with attraction of a wide range of experts: neurologists, otolaryngologists, ophthalmologists, therapists, surgeons, gynecologists.

Test questions:

1. The purpose and the tasks of occupational hygiene.
2. The classification of the harmful production factors.
3. The classification of the professional harm factors which influence on the medical personnel.

FUNCTIONS OF FOOD. THE LAWS OF NUTRITION

Rational or adequately nourished of (latin *rationalis* — reasonable, sensible) — is a physiologically balanced diet of healthy people, which corresponds to energy, plastic, biochemical needs of the organism, provides a constant internal environment (homeostasis) and maintains the functional activity of organs and systems, resilience to adverse environmental factors on the optimal level under various conditions of its life.

Functions of food and substances that they provide:

– Energy (cereals, pasta, bread, pastries, potatoes, fats and animal products, sugar);

– Plastic products (meat, fish, milk, eggs, beans);

– Regulatory (vegetables, fruits, berries, eggs, liver of animals and fish);

– Adaptive-regulatory (bread of the poor quality of flour, cereals, vegetables, water, natural drinks);

– Protective and rehabilitative (vegetables, fruits, berries, eggs, liver of animals and fish);

– Signal-motivational function (spicy vegetables, spices).

Laws of rational (adequate) nutrition:

1. Law of the adequacy of nutrition of energy: the energy value of food must comply with energy consumption of the body. Long or short, but acute violation of the law of the adequacy of bioenergy leads to *energy imbalance.*

Causes of energy imbalance:

– Exogenous (external): inadequate or excessive intake of nutrients.

– Endogenous (internal): pathological conditions affecting the flow of food or hindering the assimilation of nutrients.

2. Law of nutrient (plastic) the adequacy of nutrition: quantity and quality (chemical structure) ingested nutrients (nutrients) should ensure that the plastic, and other biochemical processes in the body.

The classification of nutrients:

On the functional purpose:

– Mainly energy (fats, carbohydrates);

– Mostly plastic (proteins, minerals, water);

– Mainly catalytic (vitamins, trace elements) nutrients.

On the criterion of compulsion:

Interchangeable: carbohydrates, saturated fat, some fibrous substance;

Irreplaceable (the substance is not synthesized in the body, as well as those whose number in the body is limited): essential amino acids (8 — for adults and 10 — for children), 16 vitamins (mainly water-soluble), minerals, trace elements, 3–5 polyunsaturated fatty acids, water and essential facilities (phospholipids, lipoproteins, glycoproteins, phosphoproteins) — more than 50 substances.

Formula balanced nutrition adult healthy man (Pokrovsky AA) provides optimal balance basic nutrients and bioactive substances: the ratio by weight between proteins, fats, carbohydrates is 1 : 1.1–1.2 : 4.6.

Proteins of animal origin must be 55 % of the total protein.

Fats of vegetable origin must be 25–30 % of total fat.

Linoleic acid (polyunsaturated fatty acids) must be 4–6 % of caloric intake.

For micronutrients (vitamins and trace elements) is installed *adequate and the maximum admissible level of consumption.*

3. Law of enzymatic adequacy of nutrition: match the chemical composition of the food enzyme systems of the body. If you violate the law enzymatic adequacy, if in the digestive tract lacks adequate chemical structure of food enzymes, it is an infringement of digestion and absorption. The absence of the enzyme or inhibition of its formation and activity leads to *enzimopathy.*

Reasons enzimopathy are:

– Hereditary (due to loss of genetically pre-programmed synthesis of enzymes);

– Nutritional (as a result of a deficiency of vitamin $B_{12,}$ $B_{1,}$ with a deficit of protein and micronutrients — Fe, Cu, Mn, Cr;

– Toxic (most poisons lead to the oppression of the synthesis of enzyme systems);

– Violation of neuroendocrine regulation.

4. Law of biotic adequate nutrition: food as an element of the environment should be friendly and not to make the body xenobiotics (foreign substances). Acute or chronic effects on the body of xenobiotics originating from food are leads to food poisoning.

5. Law of biorhythmological the adequacy of nutrition it means construction of the diet taking into account the cyclic activity of digestive tract, as well as the influence of the rhythms of other organs and systems in the *processes of digestion. Compliance with the law — is adherence to* the principles of good eating habits.

Principles of rational diet

Multiplicity of meals: 3 (4–5th working group) — 4 (1–3rd working group) twice a day, which promotes the optimal utilization of nutrients.

Intervals between doses must no more than 5 hours.

Meal in the same hour and for 2–2.5 hours before sleep, which contributes to a temporary conditioned reflex stereotype nutrition.

Respect for the optimal relations between individual nutrients at each meal.

The distribution of the energy value of daily ration for individual meals is impotant.

Accounting for the physiological condition (health, age, pregnancy, lactation) and social factors (the intensity of work, evening and night shifts).

Nutritional standards — a key recommendation of intakes of nutrients and energy for different populations. **The criterion for determining the need for energy** was the direct dependence of the energy expenditure on the degree of physical exertion in the performance of a work.

The need for essential nutrients and energy for the adult (18-60 years) working population depends on the nature of work, age, sex and population groups. By the degree of energy allocated to 5 groups (4 for women) the intensity and severity of labor, which are divided into 3 age groups: 18–29, 30–39 and 40–59 years of age and gender (male and female).

Groups of intensity and severity of labor (the degree of energy)

Group I — manual workers (humanities students, PC programmers, educators, researchers, etc.).

The coefficient of physical activity (i.e. the *ratio between total energy expenditure and the value of basal metabolic rate)* is 1.4.

Group II — light manual labor workers (nurses, working automated lines, agronomists, veterinarians, retailers of manufactured goods, etc.). The coefficient of physical activity is 1.6.

Group III — Workers moderate work (surgeons, bus drivers, workers in the food industry, food vendors and others).The coefficient of physical activity is 1.9.

Group IV — the workers of heavy physical labor (construction workers, agricultural workers, machine operators, metallurgists, athletes).The coefficient of physical activity is 2.2.

Group V — face particularly heavy physical labor (men only): steelworkers, lumberjacks, miners, porters. The coefficient of physical activity is 2.5.

Test questions:

1. Functions of food.
2. The laws of nutrition.
3. The formula of balanced nutrition.

NUTRITIONAL STATUS

Status of human nutrition is a certain state of health, which has developed under the influence of previous dietary, taking into account the genetically determined metabolism of nutrients. Criteria of nutritional status are state of the structure, physiological functions and adaptation reserves.

CLASSIFICATION OF NUTRITIONAL STATUS

Common
– compensated;
– subcompensated.
Optimal (ideal)
Excess
– I degree;
– II degree (premorbid);
– III and IV (morbid)
Insufficient
– junk food;
– premorbid;
– morbid (painful).

Normal nutritional status observed in the majority of people with adequate nutrition. Health of these people is characterized by the absence of structural damage and functional disorders, their adaptive capacities are sufficient to adapt to the usual conditions of existence.

