Federal State-funded Institution of Higher Education
«Volgograd State Medical University»
Ministry of Public Health of the Russian Federation

Department of General Hygiene and Ecology

Manual

IN HYGIENE

for General medicine students, English medium

Part1

Volgograd, 2023

УДК 613(075) =20

ББК 51.2Я7+81.2 англ.

Authors:

Latyshevskaya N.I., Davydenko L.A., Levchenko N.V., Shestopalova E.L, Novikov D.S., Yakhontova E.V.

Reviewers:

I.G. Sidorova, , Candidate of Philological Sciences, Professor of the Department of Foreign Languages with the Latin Language Course VSMU

L.P. Slivina, Doctor of Medical Sciences, Professor, Head of profession-oriented department for hygiene courses VSMU

Manual in hygiene for General medicine students, specialty «General medicine» , English medium / authors: Latyshevskaya N.I., Davydenko L.A., Levchenko N.V., Shestopalova E.L., Yakhontova E.V., Novikov D.S.

- Volgograd: Publishing house: VSMU, 2022. - 103

The present manual in Hygiene includes chapters on environmental hygiene, hygiene of nutrition. The manual is designed for General medicine students studying in the specialty « General medicine », English medium.

Федеральное государственное бюджетное
образовательное учреждение высшего образования
«Волгоградский государственный медицинский университет»
Министерства здравоохранения Российской Федерации

Кафедра общей гигиены и экологии

УЧЕБНОЕ ПОСОБИЕ

ПО ГИГИЕНЕ

Для студентов лечебного факультета, обучающихся по специальности «Лечебное дело» на английском языке

ВОЛГОГРАД

2023

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Авторы:

Латышевская Н.И., Давыденко Л.А., Левченко Н.В., Шестопалова Е.Л., Новиков Д.С., Яхонтова Е.В.

Рецензенты:

Сливина Л.П., д.м.н., профессор, заведующий кафедрой профильных гигиенических дисциплин Института общественного здоровья.

Сидорова И.Г., к. ф. н., доцент кафедры иностранных языков с курсом латинского языка ВолгГМУ

Учебное пособие по гигиене для студентов лечебного факультета, обучающихся по специальности «Лечебное дело» на английском языке/ авторы:

Латышевская Н.И., Давыденко Л.А., Левченко Н.В., Шестопалова Е.Л., Яхонтова Е.В, Новиков Д.С.

- Волгоград: Издательство «ВолгГМУ», 2023. - 104

Учебное пособие по Гигиене содержит модули: «Коммунальная гигиена», «Гигиена питания». Учебное пособие разработано для студентов лечебного факультета, обучающихся по специальности «Лечебное дело» на английском языке.

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CHAPTER 1.

ENVIRONMENTAL HYGIENE

THEME 1.1

HYGIENIC EVALUATION OF CHEMICAL AND MICROBIAL POLLUTION OF AIR ENVIRONMENT OF LIVING, EDUCATIONAL, AND MEDICAL SETTINGS

The motivational description of the theme

Most people spend more than 70% of time indoors (in their houses, educational, therapeutic establishments, etc.). Therefore, their setting conditions should be up to the physical needs of the body as well as be conducive to both efficient labour and good rest. Comfortable indoor conditions depend on the layout of the building, type of construction materials, quality of the air in the room, illumination, noise, indicators of microclimate, etc. At this practical class we shall speak in detail about the air environment, about the factors contributing to its formation and measures which should be taken to optimize the quality of the air in the room.

The problem of the quality of the indoor environment has become especially pressing nowadays. It has been aggravated by the use of modern construction and decoration materials which may be responsible for the accumulation of chemical toxic and radioactive substances in the room. One aspect of this problem, i.e. "sick building syndrome" is of great significance to us. The term "sick building syndrome" refers to a number of complaints and symptoms developed by a person and caused by the chemical and physical factors of the indoor environment. The clinical manifestations of the syndrome are as follows: drowsiness, difficulty in swallowing, headache, irritation and dryness of mucous membranes, suppressed non-specific immunity. As a result, the general disease incidence, in particular of catarrhal diseases, has increased considerably over the past years.

Thus, providing optimum hygienic conditions in the room is considered as one of the basic ways of primary prevention of diseases.

The objective: to give an idea of the air environment as a factor which has a favorable effect on the health and work capacity and productivity of people; to consider the indoor environment as a factor which has an unfavorable effect on the human health causing non-specific symptoms and pre-pathologic conditions in the human body and developing certain diseases.

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2. Microbial contamination of the indoor environment.
3. Criteria to estimate indoor air quality.
4. The notion of ventilation. Natural, artificial ventilation, air-conditioning; rules of their installation.
5. Hygienic estimation of polymeric and synthetic construction materials. Their effects on the human health.

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1. Case problems (type 1, type2). The solution of case problems should be reported in writing.
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2.2 Calculation of ventilation capacity and air change rate in a classroom.
2.3 Calculation of the time required to air the classroom.
2.4 Making a conclusion and recommendations for optimizing the quality of the air environment in a classroom.

Reference information.

Term descriptions

ANTHROPOTOXINS are toxic, gaseous and waste materials.

NATURAL VENTILATION is infiltration of the outdoor air through different cracks in windows or doors as well as through air cavities in building materials. The term also refers to the ventilation of rooms through open windows, vents and fanlights for better natural air exchange.

ARTIFICIAL VENTILATION - the supply and removal of air by mechanically - fans and other devices. It is mainly used in industrial and public buildings. Artificial ventilation can be: a) supply (it is designed to supply fresh air to the room); b) exhaust, which serves to remove spoiled air from the room; c) supply and exhaust,it provides simultaneous supply and removal of air.

AIR-CONDITIONING is a system of ventilation which makes it possible to maintain automatically the optimum temperature of the air, air humidity, air velocity and air purity for a certain period of time.

AERATION COEFFICIENT is the ratio of the window area to the floor area.

VENTILATION CAPACITY is the volume of the incoming air per hour.

AIR CHANGE RATE is the number of times the indoor air is replaced with outdoor air per hour.

"SICK BUILDING SYNDROME" includes a number of complaints and symptoms developed by a person staying indoors for a long time.

Social Hygiene of Human Dwellings.

Hygienically, residential premises should be spacious, dry and light. They should be aired regularly. The air in the room should be clean and it should not

contain any hazardous substances or pathogenic microorganisms. The microclimate in the room should be favorable. Esthetically, the interior should be pleasing. The person should feel comfortable to have a rest or to work in the room.

1. *Orientation of residential premises.*

To provide sufficient lighting and heating of the room, one should be aware of the orientation of residential premises. The room should be accessible to sunlight. From 22nd March till 22nd September the exposure to direct solar irradiation (**insolation)** in the territory of Russia should be no less than 2.5 hours per day long. In this case buildings facing south or south-east are most beneficial. In the torrid zone, sun rays fall upright. Therefore, the room is hardly accessible to sunlight. In the frigid zone, however, sun rays are more oblique. Therefore, sun rays penetrate deeper into the room. In the torrid zone, residential buildings should not face west, because sun rays penetrate into the room in the afternoon when the air in the room and the walls of the residential buildings are warm enough. It can result in overheating. In the temperate zone, meridian orientation of residential buildings should have an angle of deviation of 19 – 22º from the meridian. In this case buildings usually face east or west.

2. *Construction materials.*

The main hygienic requirement imposed on construction materials is that they should have poor heat conductivity. This will protect buildings from over-cooling or overheating. For example, the wood has a heat conductivity factor of 0.15- 0.25; the brick – 0.5- 0.75; the concrete – 0. 9- 1.25.

Low sound-conductivity of building materials used in supporting structures is also of great importance.

Beside natural construction materials, such as wood, brick and stone, some polymeric construction materials are commonly used nowadays. They are cheaper, lighter, more solid and waterproof. It is much easier to clean them. However, they can be rather dangerous for human health.

A wide use of polymeric and synthetic construction materials threatens the health of a person due to *toxic monomers* released from the materials in the course of their wear and tear. Most monomers contain functionally active chemical groups and biologically, they are much more aggressive than polymeric construction materials, which are obtained from them. The toxicity level of polymeric materials depends on the constituents added to make the construction materials more commercial. These constituents include softeners, stabilizers, colouring agents, etc. They have an unfavorable effect on the environment too. The number of hazardous substances and the terms of their emission from polymeric materials depend upon their physical and chemical properties (volatility, steam tension, etc.), operating conditions (microclimate, sun rays, etc.), rate of their wear and tear (polymer destruction).

On the basis of general hygienic evaluation, which involves sanitary, chemical, physical, physiological, hygienic, toxicological and microbiological research (the scope of research is determined by the conditions in which the materials are used) the Centre for Sanitary & Epidemiological Control regulates the use of polymeric and synthetic construction materials. According to the results of a comprehensive

study, the Centre for Sanitary & Epidemiological Control gives permission to use polymeric materials (current inspection is carried out every three years). Hygienic research is carried out according to the rules of Sanitary Law (Item № 2.1.2. 729-99 "Polymeric and polymer-impregnated construction materials, goods and constructions. Hygienic requirements imposed on safe construction materials").

However, in some cases production technologies and the use of these materials are inadequate which results in mass diseases. The doctor who establishes the diagnosis of allergic, acute respiratory and other diseases should consider that the disease can be associated with the contact of people with polymeric and synthetic materials at home or at work. Unless the effect of the construction materials is eliminated, the treatment will not be successful.

Thus, the use of rubber linoleum in the wards of a hospital promoted the development of the symptoms of drug allergy. The withdrawal of the drugs did not improve the patients' condition. The patients were discharged from the hospital and they recovered shortly after the discharge. After changing the floor in the wards of the hospital, the patients did not develop the same symptoms any more.

Beside allergic reactions, substances which are emitted as a result of polymer destruction (such as phenol, formaldehyde, styrene, phtalates, xylyl, benzol, etc.), can have a general toxic effect.

Polymeric construction materials are good dielectrics. They keep electricity from escaping the body and thus, they have an unfavorable effect on metabolic and trophic processes which take place in the human body. Moreover, polymeric construction materials are able to produce static electric fields (dc fields) on their surface. When the fields are discharged, instantaneous electrolyte rearrangement occurs in the human body which results in changes of the central nervous system. Static electric fields at a level of 500 V/cm2 can have a mutagenic and **embryotropic** effect.

The specific nature of physical and chemical properties of polymeric construction materials can be the cause of the deterioration of the microclimate in human dwellings, of considerable vertical temperature fluctuations and air humidity changes. All these can cause influenza and some other catarrhal diseases as well as peripheral central nervous system diseases, for example radiculitis.

To prevent diseases caused by polymeric and synthetic construction materials, doctors should take the following measures:

1) When taking the history of the patient presenting with the symptoms of allergy, the doctor should find out what polymeric and synthetic building materials are used at home and at work, notably: flooring, interior, decoration, furniture, carpets, etc. The doctor should also find out whether avoiding the contact with polymeric materials improves the patient's condition.

2) When establishing the polymeric material which provoked the disease in one or several patients, the doctor should inform the Centre for Sanitary and Epidemiological Control about the cases. He should do it in writing within 3 days from the day the cause of the disease has been revealed. The report should be signed by the Principal Doctor of the hospital.

3) The doctor should carry out sanitary and educational work among the population. The doctor should promote the use of natural construction materials for decorating their flats. At the same time they should convince people to reduce the amounts of polymeric and synthetic materials used in construction or to use these materials according to hygienic standards.
4) The doctor should control the use of polymeric and synthetic materials in constructing, reconstructing or redecorating patient care institutions.
Polymer materials which are permitted to be used for building and redecorating various settings are listed in *Polymer and polymer-containing materials and structures permitted for use in construction industry.*

Possible ways of using polymeric materials

According to maintenance conditions, duration of people's stay in the building, their physiological state and climatic region, some types of buildings are singled out:
Type A. Houses/dwellings. Pre-school educational establishments. Children´s homes. Patient care institutions. Nursing and residential homes. Sanatoria. Rest homes. Educational establishments. Sports facilities. Personnel facilities.
Type B. Enterprises of food industry. Public catering services. Hotels. Durable goods shops. Communication agencies. Consumer service venues. Entertainment and performance venues. Governmental offices.
Type C. Industrial venues, auxiliaries. Warehouses.
Note: 1. It is not allowed to use polymeric construction materials for covering the floor, decorating the interior of educational establishments for pre-school children and children´s homes.
2. Polymeric construction materials, which are not included in the list, can be used according to the documentation approved by the Russian Federation Public Health Ministry.

Table 1

№	Name	Type of building
	Flooring materials	
1.	Multilayer and single-layer PVC linoleum without sub-base	A-C
2.	PVC cloth supported linoleum	A-C
3.	PVC floor tile	A-C
4.	PVC expanded cloth supported linoleum	A-C
5.	Special PVC floor covering	B-C
6.	Pressed PVC tile	B-C
7.	Alkyd linoleum mats	A-C
8.	Roll chemical floor covering	B-C
	Heat- & sound-insulating materials	

9.	Insulating plastic foam board based on one-step and phenol- formaldehyde resins	A-C
10.	Phenolic plastic	B-C
11.	Wood wool building slabs	B
12.	Mineral wool synthetic binder boards & mats	A-C
13.	Urea-fomaldehyde foam	A-C
	Wall & ceiling finishing materials	
14.	PVC decorative film	A-C
15.	Paper-base PVC film, isoplan	B-C
16.	PVC finishing agent	B-C
17.	Polystyrene tile	B-C
18.	Polystyrene decorative tile	B-C
19.	Lining plastic panels	A-C
	Adhesive, reinforcement, paintwork materials	
20.	Busitilat adhesive	A-C
21.	Isotal floor covering adhesive	A-C
22.	Mastic	C
23.	Nitrocellulose putty	B-C
	Paints	
24.	Water-based paint	A-C
25.	Outdoor isoprene paint	A-B
26.	Pentaphthalic paint	B-C
	Vanishes	
27.	Polyester varnish	A-C
28.	Pentaphthalic enamel	B-C
29.	Nitrocellulose lacquer	B-C

NOTE**:** When making the diagnosis of an allergic, acute respiratory or some other diseases, the doctor should consider that the disease can develop due to the exposure to polymeric and synthetic materials at home or at work. This gave rise to the development of *Guidelines on prevention of diseases due to the exposure to polymeric materials*.

2. Layout and size of rooms

The layout of a flat is well-planned when its rooms are cross-ventilated. It means that windows should be at the opposite sides. It is important both for keeping the air clean and choosing the most appropriate room for work and rest away from street noise and other nuisances. Thus, the method of cross ventilation of rooms is reasonable in all climatic regions, except the frigid zone.

The depth of the living area should not exceed 6 m. The minimum size of the living area per person in Russia is 9 m², which is going to be increased up to 12 m². The height of the room is determined according to the peculiarities of the climate, required air space per one person and the system of ventilation. There are the following standard heights for rooms: in a frigid zone – 2, 7 m, in a temperate

zone – 3 m and in a torrid zone - 3, 2 m. In hostels, which are intended for sleeping in and resting, the minimum living space per one person is 6 m².

Table 2

Area of the rooms in medical settings

Hospital settings	Area (m ²)
Area per one bed in wards of different profiles and capacities	
1. Hospital wards for one bed:	
Wards of Intensive care	18
Wards for children up to 7, with twenty-four-hour presence of mothers	12
Wards for adults and for children over 7 years	14
2. Hospital wards for two or more beds:	
Intensive care units	13
Isolation ward for infectious diseases including tuberculosis for adults	8
Isolation ward for infectious diseases including tuberculosis for children up to 7 years	8
For adults	7
For children up to 7 years	6
3. Venues for consulting, treating and diagnosing patients:	
Doctor's office for seeing adult patients	12
Dressing room	18
Medical treatment room	12
Massage room, manual therapy room	8 for 1 place
Functional diagnostics unit	16

Table 3

The area of the room in basic educational settings per person (m²)

1	School classroom area	2,5
2	School classroom area for group work	3,5
3	Assembly hall area	0,65
4	Library area	0,6
5	University laboratory area	4
6	University classroom area	2,2
7	Lecture-hall area	1,1

3. Ventilation of rooms

Rooms in different types of buildings are ventilated to timely eliminate excess heat, moisture and hazardous gaseous substances found in the air. The air in poorly ventilated buildings can have a negative effect on human health, as well as aggravate pulmonary, cardiac, renal diseases due to the changes in its chemical

and bacterial composition, physical and other properties. The volume of the air to be exchanged depends on the number of people in a room, its cubic volume, type of work done in it.

The volume of the incoming and outcoming air is determined on the basis of different indices, one of them being carbon dioxide content. The permissible concentration of carbon dioxide in the air should not be exceeded. It should not exceed 1 ‰ (0, 1%). Air purity in a room is ensured by the required volume of air per person, i.e. by the so-called air or ventilation space per person as well as regular air exchange. Thus, in living quarters the standard air space should be 25 – 27 m^3 per person and ventilation rate – 37, 7 m^3. Therefore, to replace the vitiated air with fresh air, it is necessary to ensure approximately 1.5-fold exchange of the room air for the outdoor one per hour. Thus, air change rate is considered as one of the main criteria of the intensity of ventilation.

3.1. Types of ventilation

3.1.1. *Natural ventilation.*

Air exchange by means of infiltration ensures ½, ¾-fold air exchange per hour. Epidemiologically, it is not sufficient. Therefore, special vents and fanlights are used for airing the room. The size of a vent should be no less than 1/50 of the area of the floor (i.e. *aeration coefficient*). Cross ventilation should be created as it will ensure rapid air exchange without cooling walls and other surfaces thus preventing the so-called radiation cooling of the body. Sometimes, it is necessary to install fanlights which are open at an angle of 45º. In this case cold air first goes up to the ceiling, it partly warms up there and goes down without creating a cold airflow and causing overcooling. In many buildings, however, exhaust channels are used. In the upper part of the exhaust channel there are special intake openings. The channels usually pass into an exhaust shaft in the attic where the air goes out. This system of natural ventilation is based on natural air draft.

3.1.2. *Artificial ventilation.*

Artificial ventilation is usually used in public facilities intended to hold a great number of people at the same time, as well as industrial enterprises. There may be local (canopy, exhaust hoods, etc.), and central (general) ventilation. When air supply and air removal are considered, ventilation systems are divided into plenum systems, exhaust systems, plenum and exhaust systems, and recirculation systems.

3.2. Sanitary indices of the efficiency of air ventilation.

Sanitary indices of the efficiency of air ventilation in living and public settings are as follows: smell (or absence of smell), concentration of carbon dioxide in the air, temperature of the air, air humidity, air velocity, bacterial content in the air. If the air is polluted with chemical contaminants, the degree of air pollution should be determined.

The significance of carbon dioxide in the indoor environment.

Carbon dioxide plays a significant role in our life. Life on the Earth would not exist without carbon dioxide. Besides, it is a physiological stimulus of the respiratory centre when its concentration in the air is 0, 03 – 0, 04%.

Inhaling highly concentrated carbon dioxide can result in impaired oxidation and reduction processes. When the concentration of carbon dioxide in the air increases to 4%, one can develop headaches, tinnitus, palpitation, agitation. When the concentration of carbon dioxide in the air is 8%, it could be fatal.

Air purity of in a room is evaluated considering the concentration of carbon dioxide in the air. High concentration of carbon dioxide in the air usually suggests inadequate sanitary conditions (overcrowding, poor ventilation, etc.).

The higher the concentration of carbon dioxide in the air, the worse some other physical properties of the air. For example, when the temperature of the air and air humidity increase, the number of microorganisms in the air increase as well and anthrapotoxins begin to appear in the air.

Anthropotoxins include the following substances: dimethylamine, benzol, methylethylkethon, hexane, methylbenzene, mercaptan, indole, ammonia, nitrogen oxides, etc. The content of these substances in the air depends on the number of people in the room, duration of their stay indoors, type of work done, etc.

Concentration of anthropotoxins in the air is inversely proportional to the air supply. If the air supply is 120 m^3/h, the index of reduction of anthropotoxin accumulation in the air should be 80 – 85%. In these conditions the air can be cleaned up easily.

As the concentration of carbon dioxide in the air increases and microclimatic conditions worsen, ionization of the air changes as well (i.e. the number of heavy ions increases and the number of light ions decreases). It can be due to light ion retention during respiration and contact to skin as well heavy ion delivery with the exhaled air.

When estimating the quality of the air in the indoor environment, the concentration of carbon dioxide in the air should be considered. The maximum permissible concentration of carbon dioxide in the air is 0, 07% (for patient care settings) and 0, 1% (for residential and public venues). The latter is accepted as the calculation value when estimating the efficiency of ventilation in living and public facilities.

4. *Microflora of the indoor air.*

Microbial contamination of the air is of great epidemiological importance as air is the most common medium through which airborne and droplet infections, including dust borne infections, are transmitted to a person. In case of airborne and droplet infections, such as influenza, acute respiratory diseases, tonsillitis, diphtheria, etc., bacterial contamination occurs as small particles of saliva and sputum get into the air when a person coughs, sneezes or speaks. Dustborne infections are transmitted when inhaling airborne dust which forms as infected droplets released from human respiratory passages get dry. Airborne dust which is found in the air remain infective for 2 – 3 hours, however, some viruses, such as influenza virus, diphtheria rod, etc., have been proved to survive for 3 – 4

months. Dust and bacterial contamination of the air is interdependent: great amounts of dust in the air can rapidly increase bacterial contamination of the air. Thus, if the air has been cleaned up, the bacterial contamination of the air decreases.

The degree of bacterial contamination of the indoor air depends on air exchange, sanitary conditions of the room, number of people in the room, observation of the rules of personal hygiene, etc. These factors should be well considered in patient care institutions when admitting inpatients. No more than 750 microorganisms per 1 m³ should be in the air in summer and 150 – in winter. The indoor pure air should contain no more than 1500 microbes per 1 m³ in summer, however, in winter these amounts should be no more than 4500 per 1 m³.

Table 4

Permissible levels of bacterial contamination of the air in medical settings

Room	Total number of microorganisms in 1 m^3	Content of *Staphylococcus aureus* in 1 $м^3$ of air	Content of Gram-negative bacteria in 1 $м^3$ of air
Operating rooms having 10-20 or more air changes (prepared to be used)	No more than 100	None	None
Resuscitation wards	No more than 1000	No more than 4	None
Isolation wards/cubicles (before patients have been accommodated in them)	No more than 50	None	None
Isolation wards/cubicles (after patients have been accommodated in them)	No more than 250	No more than 1-2	No more than 1-2
Medical treatment room (before use)	No more than 50	None	None
Medical treatment room (after used)	No more than 2000	No more than 1-2	No more than 1

Bacterial contamination of the air**,** especially if it is increasing is considered to be a sign of poor sanitary conditions.

