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FOOD HYGIENE

Tutorial

Tomsk
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The tutorial is prepared in accordance with the Federal State Educational Standard of Higher Professional Education for medical students. The textbook is based on the Russian "Guide to Practical Training on Hygiene" publication, the tutorial has been revised and supplemented.

Hygienic principles of public nutrition, issues of rational, curative, preventive and dietary nutrition as well as hygienic requirements on placement, planning and the organization of work of nutrition units are stated in the tutorial.

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ГИГИЕНА ПИТАНИЯ

Учебное пособие

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2018

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Г 463 **Гигиена питания**: учебное пособие / В. С. Кавешников, Ю. А. Пфаргер, В. Н. Серебрякова, Л. П. Волкотруб, Т. В. Андропова. – Томск: СибГМУ, 2018. – 132 с.

Учебное пособие подготовлено в соответствии с Федеральным государственным образовательным стандартом высшего образования, для студентов, обучающихся по специальности лечебное дело. В основу учебного пособия положено издание на русском языке «Руководство к практическим занятиям по гигиене», пособие переработано и дополнено.

В учебно-методическом пособии изложены гигиенические принципы питания населения, вопросы рационального, лечебно-профилактического и диетического питания, гигиенические требования к размещению, планировке и организации работы пищеблоков.

Рецензент: Самойлова Ю.Г., заведующий кафедрой пропедевтики детских болезней с курсами поликлинической педиатрии и инфекционных болезней детского возраста СибГМУ, доктор медицинских наук, профессор.

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Утверждено и рекомендовано к печати учебно-методической комиссией лечебного факультета СибГМУ (протокол № 90 от 16.11.2017 г.)

1. DETERMINATION OF HUMAN ENERGY EXPENDITURE. HYGIENIC ASSESSMENT OF INDIVIDUAL NUTRITION ADEQUACY

The purpose of the topic: is to get familiar with the modern concepts of physiological needs of human body for nutrients in different population groups, as well as with the methods of determining human energy expenditure and evaluation of adequacy of individual nutrition.

Theoretical part. Nutrition is the process of nutrient inflow into the body. It is a vital condition for existence of human beings and other living organisms. It provides growth and development of the organism, its ability to work, its adaptive capabilities, and ultimately – life expectancy.

Increase or decrease in the functional capacity of the organism, development of pathological processes, as well as the recovery of the functions impaired depend a lot on how optimal is the diet, and also on individual characteristics of health. According to modern points of view, individual nutrition must be rational, that is, to meet energetic, plastic and other needs of the body in a balanced manner.

Hygienic requirements for foods: 1) quantitative completeness, compliance of caloric intake with the energy expenditure of the body; 2) qualitative usefulness of the diet as to content of essential and nonessential food components in optimal amounts and ratios; 3) compliance of the chemical composition of the food with enzyme systems of the body, ensuring good digestibility and assimilation; 4) good quality of food and its safety; 5) variety of foods used in the diet as to wide range of animal and vegetable components, cooked by various methods; 6) high organoleptic properties of the food (appearance, texture, taste, smell, color, temperature); 7) optimal nutrition regime (time and number of meals, the intervals between them, distribution of dietary energy, chemical composition, and the weight of food packages for meals), to comply with the rhythms of the organism.

The energy required for a body is obtained from oxidation of organic substances arrived into the body with food, mainly carbohydrates, fats and proteins. The resulting energy is eventually released as a heat, so through measuring it the energy expenditure of the body can be estimated. The basic law of nature – the law of energy conservation – is applicable as well with respect to a human body.

Over the past 10–15 years, the structure of nutrition in the population of Russia has revealed considerable negative tendencies that have been consequently reflected in the health status, morbidity and life expectancy. In this regard, a doctor should be able to evaluate the adequacy of individual nutrition and give recommendations on the part of a proper diet for healthy and sick people, as well as to correct malnutrition.

Healthy Eating Plate. The Healthy Eating Plate, created by nutrition experts at Harvard School of Public Health and editors at Harvard Health Publications, was designed to address deficiencies in the «MyPlate», healthy diet project previously developed by the U.S. Department of Agriculture (USDA). The Healthy Eating Plate provides detailed but simple guidance to help people make the best eating choices (Fig. 1).

Use The Healthy Eating Plate as a guide for creating healthy, balanced diet whether be it served on a plate or packed in a lunch box. Put a copy on the refrigerator as a daily reminder to create healthy, balanced meals!

The key points of the Healthy Eating Plate:

- Make most of your meal vegetables and fruits – ½ of your plate: Aim for color and variety, and remember that potatoes don't count as vegetables on the Healthy Eating Plate because of their negative impact on blood sugar.
- Go for whole grains – ¼ of your plate: Whole wheat, barley, wheat berries, quinoa, oats, brown rice, and foods made with them, such as whole wheat pasta—have a milder effect on blood sugar and insulin than white bread, white rice, and other refined grains.
- Protein proportion – ¼ of your plate: Fish, chicken, beans, and nuts are all healthy, versatile protein sources – they can be mixed into salads, and pair well with vegetables on a plate. Limit red meat, and avoid processed meats such as bacon and sausage.
- Healthy plant oils – in moderation: Choose healthy vegetable oils like olive, canola, soy, corn, sunflower, peanut, and others, and avoid partially hydrogenated oils, which contain unhealthy trans-fats. Remember that low-fat does not mean "healthy."
- Drink water, coffee or tea: Skip sugary drinks; limit milk and dairy products to 1–2 servings per day; limit juice to a small glass per day.
- Stay active: The red figure running across the Healthy Eating Plate's placemat is a reminder that staying active is also important in weight control.

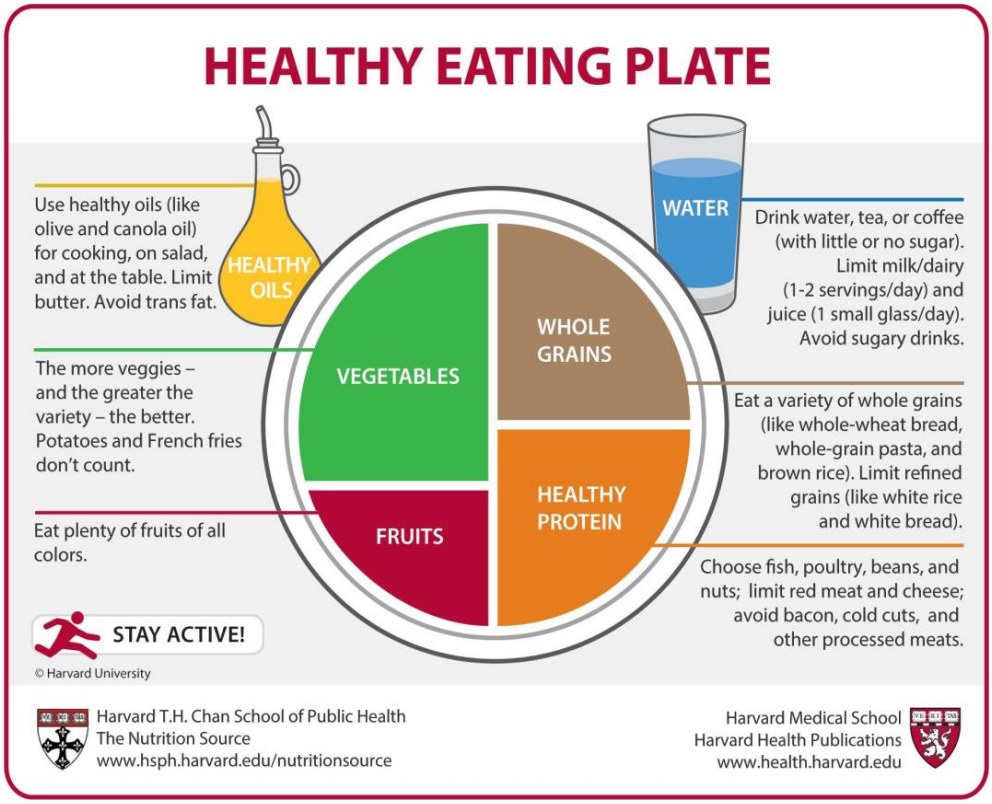

Figure 1. *The Healthy Eating Plate*

The main message of the Healthy Eating Plate is to focus on diet quality, specifically:

- The type of carbohydrate in the diet is more important than the amount of carbohydrate in the diet, because some sources of carbohydrate – like vegetables (other than potatoes), fruits, whole grains, and beans – are healthier than others.
- The Healthy Eating Plate also advises consumers to avoid sugary beverages, a major source of calories – usually with little nutritional value.
- The Healthy Eating Plate encourages consumers to use healthy oils, and it does not set a maximum on the percentage of calories people should get each day from healthy sources of fat. In this way, the Healthy Eating Plate recommends the opposite of the low-fat message promoted for decades by the USDA.

The Healthy Eating Plate does not define a certain number of calories or servings per day from each food group. The relative section sizes suggest approximate relative proportions of each of the food groups to include on a healthy plate. They are not based on specific calorie amounts, and

they are not meant to prescribe a certain number of calories or servings per day, since individuals' calorie and nutrient needs vary depending on age, gender, body size, and level of activity.

Alcohol in moderation is beneficial, and it's illustrated in Harvard's Healthy Eating Pyramid from 2005. But it's not for everyone, which is why it is not included in the Healthy Eating Plate.

Healthy Food Pyramid. The Healthy Food Pyramid is a schematic depiction of recommendations on rational nutrition. This pyramid was developed by American nutritionists at the Harvard School of Public Health. Its first version, published in 1992, was a pyramid divided into floors (Fig. 2).

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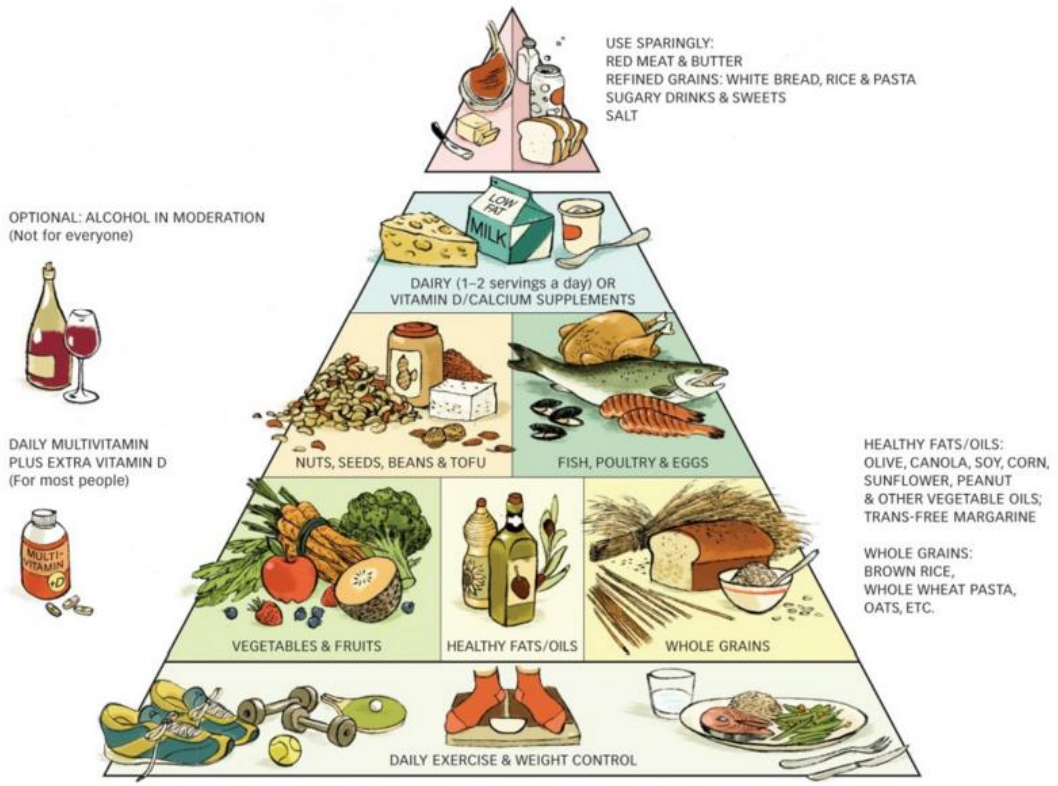

Figure 2. *The Healthy Food Pyramid by the Harvard School of Public Health*

At the base of the pyramid lay daily exercise and weight control, as well as sufficient fluid intake (at least 1.5 liters per day for women and 2 liters for men). Further each tier was occupied by this or that group of products.

The products were distributed on the "floors" as follows:

- 1st – Whole-grain products, coarse bread, cereals, bran, brown rice,

macaroni products from whole-grain flour; Vegetable oils (soybean, olive, sunflower, rapeseed, corn, peanut and others). Products of this group should be consumed every day.

- 2nd – Vegetables (in abundance), fruits, berries (2–3 servings daily).
- 3rd – Nuts, beans (1–3 servings).
- 4th – Fish, poultry (preferably fillets without skin), eggs (0–2 servings every day).
- 5th – Milk and dairy products (1–2 servings).
- 6th – Red meat, sausages, butter, margarine, sweets, potatoes, white bread and rice, carbonated drinks (rarely consumed).

As you can see, alcohol is located to the left of the pyramid - its use should be moderate (unless contraindicated at all), moreover, red wine is preferable. Certain place belongs also to vitamin-mineral complexes (used according to the prescription of the doctor in case of insufficient intake of vitamins and minerals along with food).

Thus, the main principle of the «Food Pyramid» suggested by Harvard experts was as follows: products located at the bottom of the pyramid, should be consumed as often as possible. The farther from the base the products are, the fewer amounts of them should be found in our diet. And the food located at the top of the pyramid, you either have to give up altogether, or consume it quite rarely.

The Harvard Healthy Food Pyramid has been widely accepted in the world and has long been used as a rational food pyramid and an aid for weight control.

The Healthy Food Pyramid and the Healthy Eating Plate complement each other.

- Vegetables, fruits, whole grains, healthy oils, and healthy proteins like nuts, beans, fish, and chicken should be placed into the shopping cart every week, along with a little yogurt or milk if desired.
- The Healthy Food Pyramid also addresses other aspects of a healthy lifestyle–exercise, weight control, vitamin D, and multivitamin supplements, and moderation in alcohol for people who drink, so it’s a useful tool for health professionals and health educators.
- The Healthy Eating Plate and the Healthy Food Pyramid summarize the best dietary information available today. They aren’t set in stone,

that is why nutrition researchers will undoubtedly turn up new information in the years ahead. The Healthy Food Pyramid and the Healthy Eating Plate will change to reflect important new evidence.

My Pyramid. The Harvard pyramid was repeatedly adjusted and supplemented. In 2007, its latest version was published, the «MyPyramid», developed by the US Department of Agriculture. It received the status of a state program (Fig. 3).

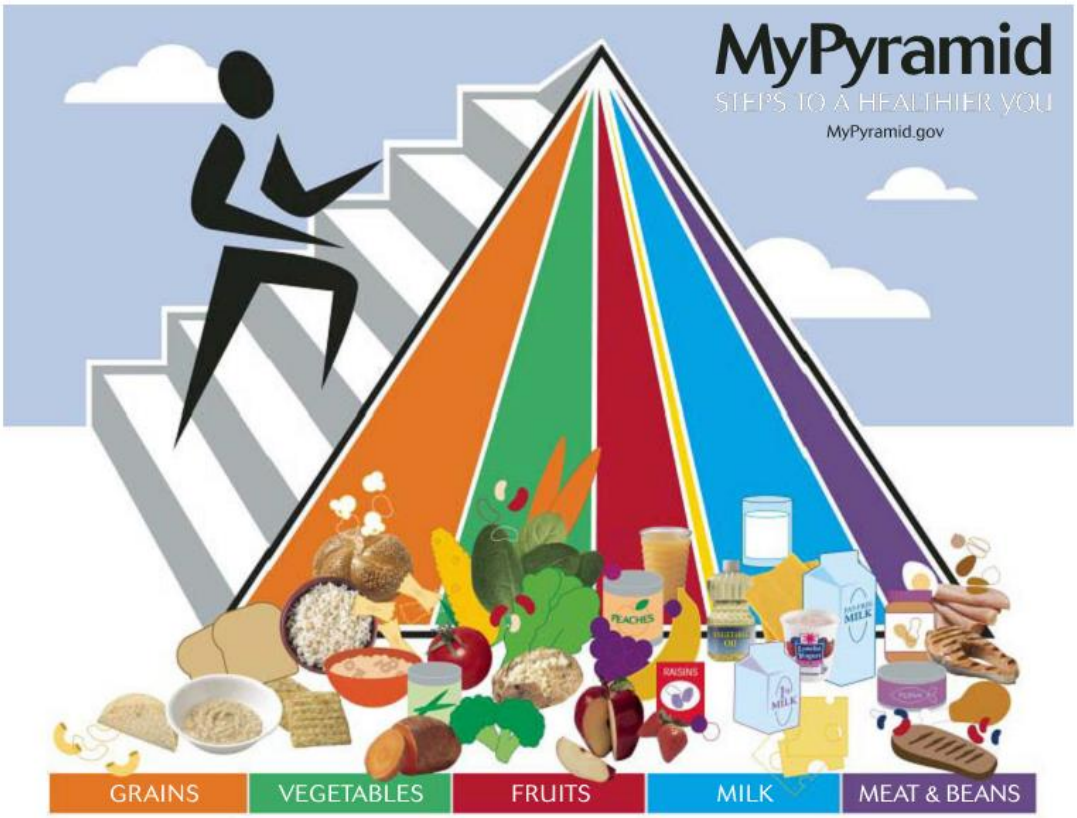

Figure 3. *The MyPyramid (2007)*

This pyramid is based on the results of new research in the field of dietology. It no longer represents a "hierarchical ladder of nutrition," where complex carbohydrates and vegetable fats act as "hierarchs" and simple carbohydrates and fats of animal origin perform the role of "rogue".

The pyramid is based on 5 principles:

1. Diversity
2. Proportionality
3. Individuality
4. Moderation
5. Motor activity

1. Principle of diversity

According to the principle of diversity, all products have the right to take place in the daily menu. The pyramid consists of multi-colored segments, each of which represents different groups of products:

- Orange – Cereals (wholegrain bread, bran, cereals, brown rice, whole wheat flour pasta).

This group of foods contains low fats and is rich in vitamins (E, B1, B2, PP), minerals (potassium, magnesium, calcium, iron, phosphorus), dietary fiber, vegetable protein, and also "useful" or "complex" carbohydrates. It is recommended to consume 6 servings of whole grains daily.

1 serving of cereals is:

- 1 piece of bread;
- 1 small bun;
- 1 cup (30 g) of cereal flakes for breakfast;
- ¼ plate (or ½ cup) of buckwheat, oatmeal, rice (preferably brown), pasta from durum wheat;
- 3–4 small or 2 large crackers.

- Green – Vegetables.

1 serving of vegetables:

- 1 cup (or ½ plate) of leafy vegetables (onion, parsley, lettuce, dill, spinach, etc.);
- ½ cup (or ¼ plate) of raw or boiled vegetables;
- 1 glass of vegetable juice.

Vegetables, fruits, berries are sources of beta-carotene (provitamin A) and other vegetable pigments, folic acid, vitamin C, water, iron, potassium, plant fiber, organic acids (citric, tartaric, salicylic, benzoic, tartronic). You should consume 3–5 servings of vegetables and 2–3 servings of fruit daily. In this case, one portion of green, yellow or orange vegetables rich in beta-carotene and one serving of citrus or other fruits with a high content of vitamin C should be present in the diet. It is recommended to choose fruits with a low glycaemic index.

- Red – Fruits, berries.

1 serving of fruit:

- 1 medium-sized fruit (orange, apple, pear, etc.);
- ½ grapefruit;
- 1 piece of melon;
- 1 glass of fruit juice;

- ½ cup of berries;
- ½ cup chopped fresh or canned fruit;
- ¼ cup dried fruits (4–5 pieces dried apricots, prunes or figs).

- Yellow – Fats.

It is better to give preference to vegetable fats (in nuts, cereals) and oils (soybean, olive, sunflower, rapeseed and others), as well as fish. These products are rich in useful fats – polyunsaturated fatty acids, as well as vitamin E. Saturated fats, trans fats (butter, margarine, confectionery fat) are recommended not to be abused and minimize them, as they are the cause of many cardiovascular diseases.

- Blue – Dairy products (milk, yogurt, cheese).

Dairy products are sources of high-grade animal proteins, vitamins A, E, D, B2, B6, B12, calcium, magnesium, phosphorus, zinc, iodine. Foods rich in calcium are necessary for the growth and development of bones. Sour-milk products contain bifidum- and lactobacilli, which ensure normal functioning of the intestine. Dietitians advise to consume 2–3 servings of milk or dairy products daily.

1 serving of dairy products:

- 1 glass of milk, yoghurt, kefir;
- 40 grams of hard cheese;

- Violet – Meat, fish, poultry, eggs, legumes, nuts.

Such animal proteins, like meat, fish, poultry and eggs, are full-fledged proteins containing all the essential amino acids. Meat contains iron, vitamins A and B groups. At the same time, it is better to use lean parts of carcass (for example, beef fillet, pork tenderloin, lamb leg, chicken breast). From the sources of harmful fats (sausages, sausages, etc.) should generally be discarded.

Fish is rich in vitamin A (found in fish oil), as well as polyunsaturated fatty acids (omega-3 and omega-6), which contribute to lowering cholesterol levels in the blood. This reduces the risk of developing cardiovascular diseases. The richest in omega-3 are trout, salmon and herring.

Eggs are "valuable pantry" of vitamins (vitamins A, D, group B) and minerals (iron, phosphorus, calcium).

Nuts, beans (peas, beans, lentils, etc.), seeds (pumpkin seeds, sunflower seeds) are rich in vegetable proteins, useful fats, vitamin E, and also of dietary fiber.

The daily norm of products of this group should be at least 2-3 servings per day.

1 serving:

- 2 eggs;
- 30 g of meat or fish;
- ½ cup (¼ plate) of legumes (peas, beans and other beans);

2. Principle of proportionality

The width of the triangle segments on the diagram reflects the principle of proportionality, that is, the ratio of products. Preference is given to cereals, vegetables, fruits and dairy foods, whereas meat, fish, legumes and eggs occupy modest and fats smaller segments in the scheme, respectively.

3. Principle of individuality

The principle of individuality excludes a rigid dictate and suggests that a person make his own diet based on age, sex, and existing diseases.

4. Principle of moderation

Using the food pyramid, it is important to observe the principle of moderation. Eating large quantities of even low-calorie foods will not lead to health improvement, but will give the opposite result.

5. Principle of motor activity

In the «MyPyramid», when compiling a daily diet, the principle of motor activity is taken into account. Its symbol is a person climbing up the stairs. Given the total hypodynamia, this is not a superfluous reminder. Physical activity, according to the doctors' advice , should take at least 60 minutes daily.

Food Pyramid for vegetarians. The food pyramid for vegetarians in most cases does not include meat, fish, poultry, milk and dairy products - sources of animal proteins. Instead, vegetable proteins such as legumes, nuts, tofu ("soy cottage cheese") are used. A lack of calcium, iron, vitamins D and Group B is replenished with additional consumption of vitamin-mineral complexes. The pyramid of healthy nutrition is recognized by nutritionists around the world as one of the most effective recommendations in the field of rational nutrition.

Glycaemic Index of Food. Glycaemic index (GI) is the estimate that reflects the ability of carbohydrate-containing products to change blood sugar level, as well as the rate of these changes. This indicator was developed by American scientists in the 1970s and 1980s for people with diabe-

tes. To determine GI, special tables have been developed (Tab. 1). The starting point is pure glucose, GI of which is equal to 100. Depending on this, the following are distinguished:

- Low GI is 40 or lower,
- Moderate GI – from 41 to 69,
- High GI – 70 and higher.

For normal life, our body needs a source of energy. Energy is derived mainly from carbohydrates. In the process of digestion carbohydrates are split to glucose (sugar), which is the main "fuel" for the body and ensures the operation of all its systems. After many years of research it has been established that carbohydrates have different effects on the level of glucose in the blood and on the rate of its assimilation. Some of them sharply increase sugar level in the blood for a short time, while others give a slight increase in blood glucose level, but for a longer period. In this regard, carbohydrates are divided into: simple ("fast") and complex ("slow"). When a person consumes simple carbohydrates, in response to a sharp increase in the blood glucose level, a large amount of insulin is released - the hormone of the pancreas. As a result of insulin release, the blood glucose level drops sharply below normal, and a person begins to experience hunger.

If carbohydrates are broken down slowly and absorbed by the intestine gradually, the glucose in the blood rises as slowly and remains at a level close to normal. A person does not feel hungry for a long time.

In addition, insulin promotes the conversion of glucose into fats and, conversely, prevents the process of their cleavage. The greater the release of insulin (as with the consumption of simple carbohydrates), the faster is the accumulation of fat, which contributes to development of obesity.

Complex carbohydrates, in addition to normalizing appetite, mostly contain fiber (coarse fibers), which is not digested in the intestines and promotes the utilization of cholesterol. Thus, complex carbohydrates may have average or low GI, and the simple ones have high GI only.

Twelve principles of healthy nutrition by the World Health Organization

1. A healthy balanced diet is based on a variety of products, predominantly vegetable and not of animal origin.

2. Bread, cereals and pasta, rice and potatoes should be eaten several times a day, with every meal.

3. A variety of vegetables and fruits should be consumed several times a day (more than 500 grams). Preference for locally produced products

4. Milk and dairy products with low fat and salt (kefir, sour milk, cheese, yogurt) are necessary in the daily diet.

5. Replace meat and meat products with high-fat legumes, fish, poultry, eggs or lean meats. Portions of meat, fish or poultry must be small.