Long-term experimental studies of the nutritional status of different population groups indicate fairly frequent changes (within the physiological norm) of a number of indicators of homeostasis, the presence of deviations in the exchange of energy and nutrients did not significantly affect health. This kind of normal nutritional status should be defined as a ***normal balanced*** nutritional *status.*

However, in some cases, found a significant decrease in the adaptive reserves, and rates of adequate supply of nutrients are at the lower limit of the physiological norm. The presence of these violations suggests that the nutritional status of the ***subject: normal subcompensated.***

Optimal status characterized by the presence of adaptive reserves, ensuring the existence and operation in extreme situations. It is formed by people with a favorable heredity and obey the rules of a healthy lifestyle. Also, such a status is formed under the influence of special diets and is found in certain professions: pilots, athletes, Marines.

The main sign of **an excess of nutritional status** is overweight. When the first degree of excess weight (10–29 %) people remains quite healthy, they remain the same efficiency, but the fatigue is faster than usual.

People with excess body weight, compared to the norm, at 30–49 % (Grade II obesity) during exercise appear temporary, transient abnormalities in

the cardiovascular system and respiratory organs. This state can be regarded as premorbid, which is intermediate between health and disease, and nutritional status — ***excess premorbid.*** It is known that overweight is a risk factor contributing to the development of diseases such as atherosclerosis, hypertension, diabetes 2nd type, and other joint diseases.

People with excess body weight of the third (50–99 %) and fourth (100 %) the extent attributed to patients who have not only functional but also structural damage — status ***supply excess morbidity.*** Found that at any genesis of obesity as a risk factor, always present excessive consumption of food.

Inadequate nutritional status occurs when the energy and (or) plastic malnutrition, as well as a limited or total inability to uptake of nutrients (enzyme deficiency disease, gastro-intestinal tract, a condition after surgery on the stomach and intestines), as well as in patients with increased energy transfer (infection, cancer).In people with poor nutritional status may be violations of the structure and function of organs, tissues reduced adaptation reserves, the level of performance and health. Inadequate nutritional status may have three types.

With a lack of body weight, not exceeding 9 %, a slight decrease of adaptive reserves, indicators of metabolism and energy, beyond the lower limit of the physiological norm, but maintaining the basic parameters of homeostasis, we can state the existence ***of insufficient inferior*** nutritional status.

Insufficient (premorbid) nutritional status occurs with a decrease in body weight up to 9 % amid a significant reduction of adaptive reserves of the organism, deterioration of health and indicators of physical condition, the availability of primary, often hidden, signs of nutritional deficiencies.

Insufficient (morbid (painful)), nutritional status is diagnosed with a deficiency of body weight in excess of 10 %, and the presence of clinical symptoms of malnutrition.

STAGES OF DIAGNOSIS OF THE ENERGY IMBALANCE

1. Determination of the body's need for energy.
2. Measure the actual consumption nutrient energy
3. Diagnosis of energy imbalance.

Methods for determining energy expenditure (energy expenditure)

1. A method of direct energometry (individual biocalorimetry) is based on measuring the absolute amount of heat released Mynkh in the body in the process of life. It conducted in Pashutin camera (Measure the temperature of circulating water in the chamber). Kind of method, thermoelectric method — measuring the heat flux from the isothermal body surface area.

2. The method of indirect energometry: identification number used by the body of energy by the number of absorbed oxygen and carbon dioxide emissions and the calculation of respiratory quotient.

3. The method of alimentary energometry based on the direct relationship between energy consumption, energy value of food and body weight.

4. Chronometer-table method: a stopwatch record the time of an activity and a table of estimated energy consumption.

5. Computational method of WHO at a rate of physical activity (CPA)

MEASURE THE ACTUAL NUTRIENT INTAKE OF ENERGY

Socio-economic methods:

– Balance method (set food consumption by an average of 1 person in the whole region).

– Budget method (allows you to analyze the distribution of family income on food).

Socio-hygienic methods:

– Questionnaire, questionnaires, interview (the method of the 24-hour recall).

– Questionnaire-weight, lab (weighing, determining the amount of food eaten, the analysis of chemical composition and energy value of food samples).

– Analytical (calculated — the menus, layouts, the cumulative statements to calculate the energy value of diet).

STAGES OF ASSESSING THE NUTRITIONAL STATUS

1. Research and evaluation of actual food. Identifying limiting factors in the diet are essential nutrients and bioactive substances, entering with the diet deficiency.

2. Health assessment in relation to the nutrition: physical development, functional state and adaptive reserves of the body, the state of the protein, vitamin and mineral supply, immune status.

3. Determination of the nutritional status and correction of nutritional status recommendations for improvement of health status, due to the actual nutrition.

The study of nutritional status is a system consistently ongoing studies (tabl. 6).

Table 6

Methods for studying the nutritional status

Stage	Research methods
Hygienic assessment of actual nutrition	The method of 24-hour recall (interview) Questionnaire Analytical (menu-layout) Statistical
Determination of somatotype	Constitutional typing
Characteristics of physical development, functional and adaptive body reserves	Somatometric Phyisiometric Physiological

Окончание табл. 6

Stage	Research methods
Study of protein, vitamin and mineral supply	Biochemical Somatoskopic Determination of capillary resistance
Study of immunological resistance of the skin and mucous membranes of the naso-pharynx	Immunological method for determining the quantity and quality of skin microflora Fotonefelometrical

Test questions:

1. Nutritional status: definition of the classification.
2. Stages of diagnosis of the energy imbalance.
3. Methods of assessing nutritional status.

HYGIENIC ASSESSMENT ADEQUATE SUPPLY OF VITAMINS A AND C

Food is the energy source for many vital processes and serves as a supplier of plastic materials, as well as essential nutrients for building structural elements, the implementation mechanisms of enzymatic catalysis and regulation of metabolism. One of the essential nutrients is called ***vitamins*** — low molecular weight organic compounds are necessary to maintain the homeostasis of normal metabolism, biochemical ensures all vital body functions.

Unlike other essential nutrients (essential amino acids, fatty acids, etc.), vitamins are not a plastic material or energy source and are included in the metabolism primarily as members of biocatalysis *(the catalytic function of vitamins)* and the regulation of specific biochemical and physiological processes *(regulatory functions).*

There are two ***main methods for assessing vitamin provision of the body:***

1. Study of vitamins in the diets surveyed populations and the actual consumption of vitamins from food.

2. Research and evaluation of the vitamin status of the human body in terms of the adequacy of the functioning of physiological and biochemical systems, which are essential components of these vitamins.

The first group of methods aims at obtaining data on the number of vitamins entering the body with food, without taking into account individual peculiarities of the physiological and metabolic processes.

The second group of methods is to judge the degree of saturation of the body with vitamins.

The main approaches to the assessment of vitamin A security man presented in tabl. 7.

Table 7

Methods of studying the body's vitamin supply

The study of dietary vitamin and actual consumption of vitamins from food	The study of the vitamin status of the organism.
1.Methods of studying the actual nutrition: – questionnaires-questionnaire; – calculate; – weight. 2. Chemical analytical methods for determination of vitamins in the diet.	1. Somatometric methods; 2. Phiziometrical methods; 3.General clinical, somatoscopic survey revealing microsimptoms vitamin A deficiency 4. Physiological and biochemical tests (direct and functional); 5. Hematological methods; 6. Immunological methods; 7. Study of morbidity (morbidity).