5. Electric properties of the indoor air (ionization of the air).

The term “ionization of the air” is usually referred to the breakdown of the air into molecules and atoms when exposed to such external factors as nuclear radiation, ultraviolet radiation, luminous radiation, cosmic radiation, water atomization. Light aero ions, whose velocity is 1 – 2 cm/s, can exist for 1 – 2 min. and then, they recombine rapidly. Light aero ions can attract airborne dust particles and microbe bodies thus turning into neutral, heavy and super heavy

ions. Ions are not only produced in the atmosphere but also destroyed as oppositely charged ions bind together. These processes constantly occur in the atmosphere accounting for ionization equilibrium. The number of light ions varies greatly depending on geographical and geological factors, weather, air contamination.

Ionization mode is determined as the ratio of the number of heavy ions to that of light ions. The greater the degree of the air contamination, the higher this ratio is. For example, in the area of public resorts the content of light ions should be 2000 – 3000 per cm^3, in industrial areas it should be 200 – 300 per cm^3 and even less. Decreased number of light ions in the air is a sign of poor sanitary condition of the air. Observation of the changes in the ionization of the indoor air also testifies to it (e.g. in the residential area, at school, at the cinema, etc.). It is noteworthy that the number of light ions in the air decreases when the microclimatic conditions of the air worsen and the concentration of carbon dioxide in the air increases. Light ions are easily absorbed by the skin, clothes and linen. When one breathes, great amounts of heavy ions are released into the air. It should be mentioned that aero ions have a multifaceted effect on the human body. Electron exchange in the pulmonary tissue as well as neuro-reflector responses to the stimulation of skin and mucous receptors of the respiratory tract by aero ions underlie the physiological mechanism of the action of the ionized air. High concentrations of light ions have a favorable effect on gaseous exchange and mineral metabolism, accelerate healing of wounds. At present, artificial negative air ionization is used in treating essential hypertension, bronchial asthma and allergies. Positive ions, however, have a depressant effect and they can cause drowsiness, depression, reduced work capacity and productivity of people.

Appendix

Calculation of ventilation capacity and air change rate in the indoor environment

Ventilation capacity is the volume of the incoming air per hour. It is calculated either per person or per room.

Air change rate is the number showing how many times the indoor air has to be replaced with the outdoor one.

Air change rate in the indoor environment is calculated in the following way: the volume of the incoming and outcoming air within a certain period of time (Y) should be determined and its value should be divided by the cubic volume of the room (K):

$$\textbf{Air change rate} = Y / K$$

The volume of the incoming or outcoming air is calculated as follows: the area of a vent should be multiplied by the air velocity. The air velocity is usually measured with the help of an anemometer which is placed in the centre of the vent. The air velocity is measured for 5 minutes. Then, the average air velocity (mps) should be calculated.

Case problem 1: The room with an area of 0, 4 m² was aired for 5 minutes. The total volume of the incoming air should be calculated using the following equation:

2 m/sec. · 0, 4 m² · 300 sec. = 240 m³

The cubic volume of the classroom is 165 m³. Hence, the air change rate can be calculated using the following equation: 240 : 165 = 1, 4. The given air change rate should be compared with the required one using the following formula:

$$S = \frac{22,6 \cdot N}{(P - 0,4) \cdot K}$$

where,

S – unknown value (ventilation rate);

22, 6 – carbonic acid (liters) inhaled by an adult per hour;

N – number of people in the room;

P – permissible concentration of carbon dioxide in the room, ‰;

0, 4 – average value of carbon dioxide in the air, ‰;

K – cubic volume of the room, m³.

The idea of the required air change rate enables us to calculate the time necessary for airing the room. The number of people in the room should be considered as well.

Case problem 2: The time necessary for airing the classroom having an area of 165 m³ and a vent having an area of 0, 4 m² should be calculated. There are 10 people in the room. One can calculate the required air change rate using the following formula:

$$\frac{22,6 \cdot 10}{(1 - 0,4) \cdot 165} = 2,3$$

Thus, the air should be changed 2.3 times in the classroom per hour. In other words, 379 m³ of air enters the room through an open vent (i.e. 165 m³ · 2, 3). The time necessary for airing the classroom can be calculated using the equation:

$$\frac{379 \text{ m}^3}{0,4 \text{ m}^2 \cdot 2 \text{ m/sec}} = 473 \text{ sec. or } 8 \text{ min.}$$

<u>Conclusion:</u> The time necessary for airing the room and providing a 2.3-fold air change rate is 8 minutes.

Air velocity measurement technique

As a rule, air velocity is measured with the help of either an anemometer or a catathermometer. It depends on the air velocity. The work of the dynamic anemometer is based on the rotation of the vanes attached to the central axis of the anemometer. For measuring high air velocity (more than 1 m/sec.) a cup (wheel-type) anemometer should be used. If the air velocity is within 0.3 to 1 m/sec., however, a vane anemometer should be used.

Before measuring the air velocity, it is necessary to record the initial readings of the anemometer. The readings of the system of thousands and hundreds on the small scale of the anemometer should be recorded first and then the readings of the decimal system and the system of the whole numbers on the large scale of the anemometer. Thus, if the hand of the anemometer is between “3” and “4” on the scale of the thousands, it will correspond to “7” and “8” on the scale of hundreds. If it reads “75” on the large scale, the initial readings of the anemometer should be recorded as follows: “3775”.

The anemometer is placed so that the impeller should be in the current of the air, above or below the centre of the vent. As soon as the vanes of the anemometer begin to rotate, the readings of the anemometer should be recorded thoroughly for 3 minutes. The required air velocity should be calculated by subtracting the given readings of the anemometer from the initial ones.

THEME 1.2
HYGIENIC EVALUATION OF AN INSOLATION MODE, NATURAL AND ARTIFICIAL LIGHTING OF LIVING, EDUCATIONAL, AND MEDICAL SETTINGS

The motivational description of the theme.

Light, electromagnetic radiation from 400 to 760 nm (nanometer) capable of producing a visual sensation, is one of the most essential components of the environment. It has a specific effect on eyesight and a person's ability to perceive light. Light gives more than 80% of information from the environment. It has a favorable effect on the human body, stimulates the person's vital activity, promotes metabolic processes, work capacity and productivity, improves general well-being and mood.

Light makes the environment healthier, i.e. "Where the sun does not shine, the doctor often comes". Inadequate, irrational lighting has a negative effect on the functioning of the visual analyzer. It increases its fatigability and that of the central nervous system. Bad lighting at a work place usually results in decreased work capacity and productivity of people and causes occupational traumatism.

The doctor has to be able to estimate the risk of inadequate lighting for the health of the patients as well as to give recommendations on the arrangement of lighting in a doctor´s office, operating room and in some other buildings (e.g. patient care institutions, educational establishments, houses, etc.).

The objective: to teach how to prognosticate visual malfunctions and decreased working capacity due to improper lighting; to learn the principles of arranging and monitoring natural and artificial lighting.

Students' classroom activities

1. Estimation of indoor natural lighting.
2. Estimation of indoor artificial lighting.
3. Stability of distinct vision**.**
4. Case problem (type 1, type 2).
5. Presenting and discussing individual students' reports.

Students' independent activities

1. Light & lighting. Hygienic importance of lighting.
2. Hygienic evaluation of an insolation mode in living, educational and patient care settings.
3. Hygienic evaluation of indoor natural lighting.
4. Hygienic evaluation of indoor artificial lighting.
5. Physiological methods of evaluating lighting sufficiency.

Plan of students' independent activities

1. Case problems. The solutions of the case problems should be reported in writing.
2. Examination and estimation of natural lighting/daylight in a classroom using the following indicators: light factor (LF), angle of incidence, aperture angle, daylight factor (see appendix).
3. Calculation and evaluation of the artificial lighting level in a classroom
4. Determination of the stability of distinct vision.

5. Drawing a conclusion about the conditions for the work of the visual analyzer in the classroom.
56. Presenting and discussing individual students' reports.

Reference information

Term descriptions

NATURAL LIGHTING is referred to as direct or indirect (reflected) light which penetrates through window openings and/or doors in the outer enclosing structures.

INSOLATION is referred to as penetration of direct solar rays through window and door openings.

COMBINED LIGHTING is a combination of natural and artificial lighting.

COEFFICIENT OF NATURAL LIGHTING is the ratio of natural lighting at a certain point within a building/room produced by direct or indirect light to the simultaneous value of external horizontal lighting produced by the light coming from a completely cloudless sky (it is expressed in %).

LOCAL LIGHTING is the lighting supplementary to general lighting produced by lamps whose light flux is directed immediately towards workplaces.

GENERAL LIGHTING is the lighting produced by the lamps regularly spaced in the upper part of the room or directed towards the equipment.

LIGHT CLIMATE - a total of all the natural lighting conditions in a certain area over the period of 10 years.

LIGHT FACTOR is the ratio of the glass area of windows to the area of the floor.

MIXED ILLUMINATION is the lighting when insufficient daylight is complemented with artificial lighting.

ANGLE OF INCIDENCE is the angle at which a light ray strikes a horizontal area in a room (e.g. desk, etc.); it is formed by two lines, a horizontal and a vertical one. The former is drawn from a certain point (the surface of the desk) to the lower edge of the window; the latter is drawn from a certain point to the upper edge of the window.

APERTURE ANGLE is the angle which determines the area of the sky which immediately illuminates the working surface. It is formed by two lines, upper and lower. The former is drawn from a certain point to the upper edge of the window, the latter is drawn to the highest point of the opposite building or tree.

STABILITY OF DISTINCT VISION is the ability of the eye to discern small pieces over a period of time.

Appendix

ESTIMATION OF NATURAL LIGHTING

Geometrical method

Determination of light factor

1. Measure the glass area of the windows in the room (window frames shouldn't be considered).
2. Calculate the glass area.
3. Determine the total area of the room.
4. Divide the glass area of the windows by the area of the room.

Standard light factor is as follows: in patient care institutions it is 1:4-1:6; in residential buildings - 1:8-1:10.
This method of estimating the light factor is rather simple, however, it has some limitations. It does not consider orientation of buildings, dimming caused by opposite buildings and/or trees, etc.
The estimation of natural lightning considering the shape and location of windows, height of the opposite buildings, the distance from a workplace to the window involves determining entrance angles, i.e. the aperture angle and the angle of incidence.

Determination of the angle of incidence (pic 1)

1. Measure the horizontal distance from the workplace to the window (L).
2. Measure the height of the window.
3. Determine the ratio H:L = tg.
4. Determine the angle of incidence of light as the tangent of an angle (use "Table of natural values of tangents")

The standard angle of incidence of the workplace should be no less than 27º.
The more the angle of incidence, the better lit the room is. The further the desk is from the window, the less the angle of incidence is. Hence, it is more poorly lit.

Determination of the aperture angle (pic 2)
1.Determine the auxiliary angle. The student should sit at a desk and visualize drawing a line from the surface of the desk to the highest point of the opposite building which can be seen through the window. Another student should mark a certain point on the glass of the window through which this line passes. The student should measure the vertical distance from the plane of the window-sill to the given point. Then, the ratio of this distance to the horizontal distance from the workplace to the window which was determined when we calculated the angle of incidence should be calculated. It is the tangent of the auxiliary angle. The value of the auxiliary angle should be determined according to the "Table of natural values of tangents".
2. Determine the aperture angle. It can be calculated using the following equation:
Aperture angle = Angle of incidence – Auxiliary angle
The standard aperture angle should be no less than 5º.
The larger the sky area seen from the window, the more the aperture angle is. Hence, the room is better lit.

LIGHT MEASUREMENT (most rigorous method)
This method is used for quantitative assessment of natural lighting by calculating daylight factor. The latter is the integrated index of daylight level considering all the factors influencing its distribution in the room.
Determination of coefficient of natural lighting. Measure natural lighting (NL internal) in a certain point, namely, at a distance of 1 m from the wall which is

most distant from the window and door openings and at the intersection of vertical centre section of the room and the working plane. It is measured in lux, by a luxmeter.

1. Light intensity in an arbitrary point in the same horizontal plane lit with diffused sky light (NL external) should be measured too.
2. The daylight factor can be calculated using the following equation:

Coefficient of natural lighting = (NL (internal) / NL (external)) x 100%

The standard coefficient of natural lighting **(**minimal values) considering the parameters of visual work done in this room:
operating-room, laboratory, classroom – 1.5%;
doctor´s consulting room, treatment room – 1%;
residential premises, ward – 0. 5%.

Evaluation of artificial lighting

Evaluation of sufficient lighting is based on the level of luminous flux density, i.e. lighting intensity.

Methods of lighting measurement

1. Photoelectric (using an objective lux meter);
2. Computation method based on lamp specific output (Watt method).

Approximate method of computing artificial lighting (Watt method):

1. Calculate the number of lamps in the room.
2. Calculate the total lamp wattage in watt (by multiplying the number of lamps by lamp wattage).
3. Calculate specific output in watt/m² (by dividing the total wattage by the total area of the room).
4. Calculate artificial lighting in lux (by multiplying specific output by the L coefficient which shows the number of luxes generated by the specific output equal to 1 watt/m²). The standard coefficient L for 100 watt incandescent bulbs is 2.0; the standard coefficient L for 100 watt and more powerful incandescent bulbs is 2.5; the standard coefficient L for luminescent lamps is 10.

Intention of a building, type of work performed in the room, small-sized objects necessary for work, a distance from the person's eyes to them, contrast between the object and its background, the speed required for the distinction of the objects, adaptation conditions for the eyes, presence of dangerous objects which can cause occupational traumatism should be considered when estimating the quality of artificial lighting in the room.

Table 1

Standard artificial lighting

Type of room	Minimum permissible lighting, lx
1. Educational establishments:	

Classroom, consulting-room	300
Classroom for drawing	500
Gymnasium	200
Rest room	150
Hall, lavatory	75
2. Pre-school educational establishments:	
Nursery, playing-room, dining-room, a room for musical studies	200
Bedroom	75
3. Residential buildings:	
Room, kitchen	100
Bathroom, hall	50
4. Patient care institutions:	
Operating room, resuscitation room (general lighting)	500
Operative (surgical) site (combined lighting)	2000-30 000
Doctor´s consulting room	300
Ward	100
Dental office (general lighting)	500
Patient's oral cavity (combined lighting)	3000-4000
Pharmacies	
Workplace of a dispenser in a public service room	300
Personnel, clean and packaging rooms	400
Wash room	150

All the standards above are relevant to lighting produced by luminescent lamps. If incandescent bulbs are used, artificial lighting standards are twice as low. As visual sensitivity to light produced by luminescent lamps is lower than that produced by incandescent bulbs, lighting intensity produced by luminescent lamps should be 2-3 times higher in similar lighting conditions.

Physiological methods of evaluating lighting

In addition to light measurement methods lighting sufficiency can be evaluated by studying visual acuity, stability of distinct vision and other functions of the visual analyzer (speed of visual distinction, time required for dark adaptation, etc.) These methods involve determining visual fatigue during visual performance which largely depends on lighting conditions.

Determining the stability of distinct vision

A subject fixes his eyes on a small, hardly discernible part – a broken Landolt ring depicted in a table for testing visual acuity (at a distance of 2.5-3 meters) for 3 minutes. The part can be either clearly discernible or fuzzy and obscure. The subject should signal the moments (e.g. by raising a finger) when he can't see the part quite clearly and when it becomes sharp again (by lowering a finger). Another student should record the time when the finger is raised or lowered.

When the test is over, a total of all the **time spans** when the part was sharply seen should be calculated. The stability of distinct vision is determined as the ratio of the total time of distinct vision to the total test time (180 sec.) in % .
It is necessary to test the stability of distinct vision before work, 1, 2 or hours after it started to determine the degree of visual fatigue and evaluate lighting conditions. This can also help observe the way the function depresses over time. When the lighting is sufficient the results of final measurements will approximate to their initial values in similar lighting conditions. When the lighting is insufficient there will be a sharp decline in the stability of distinct vision: in three hours of visual performance when the lighting is 200-300lx only by 10-15% (in relation to the initial value taken as equal to 100%), when it is 100lx – by 26%, when it is 50 lx – by 63%).

Table 2

Description of light sources

Type of a lamp	Description
Incandescent lamp	Easy to handle. Predominance of the yellow and red parts in the spectrum. Low efficiency coefficient. Inefficient use of electric power (5% – light, (95 % - heat). They run hot, heat up the air. Considerable brightness of filaments. Short life cycle.
Quartz-halogen bulb (sophisticated incandescent lamps)	High luminary efficiency. Stable bright light during the whole life cycle. Long life cycle. Small size. Possibility to regulate light flux High level of security
Luminescent lamps	Emission spectrum similar to that of daylight High luminary efficiency. Low heating temperature. Cycle economy. Extended life cycle. A start-control device (noise). Light flux pulsation. Utilization problems (presence of mercury).
Energy saving bulbs (compact fluorescent lamps)	Emission spectrum similar to that of daylight High luminary efficiency Low heating temperature Cycle economy. Extended life cycle. Small-sized lamps. New generation start-control devices (noiseless). Devoid of optical effects of flickering.

	Utilization problems (presence of mercury).

Table 3

Orientation of buildings according to the part of the world in different climatic regions

Climatic region	Orientation according to the part of the world	Colour gamma
I (cold)	South, Southeast, southwest	Warm colors (orange, pink, beige, yellow)
II (moderate)	South, Southeast, southwest	
III(warm)	South, Southeast	Cold colors (blue, violet)
IV (hot)	South, Southeast	
Operating - rooms	South	Grey-green, green-blue

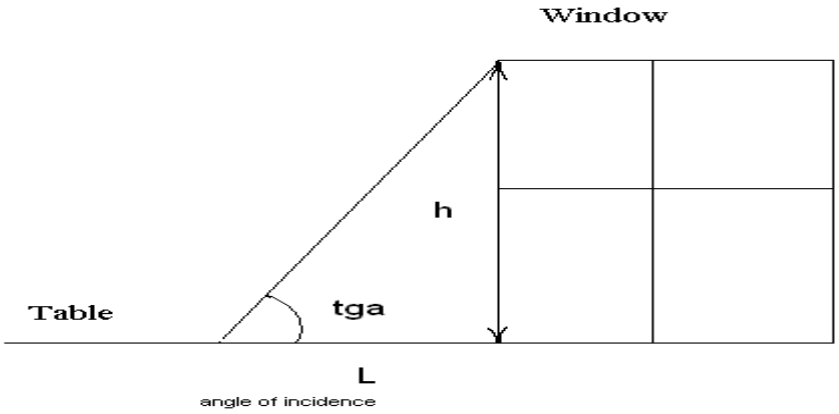
Table 4

Natural values of tangents.

Lo	**tgL**	**Lo**	**tgL**	**Lo**	**tgL**
1	0.017	16	0.287	31	0.601
2	0.035	17	0.306	32	0.625
3	0.052	18	0.325	33	0.649
4	0.070	19	0.344	34	0.675
5	0.087	20	0.364	35	0.700
6	0.105	21	0.384	36	0.727
7	0.123	22	0.404	37	0.754
8	0.141	23	0.424	38	0.781
9	0.158	24	0.445	39	0.810
10	0.176	25	0.466	40	0.839

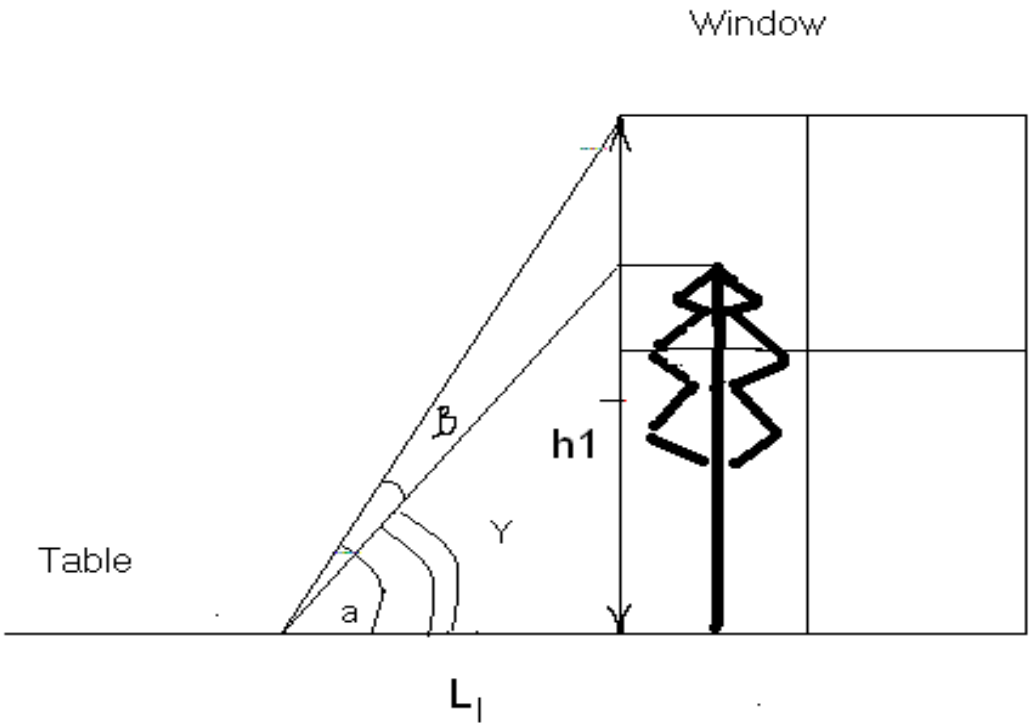
11	0.194	26	0.488	41	0.869
12	0.213	27	0.510	42	0.900
13	0.231	23	0.532	43	0.933
14	0.249	29	0.554	44	0.966
15	0.268	30	0.577	45	1.000

Angle of incidence



Pic.1

Aperture angle.



Pic.2

THEME 1.3
HYGIENIC EVALUATION OF THE INDOOR MICROCLIMATE ITS EFFECT ON A PERSON'S HEAT EXCHANGE AND HEALTH CONDITION

The motivational description of the theme

Today people spend a lot of time indoors (e.g. at home, work, hospital, etc). The indoor environment is characterized by a variety of factors affecting the human body. They are as follows: lighting, insolation, chemical composition of the air, ionization of the air, noise, etc.

At our practical classes we shall discuss in detail the physical properties of the air such as the temperature of the air and that of the surfaces, air humidity and air velocity. A certain combination of factors makes what we call a microclimate.

Microclimatic factors influence the human body creating certain conditions for heat exchange between a person and the environment. The functional state of a person is referred to as a thermal state. The thermal state of a person accounts for high work capacity and productivity, temperature sensitivity and the general well-being.

The doctor should be able to evaluate the quality of the microclimate and to predict possible changes in the thermal state and health of a person under the impact of the microclimate, catarrhal diseases or complicated chronic inflammatory processes.