Table 1

Distribution of products depending on the glycaemic index (GI)

Food	GI	Food	GI	Food	GI
High GI foods					
Beer	110	Carrots, Cooked	85	Millet	71
Fried potato	95	Popcorn	85	White steamed rice	70
Baked potatoes	95	Cornflakes	85	Turnip	70
Apricots (canned)	91	Potato chips	80	Chocolate bars	70
Mashed potatoes	90	Crackers	80	Milk chocolate	70
Instant rice porridge	90	Sugar	75	Marmalade	70
Honey	90	Watermelon	75	Boiled potatoes	70
Ice cream	87	Courgettes	75	Corn	70
Bread white	85	Pumpkin	75	Sweet carbonated drinks	70
Moderate GI foods					
Wheat flour	69	Pizza with cheese and tomatoes	60	Buckwheat	50
Instant oatmeal porridge	66	White rice	60	Kiwi	50
Pineapple	66	Canned corn	59	Sugar free muesli	50
Melon	65	Papaya	58	Scherbet	50
Semolina	65	Macaroni from a flour of the first grade	55	Oatmeal porridge	49
Bananas	65	Mango	55	Canned peas	48
Potatoes in jackets	65	Oatmeal cookies	55	Grape juice (sugar free)	48
Fruit juices	65	Yoghurt sweet	52	Grapefruit juice (sugar free)	48
Beet	64	Bran	51	Pineapple juice (sugar free)	46
Raisins	64	Brown rice	50	Bread with bran	45
Low GI foods					
Rye bread	40	Whole milk	32	Asparagus	15
Macaroni from wholemeal flour	40	Bananas (green)	30	Radish	15
Grapes	40	Mandarins	30	Cucumbers	15
White beans	40	Apples	30	Walnuts	15
Peas green (fresh)	40	Peaches	30	Almond	15

Apple juice (sugar free)	40	Lentil red	25	Cedar nuts	15
Orange juice (fresh)	40	Pumpkin seeds	25	Pistachios	15
Celery root	35	Pearl barley	22	Cabbage	10
Garnet	35	Lentils green	22	Broccoli	10
Carrot (raw)	35	Black chocolate (70% cocoa)	22	Salad leaves	10
Dried apricots	35	Plums	22	Lettuce Salad	10
Figs	35	Cherry	22	Garlic	10
Oranges	35	Grapefruits	22	Mushrooms	10
Yoghurt (low-fat)	35	Peanut	20	Tomatoes	10
Pears	34	Apricot (fresh)	20	Pepper	10
Strawberry	32	Cauliflower	15	Green bow	10

6. Limit the consumption of "visible" fat in porridges and on sandwiches, choose low-fat varieties of meat and milk products.

7. Limit sugar consumption: sweets, confectionery, and dessert.

8. The total consumption of salt, taking into account the salt contained in bread, canned and other products, should not exceed one teaspoon (6 grams) per day. It is recommended to use iodized salt.

9. The body weight should correspond to the recommended boundaries: the body mass index is to be within the range of 20–25 kg/m^2. A moderate level of physical activity should be maintained, appropriate to age.

10. Do not consume more than two servings of alcohol per day (each serving contains 10 grams of pure ethanol).

11. Choose a variety of foods (fresh, frozen, dried), primarily grown in your area. Prefer to cook products steamed or in a microwave oven, by boiling, baking. Reduce the addition of fats, oils, sugar during a cooking.

12. Adhere exclusively to breastfeeding during the first six months of life. Breastfeeding can be continued up to two years.

- If 11–12 points (out of the total 12) are observed, then the nutrition is considered healthy.
- 8–10 points indicate that there may be health impaired.
- At 5–8 points risk of cardiovascular diseases, obesity and gastrointestinal disorders is great.
- If less than 5, it is necessary to radically revise the daily nutrition system. Otherwise, the damage to health can lead to a reduction of the

life expectancy of the individual.

Energy expenditure. Energy expenditure in a human may be non-regulated and regulated by the will of a man.

Unregulated energy expenditure is the energy consumption by the body required for basal metabolism, specific dynamic processing of food, as well as for the growth and development of tissues.

The energy expended on the basal metabolic needs serves for maintaining of the life-supporting functions (respiration, circulation, digestion, excretion), maintaining the constant body temperature, to ensure the required muscle tone, function of the heart, lungs, kidneys, liver, nervous, endocrine and other systems.

The basal metabolism rate (BMR) is determined in a state of nervous and muscular rest in the supine position, with a comfortable air temperature (20°C), in the morning, on an empty stomach (the last meal for 14–16 hours prior to the study). Basal metabolic energy required for each person is individual and at the same time is fairly constant. It is about 1700 kcal for an adult male of average body weight (70 kg) and about 1300 kcal per day for a young woman of average weight (55 kg) (Tab. 2).

Approximately for a medium person (mean age, average body weight, etc.) we may take the quantity of basal metabolism rate in amount of 1 kcal per 1 kg of body weight per hour. More precisely, a special study can determine the basal metabolic value, and is calculated by using special formulas and tables (Harris, Benedict et al.).

Energy consumption as to the basal metabolic rate is subject to fluctuations depending on many factors, specifically on the both: state of the body and environmental conditions. BMR depends on age, body weight, sex. In women, the basal metabolic rate is 10–15% lower than in men. In children BMR is by 15% higher than in adults, and even still higher in the children of the lower age. In the elderly basal metabolism is reduced by 10–15% compared with the young people. Reduction of basal metabolism is observed from the age of 40 years on: by 5% between 40 and 59 years, by 10% – between 60 and 69 years and by 10% – after 70 years. Thus, a basal metabolism rate established in certain age periods is typical for certain age level.

The basal metabolism rate is influenced by the conditions and functioning of the central nervous system as well as cerebral cortex. Stressful conditions, including diseases accompanied by fever, and other acute and subacute diseases (tuberculosis, sepsis, burn disease) increase the basal

metabolic rate. For example, during severe meningitis or stomach cancer basal metabolism rate increases by 40%. With an increase in the body temperature above 37°C, for each 1°C increase heat production further increases by 7–13%.

Table 2

The basal metabolism rate for adults of Russian Federation according to gender, age and body weight (kcal per day)

Male					Female				
Mass, kg	Age, year				Mass, kg	Age, year			
	18-29	30-39	40-59	60-74		18-29	30-39	40-59	60-74
50	1450	1370	1280	1180	40	1080	1050	1020	960
55	1520	1430	1350	1240	45	1150	1120	1080	1030
60	1590	1500	1410	1300	50	1230	1190	1160	1100
65	1670	1570	1480	1360	55	1300	1260	1220	1160
70	1750	1650	1550	1430	60	1380	1340	1330	1230
75	1830	1720	1620	1500	65	1450	1410	1370	1290
80	1920	1810	1700	1570	70	1530	1490	1440	1360
85	2010	1900	1780	1640	75	1600	1550	1510	1430
90	2110	1990	1870	1720	80	1680	1630	1580	1500

Significant impact on the value of basal metabolism rate is attributed to the endocrine system. Thus, patients with thyroid gland up-regulation tend to have basal metabolic rate increased by 150%.

The activity of the pituitary and gonads is focused on reducing the intensity of the basic exchange. In hypothyroidism, during starvation, recovery from diseases, when taking barbiturates and muscle relaxants basal metabolic rate decreases.

The need for calories increases during pregnancy and lactation. Pregnant women have increased food consumption due to fetal growth and changes in the mother's body itself, in particular the increase in the body weight. In the last trimester of pregnancy basal metabolism rate increases by 20%. In this connection, it is recommended during the first 3 months to take additionally 150 calories a day, in the subsequent months of pregnancy – 350 kcal per day. During lactation additional energy is required in the amount of up to 500 kcal per day in the first half-year and 450 kcal – in the second.

Drop in the environmental temperature greatly enhances the heat generation processes, therefore, the basal exchange. It is believed that at lower

temperatures for each 10ºC decrease below the value of annual temperature equal to 10ºC (standard), it is necessary to make amendments to the effect of cold, specifically consider additional 5-10% of energy consumption. An increase in the value of annual air temperature, compared to the standard, the need for calories decreases by 5% for every 10ºC. Thus, seasonal and climatic conditions have a significant impact on the energy consumption of the body. This should be considered in the preparation of diets.

Specific dynamic action of food is the energy loss on digestion that is digestion, absorption and assimilation of nutrients at the cellular level. Nutrients have different ability to increase the basal metabolic rate: protein – by 30–40%, fats – by 4–14%, carbohydrates – by 4–7%. When mixed diet basal metabolic rate is increased by 10–15% per day. Thus, when calculating, the energy consumption must be adapted to the value of basal metabolism rate, respectively, add 10–15% on energy consumption, due to the specific dynamic action of nutrients.

Regulated energy waste includes energy consumption in the workplace, individual behavior, sport and other activities. This type of energy expenditure may increase or decrease depending on the conditions and the will of man. Coefficient of physical activity (CPA) is used to further adjust the energy expenditure with basal metabolism for different kinds of physical activity (Tab. 3).

The value of energy expenditure during physical work has a decisive influence on the volume and nature of muscular effort required to execute the work.

A mental work is of a particular note, energy loss at which is negligible. Whatever intense and prolonged is a mental work, applied research methods are consistent in showing insignificance of resulting energy expenditure.

Table 3 presents data showing that energy loss due to mental work is a little different from those in a state of rest and relaxation, and increases only in cases involving muscle activity in the mental work (doing a scientific experiment). So, at rest while standing basal metabolic rate increases by 1.4 times, and when reading, studying – by 1.6 times.

Table 3

Energy expenditure in adults at different physical activity relative to the basal metabolism rate (coefficient of physical activity)

Kind of activity	Male	Female
Sleeping	1.0	1.0
Recumbency	1.2	1.2
Rest sitting	1.2	1.4
Recreation standing	1.4	1.5
Dress and removal of clothing and footwear	1.8	1.8
Physical exercise (morning exercise)	4.2	4.0
Cleaning of bed	2.1	2.1
Restroom	1.4	1.8
Walking:		
housework	2.5	2.4
walk slow	2.8	3.0
at a normal pace	3.2	3.4
with a load of 10 kg	3.5	4.0
Walking up the hill:		
slow	4.7	4.7
at a normal pace	5.7	4.6
fast	7.5	6.6
at a normal pace with a load of 10 kg	6.7	6.0
Walking downhill:		
slow	2.8	2.3
at a normal pace	3.1	3.0
fast	3.6	3.4
the load	4.6	4.6
on a snowy road	4.9	4.9
Eating	1.5	1.7
Riding in a truck	1.7	1.5
Cooking and childcare	2.2	2.2
Washing-up	2.2	2.2
Hand Washing	3.8	3.8
Sweeping the floor	2.6	2.6
Reading, study	1.6	1.6
Household chores	3.3	3.3
Students:		
listening to lectures, laboratory work (sedentary)		
lessons in the classroom	1.6	1.6
a break between classes	1.9	1.8
reading aloud	2.8	2.5

work in the laboratory (practical exercises)	1.6 2.3	1.6 2.3
Scientists: view of the scientific literature abstracting scientific literature discussion of scientific problems perform a scientific experiment typing on a typewriter (computer work)	 1.8 2.0 2.2 2.6 2.1	 1.8 2.0 2.2 2.6 2.1
Running	8.8	8.8
Swimming	7.7	7.7
Rowing	7.1	7.1
Bicycle riding	8.7	8.7
Skating	6.9	6.9
Skiing: movement on rough terrain training sessions (training)	 13.5 11.0	 13.5 11.0
Singing	1.9	1.9
Ballroom dancing (waltz)	4.1	4.1
Job of surgeon (operation)	1.7	1.7
Driving a car, bus	3.3	3.3

However, it is well known that strain and fatigue occurs due to intense mental work (examinations, creative work, and others). Thus, the methods of determining energy expenditure are usually not useful to assess energy expenditure due to mental work. Probably, for this purpose it is necessary to use other methods based on different principles and criteria.

The study of working conditions and magnitude of the energy loss by industrial workers showed that the most influential factor in this respect is the level of mechanization of the working process. In moderately mechanized works the increase in the energy consumption makes about 2.5–5 times the value of the basal metabolic rate. With full automation the energy expenditure of a worker is close to the values of the energy expenditure during mental work.

With mental work and sedentary lifestyle energy loss is typically less than 2300 kcal; with an average physical activity and moderate mobility - 3000 kcal and 4000 kcal is with heavy physical labor and more. The amount of daily energy expenditure is the basis for determining the quantitative side of nutrition adequacy that is the energy value of the daily diet should meet the loss of energy.

Energy balance. Energy expenditure of a man is usually expressed in large calories or kilocalories (kcal) and in units of the International System (SI) – kilojoules (kJ). Calorie is the amount of heat which is necessary to heat 1 liter of water by 1°C. 1 calorie is equal to 4.18 J, respectively, 1 J is equal to 0.239 calories. The energy value of food is usually expressed in these units (kcal and kJ).

One of the main requirements of a balanced diet is that dietary energy consumption should meet the energy loss of the body (the law of quantitative adequacy of food). If caloric content of the diet does not cover daily energy loss, there is a negative energy balance, which leads to a mobilization of all resources of the organism to the energy production for the greatest possible energy deficit covering. In this case, all the nutrients, including protein are used as energy sources. The protein assimilation mostly in favor of the energetic needs of the body instead of its true usage for plastic anabolic needs is considered as the main negative factor taking place in case of negative energy balance. At the same time not only the protein consumed with food serves then for energy recovering, but also the protein of the body tissues (for example muscle tissue) which, in case of a prolonged negative energy balance, is used for energetic needs, causing malnutrition, which plays a major role in the formation of some related serious diseases of malnutrition as alimentary dystrophy, nutritional marasmus, kwashiorkor.

Equally serious adverse effects may result from a pronounced positive energy balance, as for an extended period of time the energy value of the diet produced exceeds energy expenditure. Status of sharp positive balance often occurs in the second half of life, when the "protein" metabolic program is replaced by the "fat" metabolic program. People mostly involved into mental and automated work, if do not use more exercise, then due to long-termed positive energy balance metabolic diseases may develop such diseases as obesity, atherosclerosis, hypertension, diabetes, cholelithiasis, and etc.

Extremely negative and positive energy balance adversely affects the physical condition of the body, resulting in significant metabolic disorders, functional and morphological changes in his life-support systems.

Normal physiological condition is such an energy balance achieved when the energy income and energy expenditure are more or less equal during the day. In the first half of life, when there is a process of active growth and development, you need some excess (10–15%) of the energy

value of food to recover energy loss. In the second half of life such excess of food intake shall be allowed only under intense physical stress (work, sports, etc.). People who are not engaged in any kind of physical activity, excess caloric intake even 5–10% can lead to obesity and the progression of the atherosclerotic process. Thus, in making individual recommendations on diet, in determining the caloric intake it is necessary to take into account a variety of factors: age; housing floor; the nature of employment; availability of additional types of physical activity; schedule; climatic conditions; the physiological condition of the body.

Methods for determination of energy expenditure of the body. Energy expenditure of a body is determined by the amount of heat released during activity. The amount of heat can be measured directly by the method of direct calorimetry, as well as determined by gas exchange principle, that is indirect calorimetry, or it may be calculated with the chronometer-tabular method.

The method of direct calorimetry. The resulting heat, generated in the body, is released into the surrounding space. To measure this heat, a man is placed for a certain period of time (day) into the calorimeter box, made of a thermally insulating material. The chamber is supplied with air heated to a temperature of the chamber. The heat generated by the body is absorbed by the water flowing through the system of tubes extending between the chamber walls. The water temperature is maintained at a constant level. Knowing the volume of water flow and temperature difference in leading and outlet tubes, determine the amount of heat released from the human body. The widespread use of this method is limited due to the lack of sufficient amount of calorimeters, expensive cameras, the ability to study only the simplest individual work processes, as well as the isolation of a human from the influence of multiple environmental factors that have a great influence on the metabolism and energy exchange.

The method of indirect calorimetry. A relatively simple method of determining energy expenditure, method of indirect calorimetry based on gas exchange principle, was much more common.

In the oxidation of food components main body consumes a certain amount of oxygen. Oxidizing agents are destroyed, forming a corresponding amount of carbon dioxide that is released from the exhaled air. Investigating the chemical composition of the inhaled and exhaled air, it can be determined the amount of oxygen absorbed and carbon dioxide released by the body over the same time, and thence the respiratory quotient (CO_2/O_2)

and the energy consumption from the amount of the oxygen absorbed is calculated. Respiratory quotient value depending on the food composition ranges from 1.0 during the oxidation of carbohydrate to 0.7 in the oxidation of fats and is 0.81 in the oxidation of proteins. Caloric ratio of 1 liter of oxygen at these values of breathing rate ranges from 5.06 to 4.69.

Gas exchange is examined in special chambers or using special masks, the design of which allows you to collect exhaled air in the gas-tight bags. Based on the data of the gas exchange the amount of heat is calculated, which has been allocated to a person and, consequently, the energy consumption of the body.

Chronometer-table method. Its essence lies in the accurate recording of the time spent on execution of various activities, including sleep and rest for the night. The data obtained with the help of tables of energy costs in various activities (Tab. 3) make it possible to accurately determine a daily amount of energy loss by people of different professions. The table shows energy loss for different types of work, recreation, homework; extra exercise is made on the basis of the study and an accurate accounting of energy consumption produced per unit of time at certain kinds of activity, taking into account the basal metabolism.

The amount of calories required. Human needs for nutrients and the energy amount is changing under the influence of many external and internal factors. The norm is based on the concept of optimal nutrition, which is well organized and appropriate for physiological rhythms of the body provision with well-cooked, nutritious and delicious diet, containing adequate amounts of essential and non-essential nutrients, required for its development and operation.

The basis of nutritional standards is the difference between the body's needs for energy and nutrients depending on age, gender, household and climatic conditions of life, the type of work and intensity of muscular work performed. Accepted values are averages for certain groups of the population.

The Institute of Nutrition of the Russian Academy of Medical Sciences developed "Standards of physiologic needs for energy and nutrients for different groups of the population of the Russian Federation" (2008) relying on the data on the average energy consumption of people of various professions. This is a state regulatory document that serves as a criterion for practical assessment of nutrition of the population. Specifically it is used for calculation of the consumer goods basket, as well as for construc-

tion of diets for organized groups; it is a scientific basis for planning of food production and is used for development of the nutrition based health care preventive efforts. The “standards” are used in medical practice for the assessment of individual nutrition, and if necessary, to support the recommendations aimed at its correction.

The values recommended in the "Standards" are based on scientific data of biochemistry, physiology and other branches of medical science, the role, relationships, digestibility of individual nutrients and values of their real needs. For justification of the normative values there have been used the results of the study of actual nutrition and health of the population in different regions of the country, as well as the results of clinical observations. However, the values contained in the "Standards" are of general nature and relate to groups of individuals with similar characteristics: gender, age, body weight, energy expenditure size.

Adult working-age population according to gender, and the intensity of work is differentiated into 5 groups according to specific criteria proposed by the World Health Organization, the so-called coefficient of physical activity, showing how many times the energy consumption at each type of activity exceeds the value of basal metabolism.

If, for example, energy consumption for all kinds of life is 2 times higher than the value of basal metabolism for the respective age and sex group in population, then it means that for this group the CPA will be equal to 2. The group with the same energy consumption can be attributed to the people of different professions depending on the energy intensity of labor processes and conditions related to non-professional activities.

The following is the classification of the population by groups dependent on labor intensity of profession.

Group I (CPA=1.4). Very light physical activity. These are mainly intellectual workers, for example teachers, scientists, students, medical specialists, computer operators, museum workers, librarians, and others.

Group II (CPA=1.6). Light physical activity. These are workers employed in a light physical labor, for example the drivers of public transport, , packers, workers of radio-electronic industry, sewers, local doctors, surgeons, nurses, retailers, police officers, hairdressers, photographers, communication workers, employees of public catering establishments, etc.

Group III (CPA=1.9). Moderate physical activity. This is a work of average intensity which is performed by machine operators, fitters, install-

ers, drillers, excavator drivers, bulldozers and other heavy equipment, workers of greenhouses and etc.

Group IV (CPA=2.2). High physical activity. It is hard physical work carried out by construction workers, porters, workers of forestry, hunting and agriculture, woodworkers, metallurgists and other related activities.

Group V (CPA=2.5). Very high physical activity. These workers are of especially hard physical labor. They are miners, bricklayers, concrete workers, porters, non-mechanized labor, machine and agricultural laborers in sowing and harvesting periods, herders and others.

The 5-group classification of labor intensity given above for men is as well applied for women except for the fifth group, particularly heavy physical labor, is excluded. The value of CPA as the main physiological characteristic of each group is the same for men and women, but due to smaller body size and weight, respectively, basal metabolism, energy value of diets for men and women in the same groups has different CPA. To determine the energy needs of a particular person it requires information about his profession, sex, age and body weight.

Example of calculating the energy requirements for a 40 years old man with a body weight of 70 kg, the bus driver (Tab. 4).

Table 4

Example of calculation of energy needs

Kind of activity	Duration, hours	Energy expenditure from table 3 (CPA)	Basal metabolism rate, per hour	Energy consumption, per day, kcal
Sleep and rest in bed	8	1.0	65	520
Professional activity (Working on a bull-dozer)	6	3.3	65	1287
Restroom	1	1.4	65	91
Food	1.5	1.5	65	146.2
Walking around the house	1.5	2.5	65	164
Household work at home	3	3.3	65	643.5
Reading	2	1.6	65	208
Rest sitting	1	1.2	65	78
Total	24 hours			3137.7 kcal

It should be referred to the labor intensity of the group III - average labor workers, average physical activity, CPA = 1.9. We should draw the timing of activities for the day, that is, fix, how much time (in hours) that person has spent on professional activity, food intake, rest, sleep, etc. The data shall be in the form of a table (Tab. 4).

In order to facilitate the calculation of activities with the same energy expenditure combined. Then, the duration of each activity must be multiplied by the value of the CPA, corresponding to the type of activity (they are listed in Table 3). Then we multiply the resulting value by the amount of basal metabolism per hour. To obtain the value of basal metabolism per hour we must take table value of basal metabolism values for a particular sex, age and body weight (Tab. 2), divided by 24 hours.

In this case, 1550/24 = 65 kcal/hour. Summing up all the energy costs for the periods of work and rest (right column in Table 4) we calculate the total energy consumption per day.

Caloric needs can be calculated Faster but with less precision as follows. The value of basal metabolism of bulldozer-driver (1550 kcal per day) should be multiplied by the CPA, which is equal 1.9 for the professional group III: 1550×1.9=2945 calories per day.

Norms of nutrition. The chemical composition of food is complex and diverse biological effects on the body are produced by the following components of food (Tab. 5).

Table 5

Components of food

Nutrients		Antinutritients	Alien substances (impurities)
Nutritious	Flavor		
Proteins Fats Carbohydrates Vitamins Minerals Water	Organic acids Esters Dyes Phytoncides Tannins	Anti amino acids Antivitamin Demineralizers	Pesticide residues Salts of heavy metals Nitrosamines Radioactive substances

In the Tables 6 to 9 the norms of physiological needs for energy and essential nutrients for adult population are given, in Tab. 10 - for children, respectively.

Table 6

The norms for physiological energy and nutrient requirements in men

Indicator (per 24 hours)	Group of physical activity (CPA)															60+
	I (1.4)			II (1.6)			III (1.9)			IV (2.2)			V (2.5)			
	Age groups															
	18-29	30-39	40-59	18-29	30-39	40-59	18-29	30-39	40-59	18-29	30-39	40-59	18-29	30-39	40-59	
Energy and macronutrients																
Energy kcal	2450	2300	2100	2800	2650	2500	3300	3150	2950	3850	3600	3400	<4200	3950	3750	2300
Protein, g	72	68	65	80	77	72	94	89	84	108	102	96	117	111	104	68
Animal protein, g	36	34	32.5	40	38.5	36	47	44.5	42	54	51	48	58.5	55.5	52	34
% of calories	12	12	12	12	12	12	11	11	11	11	11	11	11	11	11	12
Fat, g	81	77	70	93	88	83	110	105	98	128	120	113	154	144	137	77
Fat,% of calo-ries	30	30	30	30	30	30	30	30	30	30	30	30	33	33	33	30
Carbohydrates, g	358	335	303	411	387	366	484	462	432	566	528	499	586	550	524	335

Note. * - For those working in the Far North, energy consumption increased by 15% and as well there will be increase in the needs for proteins, fats and carbohydrates proportionally.

Table 7

The norms for physiological energy and nutrient requirements in women

Indicator (per 24 hours)	Group of physical activity (CPA)												60+
	I (1.4)			II (1.6)			III (1.9)			IV (2.2)			
	Age Groups												
	18-29	30-39	40-59	18-29	30-39	40-59	18-29	30-39	40-59	18-29	30-39	40-59	
Energy and macronutrients													
Energy kcal	2000	1900	1800	2200	2150	2100	2600	2550	2500	3050	2950	2850	1975
Protein, g	61	59	58	66	65	63	76	74	72	87	84	82	61
Animal protein, g	30.5	29.5	29	33	32.5	31.5	38	37	36	43.5	42	41	30.5
% of calories	12	12	12	12	12	12	12	12	12	12	12	12	12
Fat, g	67	63	60	73	72	70	87	85	83	102	98	95	66
Fat,% of calories	30	30	30	30	30	30	30	30	30	30	30	30	30
Carbohydrates, g	289	274	257	318	311	305	378	372	366	462	432	417	284

Note. * - For those working in the Far North, energy consumption increased by 15% and as well there will be increase in the needs for proteins, fats and carbohydrates proportionally.