THE STUDY OF THE VITAMIN VALUE OF FOOD RATIONS AND ACTUAL DIETARY INTAKE OF ASCORBIC ACID AND VITAMIN A

Computational method is to examine the human consumption of the product set for official documents (menus, layouts, cumulative statements) with subsequent calculation of the tables of the «chemical composition of food products» content of vitamins A and C. The data obtained using the calculation method, give an idea of vitamin values used by the diet, the main food sources of vitamins in the diet of the subject populations. However, they do not allow to take into account the true intake of vitamins surveyed since records actually eaten their food is absent. This shortage is deprived of the weight and to a lesser extent, questionnaire, questionnaire methods for studying the actual nutrition.

Personal-questionnaire method is to examine the actual nutrition of the population with the help of specially designed questionnaires. The method is simple, accessible, requires no special equipment and can be used in the analysis as a group and individual nutrition at home. To assess the vitamin A supply in the questionnaire included questions on consumption during the day for additional sources of vitamins — multivitamin preparations, vitamin-fortified beverages, etc.

The weighting method is strictly quantifiable (weighting) of all consumed per day food and dishes. The method of time-consuming, but allows a complete quantitative evaluation of the actual food.

In the analysis of dietary intake of vitamin C is necessary to consider the decay of them in cooking and heat-treated products.

THE STUDY OF THE VITAMIN STATUS OF THE ORGANISM

Assessment of health status and physical development. Comprehensive study of health status, including general clinical examination, assessment of incidence, the study of immunological status and anthropometric indices in the subjects, is an important approach to the assessment of adequate supply of vitamins.

Clinical and somatoscopic survey aimed at identifying possible microsymptoms of vitamin deficiency states. One of the key indicators of health status, is a *study of morbidity,* including a *record total number of cases with temporary disability, the study of the structure of morbidity, the calculation of the index of health staff* (number of subjects, did not seek medical care / total number of multiplied by 100%).

Deviation *of anthropometric indicators* of standard indices of physical development of healthy individuals may also indicate a deficiency in the diet of vitamins, which play an important role in ensuring normal growth and development.

Indicators of *immunologic and hematologic status* are sensitive tests that can be modified at the earlier stages of vitamin A deficiency than other health indicators.

Physical and biochemical tests assessing security vitamins

The essence of these methods is the direct study of vitamins and their metabolites in biological fluids *(biochemical tests)* or in the assessment of physiological or metabolic processes, which affect the implementation of vitamins *(physiological tests).*

Physiological tests:

1. Investigation of the permeability of blood vessels (to assess adequate supply of ascorbic acid and bioflavonoids

2. Estimate of the time dark adaptation (as an indicator of adequate supply of retinol). The method consists in studying the threshold of dark adaptation, which represents the minimum intensity of illumination, which takes surveyed after their stay in the dark. If you breach security body retinol threshold of dark adaptation increases. Along with the study of dark adaptation can be used electroretinography retina.

Biochemical tests:

Methods based on determining the content of vitamins and products of their metabolism in biological fluids, tissues and determination of vitamin C in serum, leukocytes, urine.

On the security of the body with vitamin C is judged by the amount of ascorbic acid excreted in urine (mg/hour or daily excretion); relative amount excreted in the urine of ascorbic acid to the amount of excreted total nitrogen (rate of 0.21–0.33) content in blood serum and white blood cells (normal 0.7–1.2/100 ml);

Investigation of vitamin A in blood (fasting and after loading with vitamin A). Normally, the content of retinol in blood 1,05–2.44 umol/L, carotenoid 1,5–4.6 mmol/l. Lower numbers indicate a deficit of retinol in the diet. Methods for stock assessment of vitamin A in the liver. Methods are based on the assessment of metabolic processes which involve vitamins.

Study of vitamin A-dependent physiological and metabolic processes, including biomicroscopy of the cornea needed.

Study of proline-hydroxylase activity and urinary hydroxyproline excretion (a reflection of the participation of vitamin C in the process of hydroxylation of proline) needed.

The daily need for vitamin A an adult ranges 800–1000 micrograms retinoic equivalent. In this case, $\frac{1}{3}$ should be borne by retinol and $\frac{2}{3}$ — by carotene.

Need adults in ascorbic acid is calculated by 1 Mcal (1000 kcal intake to 25 milligrams of vitamin C).

Food sources of vitamin C, the content of ascorbic acid can be divided into 3 groups: group 1, with vitamin C above 100 mg%, Group 2, with the vitamin C content from 50 to 100 mg%, Group 3 — vitamin C content of less than 50 mg % (tabl. 8).

Table 8

Food sources of vitamin C

Product group	Product
I. The content of vitamin C above 100 mg%	Apricot (dried fruits) (1500), black currant (250), sweet red pepper (250), buckthorn (120), Brussels sprouts (120), dill (150), parsley (150), horseradish (200).
II. Vitamin C content of 50 to 100 mg%	Red cabbage (60), cauliflower (70), Strawberry (70), grapefruit (60), sorrel (55).
III. Vitamin C content to 50 mg%	average activity (up to 50 mg%): cabbage (30), citrus (40–50), apples (16), peas (25), tomatoes (22), gooseberries (45), raspberry (37), potato (20–30); weak activity (up to 10 mg%): Carrots (5), cucumbers (9), beets (10), watermelon (7), grenades (5).

Vitamin A and carotene in certain foods is given in tabl. 9.

Table 9

Vitamin A and carotene in foods

Vitamin A content, mg%		Contents of carotene, mg%	
Cod liver oil	19.0	Red pepper	10.0
Beef Liver	14.0	Carrot red	8.0
Pork liver	6.0	Green onion	4.8
Cod-liver	3.3	Briar	8.0
Eggs	0.6	Dried apricots	5.0
Butter	0.3	Fresh apricots	1.72
Cream, sour cream	0.3	Red tomatoes	1.7
Milk	0.05	Blackcurrant	0.7

Test questions:

1. Vitamins: definition, classification, functions.
2. Methods of assessing supply the body with vitamins.
3. Vitamin A: physiological significance, the daily demand, the main sources.
4. Vitamin C: The physiological significance of the daily demand, the main sources.

ALIMENTARY (NUTRITIONAL) DISEASES

Alimentary (nutritional) **diseases** are diseases associated with deficiency or excess of the nutritional substances or bad quality food consumption.

Classification of alimentary (nutritional) diseases:

Diseases of the nutritional deficiency:

1. Protein-energy malnutrition (alimentary dystrophy, marasmus);
2. Protein malnutrition (kwashiorkor)
3. Mineral deficiency;
   - J: endemic goiter;
   - Se: gyposelenosis;
   - F: caries;
4. Vitamin deficiency (hypovitaminosis):
   - A: xerophthalmia, day-blindness (night blindness);
   - D: rickets, osteomalacia;
   - C: scurvy;
   - B_1: beri-beri;
   - Niacin: pellagra;
   - B_2: ariboflavinosis;
   - B_{12}: anemia.
5. Amino acid and PUFA deficiency;
6. Alimentary anemia:
   - Iron-deficiency anemia.
   - Other (vitamin B_6, B_{12}, folate-deficienoy).

Diseases of the nutritional excess:

1. Protein-energy excess (obesity);
2. Mineral excess;
3. Vitamin excess (hypervitaminosis);
4. Amino acid and PUFA excess.

Starvation (alimentary dystrophy) is structural and functional changes due to inadequate intake of nutrients and energy sources.