The objective: to master the techniques of evaluating the indoor microclimate, to learn to perform hygienic evaluation of their integrated effect on people.

Students' classroom activities

1. Evaluating the quality of the microclimate in a room.
2. Evaluating the thermal state of the body
3. Case problem (type 1, type 2).
4. Presenting and discussing individual students' reports.

Self-study task

1. The notion of a microclimate. Factors shaping it. Classification of the factors.
2. Hygienic requirements imposed on the microclimate of private and public facilities (e.g. rooms, gyms, wards, etc.) & the documents regulating these requirements.
3. Human thermal homeostasis & thermoregulation. Chemical and physical thermoregulation.
4. Types of thermal states of a person. Physiological indicators of the thermal state of a person.
5. Measures preventing overheating and overcooling.

Plan of students' independent activities

1. Hygienic evaluation of the microclimate in a room at the Hygiene and Ecology Department.
1.1. Calculating the average temperature of the air and vertical and horizontal temperature gradient.
Measurements are made at three points (at the interior wall, in the centre and at the outer wall of a classroom) at a level of 1.5 and 0.15 m; the arithmetic mean of six temperature values as well as their vertical and horizontal gradients are calculated.
1.2. Determining relative air humidity using an aspirated psychrometer.
1.3. Determining air velocity using a globe katathermometer.
2. Evaluation of a thermal state of a student staying in microclimatic conditions of a certain classroom.
2.1. Measuring skin temperatures (forehead, chest, hand) using an electric thermometer.
2.2. Checking the pulse rate using a standard technique.
2.3. Checking the respiratory rhythm using a standard technique.
2.4. Evaluation of thermal sensations using a seven-point scale (see Reference Information on the theme).
3. Making a conclusion:
state the type of microclimate in a classroom, evaluate a thermal state of the students in this classroom; make a prognosis of their working capacity, health and well-being; if necessary, give recommendations for correcting microclimatic parameters.

Reference information

Term descriptions

MICROCLIMATE is a thermal state of spatially restricted environment conditioned by a variety of physical factors such as the temperature of the air, air humidity, air velocity, radiant heat, etc. which affects heat exchange.
THERMAL STATE is a functional state of a person exposed to certain microclimatic factors.
THERMAL COMFORT is well-being of a person in certain microclimatic conditions that produce the optimal functional state of the body.

Principles of hygienic standardization of microclimatic parameters in living and public locations.

1. Hygienic rating of the optimal and permissible microclimatic parameters should consider the circadian and seasonal dynamics of the variation of physiological functions as well as people’s adjustment to various climatic conditions.

2. Hygienic rating of microclimatic parameters should be different for different age groups of people.

3. When rating the optimal parameters of a microclimate one should consider the level of energy expenditure (physical activities of people staying inside a

building) and the level of heat retention properties of the clothes of the corresponding groups of the population.

4. Hygienic rating of microclimatic parameters of health-care settings should also consider the types of diseases treated in a setting and the nature of treatments and procedures performed by the medical staff.

Heating and ventilation systems must create acceptable conditions of the microclimate and indoor air environment. Heating systems must produce even heating of the indoor air over the heating season without making scents, polluting the indoor air with harmful substances emitted while they are in operation. Nor they must make any additional noise. Heating systems must be accessible for servicing and repair.

The difference between the indoor air temperature and that of the wall surfaces should not exceed 3 Cº; the difference between the indoor air temperature and that of the floor should not exceed 2 Cº.

When hot-water heating is in use, the temperature of the heaters' surfaces should not exceed 90 Cº. For the heaters whose surface temperature is over 75 Cº protective covers should be fixed.

There are special documents regulating the standard parameters of the microclimate in residential and public buildings, in educational establishments and patient care settings.

Table 1

Permissible microclimatic parameters on living premises

Room type	Temperature of the air, Cº optimal/permissible	Relative air humidity, % optimal/permissible	Air velocity, mps м/с optimal/permissible
Cold season			
Living room	20-22 / 18-24	30-45 / 30-60	0,15 / 0,2
Kitchen, toilet, bathroom	19-21 / 18-26 24-26 / 18-26	No accepted values	0,15 / 0,2
Hall connecting flats	18-20 / 16-22	30-45 / 30-60	0,15 / 0,2
Lobby, staircase	16-18 / 14-20	No accepted values	No accepted values
Warm season			
Living room	22-25 / 20-28	30-60 / 30-65	0,2 / 0,3

Table 2

Parameters of microclimate in medical settings.

Microclimatic parameters	Permissible values
Temperature of the air, C°:	
Hospital wards for adults	20-26
Intensive care unit	21-24
Operating room	21-24
Relative air humidity, %	30-60
Air velocity, m/s, no more than	0,2

Table 3

The temperature of the air in educational settings

Room	Temperature of the air, C°
Classrooms, psychologist's and speech therapist's offices, laboratories, school hall, dining hall, rest rooms, library, lobby, cloakroom (depending on climactic conditions)	18-24
Gymnasium, rooms for tutorials, workshops	18-20
Bedroom, game rooms, premises of pre-school educational institutions and boarding schools	20-24
Doctor's office, cloak-rooms in the gymnasium	20-22
Shower room	24-26

In general education institutions the relative air humidity should make 40-60%, the air velocity – no more than 0.1 mps.

Table 4

Time recommended for cross ventilation of educational setiings depending on the temperature of outdoor air

Outdoor temperature, C°	Ventilation time, min.	
	During a short class break	During a long class break or between shifts
From +10 to +6	4-10	25-35
From +10 to 0	3-7	20-30
From 0 to – 5	2-5	15-20
From -5 to -10	1-3	10-15
Below -10	1-1.5	5-10

Table 5

Indicators of the microclimate in pre-school establishments

Room	Temperature of the air, C° in a certain climatic region		Relative air humidity, %
	1st climatic region	2nd climatic region	
A creche room	23	22	30-60

A nursery room for different age groups	22	20	30-60

Types of a microclimate

Term descriptions

AN OPTIMAL MICROCLIMATE is referred to as the conditions of the indoor environment in which the person of a certain age, health condition, etc. feels thermal comfort.

PERMISSIBLE MICROCLIMATE is referred to as the conditions of the indoor environment which can cause some changes in the functional and thermal state of a person.

HEATING MICROCLIMATE is referred to as the conditions of the indoor environment which can cause physiological changes and sometimes result in the development of pathological conditions and diseases (overheating, heat stroke).

COOLING MICROCLIMATE is referred to as the conditions of the indoor environment which can cause overcooling and pathological conditions and diseases associated with it.

Two types of a microclimate can be recognized according to the way of heat release:

- convectional;
- radiant.

Classification of human thermal states

An optimal state is characterized by the absence of generalized and/or localized uncomfortable thermal sensations, minimal activation of thermoregulatory mechanisms. It is a prerequisite of sustained high working capacity.

A permissible state is characterized by insignificant generalized and/or localized uncomfortable thermal sensations, maintenance of thermal stability of a person for the whole working day and involves moderate activation of thermoregulatory mechanisms. A temporary decline in working capacity may occur but it does not impair a person's health.

A maximum permissible state is characterized by pronounced generalized and/or localized uncomfortable thermal sensations; it cannot ensure that thermal homeostasis and health are maintained, restricts working capacity.

An impermissible state is characterized by excessive activation of thermoregulatory mechanisms which results in impaired health.

Activation of thermoregulatory mechanisms is the activation of responses of various systems of the body aiming to maintain temperature homeostasis. When these responses are evaluated their intensity is considered.

The following **indicators** can be used **to evaluate a thermal state of a person.**

- body temperature;
- topography of skin temperatures;
- temperature gradient of trunk and limb skin;

- water loss value;
- thermal sensations;
- heart rate.

Some other indicators appropriate for a particular situation can be used to fulfill the objectives of a certain study.

Table 6

Some indices of the optimal thermal state for different levels of energy expenditure

Indices	At rest	At work		
		Easy	Medium	Hard
Body temperature, Cº.	36.5-37.2	36.7-37.4	36.9-37.6	37.0-37.8
Temperature gradient of trunk and limb skin	2-4	2-4	Not typical	
Thermal sensations	4	4	4	4
Heart rate	Up to 80	80-90	90-100	100-120

Thermal sensations (generalized and localized) are evaluated according a 7-point scale): cold – 1; cool/chilly – 2; mild cool –3; comfortable – 4; mild warm – 5; warm – 6; hot – 7.

Appendix

Air humidity measurement technique

The relative air humidity can be measured with an Assman psychrometer. A psychrometer consists of two thermometers, notably, a mercury thermometer and an alcoholometer. The reservoir of one of the thermometers is covered with a cloth which is moistened with distilled water. As water vaporizes, the reservoir of the thermometer is cooled. The difference between the temperatures of the dry and moist thermometers is used to evaluate the air humidity, as vaporization depends on the content of water vapors in the air. The reservoirs of the thermometers in the Assaman psychrometer are protected from radiant heat with metallic shields. There are ventilation channels around the reservoirs through which the air passes. To estimate the air humidity, the thermometer covered with the cloth should be moistened with distilled water. It is necessary to start the ventilator and place the thermometer at a designated point. The readings of the dry and moist thermometers should be recorded for 4 – 5 min after the ventilator is launched. The relative air humidity is estimated using psychrometric tables.

Air velocity measurement technique

If the air velocity is lower than 0. 5 m/s, it can be estimated with the help of a bulb katathermometer. The katathermometer is heated in a glass of hot water above 40 Cº. It should be dried then and let stay for some minutes. It is noteworthy that the temperature necessary for the katathermometer to cool is from 40 Cº to

33 Cº. Air cooling capacity (per 1 sec.) can be calculated using the following equation:

H= F/3·(40-33) / T ,

where F is the readings of the katathermometer scale.

To take into account the fact how the cooling of the device depends on the air temperature, one should calculate:

Q= 36. 5º - tº,

where 36. 5 is the middle point on the katathermometer scale;

tº is the temperature of the air at the given point.

H/Q should be calculated first and according to Table 1, the air velocity at the given point should be determined.

Table 7

Air velocity (V) at various temperatures of the air

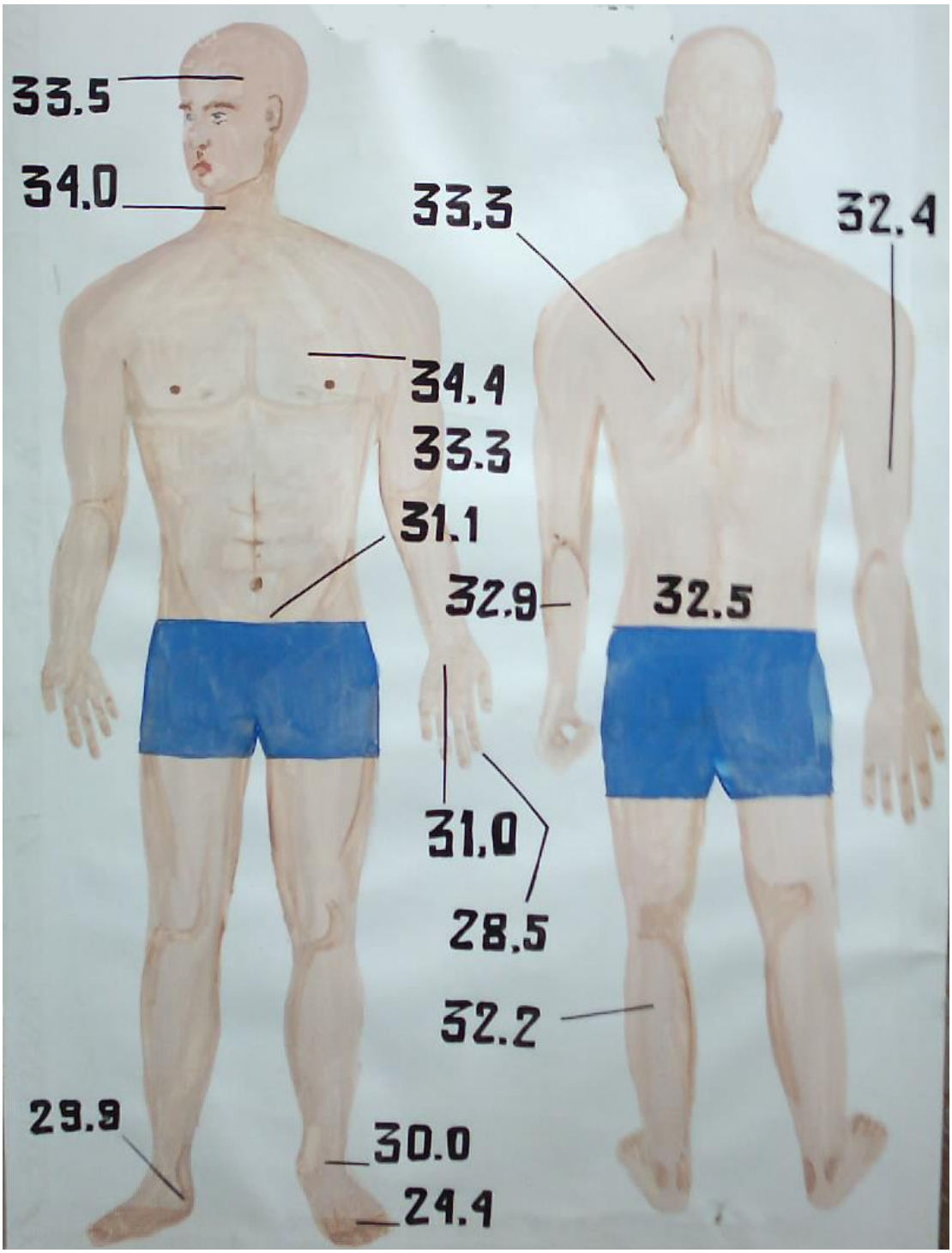
H/Q	Temperature of the air, C °			
	17.05	20.0	22.5	25.0
0.27	-	0.041	0.047	0.051
0.28	0.049	0.051	0.061	0.070
0.29	0.060	0.067	0.076	0.085
0.30	0.073	0.082	0.091	0.101
0.31	0.088	0.098	0.107	0.116
0.32	0.104	0.113	0.124	0.136
0.33	0.119	0.128	0.140	0.153
0.34	0.139	0.148	0.160	0.174
0.35	0.154	0.167	0.180	0.196
0.36	0.179	0.192	0.206	0.220
0.37	0.198	0.212	0.226	0.240
0.38	0.222	0.239	0.249	0.266
0.39	0.244	0.257	0.274	0.293
0.40	0.269	0.287	0.305	0.323
0.41	0.299	0.314	0.330	0.349
0.42	0.325	0.343	0.363	0.379
0.43	0.356	0.373	0.392	0.410
0.44	0.485	0.401	0.417	0.445
0.45	0.412	0.429	0.449	0.471

Measurement of air temperature

Two thermometers should be placed on a stand. The first should be placed 1.5 m above the floor and the second – 0.20 m above the floor. It is necessary to measure the temperature of the air at three main points, notably, at the external wall, in the centre of the room and at the internal wall. On the basis of the difference in the temperatures at different points, the horizontal temperature gradient should be calculated. On the basis of the difference in the readings of the

“upper” and “lower” thermometers, the vertical temperature gradient should be calculated.

Topography of a person’s skin temperature



THEME 1.4
HYGIENIC EVALUATION OF THE QUALITY OF DRINKING WATER AND WATER SUPPLY

The motivational description of the theme

Water is one of the most important elements of the environment. Water is of

great physiological significance as it is the main structural component of the human body.

Nearly 60 – 70% of the body of an adult is water. Pure water is used for washing, cleaning and cooking foods. Water is an important factor contributing to the formation of climate; it is rather essential for agriculture.

Hydrotherapeutic procedures and body conditioning increase the resistance of the human body to the effects of many unfavorable factors. Watching a smooth water surface or listening to rain sounds has a favorable psychotherapeutic effect on the human mind.

The requirements imposed on the quality of water used for drinking, cooking and physical exercise are its sound quality and safety. Thus, the doctor of any specialty should be able to make a hygienic assessment of the quality of water according to the results of laboratory tests.

The objective: to gain knowledge about influence of water quality on persons health; hygienic principles of set norms of water quality; learning how to make hygienic evaluation of the quality of water according to the results of laboratory analyses

Students' classroom activities

1. Case problems of two types.
2. Presentation and discussion of individual students' reports.

Self-study task

1. Physiological, hygienic, epidemiological significance of water.
2. Diseases associated with salinity or microelement composition of water.
3. Comparative estimation of the sources of water supply. Sources of surface and ground water contamination.
4. Hygienic requirements imposed on the quality of drinking water

Plan of students' independent activities

1. Case problem (type 1, type 2). The solution of case problems should be reported in writing.

Reference information

Term descriptions

QUALITY OF WATER – is a characteristic of the composition and properties of water which determine whether the water is fit for specific purposes.

CENTRALIZED WATER SUPPLY is the system which supplies the population with water through water supply systems.

NON-CENTRALIZED WATER SUPPLY is the system which supplies population with water using ground water supply sources to meet the needs of the population in drinking water and agricultural needs. The main source of a noncentralized water supply system is ground water which is obtained by means of special equipment (e.g. water bore wells and tubular wells).

1. Hygienic requirements and standards imposed on the quality of water from centralized water supply

Table 1

Microbiological and parasitological indicators

Indicator	Unit	Norm
Thermoduric coliform bacteria	Amount of bacteria in 100 ml of water	None
Common coliform bacteria	Amount of bacteria in 100 ml of water	None
Microbe value	Number of colony-forming bacteria in 1 ml	No more than 50
Cysts of lamblia	Number of cysts in 50 l of water	None

Table 2

General indicators and pollution rate

Indicator	Unit	Norm (no more than)	Hazard degree indicator	Degree of severity
General indicators				
Hydrogen (H)	PH	6-9	-	-
General mineralization	mg/l	1000 (1500)	-	-
General hardness of water	mole/l	7.0 (10)	-	-
Permanganate water oxidizability	mg/l	5.0	-	-
Inorganic substances				
Nitrates (NO3)	mg/l	45		3
Iron (Fe)	mg/l	0, 3 (1, 0)		3
Sulfates (So4)	mg/l	500		4
Chloride (Cl)	mg/l	350		4
Lead (Pb)	mg/l	0, 03		2
Fluoride (for climatic regions) 1-2 3	 mg/l mg/l	 1,5 1,2		2

Table 3

Organoleptic properties

Indicator	Unit	Norm
Smell	Points	No more than 2
Taste	Points	No more than 2
Color	Degrees	No more than 20 (35)

Turbidity	mg/l	No more than 1, 5 (2)
Turbidity	mg/l (according to kaolin/china clay)	No more than 2

Table 4

Radiation safety

Hazardous factor	Unit	Norm	Indicator
General α-radioactivity	Bq/l	0, 1	Radiation
General β-radioactivity	Bq/l	1, 0	Radiation

Table 5

Hygienic requirements imposed on the quality of water in a non-centralized water supply system

Indicator	Unit	Norm
Smell	Points	No more than 2-3
Taste	Points	No more than 2-3
Colour	Degrees	No more than 30
Turbidity	mg/l	No more than 2
Nitrates (NO3)	mg/l	No more than 45
Number of colibacilli (coli-index)	Number of colibacilli in 1000 ml of water	No more than 10
Chemical substances	mg/l	No more than MPC (maximum permissible concentration)

1. **Requirements imposed on the location and design of non-centralized water supply systems.**

The location of a non-centralized water supply intake structures is of great significance as it helps preserve the favourable properties of drinking water and prevent it from contamination with bacterial and chemical contaminants.

Noncentralized water supply systems should be located far away from dangerous water contaminants and pollutants, such as landfills for toxic and radioactive substances, places of dumping sewage, burials of the dead, and no less than 50 m upstream the flow of a ground water reservoir.

2. Requirements imposed on the design of water bore wells.

1. Water bore wells are used for obtaining ground water from the closest to the surface free aguifer. The water wells are rounded or square shafts and they consist of three main parts: the aqueduct, the bore and the water-intake portion.
2. The aqueduct is used for preventing water contamination. It should be no less than 0.7 – 0. 8 m in height, above the ground.
3. The aqueduct should have a lid. It should be located under a shed or in a box.

4. There should be a clay retainer along the perimeter of the aqueduct which is made of plastic clay. It should be 2 m in depth and 1 m in width around the bore.
5. A waterproof covering around the water well should be built. It is the so-called “blind area” made of stone, break, concrete or plate asphalt with a radius of 2 m.
6. The water well should be enclosed and there should be a bench for buckets.
7. The bore should prevent water precipitation. For this purpose one should use manhole rings or stone, break or certain timber such as larch, alder-tree, elm-tree, oak, to make the water-intake portion. Fir-tree and pine-tree could be used for the above-water part.
8. Water is obtained from the water well with the help of various devices and mechanisms. The most common devices are hand and electrical pumps. If the pump is not available, one can use a lowering winch with a tub.

THEME 1.5
METHODS OF IMPROVING THE QUALITY OF WATER

The motivational description of the theme

In their everyday life people use tap water whose quality is supervised by the government or ground water that meets the sanitary requirements. The permission for water use is issued by the Federal Service for Oversight of Consumer Protection and Welfare. In extreme situations like an earthquake or disasters at

large industrial plants (chemistry plants or atomic power stations) special requirements are imposed on the organization of water supply to the population. In such cases water is a potential threat; within 3-5 days it can cause outbreaks of infectious diseases or acute poisoning. That is why doctors should master the methods of water purification, decontamination and improvement of its quality. They should educate the population about the hazards associated with unpurified and non-decontaminated water and recommend the means of water processing, and teach the technology of its improvement in extreme situations.

The objective: to develop practical skills for improving water quality, to learn about in-field water disinfection by chlorination.

Students' independent classroom activities

1. Case problems.
2. Laboratory work.
2.1. Detection of active chlorine in chlorinated lime (%)
2.2. Estimating chlorine requirement in river water.
2.3. Detection of residual chlorine in tap drinking water.
2. Students' oral presentations.

Self-study task

1. Areas of sanitary protection of water supply sources.
2. Methods of improving the quality of water.
3. Methods of water disinfection.
4. Organization of water supply in extreme conditions.

Plan of students' independent activities

1. Case problem. The solution of case problems should be reported in writing.
2. Laboratory work (Appendix).
2.1. Evaluating active chlorine content in chlorinated lime (1%).
2.2. Assessing chlorine requirement in river water.
2.3 Determining residual chlorine content in water (qualitative method).

Reference information

Term descriptions

AREA OF SANITARY CONTROL is a certain area, where specific regime is established which aims to protect centralized water supply and water-treating facilities from contamination.

WATER DISINFECTION is processing the water to remove pathogenic microorganisms.