Table 8

Norms of physiological needs for nutrients in men and women

Indicator (per 24 hours)	Men		Women	
	18-59 years	> 60 years	18-59 years	> 60 years
Macronutrients				
Monounsaturated fatty acids,% of kcal	10			
Polyunsaturated fatty acids,% of kcal	6-10			
ω-6,% of kcal	5-8			
ω-3,% of kcal	1-2			
Phospholipids g	5-7			
Sugar,% of kcal	<10			
Dietary Fiber, g	20			
Vitamins				
Vitamin C, mg	90			
Vitamin B_1, mg	1.5			
Vitamin B_2, mg	1.8			
Vitamin B_6, mg	2.0			
Niacin, mg	20			
Vitamin B_{12}, μg	3.0			
Folate, μg	400			
Pantothenic acid, mg	5.0			
Biotin, μg	50			
Vitamin A, μg retinoid equivalents	900			
Beta-carotene, mg	5.0			
Vitamin E, μg tocopherol equivalents	15			
Vitamin K, μg	120			
Vitamin D, μg	10	15	10	15
Minerals				
Calcium, mg	1000	1200	1000	1200
Phosphorus, mg	800			
Iron, mg	10		18	
Selenium, μg	70		55	
Magnesium, mg	400			
Potassium, mg	2500			
Sodium, mg	1300			
Chloride, μg	2300			
Zinc, μg	12			

Iodine, µg	150
Copper, µg	11.0
Chromium, µg	50
Molybdenum, µg	70
Fluorine, mg	4.0
Manganese, mg	2.0

Table 9

Additional energy and nutrient requirements for women during pregnancy and breast-feeding

Indicator	Pregnancy (second half)	Breastfeeding (1-6 months)	Breastfeeding (7-12 months)
Energy and macronutrients			
Energy kcal	350	500	450
Protein, g	30	40	30
Animal protein, g	20	26	20
Fat, g	12	15	15
Carbohydrates, g	30	40	30
Vitamins			
Vitamin C, mg	10	30	30
Vitamin B_1, mg	0.2	0.3	0.3
Vitamin B_2, mg	0.2	0.3	0.3
Vitamin B_6, mg	0.3	0.5	0.5
Vitamin B_{12}, µg	0.5	0.5	0.5
Niacin, mg	2	3	3
Folate, µg	200	100	100
Vitamin A, µg retinoid equivalents	100	400	400
Pantothenic acid, mg	1.0	2	2
Vitamin E, µg tocopherol equivalents	2	4	4
Vitamin D, µg	2.5	2.5	2.5
Minerals			
Calcium, mg	300	400	400
Phosphorus, mg	200	200	200
Magnesium, mg	50	50	50
Iron, mg	15	0	0
Zinc, µg	3	3	3
Iodine, µg	70	140	140

Copper, μg	0.1	0.4	0.4
Manganese, mg	0.2	0.8	0.8
Selenium, μg	10	10	10

As shown in the Tables 6 to 9 an adult population is divided by the principle of labor intensity into three age groups: 18-29, 30-39 and 40-59 years. Rates for persons over 59 years old are further differentiated in two age categories: 60–74 years and 75 years and older. For children and teenagers the leading factor in determining the physiological need for food is their age, so the child population is distributed into 9 groups, and starting from 11 years old the values are differentiated by gender.

The value also depends on the energy requirements due to climate. Food standards account for three climatic zones, the central, northern and southern.

Energy demands in the residents of the northern zone is higher than the inhabitants of the central zone by 10–15%, which should be provided by increase in the consumption of fats, and to a lesser extent, protein and carbohydrates. The southern zone in comparison with the central one is characterized by the demands for energy reduced by 5% due to the decline in the share of fats on the expense of carbohydrates. This is because the air temperature in southern zone is high, so specific energy loss on heat production by the body is reduced.

In a balanced diet the proportion of proteins, fats and carbohydrates should be (% of daily calories), respectively 12, 33 and 55. For the north population it is recommended to slightly change the ratio of major nutrients (% of caloric intake): protein – 15, fat – 35, carbohydrates – 50%.

The recommended protein requirements are determined on the basis of research results and establish the optimal protein-energy ratio in diets for different population groups. Levels of the protein needs are on average 1.5 times higher than those necessary to maintain nitrogen balance. For adults animal protein quota shall be 55%; for children from 1 year to 3 years – 70%; from 4 to 6 years – 65%; for children and teenagers of school age – 60%.

The proportion of fat for all groups of the adult working-age population is set at 30–33% of total calories. To evaluate the physiological adequacy of the fatty part of a diet we use norm requirements in essential linoleic acid, which in the diets of adults and children older than one year and teenagers should account for 4–6% of energy.

Table 10

The physiological norms for energy and nutrient requirements in children and adolescents of Russian Federation

Indicator (per 24 hours)	Age groups										
	Months			Years				11-14 years		14-18 years	
	0-3	4-6	7-12	1-2	2-3	3-7	7-11	Boys	Girls	Boys	Girls
	Energy and nutrients										
Energy kcal	115*	115*	110*	1200	1400	1800	2100	2500	2300	2900	2500
Protein, g	-	-	-	36	42	54	63	75	69	87	75
Animal protein, %*	-	-	-	70		65	60				
g/kg body weight**	2.2	2.6	2.9	-	-	-	-	-	-	-	-
% from kcal	-	-	-	12							12
Fats, g	6.5*	6*	5.5*	40	47	60	70	83	77	97	83
Fats, % of kcal	-	-	-	30							
Polyunsaturated fatty acids,% of kcal	-	-	-	5-10						6-10	
ω-6,% of kcal				4-9						5-8	
ω-3,% of kcal				0.8-1						1-2	
Cholesterol, mg				<300							
Carbohydrates, g	13*	13*	13*	174	203	261	305	363	334	421	363
Carbohydr.,% of kcal	-	-	-	58							
Glucose,% of kcal	-	-	-	<10							
Dietary fiber	-	-	-	8		10	15	20			
Vitamins											
C, mg	30	35	40	45		50	60	70	60	90	70
B_1, mg	0.3	0.4	0.5	0.8		0.9	1.1	1.13		1.5	1.3

B_2, mg	0.4	0.5	0.6	0.9	1	1.2	1.5		1.8	1.5
B_6, mg	0.4	0.5	0.6	0.9	1.2	1.5	1.7	1.6	2	1.6
Niacin, mg	5	6	4	8	11	15	18		20	18
B_{12}, µg	0.3	0.4	0.5	0.7	1.5	2	3			
Folate, µg	50		60	100	200		300-400		400	
Pantothenic acid, mg	1	1.5	2	2.5	3		3.5		4	5
Biotin, µg	-			10	15	20	25		50	
A, µg retinoid equiv.	400			450	500	700	1000	800	1000	800
E, µg tocopherol equiv.	3		4		7	10	12	12	15	15
D, µg	10									
K, µg	-			30	55	60	80	70	120	100
Minerals										
Calcium, mg	400	500	600	800	900	1100	1200			
Phosphorus, mg	300	400	500	700	800	1100	1200			
Magnesium, mg	55	60	70	80	200	250	300	300	400	400
Potassium, mg	-	-	-	400	600	900	1500		2500	
Sodium, mg	200	280	350	500	700	1000	1100		1300	
Chloride, µg	300	450	550	800	1100	1700	1900		2300	
Iron, mg	4	7	10			12		15		18
Zinc, µg	3		4	5	8	10	12			
Iodine, µg	0.06			0.07	0.1	0.12	0.13	0.15		
Copper, µg	0.5		0.3	0.5	0.6	0.7	0.8		1	
Selenium, µg	0.01	0.012		0.015	0.02	0.03	0.04		0.05	
Chromium, µg	--	--	--	11	15		25		35	
Fluorine, mg	1	1	1.2	1.4	2	3	4		4	

Note. * - during the first year of life norms are based on the g/kg body weight; ** - requirements for infants who are bottle-fed.

The values given in the protein requirements for feeding infants with breast milk or a breast milk substitute with biological value of the protein component of more than 80%; when feeding with dairy products of the biological value of less than 80%, these values need to be increased by 20–25%.

Table 11 shows the safe levels of micronutrient intake.

Table 11

Safe amounts of micronutrient intake

Group	Age	Copper, mg	Manganese, mg	Fluorine, mg	Chromium, Mg	Molybdenum, μg
Children	0-5 months	0.4-0.6	0.3-0.6	0.1-0.5	14-40	15-30
	6-12 months	0.6-0.7	0.6-1	0.2-1	20-60	20-40
	1-3 years	0.7-1	1-1.5	0.5-1.5	20-80	25-50
	4-6 years	1-1.5	1.5-2	1-2.5	30-120	30-75
	7-10 years	1-2	2-3	1.5-2	50-200	50-150
	11 years and more	1.5-2.5	2-3	1.5-2.5	50-200	75-250
Adults	18 years and more	1.5-3	2-5	1.5-4	50-200	75-250

Methods of studying current nutritional patterns in population. To study nutritional patterns in a population several methods may be used.

Balance method. It is based on statistical reporting and allows you to characterize food intake in the average per capita population of the city, region, country, in different age and sex, social and professional groups over the years.

Budget method. Its use makes it possible to analyze the distribution of family income, including food. It can detect the amount of intake and types of food actually spent in the family during a certain period. Materials obtained through the balance sheet and budget methods, mainly used for the proper planning of production and distribution of food products.

Questionnaire method. It is used for study of individual nutrition in a

short period of time (1–2 days). The essence of the method is to poll survey with specially prepared questionnaire including questions about food: the multiplicity and the times of meals during the day, the list of dishes, their weight, recipe dishes terms of cooking and eating.

Weighting method. It is based on a direct weighing of food used for cooking. It can help you to determine the quality and quantity of nutrition.

Questionnaire survey method. This is a method, based on a combination of individual survey by specially designed questionnaire and weighting food consumed, as well as the study of diet. This method is applied selectively to study the nutrition of homogeneous groups, families and to study individual nutrition.

Statistical method. The method is based on calculating the basic components of the diet in menu. This method is widely used in the evaluation of public catering in organized groups. It is also used to assess individual food consumption.

Laboratory method. It allows you to get the most accurate information on the actual composition of the diet, but due to its labor-intensivity, it is used only in conjunction with the above methods (questionnaire-weighting and statistical methods for calculating the main components of the diet in menu).

Clinical approach. The method consists in carrying out a clinical examination of people, anthropometric studies of children and teenagers, revealing micro symptoms of deficiency of vitamin A, as well as the determination of biochemical parameters of blood and urine tests that characterize the state of the protein, lipid, carbohydrate, mineral, vitamin metabolism, total urinary nitrogen, sugars and other blood tests.

Statistical method of calculation of the main components of a diet using menu list. This table-based method has found wide application in the hygienic assessment of diet, because it is pretty accurate and it is available, does not require special equipment or reagents for its implementation. To calculate the energy value and chemical composition of a diet it is necessary to have the list and the number of products included in the daily diet (menu-list), and to use the info of "The content of the nutrients and energy value of foods" table given.

Menu-list is a list of dishes, significant in the daily menu with the weight of the products, taken for preparation of each dish.

Nutrition regime. Under the nutrition regime we understand the time and the number of meals during the day, the intervals between them, quan-

titative distribution of calories between them, chemical composition, and the weight of food packages for individual meals. When developing a diet, take into account the nature of work, day schedule, age, local habits and individual characteristics.

It was found that if one takes meals at one and the same time on a regular basis, the conditional secretion reflex is established that helps to improve appetite and digestion. On the contrary, an inordinate nutrition violates the activity of digestive glands, impairs and slows down the digestion of food and is one of the causes of chronic gastritis, colitis and other diseases of the digestive system.

The optimal interval between meals should not exceed 4-5 hours, during the night it is extended to 10 hours. If relatively small servings of food are taking in during a meal, the interval is reduced to 3 hours. It is recommended to keep the interval of 2 hours between dinner and bedtime.

Larger intervals may lead to over excitation of food center with the release of large amounts of the active gastric juice. The latter, making contact with the mucosa of the empty stomach may be irritating and cause inflammation.

The most important principle of correct diet is regularity that is eating at the same time. It is essential for the conditioned reflex training the body to receive and digest food. For adults, it is recommended 3 meals a day, but 4–5 meals a day is recognized as the most physiologically correct, since it allows you to create a uniform load on the digestive organs and the most complete enzymatic processing of the ingested food. Children, people prone to obesity, older people are advised to take a moderate amount of food 5–6 times a day.

Table 12

Distribution of the energy of a daily diet for individual meals (as a percentage of total calories)

Food intake	Caloric distribution across meals (%)	
	3 meals a day	4 meals a day
First breakfast	30	20-30
Brunch	-	10-25
Lunch	45-50	40-50
Dinner	20-25	15-20

Distribution of the energy value of the daily diet for meals made differentially depending on the nature of work (work in shifts, at night) and a steady daily routine (Tab. 12).

As a general rule, greater energy consumption must be in the first half of the day and along the day it goes down, which corresponds to biosocial rhythms of human life. Abundant food in the morning and less load on the second one – physiological, as absorption of nutrients is then carried out with less intense metabolism. Food intake in the morning promotes the release of a large number of digestive hormones, so in the morning, even large amounts of food are more easily digested and the calories consumed get "burned" completely. There are “biological clocks” for secretion of digestive juices and hormones that control the absorption of nutrients. For example, insulin lowers blood sugar, carbohydrates, promotes the transformation into fatty acids and thus the formation of fat. Insulin levels in the morning are lower, so the blood sugar is spent on replenishing of energy expenditure and gets burned, not into a stock. In the second half of the day insulin levels increase, especially if eating in late hours, thence the blood sugar is rapidly converted into fatty acids and accumulation of fat deposition proceeds.

The amino acid tyrosine, the hormone testosterone also helps to burn calories, preventing leaving fat. They level up in the morning, so the metabolism and absorption of nutrients occur strongly and more effectively.

Nutritional status as an indicator of health. The term "nutritional status" describes the state of health, coming out of prevailing constitutional peculiarities of the body under the influence of dietary intake over a long period of time. Methodology for nutritional status assessment includes the definition of nutrition inadequacy and morbidity, potentially related to it.

Digestive function is system of metabolic, neural and glandular regulation of the body which provides a relatively constant internal environment (homeostasis). Digestive function is assessed by nutritional and metabolic parameters such as protein, fat, carbohydrate, vitamins, minerals, water consumption.

Evaluation of nutrition inadequacy is based on: 1) height, body mass and body-mass index; 2) content of metabolic end products in the urine; 3) content of specific metabolites in the blood; 4) enzyme activity; 5) the functional state of the nervous, cardiovascular and digestive systems.

Highly informative and simple indicator, reflecting nutritional status of a person, recommended by experts of the World Health Organization, is *body mass index (BMI)* or *Quetelet index*, which is determined by the formula:

BMI=body weight (kg)/height (m^2)

BMI categories are given in Tab. 13.

Incidence of common chronic diseases is closely associated with nutritional status: various disorders result from inadequate nutrition, in particular from insufficient or excessive nutrition. Classification of nutritional status is shown in Tab. 14.

Table 13

Characteristics of body mass index (BMI)

BMI, kg/m^2	Evaluation
<16	Severe body weight insufficiency
16-16.99	Moderate body weight insufficiency
17-18.49	Mild body weight insufficiency
18.5-24.9	Normal weight
25-29.9	Overweight
30-34.9	I degree obesity
35-39.9	II degree obesity
40 and more	III degree obesity

Table 14

Classification of nutritional status

Nutritional status	Symptoms
Normal	No malnutrition-related symptoms, no functional or structural disorders; adaptation reserves of the body correspond to the usual conditions of existence
Optimal	The nutrition in optimal way provides efficient functioning and structural conditions of the body. Adaptation reserves in full compensate for the body's needs in emergencies.
Excessive	As a result of excessive intake of nutrients deterioration in functions occurs, decreased adaptation reserves.
Insufficient (includes the forms below):	As a result of inadequate intake of nutrients functional and structural disorders gradually occur in the body
Defective	No evident structural abnormalities, but adaptive capabilities do not meet the normal stress
Premorbid	No disease yet, but functional and structural changes are present due to malnutrition, there is a lack of the necessary adaptation reserves
Morbid (pathological)	Functional and structural disorders are clinically manifested in the form of nutritional deficiency diseases

According to the anatomical location of excessive fat deposition there may be:

1) "Upper body" (or android, male, abdominal) type of obesity – representing the body, looking like an "apple";

2) "Lower body" (or gynoid, feminine, hip) obesity type, with the body looking like a "pear".

Most often, fat is stored in the subcutaneous space (the subcutaneous fat), or around the internal organs (the visceral fat). In case of the predominant accumulation of fats in the subcutaneous tissue of the stomach or if visceral obesity is present, we speak of the abdominal form of obesity.

To establish the diagnosis of abdominal obesity, the ratio of the waist circumference to the hip circumference is estimated (waist-to-hip ratio). If this indicator exceeds 0.9 for men or 0.8 for women, the obesity is considered to be abdominal. This means that the risk for the development of serious adverse health conditions such as type 2 diabetes, arterial hypertension, dyslipidemia is markedly increased. Obesity is also related to atherosclerosis, ischemic heart disease, musculoskeletal disorders and other diseases.

The final objective of individual nutrition adequacy assessment is to correct the improper diet. In order to optimize the diet and achieve balance as to the composition of ingredients we should be guided by the recommendations of the Institute of Nutrition, presented in Tab. 15.

Table 15

Proportion of foods in the total caloric intake of a daily diet

Product	% of total daily calories
Meat and meat products	14
Milk and dairy products	14
Fish and fish products	1.5
Eggs	1.5
Bread and bakery products	32
Potatoes	6
Vegetables	3
Fruits and berries	4
Vegetable oil	10
Sugar	14

PRACTICAL PART

1. Define your own energy expenditure on the day prior to the today's class (or on an average busy day of the last week). For this purpose, the data from Tab. 2 (a simplified method for determination of basal metabolism) and Tab. 3 (chronometer-table method) is used. The example is shown in Tab. 4.

2. Record your food intake on the same day, for which the energy consumption has been already calculated; note the time of meals: what food has been eaten, when and how much of? Example of such a menu is given in Tab. 16 (left column).

3. Calculate the caloric value and chemical composition of your diet according to the menu recorded (example of such is shown in Tab. 16).

Step I – record menu-list, based on the list of foods eaten and their weights, where each dish is to be decomposed into its constituent products. Reference, auxiliary tables are to facilitate this work:

- A sample set of products for the most frequently used foods (Tab. 18);
- The average weight of fruits and vegetables (Tab. 19);
- Weight of food in grams per share (Tab. 20);
- Weight of food in the most commonly used measures of volume (Tab. 21).

Step II – count calories, proteins, fats, carbohydrates, calcium, phosphorus and vitamin C content in your own individual diet. To do this, use data from the external electronic source "Nutrient Values of Some Common Foods", accessed online at "https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/fn-an/alt_formats/pdf/nutrition/fiche-nutri-data/nvscf-vnqau-eng.pdf". Use necessary data from the electronic book given to calculate edible portion of each product, specified in your own menu-list. Fill in the Table 17 ("Data from factual diet" column).

4. Evaluate the adequacy of your diet by comparing the actual data obtained with the "Norms of physiological needs for nutrients and energy of different groups of the population" (tables 6–9).

5. Draw up conclusions on the results obtained, justify recommendations for a correction of the individual diet with specific examples of introduction to the diet of certain products taking into account their quantity; possible need to use biologically active food additives, vitamins, special methods of food processing during its cooking, etc.

Table 16

Menu-list of the daily diet

Food name; mealtime	Weight, g	Proteins, g (incl. animal)	Fats, g (incl. vegetable)	Carbs, g	Calories, kcal	Calcium, mg	Phospho-rus, mg	Vit. C, mg
Breakfast (07:00 a.m)								
Tea with sugar	20	-	-	24.9	93.5	-	-	-
Bread, wheat	100	76	0.9 (0.9)	49.7	226	26	83	-
Butter	20	0.12 (0.12)	16.5	0.18	149.6	4.4	3.8	-
Cooked sausage	30	4.11 (4.11)	6.84	-	78	8.7	53.4	-
Total		11.83 (4.23)	24.24 (0.9)	74.78	547.1	39.1	140.2	-
Lunch (01:00 p.m)								
Cutlet meat with pasta:								
Meat	150	28.35	18.6	-	280.5	13.5	297	-
Vegetable oil	20	-	19.94 (19.94)	-	179.4	-	-	-
Egg	½	3.17 (3.17)	-	0.17	39.25	13.7	46.2	-
Bread, wheat	25	1.9	28.75	12.42	56.5	6.5	20.7	-
Pasta	60	6.36	0.22 (0.22)	45.12	199.2	10.8	135.6	-
Compote:								
Dried fruits	70	1.5	0.54 (0.54)	42.0	139.3	77.7	53.9	-
Sugar	30	-	-	29.7	112.2	-	-	1.4
Rye bread	200	13.0	2.0 (2.0)	181.8	380	76	312	-
Total		54.28 (3.17)	70.05 (22.7)	1311.2	1386.35	198.2	865.4	-
Dinner (06:00 p.m)								
Kefir 2.5% fat	200	5.6 (5.6)	6.4	8.2	118	240	190	1.4
Bun	100	76	5.0 (5.0)	6.4	288	25	85	-
An Apple	100	0.4	-	11.3	46	16	11	13
Total		13.6 (5.6)	11.4 (5.0)	25.9	452	281	286	14.4
Total (all meals)		79.71 (41.34)	105.69 (28.6)	411.9	2385.45	513.3	1291.6	15.8

Table 17

Scheme of hygienic assessment of individual nutrition

№	Estimate	Data from factual diet	Normative	Assessment
1	Compare the caloric content of the individual daily food intake with the correspondent energy expenditure estimate and relevant nutritional standards	Caloric content	The norms are taken from the tables 6-7	Conformity to the norm; above; below;
2	Proteins			
2.1	Total amount of proteins, g		From table 6-7	
2.2	% of animal to the total proteins		55%	
2.3	Calories of proteins, % of the total energy intake = total amount of proteins (g) x 4 kcal x 100%		11-14%	
3	Fats			
3.1	Total amount of fats, g		From table 6-7	
3.2	% of vegetable to the total fats		25-30%	
3.3	Calories of fats, % of the total energy intake = total amount of fats x 9 kcal x 100%		30-35%	
4	Carbohydrates			
4.1	Total amount of carbohydrates, g		From table 6-7	
4.2	Calories of carbohydrates, % of the total energy intake = total amount of carbohydrates x 4 kcal x 100%		54-56%	
5	Proteins:Fats:Carbohydrates ratio, g (assume proteins estimate as 1)		1:1:4	
6	Macronutrients, mg: Calcium Phosphorus		 table 8 table 8	
7	Vitamin C, mg		table 8	
8	Nutrition regime: Multiplicity of meals Intervals between meals, hours Distribution of daily calories at meals		 3-4 4-5 From table 13	

Table 18

A sample set of products for the most commonly used dishes

Name of dishes and a sample set of one serving	Amount, g	Name of dishes and a sample set of one serving	Amount, g
First course			
Borscht			
Meat	50-100	Tomatoes and cucumbers	25
Cabbage	150	Roots	10
Potatoes	100	Tomato	10
Beet	100	Fat	10
Carrot	20	Flour	5
Onions	10	Total:	330
Tomato	10	*Soup groats (rice, barley)*	
Sour cream	20	Groats	30-50
Flour	5	Meat	50
Total:	465	Potatoes	100-150
Cabbage soup		Carrot	10-20
Meat	50	Onions	5-10
Cabbage or cabbage fermented	200	Tomato	5
Potatoes	100	Fat	10-15
Carrot	25	Total:	300
Onions	10	*Pea soup*	
Tomato	10	Pea	70
Roots	10	Meat	50
Sour cream	20	Onions	20
Flour	10	Butter	10
Total:	435	Total:	150
Rassolnik		*Noodles soup*	
Kidneys	70	Noodles or pasta	50
Pickles	50	Chicken	50
Potatoes	100	Egg	¼
Carrot	20	Carrot	20
Cabbage	50	Onions	10
Onions	5	Butter	10
Sour cream	20	Total:	140
Flour	5	*Mushroom soup*	
Total:	320	Pearl barley	40
Solyanka		Dry mushrooms	20
Meat or fish	100-150	Potatoes	200
Cabbage or potatoes	100	Onion	5

Carrot	20	Oil	15
Onions	10	Total:	280
Total:	280		
Main course			
Meat		*Sausages*	
Fried meat		Sausages	150
Meat	150	Pickles	50
Potatoes	200	Potatoes	150
Melted butter	15	Oil	10
Flour	5	Total:	360
Total:	370		
Stewed meat		*Pork chops*	
Meat	200	Pork	150
Potatoes	200	Cabbage	100
Carrot	20	Carrot	50
Onions	20	Potatoes	50
Tomato	10	Egg	¼
Oil	10	Rusk	15
Total:	460	Total:	365
Fried chicken		*Pasta with minced meat*	
Chicken	250	Meat	100
Rice	100	Pasts	80
Oil	10	Tomato	10
Sour cream	30	Oil	10
Total:	390	Total:	200
Pilaf		*Fish*	
Mutton	100	*Fried fish*	
Rice	100	Fish	150-200
Carrot	5	Potatoes	200
Onions	15	Pickles	50
Tomato	10	Onions	5
Flour	5	Rusk	20
Oil	15	Oil	20
Total:	255	Total:	495
Fried liver		*Fish chops*	
Liver	200	Fish	150
Potatoes	100	Potatoes	200
Pickles	50	Egg	¼
Sour cream	25	Bun	25
Oil	10	Tomato	10
Egg	¼	Flour	5
Total:	400	Total:	390