Exogenous reasons:

- Natural disasters,
- Catastrophes,
- Wars,
- Voluntary starvation.

Endogenous reasons:

- Maldigestion,
- Disordered absorption,
- Endocrine dysfunction,
- Prolonged infections,
- Surgical procedures,
- Malignant tumors.

3 degrees of severity:

– Mild. Carbohydrates and fat are utilized. Hunger.

– Moderate. Body weight loss. Biochemical changes (protein catabolism, electrolyte depletion and anemia).

– Severe. Total body fat loss. Muscular atrophy. Mental disorders.

Nutritional marazmus — a form of protein-energy malnutrition, which is characterized by severe malnutrition. The typical general view of the patient — the extremely emaciated child with thin limbs and a disproportionately large head, wrinkled face, like a «little old man», a clear mind and emotions expressed. Appetite, in contrast to kwashiorkor saved.

A diet without protein results in **kwashiorkor**. This is a disease of children aged 1–5 years in Africa.

Kwashiorkor is characterized by:

– generalized edema,

– dermatosis,

– thinning and decoloration of the hair,

– enlarged fatty liver,

– retarded growth,

– generalized infections.

Prevention:

– Public — to provide with sufficient quantity of food.

– Individual — medical treatment.

Obesity — the excessive accumulation of body fat. Obesity leads to hypertension, atherosclerosis and diabetes mellitus.

Etiology of obesity:

– imbalanced diet and low physical activity;

– genetic and developmental factors;

– social factors;

– endocrine and metabolic factors;

– psychological factors and brain damage.

There are 2 types of obesity — android («apple», male type) and gynoid («pear», female), which is determined by the ratio of waist to hip circumference value of more than 1.0 in men and more than 0.8 in women indicates that android obesity (male, abdominal) type — the most unfavorable type of obesity. Android type leads to glucose intolerance and insulin tolerance (risk of type 2 diabetes mellitus).

Rapid diagnosis of obesity is based on Body mass index (BMI).

$$\text{BMI} = \text{weight (kg)} / \text{height}^2\ (\text{m}^2)$$

Features of the method: only for persons 20–65 years of age; body weight may be due not only fat but also the development of muscles or edema, so an

additional measure the thickness of the fat folds, and the ratio of waist to hip circumference.

At low values of BMI (less than 18.5) — increases the risk of infectious diseases and diseases of the digestive tract. At high values of BMI (over 30) — increases the risk of cardiovascular disease, hypertension, type 2 diabetes mellitus (insulin-dependent), gallstone disease, some cancers.

Prevention:

- balanced nutrition;
- physical activity.

Test questions:

1. Nutritional disease: definition, classification.
2. Prevention of nutritional diseases.

HYGIENIC BASIKS OF CLINICAL AND PREVENTIVE NUTRITION

There are 3 **types of nutrition**:

– Balanced nutrition (rational, correct, scientifically justified, optimal, adequate);

– Preventive nutrition;

– Clinical nutrition.

Balanced nutrition is a nutrition of a **healthy individual**, aiming to prevent alimentary, cardio-vascular, allergic, stomach, bowel and other diseases.

Rational nutrition provides:

– Stability of internal media (homeostasis);

– Living requirements (growth, development, activity of different organs and systems) at a level, corresponding to the working and living conditions;

Hygienic requirements for rational nutrition:

– Energetic value of the daily ration should match the energy requirements of the organism;

– Physiological requirements of organism should be supplied with nutrients in the most useful amounts and proportions;

– Chemical structure of the food should correspond enzyme and digestive systems of the organism;

– Food consumption should be distributed correctly throughout the day;

– Food should not possess risks for health;

Preventive nutrition is a group of specialized diets that give protection for the health of people who work in the conditions of harmful professional factors. Preventive nutrition is nutrition of healthy man who has daily contact with harmful factors at his work.

The types of preventive nutrition:

– 5 special diets;

– Vitamins;

– Milk.

The aims of preventive nutrition:

– To increase health level.

– To increase organism resistance.

– To maintain high working capacity and lifetime.

– To reduce negative effects of the harmful substances.

Dietology is the section of medicine which study and a character substantiate and norms of nutrition at various diseases, and also the organization a patients feed.

Clinical nutrition is scientific system of the nutrition organization and use of certain food substances and their combinations for treatment aims. Clinical nutrition is an important part of the complex treatment of **ill man**.

Basics of clinical nutrition:

– To provide ill man with physiological requirements in nutritional substances;

– To provide digestion in enzymatic pathology;

– Interaction of the nutritional substances in the gastro-intestinal tract ;

– Modification of the dietary habits for the biochemical and physiological processes training;

– Use of principles mechanical, chemical and thermal care of organs with their training;

– Local influence of the food on organs of gastro-intestinal tract;

– Methods of training, reducing diets and contrast days;

– Food intake — 5–6 times per day, variety of dishes.

Invalid food is necessary for complex treatment of patients with acute or chronic (in remission or an exacerbation) diseases. It is carried out under the medical control in hospitals. Invalid food is a food of people with chronic diseases out of an aggravation which is organized in dietary dining rooms, at the work , in health centre or at home.

Features of invalid food:

1. Influences a clinical picture of illness, character and types of development of a pathology;

2. Raises efficiency of other kinds of therapeutic treatment, reduces frequency of relapses and aggravations of chronic diseases or transition of acute diseases in chronic — a preventive role (hypertensive illness, a gout);

3. Can be the only thing (phenylketonuria) or to leaders (at diseases of alimentary canal, kidneys, a diabetes, adiposity**)** the therapeutic factor.

Invalid food includes 3 links influence on a human body:

1. Symptomatic diet therapy (is based on the account of the available symptoms of illness also provides concrete requirement of an organism for certain nutrients: proteins, vegetative cellulose, mineral elements, a complex of vitamins);

2. Organ specific diet therapy, considers injury of concrete organ or system;

3. Metabolic diet therapy provides adaptation of a chemical compound of a diet to character of certain disease.

Rational diet therapy assumes use of all three links (for example, stomach ulcer).

At construction of any diet following principles should be considered:

1. Maintenance of physiological requirements of the sick person in nutrients and energy.

2. Invalid food is based on the doctrine about the rational, balanced nutrition of the healthy person. There are 5 laws of a food for the healthy person, and 6 — for the patient:

– Energetic value of the daily ration should match the energy requirements of the organism;

– Physiological requirements of organism should be supplied with nutrients in the most useful amounts and proportions;

– Chemical structure of the food should correspond enzyme and digestive systems of the organism;

– Food consumption should be distributed correctly throughout the day;

– Food should not possess risks for health;

– Necessity of an establishment of balance between physiological requirements for food substances and energy and possibility of an unhealthy organism to their effective assimilation. The medical diets characterized by reduction or increase some nutrients at various diseases, should be used limited time depending on a phase and a disease stage. It is necessary to compensate short-reception of one nutrients (for example, proteins at rheumatism, an allergy) increase in a quota of fats or carbohydrates for satisfaction of a sick organism of necessary energy, and also to provide physiological requirement for vitamins, irreplaceable fat acids, mineral substances.

1. Should take a biochemical and physiological features of assimilation of food at the healthy and sick person into account. his position can be solved ***at the expense of following positions:***

– Individualization of the food based on growth, weight of a body and other, and results of researches of a metabolism at the concrete patient.