RESIDUAL ACTIVE CHLORINE is an indicator that the chlorination process is complete. It arises as chlorine is bound by the substances and bacteria found in the water. It guarantees the effectiveness of water disinfection. It is an indirect

indicator of water safety when there is a threat of an epidemic; it is necessary to prevent a secondary water contamination in the distribution network.

CHLORINE ABSORPTION OF WATER is the amount of chlorine that can oxidize organic and easily oxidized inorganic substances and disinfect bacteria in 1 L of water within 30 minutes. This value is established experimentally by trial chlorination.

CHLORINE REQUIREMENT OF WATER is the total amount of chlorine necessary to ensure chlorine saturation and the presence of residual active chlorine (0.3—0.5 mg/L*)*.

The primary objective of sanitary control regimen is sanitary protection of water sources and water supply systems as well as the locations they are found in from contamination.

Sanitary control areas are organized as three belts:

1. The first belt (area of strict control) includes the location of water intake systems, water works sites and water supply canal. This is intended for protection of these sites from casual or intended contamination or damage.
2. The second and third belts (restricted area) include the territory used for prevention of contamination of water sources and waterworks as well as the territory they are located on. The second belt is intended for protection from microbial contamination, the third – from chemical contamination.

Factors determining the boundaries of sanitary control area belts:

- type of water source (above ground or underground)
- nature of contamination (microbial or chemical),
- extent of natural protection against surface contamination (for an underground water source).

First belt boundaries for an underground water source: at a distance of 30-50 m or more from the water intake structure; for an above-ground source (rivers, canals)): upstream – 200 m or more from the water intake structure, downstream –100 m or more from the water intake structure, along the adjacent bank –100 m or more.

Second and third belt boundaries are determined with hydrodynamic calculations.

Methods of water purification

General methods:

1.Water clearing & decolorization

- sedimentation
- filtration
- coagulation

2.Disinfection of water(eliminating the infectious agents like bacteria, viruses, etc.).

2.1 Chemical disinfection (Chemical processes for the removal of undesirable elements):

- Chlorination

- Ozonization
- Oligodynamic effect of silver

2.2 Physical non-reagent methods (Physical processes for the removal of undesirable elements):

- Boiling
- Ultraviolet irradiation
- Gamma irradiation (γ-irradiation)
- Water disinfection with ultrasound

Special methods: (deironing, defluoridation, desalination, softening, fluoridation, mineralization)

Appendix

Laboratory control over water chlorination

1. Determining active chlorine content in chlorinated lime (1%).
2. Chlorination of river water with normal chlorine doses
3. Determination of residual chlorine in tap water.

Water chlorination is one of the main ways of water disinfection nowadays. Gaseous chlorine, chlorinated lime, chloramine, calcium and sodium hypochloride can be used for water chlorination. Chlorine is considered the best choice due to its ability to oxidize bacteria, organic and mineral substances dissolved and suspended in water.

The amount of chlorine which is necessary for oxidizing 1 litre of water containing organic, inorganic and bacterial substances impairing its physical properties within 30 minutes, is called chlorine absorption of water. Chlorine absorptivity of water can be easily established experimentally.

The combination of chlorine with chemical substances gives rise to residual active chlorine in water. It demonstrates that the process of water purification is over and chlorinated water does not contain any bacteria. Tap water should contain small amounts of residual active chlorine (0.3 – 0.5 mg/l) so that water chlorination could be considered an efficient means of water disinfection. Excessive chlorine residue above 0.5 mg/L makes the water unfit for drinking as it entails deterioration of organoleptic properties of water giving rise to an unpleasant taste and odor.

Residual chlorine content is used to control the efficiency of water disinfection. Small doses of chlorine in the amount equal to chlorine requirement of water should be added to water. Chlorine requirement for water is calculated as the sum of values of chlorine absorptivity and residual chlorine (0.3 – 0.5 mg/l).

1. Determination of active chlorine content in chlorinated lime

1% chlorinated lime is commonly used in water chlorination. Chlorinated lime is an unstable compound which releases chlorine so it is necessary to determine active chlorine content in advance.

Droplet technique is used for this purpose. 100 ml of distilled water should be poured into a glass or flask. As little as 0.4 ml of a 1% freshly prepared chlorinated lime, 1 ml of diluted chloric acid (1:5), 1 ml of 5% potassium iodide and 1 ml of 1% freshly prepared starch should be added to the distilled water. The mixture should be shaken thoroughly. Then, it should be titrated using a special drop pipette (i.e. 1 ml corresponds to 25 drops of liquid) and 0.7% sodium thiosulfate until the water is clear.

The percentage of active chlorine is equal to the number of drops of sodium thiosulfate used for titration.

2. Chlorination of river water.

2.1. Determining chlorine requirement of river water.

The disinfecting effect of chlorine-containing agents is due to the ability of chlorine to oxidize bacteria, organic and mineral substances dissolved or suspended in water. A portion of chlorine in this process is absorbed by the suspended substances, which determines the chlorine absorption of water. To ensure a reliable disinfection, we add an amount of chlorine equal to the chlorine absorption value, which is calculated as the sum of values of chlorine absorptivity and residual chlorine. Residual chlorine (the excess of active chlorine remaining in water after oxidation of the dissolved and suspended organic and inorganic substances and demise of microorganisms) in the amount of 0.3—0.5 mg/L does not impair the organoleptic properties of water indicating, at the same time, complete disinfection. However, the worse the contamination, the more active chlorine may be required, which means a greater chlorine requirement. An accurate definition of chlorine requirement prevents using excessive chlorine; it is known that an excess of chlorine above 0.5 mg/L makes the water unfit for drinking as its organoleptic properties are impaired, the water acquires an unpleasant taste and smell.

Chlorine requirement of water is defined by test chlorination of water in three vials. Portions of 0.2 L of water samples are poured into three glasses; 1% chlorinated lime solution is added with a pipette:

- 0.1 ml to the 1st glass (5 mg of chlorinated lime per 1 L of water);
- 0.2 ml to the 2nd glass (10 mg/L)
- 0.3 ml to the 3rd glass (15 mg/L)

The contents of each glass are stirred with a glass rod. The amount of residual chlorine is estimated in 30 minutes. For this purpose, 1 ml of 5% potassium iodide solution and 1 ml of 1% starch solution is added to each glass. In the samples where the water turned blue or pale blue, the amount of residual chlorine is determined by titration of 0.01 mol/L with sodium thiosulfate. Residual chlorine after chlorination is calculated according to the formula:

$$X = \frac{A * K * 0.355 * 1000}{\quad}$$

A – amount of potassium thiosulfate used for titration, ml;
K – adjustment factor (0.95);
V– amount of water in the glass, ml.

2.2. Determining the required amount of dry chlorinated lime.

The amount of dry chlorine-containing agent necessary for chlorination of 1.0 L of river water is calculated on the basis of test chlorination.

Example: let us assume that blue coloration appeared in glass 2 where 2 drops of 0.7% sodium thiosulfate were used for titration to define residual chlorine. In this glass, 2 drops of 1% chlorinated lime were added to 200 ml of water. Hence, 2 by 5 +10 drops are required per 1 L of water or 0.4 ml of 1% chlorinated lime solution as 1 ml contains 25 drops. The amount of dry chlorinated lime contained in 0.4 ml of 1% chlorinated lime solution is a hundred times smaller (as it is a 1% solution) and amounts to 0.4/100 – 0.005 or 4 mg of dry chlorinated lime. That means that the dose of chlorine is 4 mg/L of chlorinated lime.

2.3. Determination of residual chlorine content in tap water (qualitative method).

Some water should be poured into a test-tube. The column of water should be 10 cm high (indicated on the tube). Before taking water for a laboratory analysis, it should be drained for some minutes. As little as 1 ml of 10% potassium iodide and 0.5 ml of 1% freshly prepared starch should be added to it. The mixture should be shaken thoroughly. The tube should be covered with a white sheet of paper and the active chlorine content should be determined.

The amount of residual chlorine is determined according to the colouring of the solution:

Very pale blue – 0.05 mg/L of residual chloride
Light blue – 0.1 mg/L of residual chlorine
Blue – 0.3 mg/L of residual chlorine
Dark blue – 0.5 mg/L of residual chlorine
Bluish-black (the bottom of the flask cannot be seen) – 1 mg/l and even more.

CHAPTER 2 HYGIENE OF NUTRITION

THEME 2.1.

NUTRITION VALUE AND BIOAVAILABILITY OF FOODSTUFFS OF ANIMAL AND VEGETABLE ORIGIN

The motivational description of the theme

Nutrition is one of the health-forming factors. More than 60 essential nutrients have to be consumed in appropriate amounts daily during regular meals. This is achieved by including over 30 various products in a weekly diet and about 15 various products in a daily diet.

There is no ideal food capable of meeting all human needs for nutrients. Foods vary in their chemical composition, digestibility, the nature of their effect on the human body, which should be taken into account when designing a diet or choosing the optimal way of cooking foods. It is important to ensure adequate nutrition in various conditions: pregnancy, breastfeeding, intensive growth and development, physical and emotional load. When a diet is designed for a specific patient, one should make a justified choice of foods based on their chemical composition and caloric value.

The objective: studying the nutritional and biological value of basic foodstuffs of animal and vegetable origin

Students' independent classroom activities

1. Presentation of students' reports and their discussion.
2. Solving case problems of 2 types.

Self-study task

1. Classification of foodstuffs (according to specific characteristics and usage)
2. Nutritional and biological value of milk and dairy products.
3. Nutritional and biological value of meat and meat foods.
4. Nutritional and biological value of fish and sea foods.
5. Nutritional and biological value of eggs.
6. Nutritional and biological value of bread.
7. Nutritional and biological value of cereals and pasta.
8. Nutritional and biological value of fruits and vegetables.

Reports:

1. Milk and dairy products in an everyday diet and clinical nutrition.
2. Fruits and vegetables in an everyday diet and clinical nutrition.

Plan of students' independent work

1. Case problem (type 1, type 2). The solutions of case problems should be reported in writing.

Reference information

Term descriptions

FOOD PRODUCTS - animal and vegetable origin products, the chemical composition and physical properties of which allow them to be used as food, and the organoleptic properties (appearance - color and shape,smell and taste) correspond to established ideas about the properties of a particular product.

BIOLOGICAL VALUE is an indicator of the quality of food proteins reflecting how their amino acid composition meets the needs of the body for amino acids which are necessary for the synthesis of proteins.

MACRONUTRIENTS are food substances (fats, proteins and carbohydrates) whose requirement in the human body is measured in grams; they satisfy the body's need for energy and synthesis.
MICRONUTRIENTS are food substances (vitamins, minerals, and microelements) contained in the food in very small quantities: milligrams or micrograms. They are not a source of energy; they are involved in food assimilation, in the process of growth, adaptation and development of the body.
ESSENTIAL FOODS are those which are not synthesized by the body; they should arrive with foods to ensure the body's vital functions.
FOOD is a complex mixture of food substances cooked for consumption.
FOODSTUFFS are products consumed by people in natural or processed forms.
FOOD ADDITIVES are natural or synthesized substances or mixtures added to foods in small quantities to give the foods valuable properties, to preserve them.
NUTRITIONAL VALUE is a complex of food properties meeting the need of the human body for energy, basic nutritional substances, as well as digestibility, availability, self-tapering action.
DIGESTIBILITY indicates how the chemical composition of a food matches the body's enzymatic systems.
SELF-TAPERING ACTION is the rate at which the body develops a negative dynamic stereotype of choosing and consuming a food.
AVAILABILITY is the relative extent to which the body utilizes certain nutrients consumed with foods.
ENERGY VALUE is the amount of energy released in the human body upon product dissimilation.

Classification of foods

According to characteristic features and specifics of use one can distinguish the following types of foods:
1. Milk and dairy products.
2. Meat and meat foods.
3. Fish, fish foods and sea foods.
4. Eggs and egg products.
5. Edible fats.
6. Cereals and pasta.
7. Flour, bread and baked goods.
8. Vegetables, fruits (fruits proper, berries, nuts), fresh and cooked mushrooms.
9. Sugar and its substitutes, honey, confectionery.
10. Preserves and concentrates
11. Flavor products (tea, coffee, spices, seasonings, edible acids)
12. Mineral water.

Foods of all types are divided according to their origin or way of procurement.
Some foods are divided into degrees and categories according to standard requirements.

Food and energy value, %

Milk	Proteins	2.8-3.0	46-65 kcal
	Fats	1.5-6.0	
	Carbohydrates	4.0-5.0	
Meat	Proteins	14 – 20	98-355 kcal
	Fats	10 – 33	
Bread	Proteins	6.0-8.0	190- 225 kcal
	Fats	0.8-0.2	
	Carbohydrates	40 – 54	

THEME 2.2.

HYGIENIC EVALUATION OF THE QUALITY OF FOODSTUFFS

The motivational description of the theme

In ordinary circumstances, food items present no threat to human health. To control their quality, their sanitary inspection is performed: estimating their organoleptic properties, checking the chemical composition against hygienic

indices and requirements, the nature of bacterial or parasitic contamination, the role of a food item in potential infection transmission and triggering a foodborne disease, investigating the storing conditions that caused a change in the food properties. When an inspection of a food item is complete, a conclusion is made stating its quality, conditions of sale depending on its revealed properties, and the possibility of processing it or a need to destroy it altogether.

The objective: mastering the technique of estimating the quality of food items (example: milk, meat, bread).

Students' independent classroom activities

2. Case problems.

2. Laboratory work investigating and estimating the quality of milk and bread samples.

3. Student's presentation and their discussion.

Self-study task

1. Degrees of the quality of food items.
2. Diseases transmitted to humans via milk and meat.
3. Hygienic requirements imposed on the quality of milk.
4. Hygienic requirements imposed on the quality of meat.
5. Hygienic requirements imposed on the quality of bread.

Plan of students' independent work

1. Case problem. The solution of case problems should be reported in writing.

2. Sanitary estimation of the quality of milk.

2.1. Determining organoleptic properties of milk (appearance, consistency, taste, smell, colour).

2.2 Determining physical and chemical indicators of the quality of milk:

- specific weight of milk,
- milk acidity.

2.3. Testing milk for adulteration:

- revealing the presence of starch
- revealing the presence of soda

2.4. Conclusion about the quality of milk and the possibility of its use

3. Sanitary estimation of the quality of bread.

3.1. Determining organoleptic properties of bread:

surface, colour, shape of bread, bread crumb, smell;

3.2. Determining physical and chemical indicators of bread:

-porosity of a bread sample;

- acidity of a bread sample)

3.3. Conclusions about the quality of bread and the possibility of its use

Reference information

Term descriptions

QUALITY OF FOOD ITEMS is a complex of characteristics describing the food nutritional value and safety. If the food item meets the hygienic requirements, it can contribute to satisfying the physiological need in nutritients and energy without any detriment to health.

BABY FOOD is referred to as special foodstuffs which meet the physiological requirements of a baby´s organism.

DIETARY PRODUCTS are special foodstuffs used in preventive or clinical nutrition.

CERTIFICATE OF QUALITY is a document in which the manufacturer confirms the origin of the food and ensures that it corresponds to the requirements of standardizing and technical documentation.

SAFETY OF FOODSTUFFS means absence of factors which may endanger the life and/or health of people of the present and future generations. The foods are qualified as safe if they meet the requirements imposed on food production, sanitary rules, and hygienic norms.

The composition and properties of foodstuffs, especially their consumer properties and indications for their safe use, are determined on the basis of their organoleptic, physical, chemical, microbiological, parasitic and radiological properties as well as on their nutritional value.

Organoleptic properties of raw materials and cooked foods are determined on the basis of their taste, colour, smell, consistency and appearance that are specific to each product. Organoleptic properties should satisfy traditional tastes and eating habits of the population and should not cause any complaints on the part of consumers.

The content of basic chemical hazardous substances, such arsenic, cadmium, mercury, copper and zinc, in raw materials and cooked foods should be controlled. The content of mycotoxins, such as aflatoxin B1, desoxynivalenol, zearalenone, T-2 toxine, in vegetables should be also monitored. The content of aflatoxin M1 in milk and dairy products should be limited.

The content of pesticides, such as hexachlorocyclohexane, DDT (dichloro-diphenyl-trichloroethane) and its metabolites, in all kinds of raw materials and cooked food, should be supervised as well. The content of veterinary agents and antibiotics used for feeding cattle and poultry, for treating and preventing their diseases must be limited in meat products. No presence of pathogenic or parasitic microorganisms which cause infectious diseases of animals and people is allowed. Nutritional value of products, including the content of basic food substances, such as proteins, fats, carbohydrates, macro- and microelements, and the energy value of a product are the basic criteria used in estimation of the quality of raw materials and cooked food.

Degrees of food quality

1. *Foods of high quality* meet all hygienic requirements; their consumption poses no threat or doubt; there are no limitations to selling them for consumption purposes
2. *Foods of poor quality* can pose a threat to human health upon consumption; they may have a marked unpleasant taste or other organoleptic qualities; they do not meet the hygienic requirements; no way of processing them can improve their quality; they are not allowed to be sold for consumption purposes.
3. *Conditionally suitable food foods* in their natural condition pose a threat to human health; upon certain processing the defect may be eliminated and the food allowed to be consumed.
4. *Foods with decreased nutritional value* due to violation of technological processing and terms of storage do not meet all the hygienic requirements; however, they do not pose a threat to human health; their organoleptic and other properties are satisfactory.

Table 1

Organoleptic indicators of baked goods of wheat flour

Index	Description
Appearance: form, surface, colour - Baked in the hearth - Shaped -Structure of the bread crumb -Degree of baking -Degree of kneading - Porosity Taste Smell	Rounded, oval-oblong. Corresponds to the form in which the bread is baked without any changes. From light yellow to brown. Smooth, without any large cracks or tears. Bread baked in the hearth may have some cuts or cracks; shaped bread may have a seam. Well-baked, not damp to the touch. Elastic. When pressed, the bread reverts back to its initial shape. Without lumps or traces of poor kneading. Advanced, without holes or lumps. Detachment of the crust from the bread crumb is not allowed. Typical of the given product, without any particular taste. Typical of the given product, without any additional smell.

Table 2

Physical and chemical indicators baked goods of bread wheat flour

Name of index	Dampness of bread crumb, % no more than	Acidity of bread crumb, g no more than	Porosity of bread crumb, % no less than
Baked goods of wheat flour: Wholemeal flour	 19.0 – 52.0	 8.0	 54.0

Second grade	19.0 – 48.0	5.0	63.0
First grade	19.0 – 48.0	4.0	65.0
Granular flour	19.0 – 48.0	3,5	68,0
Best quality	19.0 – 48.0	3.5	68.0
Extra quality	19.0 – 48.0	3.5	70.0

Table 3

Organoleptic indicators of cow milk

Index	Description
Appearance and consistency	Homogeneous liquid without any sediment. For baked milk and for pasteurized milk 4.6 % of fat content without a sediment of cream is normal.
Taste and smell	Pure, without any additional taste or smell, atypical of raw milk.
Colour	White with a slightly yellowish shade, for baked milk – with a cream shade, for low-fat milk – with a slightly bluish shade.

Table 4

Physical and chemical indicators of milk

Index	Value of the index for a product with the fat percentage, % no less				
	fat less than 0.5	0.5; 1.0	1.2; 1.5; 2.0; 2.5	2.7; 2.8; 3.0; 3.2; 3.5; 4.0; 4.5	4.7; 5.0; 5.5; 6.0; 6.5; 7.0; 7.2; 7.5; 8.0; 8.5; 9.0; 9.5
Density, g/cm³. no less than	1030	1029	1028	1027	1024
Protein, % no less than	3.0				
Acidity, T no more than	21				20

Sanitary examination of the quality of meat

Sanitary examination is carried out considering the indicators of organoleptic and chemical properties of meat as well as the results of bacterioscopic and helminthic investigations.

Table 5

Indicators of meat freshness

Indicator	Fresh	Of doubtful freshness	Tainted
1	*2*	*3*	*4*
Surface of the carcass or semi-carcass	Clean, dry, pale pink or pale red drying crust	Some amount of mucus on the surface sticks to the fingers	Gray or greenish color, often covered with mold or mucus
Muscles on the cut	Surface of a fresh cut is slightly moist but not sticky	Surface of muscles is sticky to the touch	Surface of muscles is sticky to the touch, of gray or greenish color
Meat juice	In small amount; red, transparent	Turbid	Turbid with an unpleasant smell
Consistency	Muscular tissue is dense, elastic. A pit formed by pressing levels out quickly	Muscular tissue is flabby, loose. A pit formed by pressing levels out in over 1 minute	Muscular tissue is flabby, loose. A pit formed by pressing does not level out
Odor	Pleasant, typical of each category of meat	Putrefactive odor on the surface; no odor by the bone	Clearly putrefactive marked odor, stale or sour in the depth of muscle
Bone marrow	It fills the whole space of the tubular bone; it is resilient, of yellowish color, shiny, does not detach from the bone edge	Of gray color. slightly detached from the bone, soft. without shine	Of dirty gray color, does not fill the tubular bone space, spreads easily
Tendons	Resilient, dense, smooth, shiny	Of grayish color, softened	Of dirty gray color, moist, covered with mucus
Cooked broth	Clear, fragrant, of pleasant taste	Turbid, without fragrance, with stale odor	Dirty with flakes and putrefactive odor
Sanitary conclusion	*Can be used without limitations*	*Semicondemned meat must be subjected to*	*Should be rejected on the basis of organoleptic*

		laboratory investigations. Depending on the findings a decision is made whether it is fit for use	*properties; no lab tests necessary*

Helminthic investigation of meat

Meat can be invaded by larvae of some helminthes, such as pork tapeworm or beef tapeworm. The meat invaded by larvae of these helminths is called measled meat. The larvae can be seen with a naked eye on the cut of muscular tissues. They look like lentil- or pea-sized whitish bubbles. The larvae produce specific crunching upon squashing.

Meat is considered conditionally suitable for human consumption if on the general area of the cuts of a size about 40 cm² no more than 3 larvae are found. Such meat is allowed to be used as raw material for manufacturing sausages or canned food after disinfection.

There are some ways of disinfecting such meat:

1. Boiling the pieces of meat (they should be no more than 2 kg and no more than 8 cm in width) for 3 hours.
2. Freezing the meat at -12 Cº for 20 days.
3. Salting the pieces of meat (they should be no more than 2.5 kg) for 20 days.

If there are more than 3 larvae on the area of 40 cm², the meat is subjected to technical recycling.

Meat can be invaded by larvae of trichina. Meat is considered unsuitable for

human consumption if at least one trichina is found in 24 cuts.