Chops		*Herring with egg*	
Beef	100-150	Herring	50
Potatoes	200	Egg	¼
Carrot	60	Onion	5
Bun	30	Total:	65
Flour	5	*Groats*	
Onions	10	*Rice porridge, semolina*	
Tomato	10	Groats	60
Oil	10	Butter	10
Total:	475	Milk	150
		Total:	220
Buckwheat porridge, millet cereal, barley		*Oatmeal*	
Groats	70	Groats	60
Butter	30	Butter	10
Total:	100	Milk	150
Chop rice		Total:	220
Rice	70	*Rice pudding*	
Butter	20	Rice	60
Egg	¼	Milk	100
Flour	15	Butter	10
Total:	110	Rusk	25
		Sugar	10
		Raisins	10
		Egg	¼
		Total:	215
Floury		*Vegetable*	
Baked pasta		*The vinaigrette*	
Pasta	80	Potatoes	150
Butter	20	Beet	80
Milk	50	Sauerkraut	50
Cheese	10	Pickles	25
Egg	½	Carrot	20
Total:	170	Onion	10
Cheesecake		Oil	20
Flour	50	Total:	355
Cottage cheese	80		
Butter	20		
Milk	50		
Sugar	15		
Egg	¼		
Total:	225		

Table 19

Average mass of vegetables and fruits

Food product	Mass, g
Potatoes, cucumber	100
Carrots, onions	75
Root of parsley	50
Tomato, cm in diameter: 5.5 and 6.5	75 and 115
Garnet	125
Orange	150
Mandarin	45
Lemon	60
Apple, cm in diameter: 5 and 6.5	90 and 130
Apple aport winter	250
Peach, persimmon	85
Apricot	26
Figs	40
Plum	30
Pear	135
Banana	72
Cherries, gooseberries, raspberries	2.5—3
Black currant	1
Strawberries	8

Table 20

Mass of food products, g (in one)

Product	Mass, g
Bulk	200
Baking ordinary	50
Horn	60
Cream cracker	20
Refined sugar	7.5
Caramel with filling	6
Candy glazed with chocolate, jujube	12.5
Pastille	15
Iris	7
Zephyr	33
Sugar cookies	13.5
Biscuit cookies	35

Biscuit	15.5
Gingerbread	20
Cake	75
Sausage	100
Chicken egg	47

Table 21

Mass of foods as measured for the mostly used volume units

Product	Food mass (g) in the volume		
	Glass, 250 cm³	Spoon	
		table	tea
		18 ml	5 ml
Wheat flour	160	25	8
Breadcrumbs	125	15	5
Buckwheat groats	210	25	8
Semolina	200	25	8
Groats of barley	180	20	7
Oat flakes "Hercules"	90	12	3
Millet	220	25	8
Croup of corn, barley, wheat	180	20	6
Pasta	100	-	-
Rice, pearl barley	230	25	8
Beans	220	30	10
Peas chopped	230	-	-
Sugar-sand	200	25	8
Salt	325	30	10
Milk, cream, kefir, yogurt	250	20	5
Sour cream 10% fat content	250	20	9
Curd fatty, low-fat	-	17	5
Milk powder	-	20	6
Milk, condensed, sterilized	-	18	5
Cream condensed with sugar	-	30	12
Margarine, mayonnaise	-	15	4
Baking oil	245	20	5
Butter	210	50	30
Vegetable oil	240	20	5
Honey natural	325	30	8
Vinegar	250	15	5
Tomato puree	220	25	8
Tomato paste	225	30	10

Gelatin	-	15	6
Lemon acid	-		3
Black pepper powder	-	9	5
Jam	300	40	15
Tomato and fruit juices	250	18	5
Fruit compotes (canned)	250	-	-
Potato starch	200	30	9
The core of almonds, walnuts (hazelnuts)	165	30	-
Cocoa powder	-	25	9
Fresh berries:			
Cherry, cherry	165	-	-
Lingonberry	140	-	-
Cranberry	145	-	-
Gooseberry	210	-	-
Raspberries	180	-	-
Currant black	155	-	-
Red currants	175	-	-
Blueberries	200	-	-
Dogrose dry	-	20	6

QUESTIONS FOR SELF-CONTROL

1. Forms of energy expenditure of the body.
2. Methods for determination of energy expenditure.
3. Methods of obtaining information about actual nutrition in population.
4. Components of food.
5. Norms of nutrition for different groups of population.
6. The nutrition regime recommended.
7. Nutritional status as an indicator of the state of human health.
8. Method of determining and criteria of Quetelet index evaluation.

TEST TASKS

Choose one correct answer

1. CALORIC COEFFICIENT OF 1 g OF CARBOHYDRATES (KCAL)
    1) 2
    2) 4
    3) 6
    4) 9

2. THE MOST ACCURATE METHOD OF DETERMINATION OF ENERGY EXPENDITURE BY HUMAN ORGANISM

1) method of direct calorimetry
2) method of indirect calorimetry
3) chronometer-table method

3. THE FIRST GROUP OF ENERGY EXPENDITURE BY THE COEFFICIENT OF PHYSICAL ACTIVITY IS CORRESPONDENT TO

1) surgeons
2) nurses
3) medical orderly
4) students

4. THE OPTIMAL RATIO OF THE ANIMAL AND VEGETABLE FOOD IN THE DIET OF WORKING AGE PERSONS

1) 10:90
2) 30:70
3) 70:30
4) 90:10

5. DAILY NEEDS OF CARBOHYDRATES FOR ADULTS (g)

1) 100-150
2) 200-250
3) 300-500

6. NUTRITIONAL STATUS, IN WHICH ADAPTATION RESERVES OF THE BODY COMPENSATE ITS NEEDS IN EMERGENCIES

1) usual
2) optimal
3) excessive

SITUATIONAL PROBLEMS

Problem 1. The daily diet of the student (20 years old), having energy expenditure of 2850 kcal includes: 48 g of proteins, of which 15 grams of animal origin; 64 g of fat, of which 20 g of plant origin; 320 g of carbohydrates; 400 mg of calcium; 680 mg of phosphorus; 8 mg of vitamin C.

Evaluate adequacy of the student's diet of on the following indicators:

1) Caloric content of the diet, its compliance with energy expenditure;

2) Compliance with the norm of amounts of nutrients, minerals, vitamin C in the diet;

3) Compliance with the normative ratio of animal protein relative to total protein quantity, vegetable fats relative to their total quantity;

4) The ratio of proteins, fats and carbohydrates content in the whole structure of the diet.

Problem 2. The student's lunch consisted of a glass of milk (200 g) and white bread (100 grams) with cheese (20 grams).

Table of the chemical composition of food products (in 100 g)

Products	Proteins, g	Fats, g	Carbs, g
White bread	7	0.7	49.9
Milk	2.8	3.5	4.5
Processed cheese	26.8	27.3	1.8

Calculate the caloric value of the lunch.

Problem 3. The diet of the student was as follows: first breakfast at 6.30, caloric content – 300 kcal; Second breakfast at 12 o'clock, caloric content - 200 kcal; Lunch at 15 o'clock, caloric content – 400 kcal; Dinner at 21:00, caloric content – 1000 calories.

1. Assess compliance of the number of meals with hygienic recommendations.

2. Identify and evaluate the intervals between meals.

3. Determine and evaluate the caloric content distribution across the meals.

2. SANITARY-HYGIENIC EXAMINATION OF THE QUALITY OF BASIC FOODS

The purpose of the lesson: introduction to regulatory documents governing the goodness of foods, types of foods examination, categories of food quality, order of sanitary-hygienic examination of certain foods.

Theoretical part. Sanitary-hygienic examination of food quality is a set of practical steps aimed at the determination of food product quality in order to establish the possibility and order of its implementation for nutrition.

The main type of state legislation regulating quality of food products is the standards. Translation of the word "standard" means example. Standards that must be in observance with in the country are called State Social Standards (SSS). If some foods are out of being regulated by an existent SSS, then technical conditions (TC) are developed for them, which are mandatory for execution at all the stages of preparation, production and implementation of food products.

Food quality is a combination of the usefulness (nutritional and biological), and safety of food products, determining their suitability for usage as meals, as well as their reliability during manufacturing and storage. Beyond SSS and TC, quality of food products is regulated by the sanitary norms and rules (SanPiN).

Consumer properties of food products in European countries are defined by the Codex Alimentarius (Latin for "Codex Alimentarius" - "Food Codex").

Since Russia having joined the World Trade Organization (WTO), the main document regulating the quality and safety of foods is the *Codex Alimentarius*. Gradually the state standards and TCs for food products will be replaced with relevant technical regulations (TR), carrying a legislative character for the countries having them adopted.

The basic requirement for food products, according to the Federal Law "On quality and food safety," number 29-FL of 02.01.2000 and of the Technical Regulations of the Customs Union (021/2011) "On food safety", is their safety. Food safety is the state of compliance of the foods intended to be used for meals with safety requirements, including sanitary and epidemiological norms and hygienic standards, insuring the absence of unacceptable risk to life and health of people, and the future generations.

All foods must meet the hygienic requirements of the above mentioned regulations, in order for a food to be benign, and exclude the possibility of negative effects on human health. Food must be fresh, not contaminated, not infected, have a peculiar composition and not be falsified.

The necessity for sanitary-hygienic examination of food products is due to the fact that on the way of production, transportation, storage and marketing foods can deteriorate in quality, become infected and contaminated with harmful impurities. Sanitary-hygienic examination of food products is carried out in a routine (scheduled) and emergent (unscheduled) manners. Routine examination is one of the main functions of the Sanitary Epidemiological Medical Service, providing supervision over the public nutrition.

Routine examination is conducted in the following directions:

- Control over the quality of perishable foods (milk, boiled sausage, cream confectionery foods and others). The quality of the heat treatment, bacteriological indicators are assessed;
- Control over the release of new products, as well as the use of new materials for the products and equipment that come into contact with foods;
- monitoring of compliance with recipes for foods, approved with the authorities of public health surveillance, in particular for vitamin-fortified foods and culinary products;
- Control over the content of pesticide residues, heavy metals, antibiotics, weed contaminants, food additives (preservatives, dyes, stabilizers, and others);
- Control over the benign quality and nutritional value of prepared food in child care centers, schools, nutrition units of medical organizations, public catering enterprises, etc.

An unscheduled examination is carried out by epidemiological indications (suspicion of food poisoning or food infection, emergent evidences for bacterial or chemical contamination of food during its manufacture, storage, transport), in cases of dispute in the arbitration procedure, as well as on behalf of the government, investigating authorities, regulatory institutions.

To obtain objective data on a food product, the first important step of its sanitary-hygienic examination is to take properly the food sample for further analysis. It should reflect the actual condition of the lot or product

series, be a representative, which is achieved by selecting an average sample. The average sample is obtained by mixing up the samples taken from different parts of the packaging (of several bags, boxes, jars, and so on). In some cases, instead of an average sample only certain product samples are taken, for example from suspicious areas of a fresh beef carcass.

Evaluation of the results of laboratory food analysis is given on the basis of a comparison of the data obtained with the requirements of the standard.

There are principally two categories of food product quality: 1) *The standard food product* is the product, suitable for nutrition without limitations. This is a complete product with good organoleptic properties, harmless to health, which meets all the requirements of the regulatory documents; 2) *The non-standard food product.* This category includes the following quality categories:

2.1. *The product suitable for nutrition, but of lower quality.* Such product does not fully meet the requirements of the standard or has any defect, which, however, only insignificantly deteriorates the organoleptic properties and does not make it dangerous for consumer's health. For example, sour cream with reduced fat content, or potatoes with a high percentage of waste. These products are permitted to use under the condition that the consumer is aware of the reduced quality of the product;

2.2. *The conditionally suitable product.* This is a product with defects making it unfit for consumption without additional pretreatment, which is carried out with the aim of neutralizing or improving its organoleptic properties. For example, milk with high acidity. By allowing the use of conditionally suitable foods, sanitary doctor indicates how to handle it and those persons, responsible for its implementation;

2.3. *The food product of poor quality* (inedible, substandard). Such food has defects that do not allow its usage for meals. For example: inferior organoleptic properties, contamination with pathogenic microorganisms or toxic substances. With permission of the Veterinary Service the substandard food products may be sent to animal feed or disposed of by incineration or landfill after pre-treatment with disinfectants or mineral oils, making the product completely unsuitable for further nutrition;

2.4. *The falsified food product.* In such food product its natural properties are changed in order to deceive consumers: defects are intentionally masked to ensure benign outward appearance (dilution of milk with water,

adding of soda and starch in milk). Falsification of food is considered a criminal offense.

Surrogate foods (from the Latin *surrogatus* – "Put in the place of another") are incompletely natural foods, produced specially to replace the natural ones. They only partly replace the natural product, usually possessing the same organoleptic properties (appearance, taste and color). They do not have all of the properties of the natural food product and are inferior in the nutritional value. For example: saccharin instead of sugar, soy instead of chocolate. In our country surrogates are allowed for usage provided they are not harmful to health and consumer is aware (informed) of their composition and origin.

PRACTICAL PART

1. Carrying out the laboratory analysis of the foods as follows:

- Milk – organoleptic properties (appearance, consistency, color, smell, taste); physic-chemical parameters (density, acidity); presence of potentially falsifying substances (soda and starch);
- Meat – organoleptic properties (appearance, texture, smell, color);
- Flour – organoleptic properties (color, odor, presence of foreign inclusions); acidity;
- Bread – organoleptic characteristics (appearance, odor); physico-chemical parameters (acidity, porosity).

2. Evaluation of the study results, compliance of the results with the hygienic standards.

Study of milk. Milk is one of the most valuable foods. It contains proteins (3.3%), fat (3.6%), milk sugar - lactose (4.7%), vitamins A and D, calcium and phosphorus, and others. Milk is indispensable in the diet of infants, helpful for nutrition of sick and convalescent patients, as well as healthy adults. Due to the fact that milk is a liquid and fat in it is in the emulsified state, it is absorbed by 95–98% and does not require significant energy for digestion.

However, milk has several hygienic disadvantages:

1. Due to the fact that milk is a good breeding ground for various microorganisms, including pathogens, it may be a factor in the transmission of infectious diseases.

2. Milk is a perishable product, during storage its acidity increases rapidly due to the abundant growth of lactic acid bacteria.

3. Milk can easily be falsified (skimming, dilution with water, adding soda and starch).

4. With milk there can be transmitted anthropozoonosis, infectious diseases common for humans and animals (brucellosis, foot and mouth disease, tuberculosis, Q fever, etc.).

Therefore, milk and milk products are subject to sanitary and veterinary examination. Examination of milk is done mainly by organoleptic (appearance, texture, flavor, odor, color), physicochemical (specific gravity, pH, presence of impurities), and bacteriological parameters.

Organoleptic evaluation of milk. Appearance and consistency of milk is examined by looking at it in a transparent vessel. Milk should be a homogeneous liquid without sediment. The consistency of milk should not be watery; as result of fermentation milk can acquire mucous, viscous consistency; such milk is not suitable for nutrition.

The consistency of the milk is determined by eye in a glass or use "nail" test – a drop of milk is applied to the thumb nail and the spreading of the drop across the nail in the shape of a thin film is normally seen. When determining consistency of milk it’s poured into a glass and got slightly shaken. Whole milk leaves a white trail (thin film) on the glass walls. If milk is too liquid in consistency (too watery) it quickly runs down to the wall without a visible trace. In case of a mucous or viscous consistency, due to high viscosity it stretches along the walls of the glass.

Color of milk is determined by looking at it in a glass on a white background. Whole cow's milk is white with a slightly yellowish tinge; baked milk is with a cream shade; low-fat, skim milk or if diluted with water has a bluish tint.

The smell of fresh milk is peculiar, nice. Sour smell indicates the beginning of the process of milk souring. Development of septic bacteria in milk causes the smell of ammonia, hydrogen sulfide. Alien smells can occur during storage of milk near the odorous substances (kerosene, turpentine, naphthalene, soap, herring, etc.).

Fresh milk taste is pleasant, slightly sweet. The sour taste indicates a souring of milk. Bitter, salty and other off-flavors may be due to improper feeding of animals (wormwood, slop, garlic, onions, etc.) or due to not optimal housing and milking of cows (use of contaminated cookware, diseases of the udder, the use of drugs).

In case of fresh milk having unusual appearance, texture, taste and flavor, it is not allowed to further implement it.

Physical and chemical indicators of milk quality. Milk density is the ratio of weight of certain volume of milk at the temperature of 20ºC to the weight of the same volume of water at 4ºC. Standard density of fresh milk lies within a range of 1.027 to 1.034 g/cm³.

Addition of water to milk causes decrease in density as the density of water is 1.0; and skimming increases the density of milk, because in such a case we remove the easiest component of the milk - fat, which has a density below 1.0.

Density assessment is made using a special device - lactodensimeter (Fig. 4). In the narrowed upper portion a lactodensimeter has the scale graduated from 20 to 40, which shows the last two digits of the density. Thus, the number 20 represents the density of 1.020, the number 30 means 1.030 and so on. Consequently, the device readings must be multiplied by 0.001 and add to 1.0. If the meniscus of milk stops at 30 of the scale, then the density of milk is equal to 1.0+0.030=1.030 g/cm³.

While milk density depends on its temperature, lactodensimeter has thermometer, showing the temperature of milk at the time of the density measurement. Determination of milk density can be performed within a temperature range from 10 to 25°C. To determine the density of milk its temperature must be 20ºC. It was established that per each degree of temperature change the density of milk changes by 0.2 units of lactodensimeter, which corresponds to 0.0002 units of density.

Figure 4. *Lactodensimeter*

If milk temperature goes above 20ºC, its density will be less than at 20ºC, therefore, per each degree above 20ºC 0.2 units should be added to the lactodensimeter readings, which corresponds to the density change of 0.0002 (in density units). If milk temperature goes below 20ºC, then its density will be higher than at 20ºC and the same principle is applied, we subtract 0.2 units of lactodensimeter scale per degree below 20ºC.

Methods of determining the density of milk:

1. Mix the milk sample thoroughly and carefully, avoiding foaming, pour 2/3 of volume in a glass cylinder with a capacity of 200–250 ml and diameter of at least 5 cm.

2. Clean, dry lactodensimeter is to be gently submerged in the milk to the 30th division, providing device not touching the walls of the glass, leave it in a free floating state.

3. 5 minutes later, read the density scale (on the upper edge of the meniscus) and the thermometer scale of lactodensimeter.

Example. Milk temperature is 25ºC, and the milk surface corresponds to the 26 on the scale. To bring the density of milk to 20ºC, we introduce the above adjustment 0.2 due to the temperature difference (25–20)×0.2=1.0, add the resulting number to the lactodensimeter reading (26), as the temperature of milk was above 20ºC: 26+1.0=27.

Consequently, the density of milk is equal to 1.0+0.027=1.027 g/cm³.

Determination of milk acidity. The acidity of milk is an indicator of its freshness to some extent and naturalness; it is due to the presence of lactic acid, phosphates and proteins. Acidity is expressed in Turner degrees (ºT). So, 1ºT is equal to 1 ml of 0.1 N sodium hydroxide solution (potassium) required for neutralizing of acids in 100 ml of milk. The normal acidity of pasteurized cow's milk should not be above 21ºT; milk for baby feeding - 19ºT. Milk diluted with water or with a dash of soda, has acidity below 16ºT.

Methods of determining the acidity of milk:

1. Pour 10 ml of milk in a 100 ml conical flask.

2. Add 20 ml of distilled water and 3–4 drops of 1% phenolphthalein alcohol solution.

3. Stir the contents of the flask, then titrate with 0.1 N sodium hydroxide to a faint pink color, which does not disappear within 1–2 minutes.

The number of expended milliliters of 0.1 N sodium hydroxide multiplied by 10 (to convert to 100 ml milk) corresponds to the degrees of acidity of milk.

Example. Assume that titration of 10 ml of milk took 2.5 ml of 0.1 N sodium hydroxide solution; then acidity of the milk is equal to 2.5×10 = 25ºT.

Determination of impurities in milk. Impurities are added to milk for its falsification. Most commonly sodium bicarbonate (baking soda) and starch are used. Soda is added to milk to delay its souring, and often to milk having already poor quality. From the hygienic point of view and in accordance with the current sanitary legislation the addition of soda to milk and other preservatives is not permitted and is considered as an attempt of falsification.

Reaction to the presence of soda. Pour 1/3 of the vial of milk, add the same amount of 0.2% rosolic acid in 96ºethanol and shake. If there is soda in milk the mixture becomes pink. Pure milk in such case becomes only slightly yellow in color and quickly gets denatured, leaving the walls of the test-tube large flakes of casein.

Reaction to the presence of starch. Starch is added to milk to mask the dilution with water, to create density visibility. To detect this falsification it is necessary to pour about 5-10 ml of milk into the tube, bring it to a boil over a spirit lamp to convert starch to paste, cool and add a few drops of Lugol's solution containing iodine. Mix it. If there is starch the liquid gets colored blue.

Conclusion on the quality of milk is done in accordance with the findings of organoleptic and physic-chemical studies.

Not allowed the use of milk with musty, putrid, bitter, rancid, soap and other unpleasant odors and tastes, with stringy, non-uniform consistency, with unusual color and other organoleptic defects. This milk must be denatured or destroyed. With the permission of the veterinary supervision, it can be directed to animal feed or used for technical purposes.

Milk of low quality (low-fat, high acidity, mechanical and bacterial contamination) may be allowed to eat only after appropriate treatment (filtration with subsequent heat treatment, processing to sour-milk products, the use for the manufacture of dairy foods and other products). In each case check for conditions of milk use and establish the causes of the defects revealed.

Investigation of meat. Animal meat is the main source of complete protein providing a body with essential amino acids, especially tryptophan, lysine and arginine, also with mineral salts (potassium, phosphorus, sodium, iron) and vitamins (A and B). Meat refers to fast perishable kinds of

food and is susceptible to rotting. Meat is of high epidemiological significance as a transmission factor for infectious disease (anthrax, brucellosis, tuberculosis, actinomycosis) and parasitic (measles, trichinosis) and food poisoning (botulism), salmonellosis. Sanitary examination of meat is based on its freshness (organoleptic and chemical), microbial contamination and infestation indicators.

Organoleptic evaluation of meat. The study comprises determination of appearance, texture, smell, condition of fat and bone marrow broth quality when cooked (Tab. 22).

Table 22

Hygienic examination of meat

Features	Fresh meat	Doubtfully fresh meat	Not fresh meat
Color	Dark-red	Lighter than usual	Green or grey
Surface	Shiny with marble	Dry with a weathered dark crust	Covered with mucus
Elasticity	When pressing with your finger, the surface is quickly leveled	When pressing with your finger, the surface is poorly leveled	When pressing with your finger, the surface relapse remains
Fat	White	Grayish-matt, crushed when smeared	Gray with a dirty tint, sticking to the fingers
Smell	Specific	Slightly acidic, musty	Septic

Appearance. At external examination mark color of muscle tissue and fat on the meat surface. Fresh meat has a dark red color; the cut of its surface is shiny with marble, slightly moist. Pay attention to the presence of mucus and stickiness of meat on the surface and on the cut. Then make an incision and determine the appearance and moisture of the surface of the fresh cut by applying filter paper to it. Fresh meat leaves a light moisture trace on a filter paper, while old meat fully impregnates the paper.

The consistency of fresh meat is dense and flexible. After a light finger pressure on the surface of fresh meat deepening is formed which disappears quickly. In case of meat of doubtful freshness, it disappears slowly (for a minute). Not fresh meat is devoid of elasticity.

Smell. Fresh meat has a pleasant smell, which is specific for each species of animal. First, define the odor of the surface layer, followed by cross-sectional review of the muscle tissue, especially adjacent to the bone. The smell of meat is easier to define "on the knife": knife is heated in a

glass of hot water and gets injected into the meat, trying to reach the bone (the meat begins to deteriorate in depth from bone), and then determine the odor coming from the knife. An unpleasant, putrid smell of the knife blade indicates spoilage of meat has begun.

The freshness of meat can be determined by boiling test: 30–50 g meat cuts, boiled in a small amount of distilled water for 20–30 minutes in the pan, the lid closed. Determine the odor at the time of occurrence of vapor when you open the pot. When cooking fresh meat we obtain clear broth with a slight opalescence and a pleasant smell. In case of not good meat broth is turbid, with an unpleasant odor.

Color and smell of the fat. Fat of fresh meat is white, yellowish or yellow (depending on the age of the animal), solid, crush crumble; there is no smell of rancidity. Fat of small cattle is white, dense, and odorless. Fat of stale meat has a greenish or grayish color and unpleasant putrid odor. Try to crush it with your fingers and it appears to become greasy and sticky. In the course of analysis the quality of meat and its potential for use for meals are assessed.

Study of flour. For bakery the following varieties or yields of flour are used: wheat – 97.5% (raw); 85% (II grade); 75% (I grade); 25% (the highest grade); Rye – 95–96.5%; 85–87% (reak flour); 63–65% (seeded); 60% (finely milled and sieved).