– Dietary correction of the ferment block of illness. For example, at a lack of the enzyme splitting lactose of milk — fresh milk replace with sour-milk products.

– The account of interaction of food substances in the alimentary canal. The raised maintenance of carbohydrates in a diet at chronic insufficiency of kidneys demands maintenance increase thiamine, regulating a carbohydrate exchange.

– Dietary correction the structurally — functional block. For example, stimulation of regenerative processes in organs and tissues by selection of necessary substances. At illnesses of a liver there are dystrophic changes hepatic tissue (a diabetes, adiposity, an alcoholism). Application choline, lecithin, zinc, sulfur-amino acids, vitamins B_6 and B_{12} improve structure of tissue of a liver and raise its antitoxic activity.

– Compensation of the food substances lost by an organism of the patient. In a case anemias in a diet it is necessary to increase the maintenance of iron, copper, of some vitamins and high-grade proteins of an animal origin.

– Dietary correction of the biochemical block of illness. So, at allergic diseases from tryptophan synthesis niacin (PP) is blocked and, on the contrary, is strenuously synthesized serotonin. In this case it is necessary to use products

with the low maintenance of tryptophan (dairy, meat of a rabbit, heart, carp), and also to enrich a diet vitamin PP that leads to hypoallergenic effect.

– Dietary correction of the immunological block. If immunity is lowered, the diet is enriched by biologically valuable balanced proteins of an animal origin and a vitamins and mineral substances (vitamins C, P, B_6).

– Dietary correction of normal microflora alimentary canal, respiratory tract, urogenital system.

– Dietary correction of the antioxidant block inclusion in a diet antioxidant complexes — vitamins A, E, C, beta-carotene, selenium, sulfur-amino acids, polyunsaturated fat acids.

– Dietary correction of the hormonal block. At the deficiency of hormones of a thyroid gland and adrenal glands include in a diet I-products, high-grade proteins, vitamins A, C, P.

– Diet change. Fractional ingestion (5–6 times a day) possesses.

2. The account of local and general influence of food on an organism. At local action the food influences sense organs (sight, sense of smell, taste) and is direct on an alimentary canal. Thus the food has mechanical effect which is defined by its volume, a consistence, crushing degree, character of thermal processing, qualitative structure (presence cellulose);chemical action is caused by substances which are a part of products or are formed at their culinary processing; temperature action — arises at contact to mucous membranes of a mouth, a gullet and a stomach. The general action of food is defined by change of structure of blood in the course of digestion of food and absorption food substances that conducts to changes of a functional condition nervous and endocrine systems, and then all bodies and organism systems.

3. Use of principles mechanical, chemical and thermal care of organs with their training.

It is reached by preparation of dishes without rough vegetative cellulose and connecting tissues (rough meat), improvement of a consistence of dishes at the expense of crushing, rubbing, beating, steaming, not use of products– Sources of essence (an onions, garlic, a garden radish), extractive substances (clear soup), peroxides and aldehydes (the products fried and prepared in hot fan), carbonic acids (the aerated drinks), the concentrated organic acids (vinegar, marinades), alcohol, and also strong tea and coffee. Thermal care reached by use of dishes with temperature 15–60 °C.

The important indicator of dietetic therapy is its dynamism. It is necessary to train an organism. Training is an expansion of strict diets at the expense of introduction of new less sparing products and dishes at the strict control over a condition of the patient. The training principle is carried out on **«step»** system and system **of «zigzags».** The «step» system provides gradual expansion of a strict diet at the expense of the dosed out removal of restrictions. The system of «zigzags» provides rather sharp, short-term change of a diet. Such diets are

called **contrast.** Contrast diets loading provide inclusion in a diet of the food substances which maintenance was or is sharply limited (cellulose, table salt), or they are at all excluded from a diet. Unloading diets are based on restriction of power value or connected with reorganization of a chemical compound of a diet. The purpose of these diets is quickly to facilitate functions of bodies and systems.

4. The account of the subjective relation of patients to a food.

This principle is based on display of the certain psychoemotional status of the sick person, the appetite of the patient can be lowered, taste inversion is shown, and there is an uncooperative altitude to diet observance. It is necessary to make the optimum menu, to choose various forms of preparation of dishes, not to use the same dish within a week, whenever possible to consider at a choice of dishes of a wish of the patient.

5. Diet strict observance.

Ingestion should be correctly distributed within day. Intervals between receptions should not exceed 4 hours. It is accepted to use 4–6 single food with caloric content depending on appointment of the doctor.

***Each diet should include*:**

1. Indications to appointment;
2. The appointment aim;
3. General characteristic — the main features of a chemical compound, grocery set and culinary processing;
4. Chemical compound and food value;
5. Intervals between ingestion; frequency of ingestions;
6. The list of admissible and counter-indicative products and dishes and the basic ways of their preparation.

There are **15 clinical diets** according to diagnosis. They have different modifications according to severity of disease, indications and contraindications, concomitant diseases, dietary and national habits.

15 diets or types of treating nutrition

№ 0 — liquid, used after surgery;
№ 1 — for peptic ulcer disease and exacerbations of gastritis;
№ 2 — gastritis with diminished secretion;
№ 3 — chronic constipations of alimentary origin;
№ 4 — bowel diseases;
№ 5 — liver and biliary tract diseases;
№ 6 — gout and urine acid diathesis;
№ 7 — renal diseases;
№ 8 — obesity;
№ 9 — diabetes mellitus;
№ 10 — cardiovascular diseases;
№ 11 — tuberculosis;
№ 12 — haematological diseases;

№ 13 — acute transmissible diseases;
№ 14 — susceptibility to stone formation, phosphaturia;
№ 15 — balanced nutrition within the hospital.

Test questions:

1. Classification of alimentary (nutritional) diseases.
2. Tell about diseases of the nutritional deficiency.
3. Tell about diseases of the nutritional excess.
4. What is the balanced nutrition?
5. What is the preventive nutrition?
6. Tell about clinical nutrition.

FOOD POISONONG

Food poisoning is any disease of the bacterial or toxic nature caused by the consumption of food.

There are three groups of food poisoning:

1 — Bacterial (microbial);

2 — Nonbacterial (nonmicrobial);

3 — Uncertain etiology.

The basic signs of food poisoning of microbial nature:

– Occurs singly (sporadic cases) or in outbreaks where two or more cases are related to food consumption.

– Has a short incubation period.

– Can`t be transmitted from man to man.

– Has a sudden onset, short duration of illness.

Classification of food poisoning of microbial nature:

1. Foodborne diseases (Escherichia coli, Proteus vulgaris, Clostridium perfringens type A, Bacillus cereus, Streptococcus faecalis and other).

2. Food toxicosis (intoxication):

– Bacterial (Staphyloccus aureus, Clostridium botulinum)

– Mycotoxicosis (toxin-producing moulds Aspergillus, Fusarium, Penicillium, Claviceps purpurea)

– Ficotoxicosis.

Foodborne diseases — an acute disease that emerged as a result of using food containing opportunistic (less pathogenic) microorganisms and their toxins.

Infecting agents (microorganisms) are Escherichia coli, Proteus vulgaris, Clostridium perfringens type A, Bacillus cereus, Streptococcus faecalis and other.