The following safety and microbiological indicators are regulated and not allowed:

In bread and bakery products:

• toxic elements (lead, arsenic, cadmium, mercury);
• mycotoxins (aflatoxin Bb deoxynivalenol, T-2-toxin, zearalenone);
• pesticides (hexachlorocyclohexane and its isomers, DDT and its metabolites, hexachlorobenzene); organic mercury pesticides, 2,4-D-acid, its salts, esters are not allowed;
• radionuclides (cesium-137, strontium-90);
• contamination, pest infestation of grain stocks (insects, mites) - not allowed;
• infection with the causative agent of "potato disease" of bread - not allowed;
• microbiological indicators: the number of mesophilic, aerobic and facultative anaerobic microbes (KMAFAnM), bacteria of the Escherichia coli group (Coliform coliforms), St. aureus, bacteria of the genus Proteus, pathogenic, including salmonella, molds;

In meat and semi-finished products from it:
• toxic elements (lead, arsenic, cadmium, mercury,);
• pesticides (hexachlorocyclohexane and its isomers, DDT and its metabolites);
• radionuclides (cesium-137, strontium-90);
• antibiotics (levomycetin, tetracycline group, grisin, bacitracin) are not allowed;
• microbiological indicators (QMAFAnM, BGKP, pathogenic microbes, including salmonella; yeasts, molds; L. monocytogenes are not allowed;
• the presence of the causative agent of parasitic diseases is not allowed: Finns (cysticerci), larvae of trichinella and echinococcus, cysts of sarcocysts and toxoplasma;
In milk, cream, diary products:
• toxic elements (lead, arsenic, cadmium, mercury,);
• mycotoxins (aflatoxin Mj);
• antibiotics (levomycetin, tetracycline group, streptomycin, penicillin) are not allowed;
• inhibitory substances – not allowed;
• pesticides (hexachlorocyclohexane and its isomers, DDT and its metabolites);
• radionuclides (cesium-137, strontium-90);
• microbiological indicators (QMAFAnM, BGKP (coliforms), pathogenic, including Salmonella; St. aureus, L. monocytogenes are not allowed.

Appendix

SANITARY & HYGIENIC ESTIMATION OF MILK

Assignment 1

1. Determining organoleptic properties of milk

1.1. Appearance. The appearance of milk is estimated in a transparent vessel. Milk may be homogenous, sedimented, polluted. It contains some admixtures.

1.2. Colour. The colour of milk is determined in a cylinder made of colourless glass. It usually contains 50-60 ml of milk.

1.3. Consistency. The consistency of milk is determined considering the traces remaining on the walls of a vessel after shaking. If the consistency of milk is normal, white traces on the walls of a vessel usually remain.

1.4. Smell. One should pour 100 ml of milk into a conical vessel, close it with a glass and shake the milk. Only then the smell of milk can be determined. Fresh milk has a specific smell.

1.5. Taste. One should drink some milk (5-10 ml) keeping it for some time in the mouth. The taste of milk of high quality is slightly sweetish.

2. Determining physical & chemical properties of milk.

2.1. Determining the specific weight of milk.

Specific weight of milk is determined with the help of a lactodensimeter which has two scales: the lower for determining specific weight of milk and the

upper to measure the temperature. The specific weight of milk can be conventional (Keven´s degree). Each Keven´s degree corresponds to one thousandths of a gram. For example, if the specific weight of milk is 1. 027, the density of milk should be 27 Keven´s degrees.

One should pour 150 ml of milk into a glass. Then the lactodensimeter should be put into the milk to the mark 1.030 so that it does not touch the walls of the glass. The specific weight of milk is determined considering the indicators of the upper level of milk. One should do it within 5 minutes after pouring the milk into the glass. Considering the indicators on the upper scale, one can determine the temperature of milk. If the temperature of milk is over 20 Cº, one should correlate it with the readings of the lactodensimeter and add the difference which is 0.2 Keven´s degree. If the temperature of milk is below 20 Cº, the difference of 0.2 Keven´s degree is subtracted.

2.2. Determining milk acidity.

One should pour 10 ml of milk, 20 ml of purified water, 3-4 drops of 1%-solution of phenolphthalein into a conical vessel. It should be titrated by 1%-solution of alkali NAOH till the solution is very pale pink.

The amount of titrated alkali multiplied by 10 is considered to be milk acidity shown in Terner´s degree. It corresponds to the amount of 0.1% alkali used for neutralizing the acids found in 100 g of milk.

3. Testing milk for adulteration

3.1. Revealing the presence of soda.

One can add soda to the milk in order to conceal increased milk acidity. Soda neutralizes lactic acid and thus there is no protection against the development of microorganisms. Besides, soda stimulates the loss of vitamin C. Such milk is not suitable for human consumption.

One should pour 5 ml of milk and 4-5 drops of 0.2%-alcoholic solution of rosolic acid into a glass. The milk usually becomes crimson-red in the presence of soda. If there is no soda in the milk, it usually turns a yellow-brownish colour.

3.2. Revealing the presence of starch.

One can add starch or flour to milk in order to give it a much denser consistency after adding some water to it.

One should pour 10-15 ml of milk into a test-tube and boil it. After cooling it, one should add 1 ml of Lugol´s iodine into the milk. If the milk becomes blue, it contains some starch.

Assignment 2. Sanitary & hygienic estimation of bread

1. Determining organoleptic properties of bread

One should examine the surface of bread (the outer and lateral crust) and evaluate its colour and shape.

One should press the bread crumb and evaluate its elasticity and porosity.

One should estimate the taste and smell of bread.

2. Determining physical and chemical properties of bread

2.1. Determining the porosity of bread.

Porosity of bread is the number of pores per some proportion of bread. It is calculated in percent.

The density of non-porous proportion of bread is a relative constant.

Type of bread	Density g/cm³
Rye bread & rye-wheat bread	1.21
Rye bread from the flour made of scald milk	1.27
Wheat bread of the second grade	1.26
Wheat bread of the first grade	1.1

One should cut off a slice of bread 27 cm³ in size with a cylindrical knife. The weight of the slice of bread should be measured. The porosity of bread can be calculated using the following equation:

$$X = \frac{(в - а/б) \cdot 100}{B}.$$

where: X – porosity of bread, %;

B – volume of the bread crumb with pores (27 cm³);

A – weight of the bread crumb;

Б – density of non-porous proportion of the bread.

The relation а/б is the volume of non-porous part of the bread crumb.

2.2. Determining the acidity of bread.

The acidity of bread is conditioned by the presence of acetic and lactic acids in it. It is calculated in degrees which corresponds to the amount of milliliters of 1%-solution of NAOH used for neutralizing the acetic and lactic acids found in 100 g of bread.

25 g of bread taken from different parts of the loaf should be cut off and put into a 250-300 ml vessel. One should pour 50 ml of purified water into the vessel and stir it with the help of a glass stick. It is necessary to make the mass homogenous. Then one should add some more water (150 ml) to the vessel. close it with a lid and shake it for 2-3 minutes. The bread should be left for 10 minutes to achieve sedimentation. The upper layer of the fluid should pass through a fine filter. 50 ml of the filtrate should be put into a conical vessel. One should add 2-3 drops of 1%-solution of phenolphthalein into it. The mixture is titrated by 0.1%-solution of NAOH until it becomes pink. The acidity of bread is calculated in degrees.

Example: One took 7.5 ml of 0.1%-solution of NAOH for titrating 50 ml of filtrate. Hence, one should take $7.5 \cdot 4 = 30$ ml of 0.1%-solution of NAOH for titrating 200 ml of filtrate, or 25 g of bread.

One should take $30 \cdot 4 = 120$ ml of 0.1%-solution of NAOH, or 12 ml of 1%-solution of NAOH for titrating 100 g of bread.

Thus, the acidity of the bread is 12 degrees.

THEME 2.3.
HYGIENIC EVALUATION OF NUTRITION. NUTRITION-RELATED DISEASES, THEIR CAUSES AND PREVENTION

The motivational description of the theme:

A balanced diet fosters normal growth and development, helps to maintain a high efficiency and productivity, increases life expectancy and promotes resistance to various unfavorable somatic factors.

The doctor must be aware of the problems associated with the impact of diet on the health of individuals and the population as a whole. Most nutrition-related diseases are manageable. Nutrition plays an important role in the prevention of

many chronic and noninfectious diseases in a population. Implementation of the principles of a balanced diet requires both the support of the state and that of every individual. All must strive to lead a healthy lifestyle and learn the practical skills of healthy nutrition. The doctor plays a crucial role in the dissemination of these skills and knowledge.

The objective: To learn the principles of rational nutrition, to learn the ways of preventing nutrition-related diseases, to learn how to calculate certain physiological energy and nutritional requirements of the body. To be able to determine and tabulate human energy expenditure using the time-keeping method. To learn the recommended standards for physiological energy and nutritional requirements.

Students' independent classroom activities

1. Solving case problems.
2. Determining and tabulating human energy expenditure using time-keeping data.
3. Determining the physiological energy and nutritional requirements of a student using the "Standard physiological requirements for energy and nutrients for different groups in the Russian Federation."
4. Students' presentations.

Self-study task:

1. Rational nutrition: Definition. The principles of rational nutrition.
2. Principles of standardization of nutritional needs of various population groups.
3. Standard physiological requirements for energy and nutrients.
4. Classification of nutrition-related diseases.
5. Prevention of nutrition-related noninfectious diseases.

Plan of students' independent activities

1. Case problem. The solution of case problems should be reported in writing.

2. Determining and tabulating human energy expenditure using time-keeping data according to the following algorithm:
- Chronometry of the various activities carried out for a period of 24 hrs;
- Drawing a chronogram of the day;
- Calculating the energy consumption for particular activities;
- Calculating the total energy consumption for all activities carried out within 24 hrs;
- Calculating unaccounted energy expenditure (5% of total energy consumption);
- Calculating energy consumption due to specific dynamic action of food (10-15% of the basal metabolic rate);
- Calculating daily energy expenditure (needs).

3. Determination of the physiological energy and nutritional requirements of a student using the "Standard physiological requirements for energy and nutrients for different groups in the Russian Federation" (Guidelines. 2.3.1.2432-08 MR).

Reference Information

Term descriptions

NUTRITION-RELATED DISEASES are diseases of microbial or other nature associated with consumed foods.

BASAL METABOLIC RATE is the minimum amount of energy needed for vital somatic processes to occur (physiological and biochemical processes, functioning of organs and systems of the body) in a state of thermal comfort, complete physical and mental rest and on an empty stomach. For people with a medium body size, BMR per 1 kg of body weight in men is 1 kcal / h on average, for women - 0.9 kcal/h.

HEALTHY NUTRITION is a physiologically complete nutrition of healthy people, taking into account their gender, age, nature of work and other factors. Healthy nutrition ensures normal growth and development of the body, it helps to maintain high performance, and it increases life expectancy, resistance to various adverse factors.

STANDARD PHYSIOLOGICAL REQUIREMENTS FOR ENERGY AND STANDARD NUTRITIONAL REQUIREMENTS: an average amount of food and biologically active substances required to ensure optimal physiological and biochemical processes, registered in the human genotype.

RATIONAL NUTRITION is a physiologically balanced diet of healthy people adjusted to their sex, age, occupation and other factors. A rational diet ensures normal growth and development, promotes high efficiency and productivity, increases life expectancy and resistance to various unfavorable factors.

'ADJUSTABLE' ENERGY CONSUMPTION means energy consumption caused by mental and physical activity.

A BALANCED DIET is a balance of individual nutrients (proteins, fats, carbohydrates, vitamins. etc.), when each of them can optimally perform their functions.

SPECIFIC DYNAMIC ACTION OF FOOD (FOOD THERMOGENESIS) means consumption of energy to metabolize nutrients in the body. If a diet is mixed, the SDDP is 10% (women) - 15% (male) of the value of basal metabolism.

ENERGY BALANCE is the equilibrium between the energy obtained with food and energy consumption to carry out all types of physical activity, to maintain basal metabolism, growth, development; as well as additional energy expenditure in women during pregnancy and breastfeeding.

DAILY ENERGY CONSUMPTION is the total daily energy expenditure of the body, consisting of general metabolism, energy expenditure on physical activity, specific dynamic action of food (food thermogenesis), growth and development

of tissues in children and additional consumption in pregnant and lactating women.

REGULATED ENERGY COSTS OF THE BODY - energy consumption for mental and physical activities.

DAILY ENERGY EXPENDITURE - the sum of daily energy expenditure of the body, consisting of basal metabolic energy, energy expenditure for physical activity, the specific dynamic effect of food (food thermogenesis), cold thermogenesis, growth and formation of tissues in children and additional costs for pregnant and breastfeeding women. Energy expenditure can be calculated as the product of the basal metabolic rate (hereinafter - BMR) by the corresponding coefficient of physical activity (for specific types of activity) and the time during which these types of activities are performed.

The basal metabolic rate for each age-sex group of the population, calculated on the basis of the anthropometric parameters of a standard adult according to the Mifflin-St. Jeor formula, is used to determine the physiological need for energy:

Mifflin-San Jeora formula for men and women

Men	**BMR(per day) = 9,99 x body weight (kg) + 6,25 x height (cm) - 4,92 x age (years) + 5**
Women	**BMR (per day) = 9,99 x body weight (kg) + 6,25 x height (cm)-- 4,92 x age (years) - 161**

The standard document:

MR 2.3.1.0253-21 “Norms of physiological needs for energy and nutrients for various groups of the population of the Russian Federation. Guidelines” dated 22.07.2021.

These standards are the scientific basis for:

- planning of production of basic food commodities and food products in the Russian Federation;
- developing perspective average standards for consumption of basic food products taking into account changes in the socio-economic situation and the demographic composition of the population of the Russian Federation. Their aim is to support an optimal development of domestic agriculture and food security;
- planning food service in organized groups, and health care centers;
- working out nutrition recommendations for various groups and social protection measures;
- justifying the ingredients of specialized and fortified foods;
- assessing the actual diet of the individual and the population when used as criteria;
- developing programs for training specialists and educating the population about the principles of healthy nutrition.

Gender groups of adults:

Men and women aged 18-29, 30-39, 40-59, over 60

Classification of the population according to the physiological nutritional and energy requirements of the human body

Nutritional needs of individuals are varied. When planning dietary patterns, one should consider that the diet should be adequate to meet the nutritional and energy needs of an individual. There is a certain regulation in the Russian Federation that is designed for the maintenance of adequate nutrition of different professional groups. This regulation is known as "Standard physiological requirements for nutrients and energy intake for different groups of the population". According to this regulation, all working people are divided into the following groups:

I group. Workers engaged in mental activity (research workers, students. computer operators, teachers, traffic controllers, etc.).

II group. Workers engaged in low energy-consuming activity (tram and trolley-bus drivers, conveyor operators, postal or telecommunications workers, nurses, salespeople of manufactured goods, etc.).

III group. Workers engaged in more energy-consuming activity (metal workers, adjusters, machine operators, drilling technicians, textile workers, rail-workers, bus drivers, salespeople of foodstuffs, surgeons. etc.).

IV group. Workers engaged in high energy-consuming activity (builders, drifters, farmers, steelworkers. etc.).

When planning the dietary pattern for different groups of the population, the following principles should be considered:

- Sex (male, female);
- Age (Adult workers are subdivided into the following age groups: 18-29 years old, 30-44, 45-64, 65-74,75 years old and older.);
- Level of physical activity;
- Special physiological states of the body (pregnancy, lactation) ;
- Climatic conditions (regions of the Far North and territories equated to them).

Table 1

Hourly energy consuption (per 1 kg)

Activity	Energy consumed
Sleeping	0.9 kcal
Dressing & washing	2 kcal
Having a meal	1.4 kcal
Doing morning exercises	4 kcal
Walking to work	4 kcal
Making notes of lectures (sitting)	1.5 kcal
Having practical classes in a laboratory room (standing)	2.4 kcal
Studying	1.4 kcal
Reading (leaning against the desk)	1.3 kcal
Reading aloud (sitting)	1.5 kcal
Slow walking	2.7 kcal
Sewing & knitting	1.4 kcal

Washing dishes	1.4 kcal
Ironing	1.9 kcal
Laundering, sweeping the floor	3.4 kcal
Standing	1.6 kcal
Cleaning the shoes	2.4 kcal
Cleaning the carpet	3-4.8 kcal
Playing musical instruments	2.2 kcal
Driving a car	2.4 kcal
Driving a bicycle	9.0 kcal
Playing volleyball	3.0 kcal
Playing tennis	6.1 kcal
Playing football	8.5 kcal
Running at a speed of 8km/h	8.1 kcal
Swimming	7.1 kcal
Skating	10.0 kcal

Classification of nutrition-related diseases

1.Food borne diseases associated with infectious agents and parasites:

Anthrax. Brucellosis, tuberculosis, typhoid and paratyphoid fever, shigellosis and other bacterial intestinal infections;

Amebiasis, toxoplasmosis, giardiasis, foot and mouth disease, trichinosis, cysticercosis, bothriocephaliasis etc.

2. Food poisoning of microbial and non-microbial etiology.

3. Diseases caused by irrational, unbalanced diets.

3.1. Malnutrition, and lack of proper food: Protein and energy insufficiency. kwashiorkor; marasmus, avitaminosis, anemia.

3.2. Disease from excess feeding: obesity, hypertension.

3.3. Diseases caused by irrational, unbalanced diets: violation of nutritional status; overweight; hyperlipidemia, dyslipoproteinemia, hyperglycemia; hypovitaminosis, macro- and microelementosis; atherosclerosis and vascular disease, ischemic heart disease; diabetes mellitus, thyroid disease, diseases of the gastro-intestinal tract, gall stones, impaired bone structure and density; cancer; secondary immunodeficiency, tooth decay, gout.

4. Food allergy and intolerance.

5. Congenital metabolic disorders.

Table 2

Criteria for calculating probable risk from insufficient intake of food substances

Food substances	Level of probable risk					
	No risk	Low	Medium			High
		2%	16%	50%	84%	98%
Proteins, g/kg of body weight, per	0.75-1.0 and higher	0.75	0.675	0.60	0.525	0.45

day for men & women over the age of 18	(but not over 1.6)					
Vit B_1, mg/day Men over 18 yrs Women over 18 yrs	 1.2-1.5 1.1-1.5	 1.2 1.1	 1.1 1.0	 1.0 0.9	 0.9 0.8	 0.8 0.7
Vit B_2, mg/day Men over 18 yrs Women over 18 yrs	 1.3-1.8 1.1-1.8	 1.3 1.1	 1.2 1.0	 1.1 0.9	 1.0 0.8	 0.9 0.7
Vit C, mg/day Men and women over 18 yrs	40-90	40.0	32.5	25.0	17.5	10.0
Vit A, Mkg eq/day Men over 18 yrs Women over 18 yrs	-	900.0 700.0	762.5 600.0	625.0 500.0	487.5 400.0	350.0 300.0
Calcium, mg/day Men & women over 18 yrs	700-1000	700.0	612.5	525.0	462.5	450.0
Iron, mg/day Men over 18 yrs Women 18-49 yrs Women over 50	 8.7-10 14.8-18 -	 8.7 14.8 8.7	 7.7 13.1 7.7	 6.7 11.4 6.7	 5.7 9.7 5.7	 4.7 8.0 4.7

Table 3

Factors preventing vs. factors promoting excessive body weight and obesity (WHO)

Risk reducing factors	Risk increasing factors
Proven	
Regular physical activity.	Sedentary lifestyle
High content of dietary fiber in the diet	Regular consumption of energy-dense foods (including fast food)
Highly Probable	
Optimization of feeding habits in children	Regular consumption of sweet soft drinks and juices
Breastfeeding	
Probable	
Low glycemic index foods *	Habit of using large meals

	Constant use of public catering system
Presumptive	
Limited intake of alcohol and in manageable fractions.	Alcohol abuse

* The glycemic index is the value showing the difference in the concentration of glucose in the blood serum within 2 hours after the consumption of a product compared to the same result after the consumption of the test product (50 g glucose).