The output is the amount of flour in the percentage obtained by grinding 100 kg of grain. Thus, at 95% yield from 100 kg of grain 95 kg of flour is obtained and 5 kg of bran; 87% output means that from 100 kg of grain we obtain 87 kg of flour and 13 kg of the bran. With decreasing yield percentage flour contains less of the surface layers of grain in its composition, including its membranes.

Flour consists of the inner part of the grain called endosperm. The biological value of flour by the content of vitamins and minerals decreases with decreasing percent of its output.

Sensory evaluation of flour comprises determining the color, smell, taste, crunch, and the availability of pests in the flour.

The color of the flour depends on the type of grain, grinding, impurities, freshness and so on. In order to determine the color, 3–5 g of the flour is poured on a black paper as a layer having thickness of 4–5 mm. The study is conducted under daylight (diffused light) conditions. Rye flour has a grayish-brown color, in case of large amount of bran – red color; wheat - pure white or yellowish color. The higher the grade of the flour, the lighter

and more uniform color would be. The appearance of dark brown color may be due to a long-term storage, as well as appearance of pests in the flour. With naked eye the presence of barn moths in a flour, as well as mealworms and caterpillars can be determined. Appearance of a large number of black particles may be caused by the presence of ergot.

Smell of flour. To determine the odor take a small amount of flour on the palm and warm it. Or pour it into a tube with warm water, shake several times in a closed tube, and then open the tube and determine the smell. Benign flour should have a nice, very faint, peculiar odor of the grain culture from which it is cooked, without the presence of sour or musty, moldy, and other alien odors.

Physical and chemical evaluation of flour. Physical and chemical indicators of the flour quality are the acidity, moisture, gluten content, the presence of vegetable and metallic impurities.

The acidity of the flour is an indicator of its freshness. Acidity is due to the presence of acidic phosphates and is negligible in fresh flour. In case of prolonged storage, especially under adverse conditions (high temperature and humidity), it increases due to fat splitting to free fatty acids. The surface layers of the grain have greater acidity, so 97.5% raw flour has a higher acidity in comparison with the finer (75%) flour.

Gluten (hydrated protein of the flour) is an indicator of the baking quality of wheat flour. Gluten gives dough elasticity and flexibility, improves the lifting properties of flour, and increases the porosity of bread. The wheat flour should contain at least 25–30% of gluten; in rye flour gluten content is little.

Humidity of flour sample is determined by drying it until the weight is constant. By the difference in weight before and after drying, the moisture content is calculated in percentage of the flour. Normally, flour humidity should not exceed 15%. Flour gets spoilt easily at higher humidity values.

Study of flour acidity:

1. 5 g of flour is placed into a conical flask with 40 ml of distilled water.

2. The content of the flask is thoroughly shaken until a homogeneous state.

3. Add 3 drops of 1% phenolphthalein alcohol solution.

4. Titrate with 0.1 N sodium hydroxide solution (potassium) until the pink color, not disappearing within 1–2 minutes.

Acidity of the flour is expressed as Turner degrees. 1 degree of acidity is equal to the number of milliliters of 1N sodium hydroxide solution or potassium hydroxide spent to neutralize acids contained in 100 g of the flour.

Example of calculation. To titrate 5 g of flour we spent 2.3 ml of 0.1 N alkali solution.

$X=(2.3\times100)/(5\times10)=4.6°$ T, where

5 – weighed flour taken for analysis;

100 – recalculation of acidity per 100 grams of flour;

10 – recalculation of 0.1N sodium hydroxide solution, used for the titration of 1N solution.

Note. To simplify the calculation of the amount consumed for the titration (ml) sodium hydroxide solution to be multiplied by 2, we obtain the flour acidity in T degrees.

The acidity of different grades of flour is shown in Tab. 23.

Table 23

Acidity of flour

Sort of flour	Acidity in degrees of Turner		
	Normal	Increased	High
Wheat grade I	up to 2.5	2.5-3.0	above 3
Wheat grade II	up to 3.5	3.5-4.5	above 4.5
Entirely wheat flour	up to 4.5	4.5-5.5	above 5.5
Kye flour	up to 5	6.0	above 6

Upon completion of the analysis, flour quality is assessed and conclusion is drawn about the possibility of its use for meals.

Investigation of bread. Bread is important part of a daily diet. It is composed of carbohydrates (43–54%), proteins (6–11%), B vitamins (for coarse grinding), salts of calcium and phosphorus. Goodness of bread depends on the quality of flour, yeast and technological process of baking bread.

In the study of bread we define organoleptic (appearance, smell, taste) and physic-chemical parameters (humidity, acidity and porosity).

Organoleptic parameters of bread quality. Appearance. Bread should have a specific form (tin – baked in forms hearth - baked on trays), a smooth, flat, shiny surface, without cracking, blistering, scorched places,

and alien inclusions. The top crust should keep up the crumb. In rye bread it has a brownish-brown, in wheat – light or dark yellow.

Lower crust must not contain ash or coal, and around it there should be no temper – soggy dough layer. The thickness of the crust must not exceed 0.5 cm.

Crumb should be uniform on the cut, without layers of flour, finely porous, well-baked and elastic. The smell must be peculiar to this type of bread, aromatic and pleasant.

The taste should be pleasant, without bitterness and foreign taste, no crunch of mineral impurities on the teeth. Bitter or musty taste of bread refers to the use of substandard flour or its improper storage. Bread should be used after 3–4 hours after baking. Fresh, still warm bread is worse chewed, contains more water, less absorbs saliva and harder to digest. The defeat of bread with mold, potato disease, and chromogenic bacteria is not allowed.

Moldy bread. The process of growth of molds may be due to the development of microscopic fungi Penicillium Glaucus (green mold), Mucor Mucedo and others. Mould fall into the bread from the air during storage and, in developing it, spoil the taste and smell of bread, and paint it in different colors.

Moldy bread is observed at high humidity and storing of it under adverse conditions, i.e. in the dark and poorly ventilated rooms. It leads to the change of the chemical composition of moldy bread and production of substances with an unpleasant odor. Sprouted bread unfits for consumption not only due to the unpleasant taste and odor, but also because of the risk of human infection called *mycotoxicosis*. To prevent it bread should be stored in dry, bright, clean, well-ventilated area. Bread should be well baked with a moisture content of no more than the established norm.

Potato disease. The disease develops only in wheat bread with high humidity and low acidity, prepared by leaps and bounds. The defeat of the bread is the result of development of Bacteria Mesentericum in it, constantly present in potatoes. Pathogens of potato diseases are widespread in the environment and are easy to accidentally fall into the flour and dough. They form heat-resistant spores that can withstand at the temperature of baking bread. The disease occurs during the hot summer months, especially during storage of bread in a warm, poorly ventilated place. Rye bread due to the high acidity is not affected with the potato disease.

By itself, potato sticks are not pathogenic to humans, but it spoils the bread: bread crumb affected is a sticky, viscous mass of dirty-brown or yellowish-brown color, from a distance the peculiar smell of rotting is felt. The taste of the bread is extremely unpleasant. This liquefied mass contains starch hydrolysis products – dextrin, sugar.

Bread, affected with the potato disease, is not suitable for consumption and should be destroyed.

Bread affected with chromogenic bacteria has mucous bright red stains caused by B. Prodigiosus. This kind of chromogenic microorganisms is conditionally pathogenic for humans. It lives in the soil, water, food. It develops in wheat bread with high humidity. Such bread is not allowed to implement.

Physical and chemical indicators of bread quality. Humidity is a measure of nutritional value of the grain, since every extra percentage of moisture reduces the energy value of 1 kg of bread by 40–50 kcal. Excess moisture reduces the taste of bread and makes it difficult to digest. Wet bread damps moldy faster. Standards for humidity for different varieties of bread are shown in Tab. 24.

Table 24

Physical and chemical characteristics of certain types of bread

Type of bread	Humidity,% not more	Acidity, degrees of Turner, not more	Porosity,% not less
Rye bread from wholemeal flour 95% yield	49	12	45
Mixed rye-wheat bread	49	11	47-50
Wheat bread from the flour			
95% yield	45	7	55
85% yield	43	4	68
30% yield	43	3	75

The acidity of the bread depends on the acidity of the flour, from which it is baked. Moreover, during baking and fermentation of the dough lactic and acetic acids are produced. The presence of organic acids in the bread has a taste and dietary value. Moderate acidity of bread gives it a nice flavor and contributes to a more perfect assimilation. Bread with high acidity is not tasty and can activate processes of fermentation in the gastrointestinal tract.

Acidity of bread is as well expressed in Turner degrees, this is the number of milliliters of 1N sodium hydroxide solution (or potassium) consumed to neutralize acids contained in 100 g of the bread.

Methods of determining the acidity of bread. In a 500 ml flask put 25 g of the bread crumb, pour 50 ml of distilled water and grind the bread until homogenic state with a glass rod.

Add 200 ml of distilled water; shake the flask for 2 minutes and left for 10 minutes at rest.

10 minutes later shake the flask again and leave it again for 10 minutes. The surface layer of the liquid we drain through cheesecloth into a dry glass. Put 50 ml of filtrate to a 100 ml flask, add 3 drops of 1% phenolphthalein solution. Titrate with 0.1 N sodium hydroxide solution until slightly pink color, which does not disappear within 1 minute.

To calculate the acidity use the formula:

$X=(a\times250\times100/(50\times25\times10)$, where

X – the acidity of bread in Turner degrees;

a – the number of ml of 0.1 N sodium hydroxide, consumed for the titration of the test sample;

25 – weighed bread, g;

50 – the volume of filtrate taken for titration, ml;

100 – conversion factor per 100 grams of bread;

250 – the volume to which the divorced weighed ml;

10 – recalculation of 0.1N sodium hydroxide solution, used for the titration, at 1 N solution.

Note. After taking of 25 g of bread and 250 ml of water for its dilution, the quantity of 0.1 N sodium hydroxide consumed for titration of 50 ml of the filtrate should be multiplied by 2, which will correspond to the number of degree of acidity of bread. For example, if for titration of the sample 5.5 ml of caustic soda solution was spent, the acidity of the bread is 11 degrees of Turner.

Standards for acidity of different varieties of bread are shown in Tab. 24.

Porosity of the bread is a total pore volume contained in a volume of crumb, expressed as a percentage. Porosity is a measure of goodness of bread – a high porosity increases the area of contact with digestive juices, facilitates the process of digestion, increases digestibility.

This indicator shows the quality of bread and flour.

Method of determining the porosity of bread. From the middle of the bread loaf cut a cube, each edge of which is 3 cm. To remove the pores of this cube tightly clutch the crumb and make out of it 6-8 balls having the size of a pea. All balls simultaneously should be lowered into a graduated cylinder with a known volume of water, and the amount of water volume change is recorded. Calculate the porosity of bread as a percentage.

Example of calculation. Let us assume that after immersion of compressed balls of bread initially made from bread cube of 27 cm^3 in water, the water level in the cylinder rose from 25th to 40th tick of the scale, so increased by 15 cm^3. This volume accounts for a dense, pore-weight bread crumb.

Consequently, the pore volume of the bread is as follows: 27–15=12 cm^3, and the desired porosity of the bread in the percentages determined according to the proportion of 27 cm^3 ─ 100%

12 cm^3 ─ X

X=(12×100)/27=44.4%.

Standards for humidity, acidity and porosity of different kinds of bread are shown in Tab. 24.

At the end of the analysis give your opinion about quality of bread and draw a conclusion concerning its suitability for use.

QUESTIONS FOR SELF-CONTROL

1. Normative documents regulating the quality of food.
2. Types of sanitary-hygienic examination of foods.
3. Sensory indicators for evaluating the goodness of food.
4. Physical and chemical parameters for evaluating the goodness of food.
5. The standards of physical and chemical indicators of milk, flour, bread.
6. Categories of food quality used in its expertise.

TEST TASKS

Choose one correct answer

1. NORMAL ACIDITY OF FRESH COW MILK (NOT MORE THAN, °T)
   1) 10
   2) 16
   3) 21
   4) 25

2. THE MILK DENSITY INCREASES
   1) when removing fat from milk
   2) when milk is diluted with water
   3) with the vitaminization of milk

3. ACIDITY OF FLOUR IS EXPRESSED IN (UNITS)
   1) points
   2) pegrees
   3) percentages

4. CATEGORY OF FOOD QUALITY WHEN THE FOOD HAS ADVANCED ORGANOLEPTIC PROPERTIES WITHOUT MAKING IT DANGEROUS FOR PEOPLE HEALTH
   1) benign
   2) of reduced quality
   3) conditionally suitable
   4) surrogate

5. HIGH CONTENT OF GLUTEN IN FLOUR
   1) provides high porosity of bread
   2) provides low porosity of bread
   3) impairs the taste of bread
   4) shortens the shelf life of bread

SITUATIONAL PROBLEMS

Problem 1. The student's canteen has been given wheat bread of highest grade. At external survey it is established: the form is round, the surface is smooth, without cracks and alien inclusions. The crumb is not detachable from the upper crust, there are no traces of impurities and no hardening inside, it's uniformly porous, elastic, without alien inclusions; the color, taste, smell – typical of this type of bread. Humidity is 47%; acidity – 9ºT, porosity – 55%.

1. Evaluate the quality of bread; decide concerning the possibility of its use for nutrition.

Problem 2. In the study of milk by organoleptic and physicochemical indicators, it is established: color - white, with a yellowish tinge; smell - milky; sediment is absent; consistency is uniform, leaves a trace when it

flows down the wall; density at 20° C – 1.027 g/cm^3; acidity – 21ºT; lactose content – 4.8%; fat content is 3.2%.

1. *Evaluate the quality of milk.*

Problem 3. In the study of I grade wheat flour according to organoleptic and physic-chemical indicators is was found: color - white with a yellow tinge, a pleasant specific smell; in flour there were determined fine flour beetles. Acidity of flour is 2.3ºT.

1. *Evaluate the quality of the flour.*

3. STUDY OF VITAMIN-C CONTENT IN CERTAIN FOODS

The purpose of the lesson: evaluation of vitamin C content in some food products, determination of vitamin C in the body.

Theoretical part. A vitamin is an organic compound and a vital nutrient that a body requires in limited amounts. An organic chemical compound (or related set of compounds) is called a vitamin when the body cannot synthesize the compound in sufficient quantities, and it must be obtained through the diet; thus, the term "vitamin" is conditional upon the circumstances and a particular person. Vitamins represent a separate group of nutrients, as they have a high biological activity, they are catalysts of biochemical reactions and are involved in the synthesis of enzymes and hormones, they control the state of cell membranes. Also, the need for vitamins is very small in comparison with other food substances, it is measured in milligrams or micrograms, thus vitamins are so called minor components of food.

Vitamins are an essential component of food; they should be present in the daily diet. Sufficient amount of vitamins, balanced with basic nutrients and calories is the necessary condition for a balanced diet. If intake of certain vitamins with food is insufficient then it is called hypovitaminosis, and if the diet is deficient in 2–3 vitamins or more - polyvitaminosis. In case of excessive consumption of vitamins hypervitaminosis develops and this problem mostly relates to fat-soluble vitamins (A, D), because these can accumulate in the body and show toxic effects. However hypervitaminosis of vitamin C is described, although ascorbic acid is a water soluble vitamin.

Physiological role of vitamin C. In terms of biological body needs for vitamins, the vitamin C ranks the first. This water-soluble vitamin, representing a natural complex of biologically active substances, which include ascorbic acid, P-active substances, organic acids, peptin, tannins, on the one side contributing to the preservation of ascorbic acid and on the other side reinforcing its biological effects. Artificially synthesized (mainly from glucose) vitamin C consists of ascorbic acid. The physiological role of vitamin C is determined by its participation in redox reactions. As an active antioxidant, it has anti-cancer effect, slows the aging process down. Vitamin C affects all types of metabolism involved in the synthesis of antibodies, enzymes, hormones, collagen, cartilage, bone and dentin,

regulates vascular permeability. Vitamin C affects the synthesis of nucleic acids responsible for the transfer of genetic information.

In fat metabolism vitamin C normalizes the synthesis of endogenous cholesterol, participates in the recycling of exogenous cholesterol, has a pronounced anti-atherosclerotic effect due to the stabilization of the vascular wall.

In carbohydrate metabolism vitamin C causes activation of enzymes involved in glycogen synthesis. In the mineral metabolism vitamin C has a calcium-saving effect.

The amount of vitamin C in the blood is subject to fluctuations as a function of its inflow with food. In a healthy adult human body there are approximately 5 grams of vitamin C, mainly in the liver, heart, kidney, brain tissue, white blood cells and endocrine glands. These stocks are not passive; they are actively involved in metabolism.

Sources of vitamin C. Ascorbic acid is synthesized by all plants and animals, other than humans, monkeys and guinea pigs, whose bodies are not able to convert glucose to ascorbic acid. Sources of vitamin C are mainly vegetable products. According to the content of this vitamin we can distinguish 3 categories: 100 mg%; from 50 to 100 mg%; less than 50 mg% (Tab. 25).

Quantitative determination of Vitamin C content in a finished food is of great practical importance, because as compared with other vitamins, ascorbic acid is the least stable and breaks down easily during storage and cooking. Vitamin C undergoes degradation under the influence of various external factors – in the presence of oxygen, when heated, in the presence of salts of heavy metals (copper, iron, silver), in the neutral and alkaline media, as well as in case of exposure to oxidative enzymes of plants (ascorbic oxydase). The acidic environment promotes better preservation of vitamin C, so in acid first dishes (soup, pickle, cabbage soup) it lasts longer than in soups with a neutral reaction of medium. Products such as starch, cereal flour, eggs, sugar, have a stabilizing effect on ascorbic acid during both cooking and storage of ready meals.

Physiological need for vitamin C. The physiological need for vitamin C depends on the age: for an adult it is about 90 mg per day. However, it increases when staying in the Far North, in high temperature conditions, hot climate, under stressful conditions, intoxication, during pregnancy and lactation, when heavy physical work.

Table 25

Sources of vitamin C in food

Vitamin C content	Food
> 100 mg%	Rosehip (dried fruits) - 1200; rosehips (fresh fruit) - 470; black currant, lemongrass, sweet red pepper - 250; horseradish - 200; green bell pepper, parsley, dill, white dried mushrooms - 150; buckthorn, Brussels sprouts – 120;
51 to 100 mg%	Cauliflower - 70; strawberry, orange, grapefruit - 60; spinach – 55;
≤ 50 mg%	Fresh cabbage - 50; sorrel - 43; pineapple, lemon, tangerine - 40; parsley root - 35; gooseberries, fresh white mushrooms, green onion, pen - 30; raspberries, red currants, tomatoes, green peas, radishes - 25; sauerkraut, potato, turnip, melon - 20; cherry, cherries, apples, cranberries - 15; onions, garlic, lettuce, cucumbers, apricots, banana, peaches, plums, blueberries - 10; Products of animal origin: the liver - 33; kidneys - 10; milk - 1;

Below are the age norms of vitamin C in milligrams per day: 0–3 months ─ 30; 4–6 months ─ 35; 7–12 months ─ 40; 1–3 years ─ 45; 3–7 years ─ 50; 7–11 years ─ 60; 11–14 years ─ 70 (for boys) and 60 (for girls); 14–18 years ─ 90 (for boys) and 70 (for girls); adults ─ 90; pregnancy (second half) ─ 100; breastfeeding ─ 120.

Preventive C-vitamininzation of food. Given the important biological role of vitamin C and the risk of latent forms of vitamin C deficiency, preventive vitamin reinforcement of food is of particularly importance. To provide particularly vulnerable population groups with vitamin C, all ready foods should be subjected to vitamin C reinforcement, specifically in the nursery, nursery-gardens, kindergartens, children's homes, orphanages, boarding schools, forest schools, vocational schools, hospitals and sanatoriums (for children and adults), maternity hospitals, homes for the disabled and the elderly persons, in dietary canteens and kitchens. In school and industrial canteens vitamin C adding to processed food is recommended in the winter and spring, and in the Far North – all year round.

Daily vitamin C reinforcement is applied to first or third (including tea, coffee) dishes, milk, yogurt and others. Ascorbic acid is introduced in food in tablet or powder in accord with the age-related physiological

needs. In hospitals, maternity hospitals and sanatoriums it’s done by the head nurse or dietitian nurse directly in nutrition unit or in the buffet of departments. In nurseries and children's homes the person responsible for the process is the senior or group nurse.

Vitaminization of food should be carried out immediately prior to the distribution of the food. Further heating of the vitaminized foods is not allowed. If it is necessary to heat food, its vitaminization is carried out after the heating.

Vitaminization of the first course: pills of ascorbic acid, calculated for the number of servings, we put in a clean plate filled with 100–200 ml of the liquid part of the dish which is subject to vitaminization. Vitamins should be dissolved in the liquid by stirring with a spoon, and then the mass vitaminized is poured back into the common cookware 15 minutes before dispensing the food to consumers, hospital patients.

Vitaminization of third course is similar to that described for the first courses.

PRACTICAL PART

Determination of vitamin C content in milk, cheese and boiled potatoes. To determine the vitamin C content we use water solution of 2.6 – dichlorophenol sodium salt (Tillmans reagent), which in neutral and alkaline media has an intense blue color. In an acidic medium blue color becomes pink; after interaction of the colored form of the indicator with ascorbic acid the color disappears, as ascorbic acid itself turns into the oxidized form – dehydroascorbic acid.

If we add the extract of Tillman’s reagent into acidic medium, it will recover in the colorless form by an equivalent amount of ascorbic acid, and an extra drop of Tillman’s reagent brings the pink color to the liquid. By the amount of Tillman’s reagent spent we can calculate the amount of vitamin C in the test sample of the product.

For the study take sample products: potatoes – 20 g; milk – 5 ml.

Determination of vitamin C in milk. When analyzing milk, it’s diluted three times with distilled water (1 part of milk is added to 2 parts of water). For this purpose we pour 5 ml of milk and 10 ml of distilled water into a conical flask (50–100 ml). We put diluted milk (5 ml) to the flask for 50 ml, beforehand into which there have been poured 1 ml of 2% solution of hydrochloric acid and 9 ml of distilled water. The flask contents

were stirred and titrated with Tillman's reagent until the light-pink color, not fading for 0.5–1 minutes.

Calculations are made according to the formula above.

Example of calculation. Assume that for the titration of 5 ml of milk (diluted 3 times) we spent 0.25 ml of Tillman's reagent.

$X=(0.25\times0.088\times15\times100)/(5\times5)=1.32$ mg%

In the pasteurized milk the amount of vitamin C does not exceed 1 mg%, in the milk after vitaminization its amount accounts for 10 mg%.

Determination of vitamin C in potatoes. The measuring cylinder was poured with 60 ml of 2% hydrochloric acid solution. Grind Cooked potato (20 g) on the plastic grater, transfer to a mortar and rub until smooth, pour measured amount of hydrochloric acid from the cylinder and mix. The sample is left for 10 minutes to extract the ascorbic acid. The extract is then filtered through cheesecloth.

Pour 1 ml of 2% solution of hydrochloric acid and 4 ml of distilled water Into the conical 50-100 ml flask, and then select with the pipette 10 ml of the extract and bring it into a flask with an acid. The volume of liquid in the flask is 15 ml.

Titrate the liquid in the flask with Tillman's reagent with gentle stirring until slightly pink color, not fading for 0.5–1 minutes.

Calculate the content of vitamin C according to the formula:

$X=(V\times0.088\times b\times100)/(P\times a)$, where

X – amount of ascorbic acid in mg per 100 g of product (mg%);

V – the number of ml of 0.001 N solution of Tillmans reagent spent on titration of the sample;

0.088 – the amount (mg) of ascorbic acid corresponding to 1 ml of 0.001 N solution of Tillmans reagent;

b – the volume is brought up to linkage thereto after adding an extraction fluid (ml);

100 - conversion (%);

P – weight of sample (g);

a – the amount of liquid (filtrate), taken for titration (ml).

Example of calculation. To titrate 10 ml of the extract we spent 2 ml of Tillmans reagent. The volume brought up with potato weighed (20 g) after adding thereto of the extraction fluid (60 ml), was 80 ml.

$X=(2\times0.088\times80\times100)/(20\times10)=7.04$ mg%.

In the edible part of the raw potato vitamin C content is on average 20 mg% (according to table on nutritional content of the nutrients).

Calculation of the loss of vitamin C in cooked products. To conclude the number of losses of ascorbic acid during cooking, its contents is compared to the raw vegetables used in dishes subjected to heat treatment.

Example of calculation. The raw potatoes contained 20 mg% of ascorbic acid, the boiled potatoes – 5 mg%, accordingly. Consequently:

X=(5×100)/20=25% of ascorbic acid remained; hence the loss is 75%.

To reduce the loss of vitamin C we should observe the following guidelines: 1) Grinding and cleaning of green vegetables is produced immediately before heat treatment; 2) Peeled vegetables should be kept minimal time in the water before being sliced; 3) Sauerkraut should be removed from the brine immediately prior to cooking; 4) Put the vegetables in boiling water only after the addition of salt; 5) Food should be cooked in a pot with the lid closed, the glass lid is better (for visual inspection of the cooking process) stir food less often; 6) the less time Between food's readiness and its distribution the better.

Under these recommendations when preparing vegetable dishes vitamin loss shall not exceed the data presented in Tab. 26.