The source of infection:

– people who are sick, convalescents or healthy bacteriacarrier (kolienterit, cholecystitis, appendicitis, paraproctitis etc.). The greatest danger is posed by patients with light, blurred shapes of diseases;

– animals who are patients and bacillicarriers (gastroenteritis).

Transfer factor pathogen in the food mass are dirty hands, contaminated process equipment and kitchen equipment, rodents, water and soil.

Foods are sour cream, cottage cheese, meat products, etc.

The incubation period is 3–12 hours.

The clinical manifestations (1–2 days) of the disease: fever, chills (short), and then vomiting, diarrhea, abdominal pain, circulatory disorders (reduction in blood pressure, dizziness, fainting, cooling of the skin, especially in the distal extremities pale-cyanotic hue of skin. Dehydrated (loss of fluid and electro-

lytes) — secondary phenomenon in foodborne diseases (if there is vomiting and diarrhea).The total duration of illness may be 3–6 days.

The prevention of foodborne diseases:

1. Activities aimed at preventing contamination of food and ready meals pathogens:

– identification among workers in food manufacture of patients and carriers of pathogenic and opportunistic forms of microorganisms and timely treatment and sanitation of them;

– thorough sanitary and veterinary supervision of animal

– strict rules of personal hygiene and sanitary regime at the food company;

– avoiding contact and separation of flows of raw materials, semi-finished and finished products;

– transportation of products in specially designed transport and packaging;

– disinfection of equipment and inventory, control of insect and rodent infestation.

2. Activities aimed at ensuring an environment that prevents massive proliferation of microorganisms in food:

storage products and prepared food in a cold environment (not above 60 °C);

– sale of prepared food (1-x and 2 meals) at a temperature above 60 °C, snacks and drinks — below 14 °C;

– timeliness of products.

3. Compliance cooking technology:

– adequate cooked of food.

Food toxicosis (intoxication) is acute illness arising from eating food that contains toxins have accumulated as a result of a specific pathogen.

Should distinguish bacterial toxicosis (staphylococcal toxicosis and botulism), mycotoxicosis, fycotoxikosis.

Staphylococcal intoxication arises from ingestion of food containing staphylococcal enterotoxin. Staphylococcus does not alter the organoleptic properties of food.

Food are milk and dairy products, meat and meat products, salads with eggs, poultry, fish, potatoes, pasta and pastry with custard.

Rate of production of enterotoxin depends on food storage conditions (time, temperature), the chemical composition (carbohydrate, protein, fat), pH, etc. At room temperature in milk enterotoxin can be formed already after 8 hours. Aften contamination of staphylococcus milk in the refrigerator (4 °C) enterotoxin is not detected even at 18 day. In confectionery products with custard (cakes, pastries) enterotoxin accumulate after 4 hours at 37 °C.

Staphylococcus remains at a temperature of 70 °C for 30 minutes, and at 80 °C — 10 minutes. Staphylococcus enterotoxin is thermostable.

The sources of infection are:

– people (milkmaids and employees of food companies, confectioneries, milk factories) with the pustular disease of the hands (pyoderma, panaritium, festering cuts and burns, etc.). The dangerous people are sick person with angina, pneumonia, otitis media, and catarrhal diseases of upper respiratory tract.

– animals (cows, goats, sheep, etc..). The transfer factors — milk (in the presence of mastitis) and meat).

The incubation period is 2–4 hours.

The clinical manifestations of the infection: pain in the epigastric region, nausea, vomiting. In 60–70 % of cases there is diarrhea. Body temperature is normal or low-grade. There are signs of general intoxication (sometimes): weakness, muscle cramps, falling of blood pressure, thready pulse, acrocyanosis. Recovery usually occurs within 2–3 days.

The prevention of staphylococcal toxicosis:

– early identification of the individuals with inflammatory diseases of upper respiratory tract and pustular lesions of the skin, removal of their contact with ready-made dishes;

– refurbishment of Food facilities, timely treatment of dental diseases and nasopharyngeal, implementation of the prevention of the catarrhal diseases;

– sanitary and veterinary control of animal health;

– strict observance of the rules of industrial and personal hygiene;

– strict observance of technology of cooking.

Botulism — neuromuscular poisoning by Clostridium botulinum toxin. Botulism occurs in 3 forms: foodborne, wound and infant botulism.

Foods are meat, fish, vegetable products (vegetables, fruits, mushrooms, etc.), products without preliminary sufficient thermal processing. The poisoning usually arises in connection with the use in food of tinned products of house preparation (to 90 %), salted and pickled mushrooms, dried and smoked fish, and home sausage.

The incubation period is 12 to 36 hours.

The clinical manifestations of the infection: general weakness, headache; nausea, vomiting and diarrhea (in 10–20 % of cases).

Specific symptoms:

1. dry mouth, dizziness, double vision (diplopia), loss of accommodation and inability to open eyes fully (blepharoptosis);

– bulbar paresis (dysarthria, dysphagia, nasal regurgitation;

– paralysis of facial muscles;

– reduced salivation (xerostomia).

2. At normal or subnormal temperature, pulse resonant speeded.

3. Constipation and bloating.

4. Paralysis of respiratory muscles.

Infant botulism. The disease manifests as sudden constipation, loss of appetite, increased salivation, decrease behavioral responses.

Wound botulism linked to exposure clostridia in the wound, where they multiply and produce botulinum toxin, which causes specific symptoms.

Anti-botulinum serum is used for treatment.

The prevention of botulism:

– Proper home and commercial canning and adequate heating of home-canned food before serving are essential.

– Canned foods showing any evidence of spoilage should be discarded.

– Anyone known or thought to have been exposed to contaminated food must be carefully observed.

Mycotoxicosis — nutritional disease caused by eating food containing mycotoxins — toxins of the microscopic fungi (molds).

Ways of getting mycotoxins in the body are food (alimentary), by respiratory, by contact (through a skin).

Major producers Aspergillus flavus, Aspergillus parasiticus, Fusarium Graminearum, Penicillium expansum, Aspergillus carbonarius and etc.

The main mycotoxins are aflatoxins B1, M1, patulin, ochratoxin A, fumonisin B_1.

The main sources of mycotoxins are peanuts, corn, nuts, spices (pepper, nutmeg), milk and dairy products, wheat, barley, rye, corn, rice, fruits, vegetables.

Some toxic effects are hepatotoxic, teratogenic, immunosuppressive, neurotoxic and mutagenic.

The prevention of mycotoxicosis:

1. Breeding (it aim at disease resistance);
2. Harvesting during time;
3. Proper storage of grain;
4. Laboratory control of grain.

Fikotoxicosis — nutritional disease caused by eating food containing fykotoxins of algae and bacteria.

Sources fykotoxins are shellfish (mussels, oysters), crabs.

The prevention of fikotoxicosis — national regulatory authorities must declare the existence of potential danger eating shellfish and conduct periodic laboratory testing of seafood.

Classification of nonbacterial food poisoning:

– Food poisoning of plant origin;

– Food poisoning of animal origin;

– Mushroom poisoning;

– Chemical poisoning.

Look at the tabl. 10.