Table 4

Factors preventing vs. factors promoting diabetes mellitus (WHO)

Risk reducing factors	Risk increasing factors
Proven	
Regular physical activity.	Sedentary lifestyle
Weight loss in overweight people	Being overweight and obese
	Deposition of fat in the abdominal area
Highly Probable	
A high content of dietary fiber in the diet	Consumption of saturated fatty acids
	Hypotrophy at birth
Probable	
Sufficient content of Omega-3 fatty acids in the diet	High content of “bad” fat in the diet
Low food glycemic index	Trans-fatty acids
Breastfeeding	
Presumptive	
Vitamin E, chromium, magnesium	Alcohol abuse

Table 5

Factors preventing vs. factors promoting diseases of the cardiovascular system (WHO)

Risk reducing factors	Risk increasing factors
Proven	
Regular physical activity	saturated fatty acids
Polyunsaturated fatty acids (linoleic and omega-3 branched-chain)	Being overweight and obese
Fruits, berries, vegetables	Sodium
Potassium	Alcohol abuse
Highly probable	

Polyunsaturated fatty acids (linoleic)	Dietary cholesterol
Monounsaturated fatty acids (oleic)	Unfiltered coffee
Wholegrain	
Nuts (unsalted)	
Plant sterol, folate	
Probable	
Bioflavonoids	high content of lauric acid in the edible fat
Soy products	Hypotrophy at birth
Presumptive	
Calcium, magnesium, ascorbic acid	Carbohydrates, iron (added inorganic)

Table 6

Factors preventing vs. factors promoting oncological diseases (WHO)

Risk reducing factors	Risk increasing factors
Proven	
Regular physical activity (cancer of the large intestine)	Being overweight and obese (cancer of the esophagus, colon, breast in postmenopausal endometrium, kidney, prostate)
	Alcohol abuse (cancer of the oral cavity, pharynx, larynx, esophagus. liver, breast)
	Aflatoxin (liver)
Highly probable	
Regular physical activity (breast cancer)	Meat stored for long periods of time (cancer of the large intestine)
Fruits and vegetables (cancer of the oral cavity, esophagus, stomach, large intestine)	Salty foods (stomach cancer)
	Very hot drinks and products (cancer of the oral cavity, pharynx, esophagus)
*Probable (*cancer at various sites*)*	
Dietary fiber	Animal fats
Soy products	Nitrosamines
Vitamins B2. B6. B12. folate. C. D. E	Polycyclic aromatic hydrocarbons
Calcium, zinc, selenium, lignans, indoles, carotenoids	Polychlorinated biphenyls
Bioflavonoids, isoflavones, lignans, indoles, carotenoids	

Table 7

Factors preventing vs. factors promoting osteoporosis in the elderly (WHO)

Risk reducing factors	Risk increasing factors
Proven	
Regular physical activity	Hormonal dysfunction
Calcium	Alcohol abuse
Vitamin D	Low body weight
Optimal insolation	
Highly probable	
Fruits and vegetables	Excessive consumption of salt
Soy products	Over-consumption of proteins

Appendix

Table 1

Standard physiological requirements for proteins, fats, carbohydrates and energy

Group	Age	Energy	Protein	Animal protein	Fat	Carbohydrate	Group
Male							
I	18-29; 30-44; 45-64	2400 2300 2150	84 81 75	42 41 38	80 77 70	336 322 301	20-25
II	18-29; 30-44; 45-64	2750 2650 2450	89 86 80	45 43 40	92 88 82	392 378 349	20-25
III	18-29; 30-44;	3250 3150	102 98	51 49	108 105	467 453	20-25

	45-64	2900	91	46	97	417	
IV	18-29; 30-44; 45-64	3800 3650 3400	114 110 102	57 55 51	127 122 113	551 529 493	20-25
Male 65-74 years		2400	84	42	80	336	20-25
Male 75 years and older		2300	81	41	77	322	20-25
Female							
I	18-29; 30-44; 45-64	1900 1800 1700	67 63 60	34 32 30	63 60 57	266 252 238	20-25
II	18-29; 30-44; 45-64	2200 2100 1950	72 68 63	36 34 32	73 70 65	314 299 278	20-25
III	18-29; 30-44; 45-64	2600 2500 2300	81 78 72	41 39 36	87 83 77	374 359 331	20-25
IV	18-29; 30-44; 45-64	3000 2850 2700	90 86 81	45 43 41	100 95 90	435 413 392	20-25
Female 65-74 years		1900	67	34	63	266	20-25

Female 75 and older	1800	63	32	60	252	20-25

Table 2

Menu plan (per serving) (g)

Foods	Weight (g)	Protein (g)	Fat(g)	Carbo-hydrate (g)	Energy value|Ccal
Meat broth with noodle	500	3.5	0.39	24.48	111
Russian cabbage soup with meat broth	500	4.15	6.2	19.4	150
Meat cutlets fried in vegetable oil	110	18.2	15.83	13.79	270
Meat lean cutlets steamed	100	17.34	5.75	7.78	152
Beef cooked lean	50	18.6	17.25	8.43	263
Boiled chicken	85	10.4	4.4	0.3	82
Boiled fish	110	13.1	0.45	-	56
fried fish	110	13.6	10.4	3.7	163
Egg	48	6.09	5.52	0.33	75
Omelette (2 eggs)	110	8.05	3.57	3.13	76
Cottage cheese with sour cream	130	17.26	13	11.92	233
Milk	180	5.04	5.76	7.3	101
Kefir	180	5.04	5.76	7.3	101
Cheese	30	8.04	8.19	-	105
Porridge semolina	250	7.35	7.6	39.05	254
Boiled rice	200	6.33	7.62	48.38	287
Boiled buckwheat	180	12.6	7.32	49.2	313
Boiled vermicelli	185	6.45	4.9	44.56	243
Boiled millet with pumpkin	270	9.68	8.77	50	317
Stewed beet	160	3.82	12.02	23.03	215
Boiled potato with vegetable oil	210	4.82	4.32	40	215
Mashed potato	240	4.8	6.15	40.81	237
Stewed cabbage	200	4.25	10	13.64	161
Stewed vegetables	250	5.41	7.25	30	206

Salad with sauerkraut	110	1	10	3	105
Salad with boiled cooked vegetables and vegetable oil	220	4	10	21.19	191
Stewed fruits	200	0.17	-	24	100
Stewed dried fruits	200	0.1	-	40	200
Apple juice	100	0.5	-	12	48
Tea with sugar	200	0.05	-	15	56
Coffee with sugar and milk	200	3.21	3.63	20	110

Table 3

Physiological daily requirement in vitamins

Group	Age	C Mg	A mic	E mg	D mic	B1 mg	B2 mg	B6 mg
1	2	3	4	5	6	7	8	9
Male								
I	18-59	70.0	1000.0	10.0	2.5	1.2	1.5	2.0
II	18-59	70.0	1000.0	10.0	2.5	1.4	1.7	2.0
III	18-59	80.0	1000.0	10.0	2.5	1.6	2.0	2.0
IV	18-59	80.0	1000.0	10.0	2.5	1.9	2.2	2.0
V	18-59	100.0	1000.0	10.0	2.5	2.4	2.4	2.0
Male over 59								
60-74		80.0	1000.0	15.0	2.5	1.4	1.6	2.2
Over 75		80.0	1000.0	15.5	2.5	1.2	1.4	2.2
Female								
I	18-59	70.0	800.0	8.0	2.5	1.1	1.3	1.8
II	18-59	70.0	800.0	8.0	2.5	1.1	1.3	1.8
III	18-59	80.0	1000.0	8.0	2.5	1.3	1.5	1.8
IV	18-59	80.0	1000.0	8.0	2.5	1.5	1.8	1.8
Female over 59								
60-74		80.0	800.0	12.0	2.5	1.3	1.5	2.0
Over 75		80.0	800.0	12.0	2.5	1.1	1.3	2.0
In addition to standard (pregnancy)								
		+20.0	+200.0	+2.0	+10.0	+0.4	+0.3	+0.3
1	2	3	4	5	6	7	8	9
Infant								
0-3		30.0	400.0	3.0	10.0	0.3	0.4	0.4
4-6		35.0	400.0	3.0	10.0	0.4	0.5	0.58
7-12		40.0	400.0	4.0	10.0	0.5	0.6	0.6
1-3 year		45.0	450.0	5.0	10.0	0.8	0.9	0.9

Children								
4-5 year	50.0	500.0	7.0	2.5	0.9	1.0	1.3	
Pupil								
6 year old	60.0	500.0	10.0	2.5	1.0	1.2	1.3	
7-10	60.0	700.0	10.0	2.5	1.2	1.4	1.6	
11-13 male	70.0	1000.0	12.0	2.5	1.4	1.7	1.8	
11-13 female	70.0	800.0	10.0	2.5	1.3	1.5	1.6	
14-17 male	70.0	1000.0	15.0	2.5	1.5	1.8	2.0	
14-17 female	70.0	800.0	12.0	2.5	1.3	1.5	1.6	

Table 4

Physiological daily requirement in minerals (mg)

Minerals	Male	Female	In addition to standard		
			Pregnant	Breast-feeding (1-6)	Breast-feeding (7-12)
Calcium	1000	1000	300	400	400
Phosphorus	800	800	200	200	200
Magnesium	400	400	50	50	50
Potassium	2500	2500	-	-	-
Natrium	1300	1300	-	-	--
Chiorine	2300	2300	-	-	-
Iron	10	180	15	0	0
Zinc	12	12	3	3	3
Iodine	150	150	70	140	140

THEME 2.4.
EVALUATION OF INDIVIDUAL MACRONUTRIENT AND ENERGY INTAKES

The motivational description of the theme

Nutritional status is a criterion for determining the quality of human life. Its evaluation enables the doctor to develop individual programs for the integrated prevention of nutrition-related diseases. The study and analysis of the nutritional status involves evaluating actual nutrition (the list of food products consumed; nutrient composition; dietary patterns and conditions) as well as assessing a health condition (nutritional status and nutrition-related morbidity). By correctly adjusting the feeding habits of the patient living in a particular region, the

physician can align the quality and quantity of foods consumed with the real needs of the patient's body for the proper nutrient and energy intakes.

The objective: to learn how to calculate the chemical composition and energy value of a diet (by analyzing a menu production record of the daily dietary needs of a medical student).

Students' independent classroom activities

1. Solving case problems.
2. Drawing up a menu production record of the daily dietary needs of the student (according to food intakes).
3. Determining the energy value (kcal) and qualitative composition (proteins, fats, carbohydrates, g) of food products at particular meals and in general during the day using the "table of the chemical composition and energy value of food."
4. Evaluating the actual energy value of the diet per food intake.
5. Presentation and discussion of topics individually assigned by the teacher.

Self-study tasks

1. The biological role of proteins, rationing, sources in the diet.
2. The biological role of fats, rationing, sources in the diet.
3. The biological role of carbohydrates, rationing, sources in the diet.
4. Diet, definition and importance.

Plan of students' independent activities

1. Case problem. The solution of case problems should be reported in writing.
2. Menu production record of the daily ration of a student (fill the table 1)
3. Outline of the energy values of the nutritional ration of the student according to food intake (fill the table 2)

Reference Information

Term descriptions

DIETARY INTAKE (FOOD RATION) is the composition and quantity of food consumed during the day.

DIETARY PATTERN is the number of meals per day (number of intakes), time when meals are taken, the duration of the intervals between meals, the distribution of the daily intake between individual meals.

Table 3

Chemical composition of products

№	Name of a product	Proteins	Fats	Carbohydrates	Kcal
1	*2*	*3*	*4*	*5*	*6*
1. Chemical composition of products used as major sources of proteins					
1.	First rate mutton	16.3	15.3	-	203

2.	Second rate mutton	20.8	9.0	-	164
3.	First rate beef	18.9	12.4	-	187
4.	Second rate beef	20.2	7.0	-	144
5.	Meat-type pork	51.6	33.0	-	199
6.	Fat-type pork	38.7	49.3	-	355
7.	First rate chicken	18.2	18.4	0.7	241
8.	Second rate chicken	20.8	8.8	0.6	165
9.	Chicken egg. first rate	12.7	11.5	0.7	157
10.	Beef liver	17.4	3.1	-	98
11.	Bream	17.1	4.1	-	105
12.	Semi-skimmed curd/cottage cheese	16.7	9.0	1.3	156
13.	Pacific herring (lean)	18.0	7.0	-	153
14.	Pike perch	9.0	0.8	-	83
II. Chemical composition of products used as major sources of fat					
1.	Unsalted butter	0.6	82.5	0.9	748
2.	Butter	1.3	72.5	0.9	661
3.	Milk margarine	0.3	82.3	1.0	746
4.	Purified sunflower oil	-	99.9	-	899
III. Chemical composition of products used as major sources of carbohydrates					
1.	Sand sugar	-	-	80	374
2.	Natural honey	0.8	-	80.3	308
3.	Potato starch	0.1	traces	79.6	299
4.	Tinned rye bread	6.5	1.0	41.2	190
5.	Wheat bread	7.6	0.9	49.7	226
6.	Long loaf	7.9	1.0	51.9	236
7.	Wheat farina	11.3	0.7	70.3	326
8.	Buckwheat	12.6	2.6	63.7	329
9.	Rice	7.0	0.6	73.6	323
10.	Wheat groats	12.0	2.9	64.8	334
11.	Oat flakes	13.1	6.2	59.2	355
12.	Macaroni (first rate)	10.4	0.9	68.5	332
IV. Chemical composition of dairy products					
1.	Pasteurized milk	2.8	3.2	4.7	58
2.	Skimmed milk	3.0	0.05	4.7	31
3.	Condensed milk	7.2	8.5	12.5-43.5	315

4.	Skimmed kefir	3.0	0.05	4.1	30
5.	Rich kefir	2.8	3.2	4.1	59
6.	Acidophilus milk	2.7	3.2	3.8-7.0	84
7.	Sour cream 20%	2.8	20.0	3.2	206
8.	Cake cheese	9.1	23.0	18.5	315
V. Chemical composition of vegetables. fruits. and berries					
1.	Green peas	5.0	0.2	13.3	72
2.	Marrow	0.6	0.3	5.7	27
3.	White cabbage	1.8	-	5.4	28
4.	Potatoes	2.0	0.1	19.7	83
5.	Green onion	1.3	-	4.3	22
6.	Bulb union	1.7	-	9.5	43
7.	Carrot	1.3	0.1	7.0	33
8.	Cucumbers (ground-grown)	0.8	-	3.0	15
9.	Sweet green pepper	1.3	-	4.7	23
10.	Parsley	3.7	-	8.1	45
11.	Dill	2.5	0.5	4.1-4.5	32
12.	Beet	1.7	-	10.8	48
13.	Tomatoes (ground-grown)	0.6	-	4.2	19
14.	Water-melon	0.7	-	9.2	19
15.	Melon	0.6	-	9.6	39
16.	Apricots	0.9	-	10.5	46
17.	Cherries	0.8	-	11.3	49
18.	Pears	0.4	-	10.7	42
19.	Peaches	0.9	-	10.4	44
20.	Plums	0.8	-	9.9	43
21.	Apples	0.4	-	11.3	46
22.	Oranges	0.9	-	8.4	38
23.	Lemons	0.9	-	3.6	31
24.	Grapes	0.4	-	17.5	69
25.	Raspberries	0.8	-	9.0	41
26.	Red currants	0.6	-	8.0	38
VI. Beverages					
1.	Black tea	20.0	-	4.0-6.9	109
2.	Whole bean coffee	13.9	14.3	2.8-4.1	223
3.	Instant coffee	15.0	3.6	7.0	119

Table 4

Mass of product (g) in commonly consumed quantities

Name of product	Tea Spoon	Table Spoon	Glass

Wheat farina	8	25	210
Buckwheat	8	25	210
Rice	8	25	230
Millet	8	25	220
Peas	-	22	230
Sand sugar	8	25	200
Honey	9	30	
Milk	5	18	250
Sour cream	11	25	250
Cottage cheese	5	17	-
Butter	5	17	-
Cherries	-	-	165
Raspberries	-	-	180
Currants	-	-	155
Tomato pulp	8	30	-
Fruit & Veg juices	5	18	250
Jam	20	45	-

Table 5

The mass of most commonly consumed food products (g)

Name of product	Mass of a single unit of the product (g)
Bread products and doughnuts:	
A slice of bread	50
Pone	50
Confectionery:	
Caramel with filling	6
Toffees	7
Marmalade	12
Marshmallows	33
Biscuits and crackers	13
Cookies	35
Pie	75
Milk products:	
Melted cheese	35 и 100
Ice-cream	50. 100. 250
Fruits and Vegetables:	
Potatoes. Cucumbers	100
Onions. Carrots	75
Tomatoes	50-100
Apricots	26
Pears	135
Plums	30

Apples, diameter 7.5 cm	200
Oranges, diameter 7.5 cm	150
Grapefruit	130
Lemons	60
Strawberries	8
Meat products:	
Wieners/French sausages	100
Sausages	50
Chicken eggs:	50

THEME 2.5.

EVALUATION OF INDIVIDUAL MICRONUTRIENT INTAKES: VITAMIN, MINREAL AND FIBER FOOD INTAKES

Motivational description of the theme:

A balanced diet requires not only balanced intake of proteins, fats, and carbohydrates, but also balanced micronutrient intake. The results of studies on dietary intake of different groups showed significant prevalence of polyhypovitaminoses, lack of basic minerals and fiber foods. Micronutrient deficiencies cannot be prevented by simply increasing food consumption. Modern

living and working conditions of the majority of the population lead to a relative reduction in energy consumption, which accounts for the need to reduce food intake and results in the inadequate intake of micronutrients contained in it. Awareness of the clinical manifestations of micronutrient deficiencies, sources of vitamins, minerals and fiber in the diet, and the ways and techniques of preserving the value of products (preventive fortification) enables the doctor to optimize the nutritional status of patients.

The objective: to familiarize with the biological role, rationing and nutritional sources of micronutrients and fiber foods, to calculate the chemical composition of diets based on the content of vitamins, minerals, dietary fibers (for example the menu production record of the daily dietary needs of a medical student), to learn the ways to store and cook products in order to preserve vitamins, to learn about preventive fortification.

Students' independent classroom activities

1. Determining the content of vitamins, minerals, fiber foods in the daily food consumption of a student.
2. Case problem (type 1. type 2).
3. Lab experiments to determine the content of vitamin C in vegetables.
4. Presentation and discussion of topics individually assigned by the teacher.

Self-study tasks

1. Biological role, rationing and sources of water-soluble vitamins in the diet.
2. Biological role, rationing and sources of dietary fat-soluble vitamins.
3. Types of vitamin A deficiency.
4. Causes of hypovitaminoses, their manifestation.
5. Ways to maintain and improve the vitamin value of a diet, prevention of hypovitaminoses.
6. Biological role, rationing and sources of minerals in the diet.
7. Biological role, rationing and sources of dietary fibers in the diet.

Plan of students' independent activities

1. Determining the content of vitamins, fiber foods and minerals in the daily nutritional ration of a student using the calculation method (the menu production record provided in theme 2.4.). Learning how to use the *Tables of the chemical composition and energy value of food*.

2.Case problem (type 1, type 2) The solution of case problems should be reported in writing.

3. Lab experiments: determine the content of vitamin C in vegetables, vitamin C loss in the process of food refining, processing and cooking.
3.1. Determination of vitamin C in raw and boiled potatoes, the calculation of % loss of vitamin C in the cooking process.
3.2. Determination of vitamin C in cabbage, calculation of % loss of vitamin C during storage.

3.3. Formulation of conclusions and recommendations for the preservation of vitamins in food.

Reference information

Term descriptions

AVITAMINOSIS is total depletion of all vitamins in the body (total vitamin deficiency). Avitaminosis is associated with certain clinical symptoms which are characteristic of all vitamin deficiencies. C-avitaminosis (scurvy, Barlow´s disease). B1-avitaminosis (alimentary polyneuritis, Beriberi). PP-avitaminosis (pellagra). B2-avitaminosis (ariboflavinosis). A-avitaminosis (hemeralopia, xerophthalmia). D-avitaminosis (rickets, osteoporosis).

ANTIVITAMINS are the compounds which lessen or negate the chemical action of vitamins in the body metabolism by breaking up, inactivating vitamins or preventing their assimilation. Antivitamins are divided into two groups:

a) structurally similar antivitamins (competitive inhibitors; they compete with vitamins or their derivatives in the corresponding biochemical metabolic processes). They include sulfanilamides, dicumarin, megafen, isoniaside, etc.
b) structure-modifying antivitamins (natural antivitamins; they destroy or decrease the effect of a vitamin by modifying the molecule itself or by forming complexes with the metabolite). They include thiaminase, ascorbic oxidase, avidin, etc.

VITAMINS are low molecular weight and highly biologically active organic compounds required for living. They are synthesized (or insufficiently synthesized) in the body and supplied through food. The biological role of *water-soluble vitamins* consists in the fact that they are involved in making coenzymes; the biological role of *fat-soluble vitamins* is to control the functional condition of cell membranes and subcellular structures.

VITAMIN ANTAGONISTS: B1 and B2; A and D; nicotinic acid and choline; thiamine and choline (a long-term therapy with one vitamin results in the deficiency in another vitamin).

SYNERGY VITAMINS: C and R. R, C, K; B12 and folic acid; C, K, B2; A and E; E and inositol (they can increase the biological effect of each other when used together in multivitamin medications).

HYPOVITAMINOSIS is a sharp decline in vitamin supply. It is an initial stage of avitominosis. Hypovitaminosis is caused by insufficient consumption of vitamins that need to be included in the diet during a certain period of time.

LATENT FORM OF VITAMIN DEFICIENCY occurs when the body does not have a steady supply of vitamins in the diet. Latent forms of vitamin deficiency do not have any clinical manifestations. They are considered to be a preclinical stage of vitamin deficiency and are characterized only by biochemical disorders.

However, it has a negative effect on working capacity and resistance of the body to various unfavourable factors. It also makes recovery after a disease longer.

DIETARY FIBERS are macro molecular carbohydrates (cellulose, hemicelluloses, pectin, lignin, chitin, etc.), mainly, of plant origin that are indigestible and non-

absorptive in the small intestine, but subject to full or partial fermentation in the large intestine.

MAJOR CAUSES OF HYPOVITAMINOSES AND AVITAMINOSES are as follows:

1. Inadequate intake of vitamins from food:

1.1. Low contents of vitamins in the diet

1.2. Reduced food intake due to low energy expenditures of a modern person.

1.3. Loss of vitamins during improper processing, storing, and cooking.

1.4. Imbalanced diet (a high carbohydrate diet requires more vitamins; inadequate intake of native vitamins C, PP, B 1 results in the situation when they are rapidly excreted with urine without being involved in metabolic processes. It also inhibits transformation of carotene into vitamin A).

1.5.Anorexia

1.6. Presence of vitamins in a form that cannot be utilized in some foods (inositol in the form of phytin in cereals).

1.7. Effects of antivitamin agents that are found in food.

2. Supression of intestinal flora producing a number of vitamins.

2.1.Diseases of the gastrointestinal tract.

2.2. Aftermaths of chemotherapy (dysbacterioses).

3. Malabsorption of vitamins.

3.1. Disorders related to malabsorption of vitamins in the gastrointestinal tract (diseases of the stomach, liver, gallbladder, intestinal diseases; old age disorders such as impaired bile secretion which is important for absorption of fat-soluble vitamins).

3.2. Most vitamins are utilized or broken down in the human body by intestinal parasites or pathogenic intestinal microflora (deficiency in B12 in case of broad tapeworm invasion).

3.3. Disorders of vitamin metabolism and formation of their biologically active forms (coenzymes) associated with various diseases, effects of toxic and infectious agents, chemotherapy, old age disorders.

4.Increased vitamin requirements.

4.1. Special physiological states (intensive growth, pregnancy, lactation).

4.2. Special climatic conditions (vitamin requirements increase by 30-60% due to higher energy expenditures at low temperatures in the northern climatic zone).

4.3. Intense physical activity.

4.4.Psychological and stress loads.

4.5. Effects of harmful occupational factors (People working in hot shops and exposed to high temperatures (32 degrees) require twice as much vitamins C, B1, B6, pantothenic acid as those doing the same job at 18 degrees).

4.6. Infectious diseases and intoxications (In severe sepsis daily requirements for vitamin C reach 300-500 mg).

4.7. Internal diseases and diseases of endocrine glands.

4.8. Increased excretion of vitamins.

5. Congenital genetic disorders of vitamin metabolism.

5.1. Congenital disorders of vitamin absorption.

5.2. Congenital disorders of vitamin transport in blood and across cell membranes.

5.3.Congenital disorders of vitamin biosynthesis (nicotinic acid from tryptophan).

5.4. Congenital disorders of conversion of vitamins into their coenzyme forms, prosthetic groups and active metabolites.
5.5. Disorders related to the failure to bind vitamins to the active site of an enzyme.
5.6. Impaired structure of an apoenzyme impeding its interaction with a coenzyme.
5.7. Impaired structure of an apoenzyme resulting in complete or partial enzymatic activity loss regardless of its interaction with a coenzyme.
5.8. Boosted vitamin catabolism.
5.9. Congenital disorders of renal reabsorption of vitamins.