Table 26

Preservation of vitamin C in foods after cooking

Name of food	Vitamin content as compared to the raw food,%
Potatoes peeled lain 24 hours in water at room temperature	80
Potatoes cooked in their skins for 25-30 minutes	75
Same purified	60
Potato soup	50
Potato soup stand on a hot plate 3:00	30
Potato soup stand 6 hours	Trace amount
Soup of sauerkraut (cooking 1 hour)	50
Fried potatoes raw, finely chopped	35
Cabbage soup, stand on a hot plate 3:00	20
Cabbage soup, stand on a hot plate 6:00	10
Cabbage cooked 1:00	50
Carrots boiled	40

Determination of vitamin C content in the body with express method (language test). Hypovitaminosis condition significantly increases susceptibility to infectious diseases, particularly influenza. The winter and spring outbreaks of influenza epidemics are believed to be largely con-

tributed by vitamin C hypovitaminosis state. Therefore, control of the vitamin C content in the body is important.

Provision of the body with vitamin C can be determined by testing the content of ascorbic acid in the blood, urine, and by testing the resistance of skin capillaries to a negative pressure via Nesterov test (test of capillary permeability). Criteria for good saturation of ascorbic acid in the body are: 1) its excretion – normally 20–30 mg per day; 2) serum levels – normally 0.007–0.012 g/L; 3) content in leukocytes – normal 0.2–0.3 g/L.

All laboratory tests involve the use of equipment and kits of reagents. In addition, the taking of blood samples refers to invasive methods of investigation and study with urine requires a special method of urine sampling. These deficiencies are not applied when using rapid method - for its implementation we need only a needle and syringe with 0.06% Tillman's solution. The method is useful in mass, screening survey of organized populations. The syringe through the needle is filled with 1 ml of Tillmans solution, discard the first 2 drops. Then ask the patient to open the mouth and in the middle of the tongue drip without touching the tongue with the needle 1 drop of solution having a purple color. Measure the time taken for bleaching of the drop in seconds. The study is repeated 2–3 times, calculate the average. The sample is best done on an empty stomach or 1 hour before a meal. It is believed that the body's supply with vitamin C is sufficient if the time required for drop of Tillmans solution bleaching is less than 23 seconds.

Accordingly, if the time is more than 23 seconds, the saturation of the body with vitamin C is considered insufficient.

QUESTIONS FOR SELF-CONTROL

1. Physiological role of vitamin C.
2. The needs for vitamin C, depending on the age, gender, working conditions.
3. Plant foods rich in vitamin C.
4. Ways of culinary food processing that contribute to preservation of vitamin C content.
5. Tongue test – assignment, technique of performance, evaluation criteria.
6. Methods of preventive vitamin C reinforcement of ready foods.

TEST TASKS

Choose one correct answer

1. PREVENTIVE C-VITAMINIZATION OF READY FOODS IN EXTREME NORTH REGIONS MUST BE CONDUCTED IN
    1) winter
    2) spring
    3) any time of year

2. AMOUNT OF VITAMIN C IN FOOD IS TITROMETRICALLY DETERMINED WITH
    1) Tillmans reagent
    2) rosolic acid
    3) hydrochloric acid
    4) iodinol

3. THE MAXIMUM AMOUNT OF VITAMIN-C IS CONTAINED IN
    1) sweet red pepper
    2) tomatoes
    3) lemons
    4) sauerkraut

4. THE DAILY NEEDS OF VITAMIN-C FOR ADULTS (mg)
    1) 30
    2) 50
    3) 90
    4) 200

5. VITAMIN C PRESERVATION IN FOOD DURING PROCESSING IS BETTER PROVIDED WITH THE REACTION GIVEN
    1) acidic
    2) alkali

SITUATIONAL PROBLEMS

Problem 1. The student was tested for vitamin C content in the body with the tongue test: one drop of Tillman's reagent having a violet color was dropped down on the middle of the tongue. The drop was discolored in 40 seconds.

1. *Assess vitamin C availability in the body.*

Problem 2. During quantitative determination of vitamin C content in boiled potatoes with the Tillman's reagent, it was found that its content is 15 mg%.

1. *Calculate the amount of potatoes needed to be consumed by an adult to replenish 50% of the daily requirement for vitamin C.*

Problem 3. During quantitative determination of vitamin C content in raw potatoes with the Tillmans reagent, it was found that its content was 20 mg%, and after the boiling - 15 mg%.

1. *Calculate the percentage of loss of vitamin C content after the cooking.*

4. FOOD POISONING AND ITS PREVENTION

The aim of the lesson: is to learn the modern classification of food poisoning, its etiology, clinical manifestations, the investigation procedure, prevention.

Theoretical part. One of the principles of nutritional hygiene is biotic adequacy of food, i.e. food should be harmless for consumer, it must be free from agents of infectious and parasitic diseases, as well as toxins of microbial and non-microbial origin in concentrations exceeding hygienic standards. In case of the principle violated, food poisoning can occur - mostly acute illness caused by eating of food massively contaminated with microbes or containing substances of microbial or non-microbial origin toxic for the body.

The food poisoning is characterized by a sudden acute onset; short incubation period; concurrent disease observed in a group of people; often the clinical symptoms of acute gastroenteritis; occurrence of the disease due to a poor quality product; territorial limitations of the spread of disease; flash cease after withdrawal of the poor quality product; increase in the frequency of diseases in spring and summer.

However, food poisoning can also be characterized by chronic poisoning, caused by prolonged use of foods with a low content of toxic substances.

Into the basis of classification of food poisoning etiological principle is laid. By etiology food poisoning is divided into three major groups: microbial, non-microbial and of unknown etiology (Tab. 27).

Bacterial food poisoning leads to the number of outbreaks and the number of cases.

For occurrence of this kind of poisoning, there must be three components met: 1) the source of infection (the sick person or animal); 2) factors of transmission from the patient to a healthy organism; there can be initial, intermediate and final transfer factors; 3) the susceptibility of the target organism.

Sources of food poisoning with salmonella and staphylococcus, mechanisms of transmission, transfer factors are presented in Figure 5 and 6.

Table 27

Classification of food poisoning

Nosological form	Etiological factor
1. Microbial origin	
1.1. Bacterial food poisoning	Potentially pathogenic microorganisms: Proteus mirabilis and vulgaris, enteropathogenic and enteroinvasive E. coli; Bac. cereus; Cl. perfringens type A; Str. faecalis var liquefaciens and zymogenes; Vibrio parahaemolitycus; other lesser known bacteria (Citrobacter, Hafnia, Klebsiella, Edwardsiella, Pseudomonas, Aeromonas and etc.)
1.2.1. Bacterial foodborne illness	Bacterial toxins of Staphylococcus aureus and Cl. Botulinum.
1.2.2. Fungi food poisoning	Mycotoxins which are produced by fungi types Aspergillius, Fusarium, Penicillium, Claviceps purpurea and etc.
1.3. Mixed etiology	Combination of potentially pathogenic microorganisms or potentially pathogenic microorganisms + toxin of Bac. cereus + St. Aureus and etc.
2. Non-microbial origin	
2.1. Poisoning with poisonous plants and animal tissues	Wild plants containing atropine (henbane, datura, belladonna); other poisonous plants - hemlock, Cicuta virosa, aconite, elderberry, Ledum, Convallaria and etc.); seeds of noxious weed of the cereals (Sophora, Trichodesma incanum D.C. and etc.). Poisonous mushrooms (pale toadstool, amanita and etc.); conditionally edible mushrooms, not subjected to proper cooking (Lactarius resimus, Lactarius torminosus and etc.).
2.1.1. Plants poisonous in nature	
2.1.2. Animal tissues poisonous in nature	The organs of some fish (big-muscle tissue, liver of Schizothorax); endocrine glands of slaughtered animals (adrenals, pancreas).

2.2. Poisoning products of plant and animal origin, poisonous under certain conditions	The nuclei of stone fruit containing amygdalin (peach, apricot, cherry, almond); nuts containing fagus (beech); sprouting potatoes contain solanine; raw beans of beans containing fazin.
2.2.1. Plant products	
2.2.2. Animals products	Fish containing saxitoxin; honey bee while collecting nectar from poisonous plants.
2.3. Poisoning impurities to food chemicals	Nitrates, pesticides; salts of heavy metals.
3. Unknown etiology	
Haff disease	Lake fish in some regions in some years
Kashin-Bek disease	Probably, an increased content of strontium against the lowered calcium content in the foods

Due to a possibility of a mass disease of people, sometimes leading to death, food poisoning is subject to mandatory investigation and accounting. The objectives of the sanitary-epidemiological investigation of food poisoning are the elucidation of the causes and factors contributing to its occurrence, development and implementation of efforts on their elimination and prevention of recurrent cases.

Before a sanitary physician arrival the preliminary investigation is conducted by the doctor, primarily contacted with the patients. The doctor is obliged to:

1. To render the first aid to patients, to hospitalize if indicated.

2. To stop the use of the remains of food suspicious to be causative and take samples of this food in the amount of 200-300 grams.

3. Prior to the clarification of all circumstances to prohibit sale and (or) further usage of suspicious products.

4. Immediately notify local center of sanitary-epidemiological control (by telephone, telegraph) about the food poisoning.

Additionally, the physician must send SOS message about food poisoning to the center of sanitary-epidemiological surveillance in the following form:

1. City (in the city to specify the area, neighborhood)

2. The date of poisoning

3. The place of food consumption (if the patient was eating at home, then specify where the food was purchased; if eating was in a foodservice, in this case, note the dining room, cafe, restaurant, etc.)

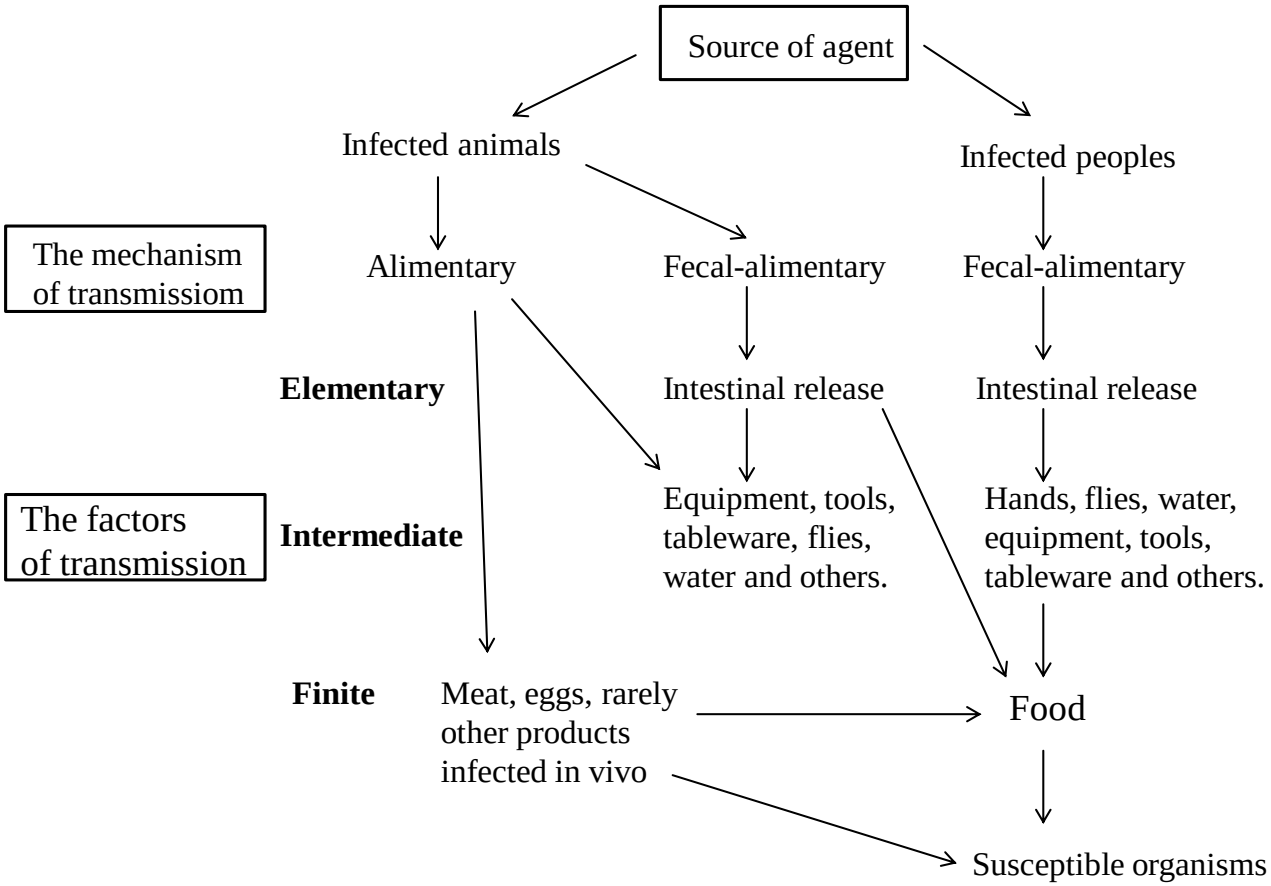

Figure 5**.** *Sources, mechanisms and factors of transmission of salmonella*

4. The number of injured and hospitalized cases, including children up to 14 years

5. The clinical picture and severity of the disease

6. The number of deaths

7. The food suspicious to be causative

8. The alleged reasons for the occurrence of food poisoning

9. The measures adopted (what is already done)

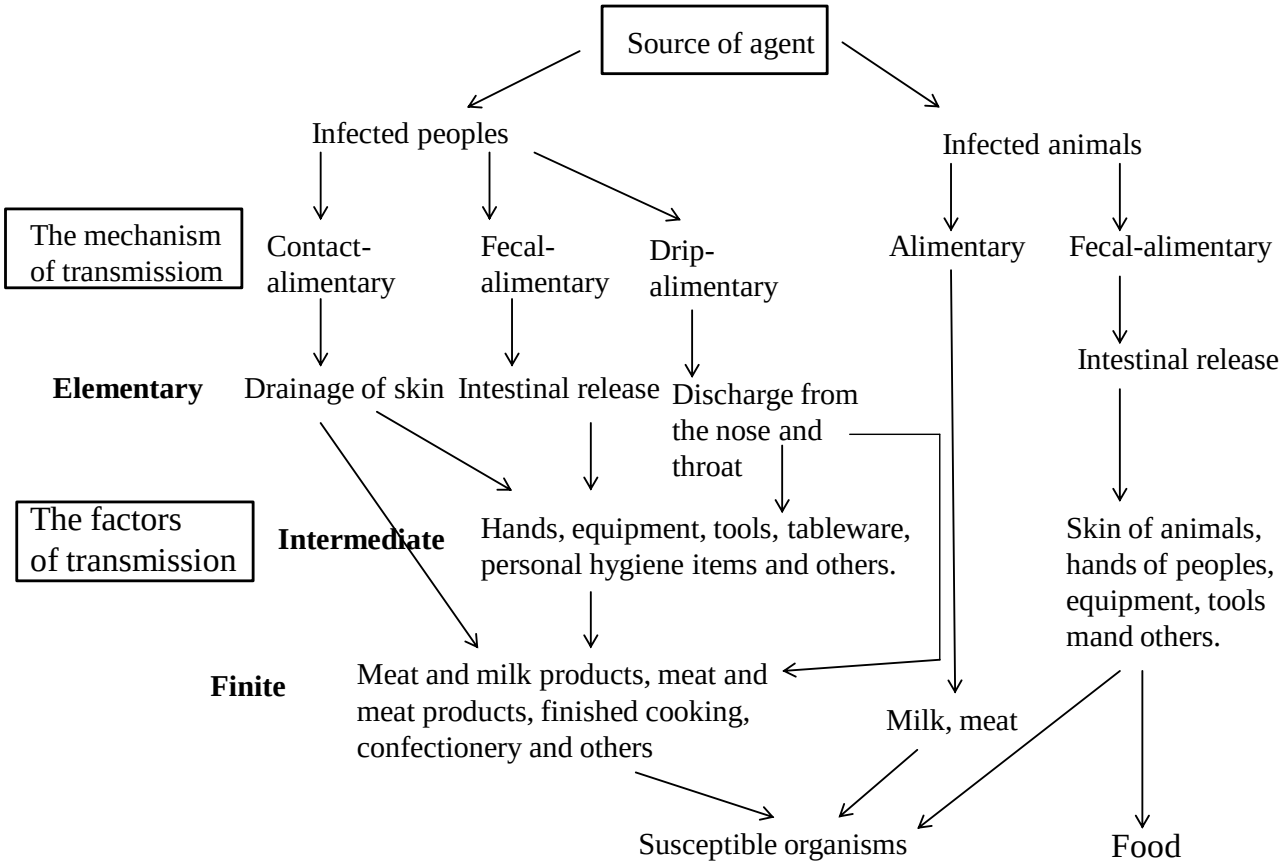

Figure 6. *Sources, mechanisms and factors of transmission of staphylococci*

10. The signature of a doctor or paramedic, indicating the position

5. To clarify the diagnosis the physician collects the following biological material from patients:

1. Vomit and fecal matter (50-100 ml)

2. Wash water (100-200 ml)

3. The blood from the cubital vein for cultivation of blood culture and serological tests (8-10 ml). Serological tests are done on 1-3rd and 7-10th day of disease. If serological tests are not done on time, they are done on the 7-10th day, and repeated on 15-20th day from onset.

4. Urine (100-150 ml)

5. The remains of suspicious food or semi-finished products

All samples for analysis should be collected in sterile glass dishes. To do this in hospitals, in blood transfusion stations, in hospital clinics, there should be available the necessary supply of sterile glassware. In

case of lack of any sterile glassware, then pure washed glassware must be boiled in water before sampling for 15 minutes.

6. To direct the food and material from patients for the studying in the sanitary-bacteriological laboratory, or keep them in the refrigerator until sanitary doctor arrives.

Having been informed further food poisoning investigation is held by the sanitary epidemiology service – specifically head of the service or medical specialist on the food sanitary. If it is necessary to investigate food poisoning there may be attracted doctors of other profiles – bacteriologists, epidemiologists, infectious disease specialists, pediatricians, pathologists, chemists and others.

The main stages of food poisoning investigation

Step 1: Identification of the food product, which was associated with the occurrence of diseases and an immediate removal of it from further use; survey of cases, and establishment of the common products used by all sick persons within the last 48 hours; prohibition of realization of the suspicious food product until obtaining a definite laboratory and advisory data.

Step 2: Investigation of the ways and manners the finished food product has acquired the toxic properties: sampling of suspicious products and sending them for laboratory testing (chemical, bacteriological, biological); taking swabs from the equipment, tools and hands of the staff engaged and sending them to the laboratory for bacteriological examination; examination of the conditions of food production technology, shelf life of perishable products; check the availability of certificates of quality; check the health of the staff (cooks, confectioners and others). Identifying among the staff and their families cases of intestinal diseases and checking for bacteria-carrying of intestinal infections.

Step 3: Clarification of common clinical manifestations (Tab. 28) in cases and establishment of diagnosis: the number of people who have the triad of symptoms – nausea, diarrhea, fever (Bacterial food poisoning?); the number of people who have complaint on visual disorders, nerve

Table 28

Severity of clinical symptoms observed in some food poisonings of microbial etiology

Clinical symptoms	Infectious agent					
	E. coli	Proteus	Staphilo-coccus au-reus	Str. faecalis	Cl. botulinum	Cl. perfringens
Incubation period	4 – 10 hours	4 – 20 hours	4 – 18 hours	8 – 24 hours	2 hours – several days	8 – 23 hours
Temperature	High	High	Norm, rare-ly low-grade fever	Norm	Norm, rarely low-grade fever or low	Norm
Chills	+ -	- +	+ -	-	-	- +
Sickness	+ -	+	+ +	+ -	+ -	- +
Vomitus	+ -	+	+ + +	-	+ -	- +
Epigastric pain	+ -	+ -	+ -	+ -	- +	+
Stomach ache	+ +	+ +	- +	+ +	-	+ + +
Diarrhea	+ + +	+ + +	- +	+ +	-	+ +
Feces with blood	- +	- +	-	-	-	-
Stool with mucus	+	- +	-	-	-	+ -
Constipation	-	-	-	-	+ +	-
Flatulence	-	-	-	-	+ -	+ +
Generalized weakness	+ +	+ -	+	+ -	+ + +	+ -
Headache	+	-	+	+ -	- +	- +
Upset of vision, diplopia	-	-	-	-	+ + +	-
Speech, swallowing disorders	-	-	-	-	+ + +	-
Dry mouth	-	-	-	-	+ + +	-
Loss of consciousness	- +	+ -	- +	-	-	-
Convulsions	- +	-	- +	-	-	-
Cardiac	- +	- +	- +	-	+ +	- +

disorders						
Breathing disorders	-	-	-	-	+ + +	-

Note: Symbols: (+++) - symptom expressed very strongly; (++) - Symptom expressed strongly; (+) - A symptom is rare; (- *) - The symptom is very rare; (-) - A symptom is not observed.

defects, difficulty of swallowing and speech disorder (botulism?); the number of people with most resent onset of disease (no later than 4 hours) after meals and showing sharp pain in the epigastric region, frequent vomiting, dizziness, and often severe general condition with a slight increase in body temperature (staphylococcal intoxication?); in cases of deaths there must be taking into account the results of post-mortem autopsy and laboratory research of the autopsy material – parenchymal organs, the contents of the stomach and intestines (200–300 grams), the blood from the heart (10 ml); data analysis and the establishment of preliminary diagnosis of food poisoning.

On arrival at the place of food poisoning a sanitary doctor on the Food Sanitation is to establish communication with medical institutions to provide assistance to patients, together with a doctor to analyze the clinical picture of the disease and to conduct a survey of patients in the following form: 1) surname, name; 2) age; 3) place of work; 4) clinical symptoms of disease: fever; chills; convulsions; cyanosis; headache, pain in the limbs, in the abdomen (the nature of pain); nausea, vomiting, diarrhea (frequency); visual disturbances; dry mouth; cardiac performance, and other symptoms (Tab. 28); 5) the duration of the incubation period; 6) if the disease is there among the family members, where and what have they eaten; 7) the date and time of onset of the disease; 8) the date and the list of the food eaten by the patient in the last two days.

The survey results are done in the form of a table (Tab. 29).

In this example, a common product in the diet of patients was cake with cream. After survey of patients and study of the clinical symptoms of the disease preliminary diagnosis is established, as well the possible cause of the disease is suggested (Tab. 29).

Table 29

The survey results of patients and the total food set to identify the food poisoning group

Surname and name of patient	Name of the eaten foods, date of their intake			
	Meat chop, date	Cottage cheese with sour cream, date	Pancakes with meat, date	Cake with a cream, date
Ivanov I.I.	-	-	+	+
Petrov V.V.	+	+	-	+
Sidorov M.I.	-	+	-	+
Vasiliev V.V.	-	-	+	+
Kuznetsov T.O.	+	-	-	+

The most important features of some food poisoning. Bacterial food poisoning. The incubation period lasts from several hours to 1–2 days, but usually 12–24 hours. The first symptoms are nausea, sometimes vomiting, headache, fatigue, chills, fever, diarrhea. Often the symptoms can vary, in some cases symptoms of acute gastroenteritis predominate, in others, for example typhus, high fever, severe headache, pain in muscles and joints and etc. The disease duration usually does not exceed 2–3 days.

Staphylococcal intoxication. Incubation period is rarely more than 2–4 hours. Symptoms: nausea, repeated vomiting, diarrhea often with blood, severe abdominal pain, in severe cases, cyanosis, heart disorder. Phenomena of gastroenteritis disappear after a few hours, recovery occurs within 1–2 days.

Botulism. The incubation period lasts from 2–3 hours to 10 days, usually 12–24 hours. The clinical picture of the disease is very specific. It is characterized by ocular symptoms - drooping of the upper eyelid (ptosis), crossed eyes (strabismus), uneven pupil dilation (anisocoria), double vision (diplopia). As a result of paralysis of the soft palate muscles, impaired swallowing, the liquid is poured from the mouth through the nose; paralysis of the throat muscles accompanied by a disorder of speech (dysarthria) up to complete aphonia.

Sometimes the disease begins with symptoms of gastroenteritis, which is then followed by constipation. The duration of the disease is from 2–3 days to 2–3 weeks. The mortality rate is 25–75%.

Prevention of food poisoning. To prevent bacterial food poisoning the efforts must be addressed to three major directions.

1. Efforts aimed at preventing contamination of food by pathogens causing bacterial food poisoning: veterinary inspection for the state of health of animals to be slaughtered; compliance with slaughtering technologies; the identification of carriers of pathogenic forms of E. coli, Proteus, and other opportunistic pathogens; compliance with the rules of processing products; observance of rules of personal hygiene and sanitary regime in the rooms where food is processed; fight against insects and rodents.

2. Efforts aimed at preventing massive reproduction of microorganisms in foods: storage of products and prepared food at temperatures below 6ºC; sale of finished food at temperatures above 60ºC for the first and second dishes, below 14ºC for cold snacks, observance of the shelf life in realization of products.

3. Sufficient heat treatment of food and food products (to achieve 80 ºC inside the food).

The sanitary inspector during investigation shall take the necessary care of localization and liquidation of the poisoning outbreak: prohibits the use, or, where necessary, establishes the procedure for the implementation of food that served as the cause of the food poisoning; immediately removes from the work or transfers to another activity unrelated to the processing, storage and transportation of the food that might have been the source of the food contamination; proposes and controls the implementation of the necessary sanitary activities at the enterprise, sanitary violations which were causative in the production of poor-quality products; states temporary or permanent prohibition of exploitation, offers disinfection, repair of food processing enterprises; attracts to administrative responsibility or lease the investigation materials of mass food poisoning in the prosecutor's office for further criminal investigation.