Table 10

Nonbacterial food poisoning

Poisoning by toxic products of nature	
Plant origin	Wild and cultivated plants (datura, belladonna) Seeds of weeds of cereal crops (chaff, Sophora). Mushroom poisoning (fly agaric, false Grebe).
Animal origin	Bodies of individual fish species, some mollusks. Some endocrine glands of animals (adrenal, pancreas).
Poisoning by toxic products under certain conditions	
Plant origin	The kernels of stone fruits of peach, apricot, cherry, almond, contain amygdalin; sprout (green) potatoes, containing solanine. Conditionally edible mushrooms (morels, russule etc.), without cooking.
Animal origin	Liver, eggs, milk, some fish during the spawning period (burbot, pike, mackerel, tench, barbel, etc.). Mussels and crustaceans acquire toxic properties of the summer as a result of feeding on planktonic organisms and brown algae**.**
Chemical poisoning	Pesticides, metals; compounds migrating from the packaging, packaging equipment; other chemical impurities

Food poisoning of plant origin:

Many wild and domestic plants contain poisons in their leaves and fruit. Common examples include yew, nightshade, castor bean, dieffenbachia (dumb cane), jequirity bean («Indian bean»).

Red kidney beans. A number of toxic substances can be extracted from the beans, but current evidence suggests that the hemagglutinin component is probably responsible for diarrhea and vomiting. Much of this substance is leached out by soaking beans for several hours, and thorough cooking will render them safe.

Solanine. Potatoes that are left to sprout or that are exposed to sunlight in such way that the skin surface becomes green, will accumulate the alkaloid solanine in skin and just below the surface. Peeling and washing will render them safe, but j**a**cket potatoes have caused some cases of poisoning.

Paralytic shellfish poisoning

From June to October mussels, clams, oysters and scallops may ingest a poisonous dinoflagellate (red tide) that produces a neurotoxin resistant to cooking.

Prophylactic measures of mushroom poisoning:

- Collect only known mushrooms;
- Adults should control children in collecting mushrooms;
- Only sorted mushrooms can be sold;
- Products in which mushrooms are cut and mixed can`t be sold.

Chemical poisoning may follow ingestion of unwashed fruits and vegetables sprayed with arsenic, lead, or organic insecticides; liquids served in lead-glazed pottery; or food stored in cadmium-lined containers.

Pesticides are used to control pests of various kinds on wheat seeds, fruit trees and vegetables. If ingested they are absorbed and particularly affect the CNS. Mortality is about 8 %.

Metals. Mercurials discharged into the sea may be taken up by fish and cause nephritis and CNS damage in people who ate them. Zinc leached from galvanized pans when acid materials, such as fruit, are boiled in them is toxic and causes acute abdominal symptoms.

Investigation of food poisoning — is a set of activities aimed at identifying the etiology of the disease and the factors contributing to its emergence, to implement the treatment and prevention of food poisoning.

Each case of food poisoning is subject to mandatory reporting.

GP or a healths professional that provided medical assistance to victims, as well as established or suspected food poisoning, are obliged:

1) immediately notify about a food poisoning Center for Hygiene and Epidemiology (CHE) by phone.

2) remove from use of the remnants of the suspected food and immediately prohibit the further implementation of these products;

3) take samples of suspected food, collect vomit and stool of affected, washings of the stomach and urine for bacteriological analysis. If there is evidence — take blood from the cubital vein for planting on blood culture (in the case of assisting a physician) and return to study in the bacteriological laboratory of CHE. All samples for analysis should be collected in a sterile dish.

Food poisoning investigation:

Stage 1:

– Presumptive epidemiological diagnosis and its characteristics.

Stage 2:

– Inspection of the object connected with a food poisoning case.
– Microbiological analysis of the stuff and equipment.
– Laboratory analysis of the biological materials from the patients.
– Blood analysis for the serum diagnostics.
– Internal organs investigation in lethal cases.

Stage 3:

– Decryption of the food poisoning mechanism.

Stage 4:

– Dangerous food utilization.
– Infection source isolation.
– Object disinfection.
– Bacteria reproduction prevention.

Stage 5:

– Compilation of the food poisoning
– Investigation Act.

Test questions:

1. Classification of food poisoning.
2. Tell about foodborne diseases.
3. Describe staphylococcal intoxication.
4. Describe botulism.
5. Tell about nonbacterial food poisoning.
6. Tell about investigation of food poisoning.

HYGIENE OF CHILDREN AND ADOLESCENTS

Hygiene of children and adolescents — medical science that studies the impact of natural and social factors in the growing organism, its interaction with the environment and developed on this basis, hygienic standards and requirements of various environmental factors and recreational activities aimed at promoting health, improving functionality and harmonic development of children and adolescents.

Objective: to study and development of hygiene education and training, a complex of recreational activities that promote health and physical development of children and adolescents.

Tasks of hygiene of children and adolescents:

1. Studies on the effect of natural and artificial factors, as well as working and living conditions for the development and health of the growing organism.

2. The growth and development of a healthy younger generation on the basis of hygienic principles for the organization of physical education.

3. Development of measures and regulations aimed at protecting and promoting the health of children and adolescents.

Basic patterns of growth and development of a growing organism

Growth — is the general biological property of living matter, expressed in quantitative changes: an increase of organs and body as a whole by increasing the size and weight of individual cells, a continuous increase in the number of cells themselves due to their division.

Development — a qualitative change in the transition from simple to more complex states. It lies in the morphological differentiation of cells, tissues and organs.

Ages of children and adolescents

1. The neonatal period (birth to 10 days).
2. Infants (from 10 days to 1 year).
3. Early childhood (from 1–3 years).
4. First childhood (preschool age from 3–7 years).
5. Second childhood (from 7–8 years to 12 years old boys and 11 girls).
6. Adolescence (13 to 16 years old boys from 12–15 years old girls).
7. Adolescence (from 17–21 years old boys from 16–to 20 years old girl).

Neonatal period

The main functions of the body in a state of unstable equilibrium:

– in the first 2–4 days are observed weight loss (6–10 %);

– icteric staining associated with a temporary failure of the liver and enhanced disintegration of erythrocytes;

– insufficient thermoregulation (body temperature can easily change with changes in ambient temperature).

Normally, all these functional changes disappear by the second week of life.

Infants (from 10 days to 1 year)

At this period marked the highest intensity of growth and development. The body length is increased approximately 1.5-fold, and weight — 3-fold. From 6 months start teething.

Fast paced neuropsychological development: the first months of developing the activities of all the senses, form positive emotions. By the year of the child may have to walk independently, formed the preparatory stages of the development of speech, begins the development of higher mental functions: attention, memory, thinking.

Some of the relative weakness of the organs and systems against a background of intense growth and development in this period of life can lead to more frequent cases of acute illness, the formation of variations in health (often exudative diathesis, rickets, anemia, and various digestive disorders).

Early childhood (from 1 to 3 years)

At this period marked ends the process of eruption of primary teeth.

After 2 years of absolute and relative values of the annual increase in body size decrease rapidly.

Begin to form complex functions of the brain develops speech (vocabulary of 200–300 words), rapid pace of morphological and functional development of all organs and systems.

With incomplete immunity associated diseases, even for minor violations of the nutrition and hygiene care. Each transferred the disease can lead to chronic diseases or lead to lag in the physical and neuropsychological development.

First childhood (preschool age from 3 to 7 years)

At this period marked the slower growth rate. The increase in body length per year on average 8 cm, body weight increase — about 2 kg. During this period, boys and girls do not differ from each other in size and shape of the body.