Table 1

Vitamin losses during processing and cooking

Foods	A	B1	B2	C	PP
Flour,cereals, beans	-	40	30	-	30
Butter	20	-	-	-	15
Sour cream, cottage cheese	20	20	15	-	15
Eggs	30	20	15	-	15
Meat	30	40	30	-	30
Fish	-	30	25	-	25
Fruits & berries	30	20	15	60-70	15
Vegetables (on average)	40-50	30	20	60-75	20
Milk	20	20	15	50	15
Flour, cereals, beans					

Table 2

Vitamin C losses in potatoes in food storage

Time	Content of vitamin C compared with initial value
After harvesting	100% (20 mg/100 g)
Storage of food for 6-8 months	50-40%

Table 3

Vitamin C losses during processing and cooking

Raw & cooked food	Vitamin C losses
Cabbage soup (shchi) with sauerkraut (boiled for 1 h)	50
Cabbage soup (shchi) that was kept on the heated stove for 6 hours	90
Potato soup (after cooking)	50
Potato soup that was kept on the heated stove for 6 hours	100
Stewed cabbage	85

Sauerkraut removed from the pickle juice in 12 hours	50
Sauerkraut removed from the pickle juice in 24 hours	70
Sauerkraut washed with cold water	60
Sauerkraut washed with hot water	80
Sauerkraut frozen	20-40
Mashed potatoes	80
Fried hashed potatoes	65
Boiled potatoes (peeled)	40
Boiled potatoes (in jackets)	25
Raw potatoes (peeled, potato tubers kept for some time in water at room temperature)	20
Raw potatoes (peeled, cut to pieces, kept in water for 30 minutes)	40
Boiled carrots (scraped)	60

Table 4

Vitamin C losses in potatoes during storage

Harvesting time	Content of vitamin C compared with the initial value
Immediately after harvesting	100% (20 mg/100 g)
9 days	90%
3 months	70%
Storage of food for 6-8 months	50-40%

Main preventive measures against vitamin deficiency

1. Increasing the production of foods which are rich in vitamins. Higher consumption of these foods per capita.
2. Making foods rich in vitamins available in the grocery throughout the year (greenhouses, etc.).
3. Proper storing and processing foods in public catering units, food industries and at home.
4. Developing new methods and facilities which will promote the preservation and increase of vitamins in foods.
5. Producing new foods by adding some food additives rich in natural vitamins.
6. Increasing the amount of vitamins we eat through the selection of crops and proper fattening of the farm livestock.
7. Increasing the production of vitamin and multivitamin supplements.
8. Educating the population about nutrition hygiene and practical vitaminology.
9. Controlling the amount of vitamins in the diet. Taking vitamin supplements or vitaminized foods (e.g. flour, sugar, milk or juices) in case of developing vitamin deficiencies.

***There are two main ways of additional* vitaminization**

1. One of the ways of food vitaminization consists in adding some vitamin supplements to the foods (e.g. margarine is usually enriched with vitamin A, lump sugar and milk are often enriched with vitamin C; flour is supplemented with

vitamins B410, B 420, PP; chocolate, marmalade and caramel are usually enriched with a B- complex multivitamin supplement as well as with vitamins C, A, D; tinned goods are often supplemented with vitamin C and carotene).

2. Another way of food vitaminization consists in adding vitamin supplements to cooked food in public catering units. Thus, vitamin C vitaminization is usually done in pre-school educational establishments, children´s homes and hospitals throughout the year, while in some other establishments – only in spring and winter.

The recommended daily intake of ascorbic acid is 30 to 70 mg for children, 100 mg for adults. Acorbic acid is usually added to the first and third courses. The dietary supplements of vitamin C may be taken as special tinctures, fruit and vegetable juices which are rich in natural vitamin C sources.

Recipe of a vitamin-rich dogrose tincture

100 g of dried dogrose fruits contain 1200-1500 mg of ascorbic acid. For the preparation of a vitamin-rich dogrose tincture one should take 15 g of dried fruits (per person), wash them in cold water, crush them thoroughly, pour in a glass of boiled water and boil the mixture for 10 minutes in the enamel sauce-pan with a lid on. The tincture should be left for 3-4 hours. Then it should be filtered. One should take one or two glasses of hot or cold tincture daily (sugar can be added). The content of vitamin C in a glass is about 100 mg. The tincture should be kept for no more than 2 days.

Ways of increasing vitamin value in vegetables

1. Storage of vegetables.

One should store fresh vegetables in well ventilated rooms at a temperature of +1-3 Cº and relative air humidity of 85-90%. It is necessary to protect them from sunlight. Fermented vegetables should be pickled and kept at a temperature of +3 Cº; sauerkraut should be pickled and stored in a compressed state (see table).

One should avoid freezing and defrosting vegetables repeatedly. Leafy vegetables (e.g. lettuce/salad, green onions, etc.) should be eaten no later than 4 hours after picking.

2. Primary processing of vegetables.

It is necessary to minimize the period of processing vegetables. The skin of vegetables and fruits which contains a great deal of vitamins is to be preserved. One should use the utensils made of stainless steel. One should not wash sauerkraut (see table 1.2).

3. Storage of convenience foods.

One should minimize the time of keeping raw potatoes in water. It is necessary to avoid keeping vegetables cut to pieces in water. Root plants and vegetables should be kept one piece under a moist cloth, while cabbage and onions – under a dry one. Convenience leafy vegetables should be cooked immediately before thermal processing or adding to cooked dishes. Sauerkraut and pickled cucumbers should be taken out of the pickle before using.

4. Thermal processing.

Vegetables should be cooked in stainless ware or ware made of aluminium alloy or tin. The sauce-pans should be completely filled with their lids on. Vegetables should be cooked in water, oil or broth. Vegetables should be put into boiling water. Frozen

vegetables should be put into the broth without defrosting. The order of putting vegetables into a sauce-pan depends on the time they take to be cooked. It is not allowed to add baking soda to the broth with vegetables. Carrots and onions for the first and second courses should be fried in oil for 15-18 min. One should avoid stewing vegetables.

5. Storage of cooked food.

Food should be cooked before serving. One should avoid re-heating the food. Dill, parsley and other greens one should put into boiling broth. Cold vegetable dishes (salad, Russian salad) should be stored for no more than 4 hours at a temperature of +8 Cº.

Appendix

Table5

Content of mineral substances in common food products (in mg per 100g of edible portion)

Food Products	Sodium	Potassium	Calcium	Magnesium	Phosphorus	Iron
1	*2*	*3*	*4*	*5*	*6*	*7*
Rye bread	383	67	21	19	87	2
White bread	488	127	26	35	83	1.6
Porridge oat	45	292	64	116	361	3.9
Wheat farina	22	120	20	30	84	2.3
Rice	26	54	24	21	97	1.8
Buckwheat	-	167	70	98	298	8
Millet	39	201	27	101	233	7
Macaroni	10	124	18	16	87	1.2
Beef	60	315	9	21	198	2.6
Pork	51	242	7	21	164	1.6
Beef liver	63	240	5	18	339	9
Sausage	900	211	7	17	146	1.7
Chicken	110	194	16	27	228	3
Chicken eggs	71	153	55	54	185	2.7
Codfish	78	338	39	23	222	0.6
Sturgeon caviar	-	-	-	-	-	-
Pasteurized milk	50	146	121	14	91	0.1
Kefir	50	146	120	14	95	0.1
Sour cream	50	124	90	10	62	0.1
Cottage cheese	41	112	164	23	220	0.4
Hard cheese	950	-	760	-	424	-
Butter	74	23	22	3	19	0.2

Refined sunflower oil	-	-	-	-	-	-
Peas	-	731	89	88	226	7
Potatoes	28	568	10	23	58	0.9
White cabbage	13	185	48	16	31	1
Green onions	57	259	121	18	26	1
Tomatoes	40	290	14	20	26	1.4
Cucumbers	8	141	23	14	42	0.9
Beet	86	288	37	43	43	1.4
Carrots	21	200	51	38	55	1.2
Mushrooms	-	-	27	-	89	5.2
Apples	26	248	16	9	11	2.2
Apricots	30	305	28	19	26	2.1
Cherries	20	256	37	26	30	1.4
1	*2*	*3*	*4*	*5*	*6*	*7*
Raspberries	19	224	40	22	37	1.6
Wild strawberries	18	161	40	18	23	1.2
Currants	32	372	36	35	33	1.3
Dogrose	13	58	66	20	20	28
Grapes	26	255	45	17	22	0.6
Lemons	11	163	40	12	22	0.6
Oranges	13	197	34	13	23	0.3
Pies. cakes	23	64	30	16	68	1

Table 6

Content of iodine in food products, mkg

Product	Portion (g)	Iodine deficient province	Non-endemic conditions
Cod	100	-	75-139
Haddock	100	-	122-169
Oysters	100	-	100-200
Shrimps	100	-	29-43
Sea cabbage	50	-	Up to 900
Fish sticks	40 (2 units)	-	35
Cheese	30	1.4	9
Pork	100	4.4	30
Eggs	100	3.4	22
Potatoes	100	2.3	5
Onion	100	1.6	4.8
Apples	100	1.6	3.9

Milk	100	-	13.9
Bread, cereals	100	-	10.5

Table 7

Content of fiber in certain food products (g)

Product	Portion (g)	Quantity of fiber (g)
Oat shorts	50	7.7
Beans	100	6.8
Raspberries	100	6.8
Blueberries	100	5.3
Apples	140 (1 unit)	3.7
Mangoes	240 (1 unit.)	3.7
Buckwhat	100	3.4
Almonds	30 (23 units)	3.3
Oranges	130 (1 units)	3.1
Dried apricots	100	3.2
Pistachios	30 (47 units)	2.9
Pumpkins	100	2.9
Bananas	120 (1 units)	2.8
Kiwi	75 (1unit)	2.6
Potatoes	135 (1 unit)	2.4
Sweet pepper (red)	120 (1 unit)	2.4
Peanuts	30 (33 units)	2.4
Nectarine	135 (1 unit)	2.2
Carrots	70 (1 unit)	2.2
Sweet pepper (green)	120 (1 unit)	2.1
White cabbage	100	1.9
Sweet cherries	70 (10 units)	1.6
Tomatoes	120 (1 unit)	1.4
Bread (wholemeal)	30 (1 slice)	1.1

Physiological effects of dietary fiber:

- Ensuring normal intestinal motility, stimulation of peristalsis;
- The maintenance of normal intestinal microflora (microbiocenosis);
- Sorption properties;
- Protection of the epithelium of the large intestine from various pathological processes, including neoplastic ones.

Table 8

Physiological daily requirement in vitamins for adults (Russia)

Group	Age	C mg	A mic	E mg	D mic	B1 mg	B2 mg	B6 mg

1	2	3	4	5	6	7	8	9
Male								
I	18-59	70.0	1000.0	10.0	2.5	1.2	1.5	2.0
II	18-59	70.0	1000.0	10.0	2.5	1.4	1.7	2.0
III	18-59	80.0	1000.0	10.0	2.5	1.6	2.0	2.0
IV	18-59	80.0	1000.0	10.0	2.5	1.9	2.2	2.0
V	18-59	100.0	1000.0	10.0	2.5	2.4	2.4	2.0
Male over 59								
60-74		80.0	1000.0	15.0	2.5	1.4	1.6	2.2
Over 75		80.0	1000.0	15.5	2.5	1.2	1.4	2.2
Female								
I	18-59	70.0	800.0	8.0	2.5	1.1	1.3	1.8
II	18-59	70.0	800.0	8.0	2.5	1.1	1.3	1.8
III	18-59	80.0	1000.0	8.0	2.5	1.3	1.5	1.8
IV	18-59	80.0	1000.0	8.0	2.5	1.5	1.8	1.8
Female over 59								
60-74		80.0	800.0	12.0	2.5	1.3	1.5	2.0
Over 75		80.0	800.0	12.0	2.5	1.1	1.3	2.0
In addition to standard (pregnancy)								
		+20.0	+200.0	+2.0	+10.0	+0.4	+0.3	+0.3
1	2	3	4	5	6	7	8	9
Infant								
0-3		30.0	400.0	3.0	10.0	0.3	0.4	0.4
4-6		35.0	400.0	3.0	10.0	0.4	0.5	0.58
7-12		40.0	400.0	4.0	10.0	0.5	0.6	0.6
1-3 year		45.0	450.0	5.0	10.0	0.8	0.9	0.9
Children								
4-5 year		50.0	500.0	7.0	2.5	0.9	1.0	1.3
Pupil								
6 year old		60.0	500.0	10.0	2.5	1.0	1.2	1.3
7-10		60.0	700.0	10.0	2.5	1.2	1.4	1.6
11-13 male		70.0	1000.0	12.0	2.5	1.4	1.7	1.8
11-13 female		70.0	800.0	10.0	2.5	1.3	1.5	1.6
14-17 male		70.0	1000.0	15.0	2.5	1.5	1.8	2.0
14-17 female		70.0	800.0	12.0	2.5	1.3	1.5	1.6

Table 9

The content of vitamins in food (100g)

Food	B1	B2	PP	B6	C	A	ß-carotene	E
	Mg/100g							
1	2	3	4	5	6	7	8	9
Rye bread	0.18	0.11	0.67	0.17	-	-	-	2.2

White bread	0.21	0.12	2.81	0.3	-	-	-	3.8
Semolina	0.14	0.07	1.0	0.17	-	-	-	2.5
Buckwheat	0.53	0.2	4.19	0.4	-	-	-	6.6
Rice	0.08	0.04	1.6	0.18	-	-	-	0.4
Millet	0.62	0.04	1.55	0.52	-	-	0.15	2.6
Macaroni	0.17	0.08	1.21	0.16	-	-	-	2.1
Beef	0.07	0.18	3.0	0.39	-	-	-	-
Pork	0.52	0.14	2.4	0.33	-	-	-	-
Beef liver	0.3	2.19	6.8	0.7	33.0	3.8	1.0	1.3
Sausage	0.25	0.18	2.47	0.19	-	-	-	-
Chicken	0.07	0.15	3.6	0.61	-	0.1	-	-
Eggs	0.07	0.44	0.2	0.14	-	0.3	-	2.0
Crash	0.09	0.16	2.3	0.17	-	-	-	0.9
Sturgeon caviar	0.3	0.36	1.5	0.29	7.8	0.2	-	-
Milk	0.03	0.13	0.1	-	1.0	-	0.01	-
Kefir	0.03	0.17	0.14	0.06	0.7	-	0.01	0.1
Sour cream	0.02	0.1	0.07	0.07	0.2	0.2	0.1	0.5
1	2	3	4	5	6	7	8	9
Cheese	0.02	0.3	0.3	0.1	1.6	0.2	0.1	0.5
Butter		0.01	0.1	-	-	0.5	0.34	
Sunflower oil	-	-	-	-	-	-	-	67.0
Peas	0.81	0.15	2.2	0.27	-	-	0.07	9.1
Potato	0.12	0.05	0.9	0.3	20.0	-	0.02	0.1
Cabbage	0.06	0.05	0.4	0.14	50.0	-	0.02	0.1
Onions	0.02	0.1	0.3	0.15	30.0	-	2.0	1.0
Tomato	0.06	0.04	0.53	0.1	25.0	-	1.2	0.4
Cucumbers	0.03	0.04	0.2	0.04	10.0	-	0.06	0.1
Beet	0.02	0.04	0.2	0.07	10.0	-	0.01	0.1
Carrots	0.06	0.07	1.0	0.13	5.0	-	9.0	0.6
Mushrooms	0.02	0.3	4.60	0.07	30.0	-	-	0.6
Apples	0.01	0.03	0.3	0.08	13.0	-	0.03	0.6
Apricots	0.03	0.06	0.7	0.05	10.0	-	1.6	0.9
Cherries	0.03	0.03	0.4	0.05	15.0	-	0.1	0.3
Raspberry	0.02	0.05	0.6	0.07	25.0	-	0.2	0.6
Wild strawberry	0.03	0.05	0.3	0.06	60.0	-	0.03	0.5
Currant	0.02	0.02	0.3	0.13	200.0	-	0.1	0.7
Dogrose	0.15	0.84	1.5	-	1200	-	6.7	-
Grapes	0.05	0.02	0.3	0.09	6.0	-	-	-
Lemon	0.04	0.02	0.1	0.06	40.0	-	0.01	-
Orange	0.04	0.03	0.2	0.06	60.0	-	0.05	0.2
Pie	0.75	0.1	0.7	-	-	0.1	0.14	-

Appendix

METHODS FOR CALCULATING VITAMIN C IN VEGETABLES

One should take 5 g of the food, crush it in a bowl and pour in 15 ml of a 2% hydrochloric acid solution. Then it should be infused for 10 min. The given mixture is to be filtered. 1 ml of the filtrate is to be placed into a flask. One should add 6. 5 ml of distilled water, 0. 5 ml of 1% iodic potassium solution and 2 ml of 0. 5% starch solution. The mixture is to be titrated with 0. 001% potassium iodate solution until a steady blue colouring appears.

The equation used for calculating vitamin C:

$$X = \frac{П \cdot К \cdot В \cdot 0.088 \cdot 100}{С \cdot Д}$$

Where,
X – content of vitamin C in 100 g of the foods;
0. 088 – constant coefficient (1 ml of 0. 001% potassium iodate solution is converted to 0. 088 mg of vitamin C);
П – the amount of 0. 001% potassium iodate used for titrating the probe (in ml);
В – the volume of the foods after adding extraction liquid (in ml) (20);
С – the volume of the filtrate used for titrating (in ml) (1);
Д – weight of the foods (in g) (5);
100 – coefficient used for calculating vitamin C in 100 g of the foods.

THEME 2.6.
ASSESSMENT OF A NUTRITIONAL STATUS. DESCRIPTION OF HEALTH RISKS. HYGIENIC RECOMMENDATIONS FOR CORRECTING ACTUAL NUTRITION

The motivational description of the theme

The health condition of a population is associated with its feeding habits, and is assessed by the nutritional status and structure of nutrition-related diseases. A nutritional status refers to a set of indicators that reflect how the actual intake meets the real needs of the body. Inadequate energy intake and imbalanced diet alters body weight, functional status of the body, its reactivity and adaptability

and therefore can be a detrimental factor in many pathological conditions. The assessment of the nutritional status enables the physician to substantiate their practical steps aimed to correct the patient's diet.

The objective: to learn how to assess the nutritional status and the actual diet of an individual (for example, a medical student), to formulate hygienic recommendations for diet correction.

Students' independent classroom activities

1. Diagnostics of nutritional status.
2. Hygienic evaluation of the food ration of a medical student.

Give a conclusion and provide recommendations.

3. Case problem.
4. Presentation and discussion of topics individually assigned by the teacher.

Self-study tasks:

1. Definition of the indicators of a nutritional status.
2. The indicators used to assess a nutritional status

Plan of students' independent activities

1. Diagnostics of nutritional status (fill the table).

1.1. According to the structural parameters:

- Body weight, % of ideal body weight;
-Weight to height ratio (kg / m ²);
- Triceps skin-fold thickness (mm);

1.2. According to the symptoms of vitamin deficiency:

- Skin dryness and flaking (vitamin A);
- Follicular hyperkeratosis / keratinization of hair follicles, rough skin, "goose bumps" on the flexor surfaces of the legs, hips, buttocks / (vitamins A, C);
- Angular stomatitis / papules, maceration and epithelial desquamation, small cracks in both corners of the mouth / (vitamin B2, B6, PP);
- Cheilosis / epithalaxia in the closing of the lips, mucous inner surface of the lips is shiny, bright red, with transverse cracks on the lips / (vitamin B2, B6, PP);
- Friability, bleeding gums (vitamin C, PP);
- Spontaneous petechiae / Punctulate hemorrhages in the skin / (vitamin C, P);
- Hypertrophy of lingual papillas (vitamin B1, B2, B6, PP);
- Dryness of the conjunctiva (vitamin A, B2);
- Increased sebaceous excretions, seborrhea / increased secretion of the sebaceous glands, glossy skin, small, easy to scrape off the scales mainly in the nasolabial, postaural folds, nose alae / (vitamins B1, B2, B6, PP).

1.3. According to the function:

- Time of dark adaptation (a function of the visual analyzer, vitamin A).

2. Hygienic evaluation of the food ration of a medical student (fill table).

3. A comprehensive assessment of the diet of a medical student (based on the calculations carried out in class when themes 2.4. and 2.5. were studied), filling in the table.
4. Give a conclusion about the "types of nutritional status" and provide recommendations.

Reference information

Term descriptions

HYGIENIC DIAGNOSTICS OF NUTRITIONAL STATUS

The nutritional status of a person as well as the evaluation of their actual nutrition (energy intake, chemical composition of foodstuffs) underlie the hygienic control over the adequacy of nutrition.

Classification of nutritional status

I. Ordinary
II. Optimum
III. Excessive
    1. Excessive nutrition
    2. Obesity
IV. Insufficient
    1. Inadequate
    2. Premorbid
    3. Morbid

ORDINARY NUTRITIONAL STATUS is referred to as the absence of any structural or functional disorders related to nutrition as well as the presence of adaptive resources adequate for normal living conditions. This nutritional status is inherent in many healthy people who eat a balanced diet.
OPTIMUM NUTRITIONAL STATUS also implies the absence of any structural or functional disorders related to nutrition as well as the presence of adaptive resources sufficient not only for normal living conditions but also for living and performing activities in extreme conditions. It is developed by means of a special diet and in those who are in such professions as pilots, spacemen, rescuers.
EXCESSIVE NUTRITIONAL STATUS is characterized by structural and functional disorders and low adaptive resources. This nutritional status is developed by individuals who are on diets with excessive energy and nutrient intake.
INSUFFICIENT NUTRITIONAL STATUS involves structural and functional disorders, low adaptive resources. It develops due to qualitative and quantitative inadequacy of food intake.

INADEQUATE NUTRITIONAL STATUS is characterized by minor structural disorders when the symptoms of dietary deficiency cannot be observed. Special diagnostics, however, can reveal a decline in adaptive resources and functional capability of the body.

PREMORBID NUTRITIONAL STATUS gives rise to micro symptoms of dietary deficiency, induces malfunctioning of the basic physiological systems, a decrease in the general resistance and adaptive resources of the body even in normal conditions. However, a disease cannot be revealed at this stage.

MORBID NUTRITIONAL STATUS is associated not only with structural and functional disorders, but also with the clearly marked syndrome of nutritional deficiency.

DIFFERENTIAL DIAGNOSTICS OF THE NUTRITIONAL STATUS

The differential diagnostics of the nutritional status is carried out on the basis of somatometric, clinical, functional, biochemical, immunologic and demographic indicators.

1. Structural indicators:

- somatometric indicators are as follows: body height, body weight, chest circumference, shoulder circumference, shin circumference, skin fold thickness, weight to height ratio, etc.
- clinical indicators are as follows: the state of the skin and its appendages, the state of the tongue, visible mucous membranes, conjunctiva, parotid and mandibular glands, lymph nodes and some other organs available for palpation or physical examination.

2.Functional indicators

- evaluation of work capacity and productivity of a person (physical fitness, the state of the cardiovascular and respiratory systems).
- functional state of certain organs and systems (the functions of the visual analyzer, central nervous system, etc.).

3. Indicators of adaptive resources

- indicators of metabolic processes (protein, fat, carbohydrate and lipid metabolism, vitamin intake, etc.)
- immune status of the human body (bactericidal power and automicroflora of the skin, lysozyme of saliva, phagocytic activity of leucocytes, etc.).