Investigation of food poisoning correctly done allows to achieve the results desired fast – to establish the source of infection or of non-microbial contamination of the food product, to identify transmission factors and conditions that facilitated the poisoning occurrence, and, acting against these parts of the epidemic process, allows to reduce the number of patients, localize the outbreak of the poisoning fast and prevent such problems in the future to a considerable extent.

QUESTIONS FOR SELF-CONTROL

1. Characteristics of food poisoning that distinguish them from infectious diseases.
2. Classification of food poisoning.
3. The steps of a doctor in case of patient suspicious for food poisoning.
4. Stages of the investigation of food poisoning.
5. Efforts to prevent food poisoning.

TEST TASKS

Choose one correct answer

1. THE ROLE OF STAPHYLOCOCCUS AUREUS TOXIN AS ETIOLOGICAL FACTOR OF FOOD POISONING WAS ESTABLISHED BY
    1) FF Erisman
    2) PN Lashchenkov
    3) GV Khlopin
    4) L Pasteur

2. REPRESENTS BACTERIAL FOODBORNE ILLNESS
    1) salmonellosis
    2) botulism
    3) aflatoxicosis
    4) ergotism

3. ALIMENTARY PAROXYSMAL TOXIC MYOGLOBINURY OCCURS AFTER EATING OF
    1) meat of animals
    2) fish
    3) eggs

4. CORRESPONDENT TO FOOD POISONING
    1) brucellosis
    2) poisoning by belladonna
    3) alcohol poisoning
    4) opisthorchiasis

5. PH, AT WHICH GROWTH OF PATHOGENIC MICROORGANISMS INSIDE CANNED FOOD PRODUCTS IS RETARDED

1) below 4.4
2) 4.4-5
3) 5-6

SITUATIONAL PROBLEMS

Problem 1. Within 12 hours, 2 members of one family (48 and 22 years old) became ill. The first signs of the disease were dizziness, diplopia, dry mouth, thirst. Then they got cramps. Next day the condition worsened, the patients were hospitalized. In the hospital there were signs of impaired vision, ptosis, swallowing difficulty, aphonia, severe weakness. Objectively: cyanosis of the skin, dry tongue, covered with plaque, dilated pupils, normal stool. The temperature of the patients did not increase. Despite the measures taken, the patients died on the 2-nd and the 3-rd days from the onset of the disease. The attending physician found out that the patients had eaten wild canned ramson, which was stored in the bathroom at room temperature. At the time the disease occurred, 4 out of 5 cans available were swollen.

Establish:

1. The group of food poisoning, to which this poisoning relates.
2. The food that may have caused the poisoning.
3. The factors contributed to the occurrence of the food poisoning.

Problem 2. Food poisoning occurred in different families at the same time. The common to all cases was consuming of cakes, made by one and the same company. The production of the batch of cakes (118 kg) lasted more than 12 hours, and the sale of cakes began only 25 hours after the manufacturing. The rest of the batch of cakes was withdrawn from the further sale.

The disease were characterized by the following symptoms: incubation period 3-6 hours, nausea, profuse vomiting, in some diarrhea (in 3 of them, blood in the bowel content), weakness, pale skin, cyanosis of the lips, in some patients, pulse 96–120 beats per minute. Recovery came in a few hours.

Number of sanitary violations was revealed by the sanitary doctor in the confectionery shop, where the cakes were made: the semi-finished

cream was prepared a day before it was implemented; conditions of food storage were violated; decrease of the concentration of sugar in the cream with a simultaneous increase in moisture of the products. When examining confectioners, one of them was found to have an abscess on the wrist due to a burn.

Establish:

1. The group of food poisoning, to which the disease relates.

2. Possible sources of the pathogen, pathways, transmission factors (initial, intermediate, final).

3. Prevention efforts.

Problem 3. At the beginning of summer, case of food poisoning in one family of the village was registered. Totally 8 people fell ill, 3 of them were children.

When examining the tonsils and the posterior pharyngeal wall, the local doctor diagnosed "septic angina", the angina flowed without temperature. The fact that the entire family fell sick at the same time, the district doctor was alerted; further the district sanitary service was informed about the disease.

Further investigation revealed the list of products that the family used for 2 preceding weeks – meat, eggs, milk and dairy products from their farms, vegetables grown in their garden. Bread was baked at home. The flour was grinded from last year's grain stored in a cold economic housing extension. Four days after the disease onset, condition of the patients worsened, the temperature began to increase, skin spots appeared in various parts of the body, including bleeding on the mucous membrane of the mouth and tongue. The whole family was hospitalized. In hospital, leukopenia, thrombocytopenia, hypochromic anemia were detected. Despite prolonged course of the disease, no lethal outcomes were observed.

Establish:

1. The food poisoning, which took place in this case.

2. Preventive efforts appropriate in case of such food poisoning.

5. HYGIENIC REQUIREMENTS FOR HOSPITAL NUTRITION UNIT

The purpose of the lesson: is to study requirements for placement, layout and equipment of hospital nutrition units, organization of clinical nutrition in hospitals; sanitary regime for preparation, storage, transportation and distribution of ready foods to patients.

Theoretical part. Since the days of Hippocrates, human nutrition is considered as one of the major health factors. The most famous was the Hippocrates aphorism: "Nutrients should be a remedy, and remedies should be nutrients." In hospitals curative (dietary) nutrition is done using the dietary nomenclature, in accordance with the basic pathology and taking into account the concomitant diseases of the patient. Action of curative nutrition is pharmacological and aimed at the restoration of homeostasis broken by the pathological process.

Organization of clinical nutrition in hospitals. Clinical nutrition is such nutrition that meets the needs of a sick body in nutrients, taking into account both specificity of the metabolic processes and the status of individual functional systems of the body. Functions of clinical nutrition: 1) maintenance of life on the optimum possible level; 2) reducing the imbalances in the body during disease by adaptation of the chemical composition and physical properties of food to the metabolic needs of the organism.

By the order of Ministry of Health of the Russian Federation № 330 from 05.08.2003 "On efforts to improve the therapeutic nutrition in medical institutions of Russian Federation," for clinical nutrition in a hospital dietitian is responsible. On admission to a hospital clinical nutrition administration is done by the doctor on duty and subsequent correction of the diet is done by the doctor to which the patient is assigned, and if necessary – by the dietician.

The order of food prescription for patients in health care organizations:

1. Writing out of meals is done by the medical dietary sister under the guidance of the dietitian.

In health care organizations, where the position of the dietitian is not available, the writing out of meals is done by the nurse on nutrition under the supervision of a physician responsible for clinical nutrition.

2. When a patient has just admitted to the hospital, nutritional administration is obligation of the doctor on duty. The diet prescribed shall be entered in medical history and at the same time into the total order containing diet info for all admitted patients, which is sent to the nutrition unit at the time scheduled.

3. The given diets are counted by the ward nurses with daily connections to the senior nurse of the department, which is given the number of patients and the distribution of the diets between them. On the basis of the information obtained the senior nurse of the department fills up the dietary list, subscribes it by itself and at the head of department, and sends it to the nutrition unit of the hospital.

4. On the basis of the information received from all departments, the dietary nurse sums up the "Total dietary list for all patients in the hospital", which is verified against the data of admissions, and is then subscribed.

5. On the basis of the "joint information" the dietary nurse with participation of the chief cook and the accountant, under the guidance of the dietitian, forms the menu list for patients for the next day. Menu list is done in accordance with the seven day menu, based on average daily food consumption in the hospital, and previously approved by the chief physician of the institution and signed by the dietitian, accountant, chief cook. In the numerator of the menu list the dietary nurse gives the number of food items to prepare one serving of each dish, in the denominator the accountant indicates the number of products required for preparation of all portions of this dish.

6. On the basis of the resulting data it is written out "Requirement on the issuance of food from a warehouse" in the form No. 45-of the Ministry of Health Care in two copies.

7. Dropping of the food products into the pot is produced in the presence of the dietitian nurse. The foods processed are always pre-weighted regardless of what was the weight while having being received from the warehouse.

8. Issuing of ready foods in departments is done on the base of "The statement on the issue of the ready meals for patients", which is filled up with the dietary nurse in one copy. When receiving breakfasts, lunches and dinners the staff of the department signs for the receipt. The statement is signed by the dietary nurse and the chief cook. Such ready products as butter, bread, tea, salt, etc. are issued to the department kitchen staff directly from the warehouse/storeroom on requirement.

9. Additional reception or refund of products is done with the invoice on the warehouse/storeroom. Foods, already incorporated in the boiler, are non-refundable.

10. Additional dietary meals order (to the basic menu) is to be issued in two copies and signed by the attending physician, head of department and approved by the chief doctor of the hospital. The first copy is passed to the nutrition unit, the second is stored in the medical case records.

11. Info about every dish prepared in a healthcare facility is written on a special card in two copies: one copy is retained by the accountant, and the second – by the dietary nurse (on the back of the card the technology of preparation of the dish is described).

Quality control of ready foods

1. Control of finished food before issuing it to the patients is performed by the doctor on duty and once a month by the chief doctor (or his deputy for medical work), and also by the dietitian, dietetic nurse, chief-cook, regardless of the activities produced by the doctor on duty.

2. Food sampling at the nutrition unit before it is delivered to the departments of the hospital is carried out in the following order:

A) Directly from the boiler, in accordance with the list of dishes indicated in the menu-list. The volume of the first dishes is established on the basis of the capacity of a pot or a boiler and the number of ordered portions and the volume of one serving. The weight of the second dishes (porridges, puddings, etc.) is determined by weighing the total quantity in a common container with a deduction of the tare weight and taking into account the number of portions. Portion dishes (cutlets, croissants, meat, poultry, etc.) are weighed in the amount of 10 servings and the average weight of one serving is determined. Deviations from the norm should not exceed 3%;

B) By the sampling of a decorated ready dish: by one per the diets used.

3. The results of the food sampling are recorded by the doctor on duty in the finished food book.

4. Selection of ready meals for laboratory analysis (determination of chemical composition and energy value taking into account losses during cold and heat treatment) is carried out by the State Sanitary Epidemiologi-

cal Service of the Ministry of Health of Russian Federation in a planned manner in the presence of the dietitian or dietary nurse.

Responsibility for the correct functioning of equipment in hospital nutrition unit and the buffet rooms of the hospital departments is carried by the deputy chief doctor on the administrative and economic part and by the dietitian.

The food advised to patients should be varied and conform to medical indications on the chemical composition, nutritional value, by the set of products, by the diet. According to the "Regulations on the organization of dietitian of the health care institutions", approved by order of Ministry of Health of the Russian Federation № 330 from 08.05.2003, the dietitian's responsibilities are to:

- advise the doctors concerning clinical nutrition;
- monitor the preparation of menu, technology of preparation of dietary dishes;
- supervise catering work by his daily visits, remove samples of prepared food, selective sending of ready meals for laboratory testing;
- participate in the preparation of 7-day menu in warm and cold periods of the year for all applicable diets;
- carry out health education to promote rational and curative nutrition among the patients and hospital staff.

Historically, in Russia 15 major medical diets were in use (classification of diets by M.I. Pevsner). As the basis of this classification nosological form and stage of disease were considered. In 2002 there were more than 100 modifications of medical tables by M.I. Pevzner.

According to the order № 330 from 2003 the old numbering system of diets in Russia was deprecated and instead of it new numberless dietary nomenclature is used in hospitals. It includes the basic version of the medical diet (basic diet) and 4 its modifications. This classification is principally based on the amount of nutrients and energy, set of recommended foods, regimes of food intake. The new dietary system is consistent with the principles of evidence-based medicine.

Basic version of the diet is a diet with normal content of proteins, fats and carbohydrates, rich in vitamins, minerals, fiber (vegetables and fruits). In a limited amount it contains nitrogenous extractives (meat, fish, and mushroom broth), salt (6-8 g per day), and foods rich in essential oils. Hot spices, spinach, sorrel, smoked foods were excluded.

Dishes are prepared boiled, steamed or baked. The temperature of hot dishes is not higher than 60-65°C, of cold food - not lower than 15°C. The cholesterol content is 300 mg per day. Free liquid - 1.5-2 liters per day. In the diet for patients with diabetes mellitus refined carbohydrates (sugar) are excluded. The main diet supposes fractional food intake – 4 to 6 meals per day. The standard diet is indicated for the most hospital patients except those having special diseases in which the diet should be modified (Tab. 30).

Table 30

Indications for using modifications of the basic medical diet

The standard diet	Indications for use
Diet with mechanical and chemical sparing	Peptic ulcer and 12 duodenal ulcer at the acute stage and unstable remission. Acute gastritis. Chronic gastritis with normal or high acidity, but not in the acute exacerbation phase. Gastroesophageal reflux disease. Violations of the functions of the masticatory apparatus. Acute pancreatitis, acute stage of fading. Severe exacerbation of chronic pancreatitis. In the period of recovery after acute infection; after surgery (not on the internal organs)
Diet with high protein content	Status after resection of the stomach in 2-4 months for peptic ulcer disease in the presence of dumping syndrome, cholecystitis, hepatitis. Chronic enteritis in the presence of the expressed violations of the functional state of the digestive organs. Celiac disease. Chronic pancreatitis in remission. Chronic glomerulonephritis nephrotic type in the stage of fading aggravation without disturbance of the nitrogen-renal excretory function. Diabetes mellitus type I or II without concomitant obesity and disorders of nitrogen-renal excretory function. Rheumatism with a low degree of active processes with protracted course of the disease without circulatory disorders; Rheumatism in the stage of fading aggravation. Pulmonary tuberculosis. Suppurative process. The anemia of various etiologies. Burn disease.
Diet with a reduced protein content	Chronic glomerulonephritis with rapidly and moderately severe disturbance of the nitrogen-renal excretory function and severe and moderate azotemia.

Diet with reduced caloric content	Different degrees of alimentary obesity in the absence of express complications from the digestive organs, blood circulation and other diseases that require special diets. Diabetes type II with obesity. Cardiovascular disease is the presence of excess weight.

Table 31 presents the products included in a weekly menu of the standard diet.

Table 31

The average list of the main diet's products per adult patient in a health care facility

Name of product	Number of products
Rye bread	150
Wheat bread	150
Wheat flour	10
Potato starch	5
Pasta	20
Groats (buckwheat, rice, oatmeal, cream of wheat, barley, wheat, corn)	45
Potatoes	200
Other vegetables (pumpkin, radishes, cauliflower, peppers, eggplant, seaweed, etc.).	400
Fresh fruits	150
Dried fruits	20
Fruit juices, vegetables	100
Beef category II	100
Bird	20
Sausages	10
Fish, fish, non-fish seafood	70
Cottage cheese	35
Cheese	15
Egg	0.5 pieces
Kefir	100
Milk	200
Butter	30
Vegetable oil	20
Sour cream	15
Sugar, jam, biscuits, confectionery	50
Tea	2
Coffee, cocoa	1

Gelatin	0.5
pressed yeast	1
Salt	6
Tomato paste, tomato puree	3
Briar	20

The diet with mechanical and chemical sparing differs by moderate limitation of content in the food of the components which are mechanical and chemical irritants to the mucosa and receptor apparatus of gastrointestinal tract. Dishes are prepared boiled or steamed, mashed or pureed. The number of meals is 5–6 times a day. The high-protein diet involves increasing protein content in the diet, compared with the standard up to 18-21%. If the diet is prescribed for patients after gastric resection with dumping syndrome, refined carbohydrates (sugar) are then excluded. Chemical and mechanical irritants of stomach, biliary tract are excluded. Dishes are steamed, boiled, stewed and baked.

The low protein diet supposes protein restriction to 0.8–0.6 g, or 0.3 g/kg of the ideal body weight (up to 60–40 or 20 g/day), sharp limitation of salt (1.5–3 g/day) and the liquid (0.8–1 liters per day). It excludes nitrogenous extractive substances, alcohol, cocoa, chocolate, coffee, salty snacks. In the diet can be used dishes from sago, protein-free bread, mousses of swellable starch. The dishes are prepared without salt, boiled, steamed, not pureed. Food boiled or steamed, not milled.

In the low-caloric diet the daily caloric content is moderately restricted (up to 1300-1600 kcal/day) mostly at the expense of fats and carbohydrates. No simple sugars, limited amount of animal fats, sodium chloride up to 5.3 g/day. It can include vegetable fats, dietary fiber (raw vegetables, fruits, edible bran). Food boiled or steamed, without salt. Restrict the free liquid to 0.8–1.5 liters per day.

Nutrient content and energy value of the diets are shown in Tab. 32.

Order № 330 from 05.08.2003 of the Ministry of Health supposes individualization of clinical nutrition and empowers the physician to make additional recommendations with respect to a diet. For example, for a patient with a gastric ulcer during the exacerbation phase, with type II diabetes and congenital lactase deficiency the exact dietary recommendations in the hospital will be the following: «Diet with mechanical and chemical sparing, with exclusion of refined carbohydrates and milk».

Table 32

Nutrient and energy content of the basic therapeutic diets

Indicator	Basic (including mechanical sparing)	High-protein	Low protein	Low-caloric
Calories, calories	2170–2400	2080–2690	2200–2650	1340–1550
Protein,%	15	18–21	4–9	21
Fat,%	30	30–35	31–33	39
Saturated fatty acid,%	7.5–8.3	7.4–9.5	7.5–9.0	9.3–10.7
Monounsaturated fatty acids%	10.1–11.2	10–13	10.2–12.3	13.9–16.1
Polyunsaturated fatty acids,%	8.6–9.5	8.3–10.8	8.5–10.8	9.9–11.4
Carbohydrates,%	55	48–52	60–63	40
Dietary fiber, g	20–25	20–25	15–20	15–20

Hygienic requirements for accommodation, room set and interior layout of a hospital nutrition unit. Hospital nutrition unit is a complex of interconnected indoor areas, arranged so as to avoid colliding streams of raw and ready-to-eat foods. Catering department of health care facilities should be located in a separate building, which can be connected by the transport tunnels with the hospital ward departments other than infectious. It is allowed for a nutrition unit to be located within medical indoor areas provided keeping with the basic principles as to unidirectional streaming of food, availability of lifting equipment and autonomous ventilation system.

Nutrition units can be built as a centralized or decentralized system, depending on the construction of the entire hospital complex. With the centralized building scheme nutrition unit may be located within the one big building if the hospital has the number of beds up to 300 (better to be located on the upper floors to minimize the risk of air contamination). Either it can be located in a separate building, if the hospital has a decentralized building layout. In this case, the finished food is transported through the system of underground corridors to ward departments (except infection and tuberculosis departments). The width of the tunnel must be at least 3 m, and if used conveyors or electric cars then 4.5 m width is required. Such way of nutrition unit accommodation is most easily implemented

with the construction of large modern multi-profile hospitals. Nutrition unit must be removed from the medical areas by 75 m.

If an infectious department is in a separate building of the hospital, delivery of food should be carried out through a special window. The food transport wares, dishes in this case are washed, disinfected and stored in the buffet of infectious department. Food residues of infectious department are subject to disinfection and descent into the sewers.

In case of decentralized nutrition unit (in hospitals with 600 or more beds) there is a head cooking center, making semi-finished food production, and the kitchens located peripherally in separate medical buildings, in which the semi-finished food is cooked up to the finished state and released directly to the ward departments located in the correspondent building.

Hygienically, optimal nutrition unit scheme is considered to be centralized. Regardless of the type of nutrition unit system its internal layout must conform a functional link between its areas, providing unidirectional food streaming processes from raw foods arrival to food storage, to preprocessing, to cooking, to final distribution of ready foods, as well as removal of the food wastes.

Nutrition unit of medical institutions should have the necessary set of production areas to ensure compliance with hygiene requirements during cooking. Planning of nutrition unit shall comply with the principle of a sequence of the cooking technologic processes, keeping off any possibility of a contact between finished and raw foods. By appointment nutrition unit indoor areas are principally divided into 3 sections: production rooms, storage rooms, service rooms.

Production rooms include: preproduction areas for vegetables, meat, poultry, fish; hot dishes cooking areas (hot production); cooking of cold dishes (cold production); confectionary areas; washing cookware; expeditionary areas (wherefrom finished food is further transported away). Production rooms also include buffets and dining rooms, located in ward departments. To prevent the spread of odors from the kitchen to the wards it is necessary to exclude the location of the wards on the floors just above or below the kitchen unit.

The internal layout of production rooms should ensure their functional relationship with each other. Every room, including cold production and expeditionary areas should not have a pass through location and must be situated as close to the kitchen as possible. It is unacceptable accommoda-

tion of production areas on the basement floor, as this reduces the natural lighting conditions and can lead to contamination of food with street dust.

Food production processes, accompanied by inevitable air pollution of the working area with harmful emissions (gas, steam, moisture, dust), also associated with a sharp noise, should be carried out in isolated areas. Rooms with the same hazard exposure should be placed adjacently.

Kitchen rooms should be large, with good daylight, artificial lighting and ventilation. The walls of the kitchen, as well as of the washing area should be lined with ceramic tiles up to the height of 1.6–1.8 m, and above this height they must be colored with an oil paint. The floors in these areas is recommended to make of a waterproof material, having hard, smooth, non-slip surface; it is desirable to equip it with the ladder, representing a light slope down of the floor towards the center of the room, which is applied for the removal of waste water to sewage.

Stove must be so located in the kitchen as to provide free access to it from all sides, cooking desks should be located at the distance of 1.5–2 m from it. Tables used in the kitchen must be made of corrosion-resistant material (stainless steel, anodized aluminum, marble), without seams on the cover surface. Cutting boards are made of solid wood (beech, oak), without cracks, with a smooth surface; knives made of stainless steel, preferably with wooden handles (good for labeling). Boards and knives are assigned to specific tables and stored in the same room in special cassettes (cells) that are installed on the edge, or on the brackets. Tables, cutting boards and knives must be separate for each type of food products (especially for the raw and boiled) and have the appropriate designation (marking):

“RM” - raw meat	“PV” - pickled vegetables
“BM’ - boiled meat	"MG" - meat gastronomy
“RV” - raw vegetables	"Bread"
“CV” - cooked vegetables	"Herring"
“RF” - raw fish	"Butter"
“BF” - boiled fish	"Greenery"

All production areas must be supplied with hot and cold water, preproduction rooms should be equipped with sinks for washing of meat, fish, vegetables, for soaking salted fish. At the kitchen hand washing sink must

be installed, whereby must be soap, disinfectant solution and a towel (preferably electric towel device).

Storehouse. The structure and equipment of storage areas should ensure strict compliance with the basic rules of the “food neighborhood” - separate storage of raw products, semi-finished and finished foods. Thus, there should be separate cooled chambers for storage of meat, fish, dairy products, fruit and vegetables, canned and pickled; storage of dry products, bread; linen closet; inventory area; storekeeper room. Placement of the storage areas is on the first floor. It’s allowed to place it on the basement floors, if such areas are protected from moisture. Above a storehouse it’s prohibited to place sanitary facilities, showers, and bathrooms. Storage areas must be kept uppermost clean, locked, non-accessible for unauthorized persons. It is unacceptable a joint storage of benign and spoiled foods, foods with a strong odor (for example, bad idea to store herring and butter in a refrigerator together), non-food objects together with food.

The service rooms include: the cabinets of the head of production, dietician doctor and nurse; closets, showers, toilets for staff; hygienic room for women; cleaning room; room for storage and washing of trucks and containers used to transport prepared food; staff room.

Area for storage of waste needs to be cooled and have an independent way out to the backyard, which excludes a connection to the other cameras. Scum and food debris are collected in metal, perfectly clean, with tight-fitting lids tanks with a capacity of not more than 15–20 liters, which as filling, but at least 1 time per shift, is made empty.

Sanitary-hygienic control in nutrition unit of health care organizations. Cooking of high-quality food and prevention of food poisoning is only possible if a hospital nutrition unit is provided with: 1) complete set of rooms and equipment; 2) rational layout of indoor areas; 3) keeping off crossing of "clean" and "dirty" processes (raw and finished foods, clean and dirty dishes); 4) mandatory labeling of all catering equipment and use of this equipment in strict accordance with the marking; 5) compliance with the heat cooking technology, especially of meat and fish; 6) compliance with the rules of food storage distribution; 7) strict observance of personal hygiene by the staff; 8) compliance with general sanitary requirements to ensure thorough washing of dishes, working surfaces, hands of the staff and equipment with the use of detergents and disinfectants.

Hygienic regime in nutrition unit of health care institutions is a difficult task. This is due to necessity of cooking of a large number of different

dishes in different amounts and different terms. To fulfill this purpose different cooking technologies are applied (grinding, rubbing, etc.), this can create a risk of bacterial contamination. Therefore, at all stages of cooking enhanced hygienic supervision is required as to compliance with food streaming principle, common sanitary regime, storage conditions, observance of the rules of ready meals distribution.

In all nutrition unit areas there should be carried out daily sweeping of the floors with wet wash and hot water, as well as dusting, wiping of furniture and so on. General cleaning in nutrition unit is carried out at least 1 time per week.

Efforts should be taken against the ingress and propagation inside catering areas of flies, cockroaches and other insects, and rodents. For that in the summer on the windows fine mesh is installed. In order to rodents could not get into the room, the foundation and the lower part of the walls are made of hard-to mice and rats a material. In the lower parts of the walls and under the floor boards it is recommended to install metal mesh with holes with a diameter not exceeding 12 mm; windows of the located at basement storage areas are shielded with fine mesh; all the holes and cracks in places of pipe fittings are subject to careful sealing of.