Starting from 6 years appear first permanent teeth.

Continuing growth and functional improvement of all organs and systems, as well as intensive development of intellectual abilities.

There is insufficient hardness of bones due to the predominance of organic matter over mineral (calcium, phosphorus, magnesium). This requires continuous monitoring of the correctness of posture while reading and writing, to avoid the appearance of spinal deformities.

Second childhood (from 7–8 years to 12 years old boys and 11 girls)

At this period marked revealed sex differences in size and shape of the body erated growth in body length. Growth rate in girls higher than boys, since puberty in girls starts on average 2 years earlier. About 10 years old girls outperform boys on the length and weight at shoulder width.

By 12–13 years in boys and girls completed a change of baby teeth to permanent teeth.

Increased secretion of sex hormones (especially girls), which begin to develop secondary sexual characteristics. In boys, the process of maturation is expressed to a lesser extent.

Ossification of the spine is not yet complete, it remains a danger of distortion during long voltage and improper posture at a desk.

In this age are not allowed **excessive** exercise. Indicated an incomplete fusion of parts of the skeleton, particularly the pelvis, which may cause displacement of the pelvic bones when jumping to incorrect splicing in the future and adversely affect the girls later in childbirth.

Adolescence 13 to 16 years old boys from 12 to 15 years old girl

Boys just beginning puberty in girls are already completed.

Observed a further increase in the rate of growth (puberty jump), which applies to all body sizes.

The greatest increase in body length in girls observed at the age of 11–12 years, boys — aged 13–14 years.

At this period marked rearrangement of the major physiological systems (musculoskeletal, circulatory, respiratory, digestive, etc), by the end of the functional characteristics of adolescents approaching the characteristics of an adult.

The boys especially intensively developed muscular system, formed secondary sexual characteristics.

The girls are continuing the development of mammary glands, growth of pubic hair and armpits. The clearest indicator of the degree of maturation of the female body is the first menstruation, whose appearance indicates the relative maturity of the uterus.

Adolescence from 17 to 21 years old boys from 16 to 20 years old girl

During this period largely completed the process of growth and the formation of the body, and all major dimensions of the body reach the final value of the adult.

Criteria for assessing the health of children and adolescents

1. The presence or absence at the time of the survey of chronic diseases.
2. The level of progress of physical and neuropsychological development and the degree of harmony.
3. Level of functioning of major body systems.
4. The degree of the body's resistance to the adverse effects.

The structure of chronic diseases

Chronic diseases appear at the age of 4–7 years.

The first place nasal disease (chronic tonsillitis) occurs.

The second place was short-sighted.

Third place incorrect posture, flat feet.

Fourth place diseases of the digestive

Fifth place neuropsychiatric disorders.

To assess the physical development of indicators are used:

somatometric — length, weight, circumference of chest;

somatoscopic — the degree of maturation, the bone and muscular systems, hypodermic fat;

physiometric — vital capacity, muscle strength of hands.

In assessing the physical development, primarily determine the child's age. Evaluation of physical development of children and adolescents based on the performance of the morphofunctional state, and it is the ratio of parameters of length and weight. In assessing the length and weight of each of the surveyed children is compared with normative values for children of the same sex and age living in the same area (with regional standards).

Methods of assessing the physical development:

1. Method sigma deviations (profiles of physical development).

2. The method of parametric analysis (regression method — regression scale).

3. The method of nonparametric analysis (method of dental — dental canals).

When evaluating the functional state of children and adolescents is determined by the functional state of the cardiovascular system, respiratory system, blood, nervous system. Reflects the functional state of CNS is the child's behavior. Estimated as a child (especially young children) is asleep, awake, what are his appetite, mood, emotional state, as it deals with children, for older children ages is important to know as they master the curriculum, whether fatigued during training.

GROUP HEALTH

Healthy. Are children without chronic diseases, age-appropriate physical and mental development, are rarely ill.

Healthy structure and function abnormalities.

This group includes children who have no chronic diseases, but there are certain deviations of morphological or functional nature (e.g., children with disabilities in physical development, not associated with endocrine disorders, with impaired posture, flattening of the foot, with a low degree of myopia, frequently ill, etc.).

Patients with chronic diseases in the compensation stage: are children who, despite the presence of chronic diseases, rarely suffer from acute illnesses, feel well and have high efficiency.

Patients with chronic diseases in the stage subcompensation: include children with chronic diseases, often ill, with reduced working capacity.

Patients with chronic diseases in the stage of decompensation: children in this group practically do not occur in pre-schools, secondary schools, because of health reasons to stay in special medical or educational institutions.

Factors influencing the formation of children's health:

– health and age of parents at the time of birth, complications of pregnancy and childbirth;

– Social Services (food, housing, lifestyle, family income, parental education, psychological climate in the family);

– epidemiology;

– environmental;

– factors of the learning process.

Indicators for assessing the health of children in child and adolescent facilities

– level of general and infectious diseases;

– health index (the percentage of long-term and frequently ill children);

– prevalence and structure of chronic diseases;

– percentage of children with normal physical development;

– distribution by health groups.

Principles of hygiene education and training of children

1. Systematicity.
2. Continuity.
3. Focus.
4. Differentiation.

Hygienic principles of physical education of children and adolescents

– an optimal motor mode, taking into account the biological needs of a growing body of movement and its functionality;

– differentiated application of methods and forms of physical education, depending on age, sex, health status and physical fitness of children and adolescents;

– systematic training, a gradual increase in load and integrated use of diverse media and forms of physical education, promoting the harmonious development, protection and health promotion;

– creating favorable environmental conditions during physical training and sports.

Test questions:

1. Hygiene of children and adolescents: definition, objectives, goals.
2. Age periods in the development of children and adolescents, their characteristics.
3. Child and adolescent health, which form its factors, the criteria of health.
4. Indicators and methods for assessing the physical development of children and adolescents.

LITERATURE

1. *Zolotareva, A. V.* General hygiene: lectures for english-speaking students / A. V. Zolotareva, N. V. Kartasheva, V. N. Bortnovsky. In 2 parts. Gomel, 2008.

2. *Makshanova, E. I.* Lectures on General Hygiene (in schemes and tables): training visual grant for the Faculty of Foreign Students (English medium) / E. I. Makshanova, E. A. Moiseenok, N.V. Roubanik. Grodno : GrSMU, 2008.

CONTENTS

Учебное издание

Борисевич Ярослав Николаевич
Рябова Надежда Владимировна

ОБЩАЯ ГИГИЕНА

GENERAL HYGIENE

Учебно-методическое пособие

2-е издание

Ответственная за выпуск Н. Л. Бацукова
Переводчики: Я. Н. Борисевич, Н. В. Рябова
Компьютерная вёрстка А. В. Янушкевич

Подписано в печать 01.11.12. Формат 60×84/16. Бумага писчая «Снегурочка».
Ризография. Гарнитура «Times».
Усл. печ. л. 4,18. Уч.-изд. л. 3,53. Тираж 50 экз. Заказ 550.

Издатель и полиграфическое исполнение:
учреждение образования «Белорусский государственный медицинский университет».
ЛИ № 02330/0494330 от 16.03.2009.
Ул. Ленинградская, 6, 220006, Минск.