4. **Demographic indicators**

- are used in considering the nutritional status of groups of people (mortality, birth rate, average life span, morbidity, etc.).

Appendix

I. BODY WEIGHT. Body weight is the most widespread indicator of the body structure. One can distinguish a permissible peak of body weight, normal body weight, standard body weight and ideal weight of the body.

Optimum weight of the body – (based on Insurance Company Statistics Society, USA), or ideal body weight (based on the Institute of Nutrition of the Russian

Academy of Medical Science, Russia) is the weight of the individual which ensures the longest life expectancy.
Body weight of a person is assessed according to the weight tables which establish the desirable weight for men and women. It´s percentage is calculated in relation to the standard weight.
If a person maintains a desirable weight (e.g. within 10% of the standard weight), this weight is considered normal. A person´s weight may be reduced by 10% to 20% of the standard body weight. In this case this weight is considered slightly reduced. A 20% to 30% reduce of the body weight means a moderately reduced body weight. If a person´s weight is reduced by 30% and even more, such a body weight is considered badly reduced.
If a person´s body weight is increased by 10% to 20%, it is referred to as excess weight. A 20% increased body weight means obesity of an individual.

2. KETLE´S INDEX

Body weight of an individual depends mainly on some other anthropometric indicators, especially on the human´s height. Adults´ height remains constant and does not change due to under- or overnutrition. Therefore, adults´ weigh to height ratio is usually referred to as an index. Ketle´s index, one of the most common dietary assessment techniques, is recommended for use by the WHO to assess nutrient adequacy and inadequacy of an individual.

Ketle´s index = Body weight (kg) / Height (m)²

According to the Metropolitan Height and Weight Tables, normative Ketle´s index is within 20-25 kg/m². In people with the 1st degree of obesity, who run the risk of dislipidemia, hypertension, diabetes and other diseases, Ketle´s index may increase up to 25-30 kg/m².
In people with the 2nd degree of obesity, Ketle´s index may vary from 30 to 40 kg/m². In patients with the 3d degree of obesity, Ketle´s index is usually 40 to 50 kg/m². In people with the 4th degree of obesity, it is more than 50 kg/m².

3. SKIN FOLD THICKNESS

By measuring skin fold thickness at certain locations body fat can be estimated. It is usually established with the help of an anthropometric sliding caliper. Skin fold thickness can be measured at various locations:
a) measurements taken at the back under the shoulder blade, at an angle of 45º to the spine (this measurement corresponds to the natural direction of the skin fold);
b) measurements taken at the stomach, inguinal region, parallel to the paraduodenal fold;
c) measurements taken at the back of the upper arm, at the back of the triceps.
Measurement of the skin fold thickness at the back of the triceps is more frequently used in class because of its ease and practicality. Measurements are taken at the back of the upper arm. The hand should be close to the body. The skin fold should be clutched by two fingers lengthwise, then, its thickness is measured with an anthropometric sliding caliper.

4. PERIOD OF DARK ADAPTATION TECHNIQUE

The test is made with the help of a black card with an area of 20x20 cm. At the corners of the box there must be blue, yellow, red and green small squares, 3´3 cm in size.

A student should take the box and stop-watch and get into a dark room. He should put the box at the level of his eyes, at a distance of 40-50 cm and start the stop-watch. As soon as he could see yellow and blue small squares in the box, the stop-watch is switched off. This is the period of dark adaptation. Normally, it is 30 to 60 sec.

An increased period of dark adaptation indicates vitamin A deficiency in the human body (i.e. hypovitaminosis), which usually results in hemerolopy (i.e. day blindness).

Table 1

Scheme for evaluating a nutritional status

Indicators	Nutritional Status					
	Ordinary	Optimal	Excessive	Insufficient		
				Inadequate	Pre-morbid	Morbid
1	2	3	4	5	6	7
Body weight (kg) % from ideal	90-110	100	>110	89-80	79-70	<70
Ketle´s index (kg/m²)	20-25	20-23	>25	19.9-18	17.9-16	<16
Skin fold thickness (mm) Men Female	7.7-10.2 14-24	8.5 18.0	>11.0 >25	7.7-6.8 14-10.0	6.8-6.0 10-8.0	<6.0 < 8.0
a) dryness & skin flaking	- +	--	--	+-	+	++
b) follicular hyperkeratinization	--	--	-+	+-	+	++
c) angular stomatitis	--	--	-+	-+	+	++
d) cheilosis	--	--	-+	-+	+	++
e) gum bleeding & gum friability	--	--	--	+	++	+++
f) spontaneous petechiae	--	--	-+	-	+	++
g) hypertrophy of lingual papilla	--	--	--	-+	+	+++

h) dryness of conjunctiva	--	--	--	-+	+	++
i) increased sebaceous excretion	--	--	++	--	--	--
Period of dark adaptation (sec.)	40-60	40	40-60	60-90	90-120	>120

Table 2

Ideal body weight

MALE				FEMALE			
Height, cm	Weight, kg	Height, cm	Weight, kg	Height, cm	Weight, kg	Height, cm	Weight, kg
145	51.9	166	64.0	140	44.9	161	56.9
146	52.4	167	64.4	141	45.4	162	57.6
147	52.9	168	65.2	142	45.9	163	58.3
148	53.5	169	65.9	143	46.4	164	58.9
149	54.0	170	66.6	144	47.0	165	59.5
150	54.5	171	67.3	145	47.5	166	50.1
151	55.0	172	68.0	146	48.0	167	60.7
152	66.6	173	63.7	147	48.6	168	61.4
153	56.1	174	69.4	148	49.2	169	62.4
154	56.6	175	70.1	149	49.8	170	63.2
155	57.2	176	70.8	150	50.4	171	64.3
156	57.9	177	71.6	151	51.0		
157	58.6	178	72.4	152	51.5		
158	59.3	179	73.3	153	52.0		
159	59.9	180	74.2	154	52.5		
160	60.5	181	75.0	155	53.1		
161	61.1	182	75.3	156	53.7		
162	61.7	183	76.5	157	54.3		
163	62.3	184	77.3	158	54.9		
164	62.9	185	78.1	159	55.5		
165	63.5	186	78.9	160	56.2		

THEME 2.7. (1.2.)
PREVENTION OF FOOD POISONINGS

The motivational description of the theme.

There exist about 250 diseases which may be caused by consumption of food. The incidence of food poisonings is second highest among these diseases. Thus, in case of the onset of an acute disease manifesting itself as enteritis and enterocolitis, the doctor should, on the one hand, examine the patient for a possibility of food poisoning and, on the other hand, he should examine the patient thoroughly for an infectious disease. It will enable the doctor to confirm the initial diagnosis or to rule it out.

Most food poisonings develop without complications. Patients usually recover in 1-2 days. However, there may be cases of mass food poisonings if preventive measures are not taken by doctors.

The objective: to learn about the classification, origin, pathogenesis, clinical manifestations and prevention of food poisoning; to learn to investigate cases of food poisoning so as to establish the causative factor and take preventive measures.

Students' classroom activities

1. Presentation of students' reports and their discussion.
2. Solving case problems.

Self-study task

1. Food-borne illness: definition, classification.
2. Bacterial food poisoning: its etiology, pathogenesis, clinical presentations, preventive measures.
3. Non-microbiotic food poisoning: etiology, pathogenesis, clinical presentations, preventive measures.
4. Measures to be taken by the doctor in case of food-borne illness (sporadic cases, mass food poisoning).

Plan of students' independent activities

1. Case problem (type1, type 2). The solution of case problems should be reported in writing according the plan:
1. Initial diagnosis (according to the given classification);
2. Management of the patient;
3. The food which caused the food poisoning;
4. Factors which may be responsible for the disease;
5. Measures to be taken to avoid the recurrence of the disease.

Urgent notification of an infectious disease, food poisoning, acute occupational poisoning

1. Diagnosis _____
2. Last name, first name_____
3. Gender: * Male * Female _____
4. Date of birth _____
5. Address:
street _____

town _____
country_____
6. Place of work, study _____
7. Date of the onset of the disease _____
8. Date of the first referral _____
9. Place and date of hospitalization _____
10. Source of infection and possible cause of the disease _____
11. Antiepidemiological measures _____
12. Date and time of notifying the Centre for Sanitary & Epidemiological Control. Name of the person who informed about the case _____
Name of the person who received the information about the case _____
13. Establishment which notified about the disease _____
Registration # _____
14. Date and time of sending the notification _____
Signature _____
15. Date and time of receiving the notification _____
Registration # _____
Signature _____

Reference information

Term descriptions

A FOOD POISONING is an acute, rarely seen chronic disease caused by consumption of food containing great amounts of microbes and toxic substances either of microbial or non-microbial origin.

A TOXICOINFECTION is an acute, quite often mass disease caused by consumption of food containing great amounts of live causative agents.

BACTERIAL TOXICOSIS is an acute disease caused by consumption of food containing toxins accumulated in the living organism as a result of the development of specific agents. The agents can be either revealed in small amounts or not revealed at all.

ALIMENTARY MYCOTOXICOSIS is a chronic disease caused by consumption of foods such as processed beans and corns, containing toxic metabolites produced by some specific forms of microscopic fungi.

General clinical manifestations of food poisoning:

- short latent period;
- acute onset of the disease;
- short period of the development of the disease characterized by the symptoms of general intoxication and gastrointestinal disturbances;
- if the infected foods are eaten by a group of people, there may be cases of mass food poisoning;

Food poisoning is not transmitted from a sick person to a healthy one;

Acute episodes are relieved right after the agent of the disease is eliminated.

Classification of food poisoning

1. Microbial food poisonings.
1.1.Toxicoinfection
1.2.Toxicosis: - mycotoxicosis;
- bacteriotoxicosis
1.3. Microbial food poisonings of mixed origin

2. Non-microbial food poisoning
2.1. Poisoning caused by essentially poisonous food: - food of animal origin;
- food of plant origin
2.2. Poisoning caused by the food which became poisonous under certain circumstances: - food of animal origin;
- food of plant origin.
2.3. Poisoning caused by chemical substances: - food additives;
- salts of heavy metals;
- substances penetrating from package, containers;
- pesticides.
3. Food poisoning of unknown origin.

The incidence of microbial food poisonings is the highest among all food poisoning cases.

Measures taken by the doctor in case of a food poisoning:

1. The doctor should make a diagnosis.
2. The doctor should provide first aid.
3. Medical analyses of blood count, feces analysis, emetic masses and lavage water analysis are required.
4. The doctor should collect samples of foods for lab tests.
5. The sale of contaminated foods should be stopped.
6. The doctor should fill in the admission form and inform the Centre for Sanitary & Epidemiological Control about the case.

Preventive measures against toxicoinfection

1. Preventive measures against contamination of foods by harmful microorganisms.

Veterinary and sanitary control over the slaughter of the cattle and processing of meat.

Sanitary control over technical facilities and public catering (separate product lines for raw materials and cooked foods are necessary).

Control over the health of food handlers. Observation of the rules of personal hygiene.

At-home slaughter of the cattle should not be allowed.

2. Preventive measures against the spread of microorganisms in foods.

Observation of the sanitary rules of primary processing of foods, such as washing, peeling and cleaning, cutting. The time passing from the primary (cold)

processing of raw material and convenience foods to the thermal processing should be minimized.

Observation of the sanitary rules of defrosting and soaking salty foods. One should defrost foods at a temperature under 15 – 20 Cº; one should defrost small fish in running water for 2 – 4 hours.

Frequent use of cold at all stages of production and transportation of raw materials, convenience foods and cooked food is advisable.

Raw materials, convenience foods and cooked food should be stored at a low temperature (4 – 8 Cº).

Compliance with the terms of shelf-life for raw and cooked foods.

3. Measures aimed at eliminating microorganisms found on the surface of foods.

Thermal processing of food is advisable. The temperature of cooking meat is to be no less than 80 Cº. Boiling or pasteurization of milk is also recommended.

Chops and steaks should be fried for 5 minutes on each side and then cooked in the oven at a temperature of 220 – 250 Cº for 5 – 8 minutes.

When cooking jellied meat, the cut meat should be boiled in broth.

Preventive measures against botulism (when making home preserves)

1. Foods which are not fit for salting (e.g. mushrooms) should not be preserved. Mushrooms should be salted and pickled when air supply is sufficient.

2. Stale vegetables, fruits or berries should not be used for making home preserves.

3. Foods should be washed properly before making preserves.

4. Salt concentration should be 8 – 10%, sugar concentration – 50-55%, pH – below 4.0.

5. Home preserves should be stored at a temperature below 14^0C.

6. Thermal processing for 10 – 15 minutes is advisable before consuming home preserves.

7. To avoid food poisoning caused by consumption of stale fish, one should eviscerate it, wash it in running water, salt it and store in a cold place for some time before preserving.

8. Gammon and homemade sausages should be boiled before consumption.

Preventive measures against staphylococcal toxicosis

1. To prevent staphylococci from spreading to the surface of foods, one should do the following:

- workers with pustular diseases, acute febrile catarrh as well as staphylococcal carriers should be suspended from work at public catering;
- observe sanitary rules at work;
- do not use milk obtained from cows with mastitis.

2. To create favorable conditions for elimination of staphylococci, that is conditions in which staphylococci will not multiply or produce toxins, one should do the following:

- perform thermal processing of foods;

- store the food at a temperature of 2 – 4 ^{0}C; see Table 1
- observe the terms of shelf-life for perishable foods.

Table 1

Storage time and shelf-life of highly perishable foods in public catering

Item of food	Storage time & shelf-life at a temperature of 4 – 8^{0C} (h)
Packaged meat (0. 4 – 1.5 kg)	36
Minced meat produced by:	
- meat processing plant	48
- public catering unit	6
Chops:	
- prefabricated raw materials	12
- cooked	24
Meat:	
- boiled	24
- fried	48
Cooked sausage (1-2 grade)	48
Milk (flasks, bottles)	36
Sour cream	72
Turnovers with meat	24
Sandwiches with sausage, fish, ham	3
Pies and cakes:	
- with whipped cream	72
- with butter cream	36
- cream made of scald milk	6
Cereals	12
Russian salad and some other salads without oil or mayonnaise	12

SUGGESTED REPORT TOPICS

1. Sick building syndrome
2. Light and illumination, their importance in hygiene.
3. Color scheme of the interior design from the point of view of hygiene.
4. Noise in homes: its sources, its effect on the human body, and protective measures.
5. Milk in everyday and therapeutic nutrition.
6. Sour milk in everyday and therapeutic nutrition.
7. Nutritional and biological value of fish and seafood; their use in everyday and therapeutic nutrition.

8. Nutritional and biological value of vegetables and fruit; their use in everyday and therapeutic nutrition.
9. Hypervitaminosis in man.
10. Nutrition for white collar workers.
11. Nutrition for the elderly.
12. Causes and prevention of obesity.
13. The importance of nutrition for preventing cardiovascular disease.
14. Toxic infection caused by Salmonella: its etiology, pathogenesis and prevention.
15. Staphylococcal infection: its etiology, pathogenesis and prevention.
16. Botulism: its etiology, pathogenesis and prevention
17. Mycotoxicosis: its etiology, pathogenesis and prevention.
18. Food poisonings caused by mushrooms, their prevention.
19. Food poisonings caused by foods containing chemical admixtures; their prevention.

Questions for formative assessment

Test 1. ***Hygienic evaluation of indoor air.***

1. Carbon dioxide content in atmospheric air; its physiological value.
2. Indicators of air pollution in residential and communal buildings.
3. Maximum admissible content of carbon dioxide in residential building air; its hygienic importance.
4. Hygienic importance of ventilation.
5. Indicators of ventilation effectiveness.
6. Major hygienic requirements for construction supplies and interior finish materials.
7. The importance of vegetation in urban life; regulations for vegetation in habitable areas.
8. Admissible noise level in residential buildings; its hygienic importance.
9. Advantages of through ventilation indoors.
10. Which concentration of carbon dioxide in the air is hazardous for the human health?
11. Sanitary requirements imposed on living space per person.
12. Sanitary requirements imposed on living space per person at a hostel.
13. Anthrapotoxins (definition).
14. Aeration coefficient (definition).

Test 2. ***Hygienic evaluation of illumination.***

1. Factors determining natural illumination indoors.
2. Geometric indicators of natural illumination indoors.
3. Incident angle: its definition, minimum admissible value and hygienic importance.
4. Opening angle: its definition, minimum admissible value and hygienic importance.
5. Light factor: its definition. Recommended light factor values for classrooms, hospital wards and residential buildings.
6. Lighting factor in the evaluation of natural illumination indoors: its definition. Its normal values for classrooms, hospital wards and residential buildings.
7. Hygienic norms for spacing between buildings; their importance.
8. The importance of depth of a room in natural illumination.
9. Optimum orientation for residential buildings in climatic area 1; the recommended color scheme, its hygienic importance.
10. Optimum orientation for residential buildings in climatic area 3; the recommended color scheme, its hygienic importance.
11. The importance of residential building insolation; the recommended insolation time.
12. The advantage of luminescent lamps over filament lamps.
13. Types of lamps recommended for general illumination of buildings.
14. Calculating the artificial lighting by Watt method.

15.Norms of artificial illumination in classrooms, residential buildings, hospital wards, and operating theatres (for luminescent lamps).

Test 3. ***Hygienic evaluation of microclimate.***

1. Wind pattern, its definition. The importance of predominant wind direction in hygiene practice.
2. Optimum microclimate; its definition.
3. Mechanisms of chemical thermoregulation.
4.Physiological mechanism regulating heat emission in various microclimates.
5.The main ways of heat emission.
6.Convection, its definition.
7.Optimum microclimate indicators in residential buildings.
8.Admissible vertical and horizontal temperature fluctuation of indoor air.
9.Hygienic importance of enclosing surface temperature; the effect of low temperature of enclosing surface on heat exchange.
10.The predominant heat emission in humans at an air temperature of 16-17^{o}C. relative humidity of 70-80%, and air velocity of 0.3—0.5 m/sec.
11.Heat emission route that increases considerably upon an increase in the temperature of air and surrounding surfaces.
12.Factors affecting heat emission by radiation.
13.Causes of radioactive cooling of a person that develops indoors.
14.The effect of high relative humidity together with high temperature on heat exchange in humans.
15.The effect of high relative humidity together with low temperature on heat exchange in humans.
16.Equipment measuring relative humidity and air velocity.
17.Equipment measuring air velocity indoors and outdoors.

Test 4. ***Hygienic evaluation of the quality of drinking water*****.**

1.Physiological and hygienic requirements for water.
2.Water-borne infectious diseases.
3.Possible sources of water supply (name them all and point up the safest).
4.Hygienic requirements to the quality of drinking water.
5.Hygienic norms for the quality of water from non-centralized supply sources.
6Microbial and parasitic indicators of the quality of drinking water.
7.Indicators of organoleptic properties of water.
8.Total microbial value for drinking water.
9.Hygienic rating of fluorine in drinking water.
10.Causes of fluorosis development.
11.The effect of low fluorine value on the body.
12.Hygienic rationing of nitrate in drinking water, its hygienic importance.
13.The causes and mechanism of endemic goiter development.

14.The causes and mechanism of water-nitrate methemoglobinemia development.

15.Areas of sanitary protection of water sources.
16.The main methods of water purification.
17.Physical methods of water decontamination.
18.Chemical methods of water decontamination.

Test 5. ***Hygienic evaluation of Nutrition.***

1.Nutritional and biological value of bread.
2.Nutritional and biological value of milk.
3.Nutritional and biological value of meat.
4.The importance of fruit and vegetables in nutrition.
5.Extractives in meat; their types and biological value.
6.Milk- and meat-borne diseases in humans.
7.Hygienic requirements imposed on the quality of milk.
8.Hygienic requirements imposed on the quality of meat.
9.Hygienic requirements imposed on the quality of bread.
10.Types of energy expenditure in man.
11.The value of basal metabolism energy (mean value in average conditions).
12.Principles of modern rating of people's need for energy and nutrition.
13.Intensity of labor classification in rating people's need for energy and nutrition. Where is the medical personnel in this classification?
14.Age-related groups of adult working population in rating people's need for energy and nutrition.
15.The recommended energy requirement in occupational group 1.
16.The recommended consumption of proteins, fats and carbohydrates for individuals in occupational group 1.
17.The principles of rational nutrition.
18. Classification of nutrition-related diseases.
19. The recommended amount of animal proteins in a daily diet (% of total protein).
20.The recommended amount of vegetable oil in a daily diet.
21.The importance of proteins in nutrition.
22.The importance of fats in nutrition.
23.The importance of carbohydrates in nutrition.
24.The importance of fiber, its sources in nutrition.
25. The nutritional status of a person(definition).
26. Classification of nutritional status.
27. Indicators for diagnostics of the nutritional status.
28. Ketle´s index, the formula for calculating, normative.

Test 6. ***Evaluation of individual micronutrient intakes.***

1.The main causes of avitaminosis development.
2.The main causes of endogenous avitaminosis development.
3.Factors increasing the requirement for vitamins in the human body.
4.Foods that are a source of vitamin C.
5.The main clinical signs of vitamin C deficiency.
6.Foods that are a source of vitamin B1, B2 and B6.
7. The main clinical signs of vitamin B1 deficiency.
8.Foods that are a source of vitamin D.
9.The main clinical signs of vitamin D deficiency in children.
10.Foods that are a source of vitamin A and carotene.
11.The main clinical signs of vitamin A deficiency.
12.Types of vitamin deficiency.
13.Latent forms of vitamin deficiency.
14.Rules of vitamin-saving cooking.
15.Properties of water-soluble vitamins that promote hypovitaminosis.
16.Properties of fat-soluble vitamins that promote hypovitaminosis.
17.Daily requirement of adults and children for vitamins A, C, D.
18.Factors that promote ascorbic acid destruction in foods during cooking.

Test 7

Prevention of food poisoning.

1.Food poisoning, its definition.
2.Common signs of a food poisoning.
3.The main types of food poisoning according to their classification.
4.Classification of a microbial food poisoning.
5.Classification of a non-microbial food poisoning.
6.The main principles of food poisoning prevention.
7.Food poisoning management.
8.Food toxicoinfection, its definition.
9.Pathogenesis of food toxicoinfection.
10Bacterial toxicosis, its definition.
11.Foods that are most common triggers of staphylococcal food poisoning.
12.Measures for preventiing staphylococcal toxicosis.
13.Foods whose consumption is associated with a botulism risk.
14.Measures of botulism prevention in making home preserves.
15.Food mycotoxicosis, definition and examples.
16.Possible sources of a food poisoning by chemical admixtures; their prevention.
17.The main measures for preventing non-microbial food poisonings.
18.The main measures for preventing mushroom poisonings.