Terms and conditions of food storage. Only those food products can be admitted in nutrition unit that have relevant certificates, ensuring their quality, safety and shelf-life information; meat must have the veterinary certificate; on a beef carcass there should be a stigma - a round seal with purple inscription (I category meat) or rectangular stamp (II category meat); meat and eggs should be at least of category II. To control the quality of incoming products and its expiration date, organoleptic evaluation is always carried out and its results are mandatory recorded in the food quality log.

The products should be stored on the by-product principle: dry (flour, sugar, cereal, pasta, etc.); bread; meat, fish; milk; fat; delicatessens; vegetables and fruits.

Bread is delivered daily in the catering department, and stored on the shelves with curtains or in cabinets with doors and holes for ventilation. The distance from the bottom shelf to the floor must be at least 35 cm. In order to prevent odor adsorption black and white kinds of bread are stored separately.

Flour, cereals, pasta, sugar is stored in bags on shelves or in bins with the lid.

Vegetables should be stored in a dry dark room in bed bins with a layer not exceeding 1.5 m in thickness; sauerkraut - in barrels, herbs - in refrigerated chambers on the shelves.

According to sanitary rules "Conditions, terms of storage and realization of easily degradable products", perishable products are stored in refrigerated chambers at the following temperatures: meat, baking and gastronomy components at 0ºC; fish, milk and fat products at 2ºC; fruits at 4ºC. Raw meat and sausage is stored in a suspended form in the tinned hooks; poultry and fish - in a container; pickled and salted vegetables - in barrels; butter - in containers or bars in the parchment on the shelves; milk - in the packaging in which it was delivered. In refrigerators storage must be adhered to the rules of the “food neighborhood”. Raw and finished products should be stored in separate coolers. In small hospitals with one cooling chamber, and in case of daily food supply cooler it may be allowed short-term joint storage of different kind of foods, provided compliance with the “food neighborhood” principle is there (storage on separate shelves, racks).

Shelf life of foods including perishable products is presented in Tab. 33 (SanPiN 2.3.2.1324-03).

According to the requirements of SanPiN 2.1.3.1375-03, in order to prevent occurrence of infectious diseases and food poisoning among hospital patients in the catering department it is not allowed to take: 1) raw materials and food products without documents confirming their quality and safety; 2) raw materials and food products with expired shelf life, signs of spoilage or contamination; tarnished products in flexible containers (flour, cereals, sugar, etc.); 3) flour, cereals, dried fruits and other foods contaminated with pests, and contaminated with mechanical impurities; 4) vegetables, fruit, berries with the presence of mold and rot signs; 5) meat and offal of farm animals without the stigma and veterinary certificates; 6) meat and eggs of waterfowl (ducks, geese); 7) unskinned poultry; 8) blood and liver sausage; 9) eggs with contaminated or damaged shell, as well as eggs from the farms known to be unfavorable for salmonellosis; 10) canned foods with leaky cans, jars with rust, warped cans, cans without labels.

Not used in hospital kitchen: 1) cask, not pasteurized milk, cottage cheese in kegs and sour cream without heat treatment (boiling); soured milk; 2) any homemade canned foods.

Table 33

Shelf life for especially perishable foods implemented in trade network and public catering facilities at +4 ± 2°C

Name of foods	Shelf Life
Meat and meat products	
Meat lumpy semi-finished products: meat packaged, portioned meal (sirloin, steak, rump steak, escalope, schnitzel) without breading	48
Breaded meat meal: steak, rump steak, chops	36
Meat small-sized meal: beef stroganoff, fried, azu, goulash, beef for fire	36
Frozen minced meat, generated by meat processing company	24
Minced meat, produced by public catering	12
Offal (liver, kidneys, tongue, heart, brain)	24
Cutlets minced meat, fish, fish and potato and vegetable semi-finished and finished	24
Pilaf, dumplings, pancakes, pies, hamburgers, cheeseburgers, sandwiches, pizza (ready)	24
Cabbage rolls stuffed with meat and rice - semi-finished products	24
Semi-finished products of poultry meat chopped, breaded and without	18
Meat boiled	24
Meat fried, stewed	36
Sausages, developed in accordance with State Standard with Premium and First Class	72
Sausages, developed in accordance with State Standard with Second Class	48
Cooked in steam-impermeable, gas-tight membranes: premium grade with the addition of preservatives	10 days
First Class	8 days
Second Class	7 days
Sausages, boiled sausages, chopped and packaged under vacuum with modified atmosphere	5 days
Fish and fish products	
Breaded fish - prefabricated	24
Fish fried, boiled, baked, stuffed	36
Fish and smoked rolls	48
Jelly fish, fish in aspic	24
Chopped herring, herring oil	24
Fish paste, structured products (crab sticks, etc.)	48
Milk and milk products	
Milk in cisterns, flasks, bags, cream	36
Liquid cultured milk products	72

Sour cream and products based on it	72
Cottage cheese and cottage cheese products	72
Products for therapeutic and preventive nutrition on pickled soy or non-dairy based	36
Children cheese cottage	36
Dishes of cottage cheese - dumplings, curd cheese cakes, toppings of cheese, cakes	24
Cheese	5 days
Cakes and pastries	
No cream, with whipped protein, butter, custard cream	72
With whipped cream, with cottage cheese-cream filling	18
Jelly, mousses	24
Vegetable dishes	
Vegetables cooked unpeeled	18
Food of boiled, fried, stewed vegetables	24
Food of boiled, fried, stewed vegetables. Side dishes: rice and pasta boiled, mashed potatoes	12

In hospital nutrition units it is prohibited to cook: 1) curd; 2) pasta with minced meat, pancakes with meat, jellies headcheese, pates, jellied dishes (meat and fish); 3) fried egg; 4) cream, pastry cream; 5) products are deep-fried, pate.

While cooking pasta and rice, their final flushing after boiling is not allowed. Processing of eggs used for cooking is in accordance with the requirements established by the sanitary rules for public nutrition enterprises. Storing of raw eggs in cassettes, boxes, in production areas is not allowed.

Nutrition unit equipment. Equipment of nutrition unit must be guided by the "Standards of equipment for nutrition units of hospitals", approved by the USSR Ministry of Health of 03.05.1963 № 203. According to these standards the catering department should be equipped with mechanical, thermal, cooling and non-mechanical equipment.

Mechanical equipment, used for the primary (cold) food processing, includes: 1) machines for cereals, potatoes and vegetables (potato peelers, vegetable slicers, juicer); 2) machine for processing of meat and fish; 3) machines for dough; 4) machines for cutting bread, butter, ham; 5) machine for whipping of liquid mixtures.

Machines for crushing and wiping of products are particularly important for catering, as they are designed for fine grinding of meat, fish,

liver, vegetables, cheese, cereals. Multi-purpose mechanism with universal drive is used for whipping of pastry mixes (mousses, egg white, cream), mixing the batter, soups, mashed potatoes, cooked vegetables, cereals, etc. It is also used for squeezing of juice from fruits, berries, vegetables, for mixing of salads, for cutting of fresh and cooked vegetables.

Mechanical equipment also includes a dishwasher.

Heating equipment (Fig. 7) is designed for heat cooking of food (cooking, frying, baking, steaming), as well as the preservation of prepared food and hot water heating.

Figure 7. *Contemporary nutrition unit*

Thermal equipment includes: 1) boiling machines (cookers with automatic thermal management; boilers, steamers, appliances for cooking of eggs, sausages, electric cooking vehicles, having two independently operating bathes for cooking of foods in water or on steam in the perforated containers and sacks); 2) griddle equipment (electric grills, electric cookers, microwave ovens, ovens with operating temperature of 150–200°C; cabinets for baking at temperatures up to 300°C).

Electric ovens are designed for baking of products made of meat, fish, cereals, cheese.

Non-mechanized equipment includes cutting tables, tubs for washing of foods and dishes, cutting boards, knives, a deck for a cut of meat, and others.

Cookware is made of stainless steel, aluminum, iron. Aluminum cookware can be used only for cooking and short-term storage of food. Galvanized containers (drums, cans) are used only for storage of bulk products. Enamel ware, due to the fragility of the coating and chipping threat, is not allowed to use.

The inner surface of glassware should be smooth, without spots and scratches. All cookware must be marked: on boilers and caps put designation – 1st, 2nd, 3rd dish, as well as "Milk," "Fish dishes", "Herring", "Salad", etc. For 1^{st} and 3^{rd} dishes and on the inner surface of the milk there must be a volume in liters marked. Kitchen cookware is not allowed to put on the floor: for this purpose should be used special stools, stands, shelves.

Cooling equipment of kitchens is presented by cooling cameras and refrigeration cabinets. Refrigeration equipment is divided into low temperature (from -15 to -18°C) for food freezing; medium temperature (from 0 to +6°C) for cooling of foods; high temperature (from +10 to +12°C) mostly for storage of drinks.

Cooking technology. Most of the dishes and culinary products produced in a nutrition unit are perishable products, which must be implemented within 2-4 hours. Even at short time delay of distribution ready dishes loose their freshness, many vitamins and other valuable nutrients are partially or totally destroyed, significantly worsening the taste qualities of the product.

Technological approaches applied in cooking of dietary dishes can save food and biological value of the food. At various heat treatments the loss of energy value and nutrients varies considerably. Loss of protein and fat in animal products is higher than in the plant foods. Mineral substances loss is 2 times greater in animal products, except for calcium, which after certain kinds of fish and poultry processing partially goes from the bones into the meat. At high temperature, initial amount of vitamins breaks down by 50% and for ascorbic acid this value may reach 75%. Total losses of the energy value of the products account for 10%.

The technology of cooking involves two main stages – primary (cold) raw food processing (preprocessing) and heat processing.

Cold food processing is performed in the vegetable and meat-fish areas and consists of screening, defrosting, washing, cleaning, crushing, molding, etc. In order to prevent reproduction of microorganisms the meat and poultry is defrosted in special cooling chambers at a temperature from 0 to + 6°C or on the meat table at + 18°C. When the meat is defrosted it’s

washed and visible dirt is removed, thus microbe contamination gets down by 90-95%. Meat cut is done on a wooden deck, which is then purified from flesh residues with a knife, washed by hot water, dried and then sprinkled with salt. The pieces of meat so obtained are stored in a cold room until putting them to the pot.

Offal and poultry is defrosted in trays laid out in a row at a temperature from +15 to +18°C. Fish is thawed in cold water for 2–4 hours. To reduce the loss of mineral substances, soluble in water, it is recommended to add the salt (7-8 g/L). Meat and fish mince is prepared as required, and stored at 0-2°C. A minced meat represents particularly favorable conditions for spread and reproduction of micro-organisms on the surface throughout the crushed mass. Therefore, products made of minced meat must be subjected to heat treatment immediately.

Vegetables, herbs, mushrooms, fruits are sorted, cleaned of dirt, washed in cold water. Especially carefully should be washed vegetables and herbs that are used in food in raw form. Tubers of peeled potatoes are stored in cold water at + 12°C no more than 3 hours, and the tuber vegetables are kept covered with a damp cloth for protection against drying out for no more than 2–3 hours. Sliced potatoes may not be stored in the water due to fast loss of mineral substances, starch and vitamin C.

Grain is sorted to remove extraneous impurity from the raw grains shells and then washed. Flour, sugar, salt is sieved with sieves before use.

Some ready-made dishes (salads, fish and meat snacks, etc.) are cooked without heat processing when only cold treatment is applied, so special attention should be given to keeping with hygienic requirements during the cold processing.

The heat treatment of food products is carried out in the hot processing areas. High temperature changes protein structure of foods, results in swelling and gelatinization of starch, which in turn lead to a change in color, odor, taste, and consistency of the products, that promotes better digestion. Those microorganisms present in the raw and semi-finished foods during heat treatment get killed.

All methods of heat treatment, depending on the environment in which heating is performed, are divided into two main types - boiling and frying. Apart from these there may be combined methods (braising, roasting, and grilling of cooked products, steaming).

Boiling is the most frequently used type of heat treatment and the most reliable in epidemic sense method of food cooking, as in many condi-

tions the product being boiled is heated up to 96-100ºC. The most difficult task is the cooking of meat – to be evenly warmed with the whole tissue; you need to boil small pieces of meat (1–1.5 kg of no more than 8 cm in thickness) for at least 2 hours.

During boiling significant loss of water-soluble nutrients - minerals, amino acids, extractives occur. Such losses depend on the heat method chosen, if cooking is performed without elimination of the broth, the loss of nutrients is low (2–5% of protein, fat, carbohydrates and minerals, 10-15% of B vitamins and β-carotene). When cooking most vegetables, rice, porridge, pasta, when the broth is poured out, the loss of proteins, fats, vitamins and minerals increase 2–3 times, which is close to the losses during frying. To reduce these losses it is recommended to lay the meat (poultry, fish) immediately into boiling water or into boiling vegetable broths. Nutrient losses are reduced when cooking foods on steam with the use of special equipment, but the cooking time is then increased.

Boiling is carried out by heating the liquid to boil, after which further heat treatment is conducted at a low boil, or the food is brought to readiness without further heating thanks to the heat accumulated. This is achieved by evenly heating of the product. To accelerate the readiness of food cooking at elevated pressure is applied at temperature of 115–130°C in pressure cooking equipment. Cooking at reduced pressure in a vacuum apparatus (for fruits, berries) at a temperature of 80–90°C may be used.

To avoid getting small sharp bones when you cut meat, cooked broth must be filtered through a sieve or a fabric before cooking the first meal. Vegetables for salads for the greater safety of vitamins should be boiled in their skins at the day they are used, but not at the day before.

Dietary food may be cooked using a water bath at 40–70°C. Omelets, puddings, some sauces are cooked in container, which is placed in the other one, having water inside, providing bath effect, temperature controlled.

Frying helps to preserve nutrients in the food, as a crust formed prevents their exit. In addition, frying contributes to improving the organoleptic properties and increases nutritional value of foods thanks to adding of fat and spices. Frying is done on fat or in heated air at a temperature of 150–180°C. In deep frying food product is fully immersed into the oil heated up to 130–190°C.

However, when frying, especially at high heat, the temperature inside the food product may however be less than 80°C, which is insufficient to destroy vegetative forms of microorganisms, including pathogens.

Frying of vegetable products results in loss of approximately 5% of proteins and 10% of fats (mainly the fat added during frying). Due to juice outflow and crust formation up to 20% of carbohydrates and minerals are lost.

Burgers, meat balls and other products from minced fish or meat are fried in boiling fat on both sides for at least 10 minutes, then they stay in oven at 220–250°C for 5-8 minutes.

When preparing dishes of boiled meat (rolls, casseroles) secondary heat treatment (boiling in a broth, sauce) for 10 minutes in the oven at 220-250°C – 5-8 minutes is mandatory. Casseroles, omelets are kept in an oven at a temperature 220–250ºC at least for 8-10 minutes.

Combined heat treatment methods make it possible to achieve juiciness and softness of ready meals, they acquire additional flavor.

In case of gastrointestinal tract diseases it is very important regulation of the mechanical irritation of the mucous membrane of food. The intensity of the mechanical action of food is determined by its consistency and quantity. Reduced mechanical action used in the cooking of vegetables, fruits, cereals, low-fat meat of young animals, poultry, rabbit, beef with a small amount of connective tissue.

For mashed soups, boiled foods are repeatedly rubbed through a fine sieve. The same dispersion of raw vegetables may be achieved through a grinding machine. To create an air consistency and ease to digestion the comminuted mass is intensively stirred and whipped egg whites are added to the mass (pudding soufflé).

In strict mechanical-sparing diets to reduce the mechanical action may be used slimy decoctions of cereals, which are prepared by prolonged heat cooking (for 3–4 hours) at ratio of 1:10 with water.

Requirements for reception, storage and transportation of food products. Foods admitted to a hospital nutrition unit should have accompanying documentation of the established form, quality certificates with indication of the date and hour of production, the time of the product shipping, the conditions and terms of storage, as well as the terms of implementation. In the absence of a central circular delivery of food, special covered vehicles are used, which are no less than 1 time per year subject to certification in the State Sanitary Facilities and has accordingly a sanitary passport, including ID-number of the car, the name of the driver, provided with sanitary clothing. It is strictly prohibited to use this transport for linen, patients, equipment and so on.

Ready-made food is transported to the buffet of ward departments through underground corridor pathways in special thermoses, thermos-carts, in tightly closed containers, which immediately before filling are scalded with boiling water. Separate lift should be used for delivery of ready foods, which opens in the buffet-dispensing. Bread is allowed to be transported in plastic bags; however storage of bread in such is not allowed.

For the food transportation special transport that has a sanitary passport issued by the Sanitary Service is used. The shipping container must not have deformations; it must be clean, sealed and clearly marked. Long-term storage of food at nutrition units in hospitals is not used. Perishable products (meat, fish, gastronomy, cheese) are stored for no longer than 3 days, taking into account the terms of their implementation. Milk is delivered daily. Butter is prepared for no more than 10 days, eggs and vegetables (cabbage root vegetables) for 20 days, loose products for 30 days. Greens and fruits are not stored for a long time, they are delivered as they are used, having a stock of no more than 3 days. For fish storage, the most favorable temperature is - 2°C. At this temperature, frozen fish is stored for up to 5 days, the chilled one – for up to 2 days. Storage is carried out in the same container as it was received in.

If there is only one refrigerating chamber, the storage areas for meat, fish and dairy products in a closed container must be strictly delimited with the mandatory arrangement of easily washable shelves. Butter, as well as cheese, is stored separately in tare or with bars wrapped in parchment; do not store the open oil together with other odoriferous products. Eggs are stored in tare or laid out on trays.

Sanitary-hygienic regime of hospital nutrition units and kitchens

1. In nutrition units of health care institutions should be strictly observed:

- Requirements for the installation of the nutrition unit, sanitation and cooking technology, provided for by existing sanitary regulations for public nutritional establishments;
- Sanitary rules on the conditions and terms of storage and implementation of particularly perishable products;
- Requirements for mandatory preventive and medical examinations of the staff occupied in nutrition units, kitchen sections, transporting ready foods.

Distribution of ready food in ward departments. All first and second dishes must be on a hot plate for no more than 2 hours. Storage of ready to use food in the kitchen is not allowed; cooking period should be timed to comply with the time of its distribution. Distribution of finished food is made no later than 2 hours after its preparation, including the time required for delivery of the food to a department.

According to the order of Ministry of Health of Russian Federation №330 from 08.05.2003, control of ready food just before its distribution is made by the doctor on duty and once a month by the head physician or its assistant on medical work, and carried out as well by dietitian, dietary nurse, chief cook regardless of responsibilities of the doctor on duty.

The purpose of food probing is to define culinary readiness and goodness of food. The quality of ready meals is evaluated by organoleptic criteria: appearance, color, smell, taste. First, examine the dish having weakest smell and taste (eggs, cereals, soups), and then the dishes, the smell of which is expressed clearly. Sweet dishes are tasted last.

In case violation of cooking technologies found, and if the dish is not ready for usage, its distribution is not allowed until the shortcomings revealed are completely removed.

In order to control the goodness and safety of ready food in nutrition unit all daily samples of finished food are left daily in the amount of one serving or 100–150 g of each dish, placed in a clean, boiled for 15 minutes, labeled and lid equipped cookware, which are stored in a separate refrigerator for 48 hours at the temperature range of +2 to +6°C. In the case of food poisoning the samples are sent to the laboratory for analysis.

At the time of ready food distribution certain temperature of the dishes must be mainteined: first dishes – no less than 75°C, second dishes not lower than 65°C, cold dishes and drinks – from 7 to 14°C.

A buffet of ward departments should have two rooms: for the distribution of food (at least 9 m^2) and for washing of dishes (at least 6 m^2). In other words the buffet area should be divided into "pure" (preparation and distribution of food) and "dirty" (washing of dishes) zones, divided by a glass partition, having a window for the transmission of disinfected tableware to the "clean" zone.

The total area of the buffet, calculated per 1 ward section, must be no less than 14 m²; for 2 sections - 22 m², at least 18 m². The buffet must have a sink for hand washing.

Ready food should arrive to the buffet no earlier than half an hour before its distribution to patients.

In the buffet the food, if necessary, should be heated, distributed into portions and given to a patient in the dining room. Dishes should be beautifully decorated and have a certain temperature: hot first dishes (except for diets that require soft thermal conditions) - 75°C, the second dishes - 65°C.

Distribution of ready dishes to patients is made by the buffet staff and the nurses on duty. Distribution of food should only be carried out in a dressing gown marked "For Food Distribution Only". Unfolding of servings on plates should be done using spatulas, forks and spoons, while doing the same with hands is not allowed. Technical personnel engaged in cleaning of rooms in the department are not allowed to distribute ready foods.

The persons, responsible for the observance of sanitary requirements when preparing and releasing ready meals in nutrition unit, are: the chief-cook, dietary nurse, dietician; in departments – the buffet staff and senior nurse.

Due to additional processing requirements for special dietary food cooking (crushing, rubbing), such ready meals are a favorable environment for the development of pathogenic microorganisms. Particular attention in this regard should be paid to the time of realization of ready meals. In the buffet food should not be stored for more than 2 hours, vegetable dishes - not more than 1 hour, including the time spent on the delivery of food. After this time, the food should be subjected to a heat treatment, the liquid food and sauces are to be heated to boiling.

Never leave the food remained in the buffet after its distribution to patients, as well as food waste should never be mixed with fresh dishes.

Today, more and more medical institutions are switching to the system of tablet-nutrition. This technology is the provision of patients with ready-made portraits of dishes, a set of which is formed in the nutrition unit. On transport trolleys the hospital staff delivers the tablet-food to the department where the patients are housed. Together with the carts, trays (Fig. 8-9) are used that preserve the heat of the cooked dishes, which makes it possible to deliver the food hot even after a long time. At the same time, the dishes on the thermal tray are securely isolated from each other, which ensure the desired temperature of the food delivery - the hot ones are served hot, and the cold ones remain cold. Washing of the dishes,

used in the system of tablet-nutrition, is done in dishwashers with disinfection.

This technology of nutrition has a lot of advantages. First of all, indoor hospital area is saved, since it is not necessary to allocate a separate room (buffet) for eating of patients. It's enough to have room, where the dishes are prepared (Fig. 9). In addition, equipment for the organization of tablet-feeding allows you to more accurately plan the purchase of raw products, because the basis of the tablet-nutrition is a strict control of the food portioning. This advantage allows you to optimize the cost of food. Thanks to the system of tablet nutrition, it is much easier to organize an individual menu, taking into account the recommended diet of the patient, his religious prohibitions, etc. Tablet-nutrition system is automation of cooking processes in a hospital. The technology has proved itself to be reliable and is used by clinics around the world, answering the international standard of nutrition quality.

The buffet must be equipped with electric boilers, wash tubs (at least 2) for rinsing and drying of dishes, electric stoves to heat food, refrigerators, cabinets for storage of tableware, appliances and products (bread, salt, sugar), tables for the distribution of food, set of dishes (per 1 patient: one deep, shallow and dessert plates, forks, teaspoons).

Washing baths should be supplied with hot and cold water, sewage from the jet break of at least 20 mm from the upper edge of the hopper.

A buffet must have a stock with detergents and disinfectants, cleaning equipment (bucket, a rag, a brush, and so on), which marked "For the Buffet". In the washing room there must be instructions attached on the wall about the rules of washing dishes and inventory with indications of the concentrations and volumes of the detergents and disinfectants used.

Dining rooms are designed to receive at the same time of 50-60% of the patients, being on treatment in the ward department. In postnatal physiological, tuberculosis, psychiatric and rehabilitation treatment wards the number of seats in the dining rooms of up to 80% of the number of beds. Area of 1 seat in hospital rehabilitation treatment – 2.5 m², in other hospitals – 1.5 m², but not less than 1.2 m². One dining room may serve for 2 ward section of department. Dry cleaning is produced after each meal in the buffet and dining room.

Figure 8. *Tray for tablet-nutrition*

Figure 9. *Production of tablet-nutrition dishes in hospital nutrition unit*

Tableware is washed immediately after use, taking into account its purpose and degree of pollution. Firstly cups (glasses) and teaspoons are washed, then plates, then spoons and forks. Tableware processing is carried out in the following order: mechanical removal of food remnants and the first washing with fat removing agents, then rinse with hot water, then

the second washing, then finally drying of dishes on special shelves or gratings.

Disinfection of dishes is held in infectious departments with chemical or thermal treatment (boiling, handling in dry air sterilizer, etc), as well as disinfecting of food remnants from the patients by the special procedures, prescribed for the respective infections.

After the work brushes for dish washing and cloth for wiping of tables are washed with degreasers, then disinfected (after chemical disinfection they are washed with running water), dried and stored in a dedicated place.

Personal food of patients (brought from home) is stored in a cabinet or bedside table (dry food only), whereas the perishable food is kept in a special refrigerated cabinet. At the hospital admission board and in ward departments there should be posted lists of personal foods and wares allowed for bringing into hospital (with their marginal amount).

In ward departments the nurse on duty daily verifies the food stored in the department refrigerator cabinet as to compliance with the rules and shelf life of food storage. If there is food in the refrigerator found to be expired, stored without packaging or without label with the name of the patient, as well as, in case the food is showing signs of damage, such foods must be withdrawn immediately and sent to waste. Patient coming in hospital for treatment should be informed on the rules of personal food storage.

In case if you intend to provide medical care for children under the age of 1 year then divisions for children are provided with facilities for the preparation and bottling of infant formula.

In the hospitals with short-term daytime residence of patients (no more than 4 hours), when hot meals are not supposed, food heating room may be provided (with sink, fridge and food heating equipment). You can use then disposable utensils.

Washing modes of kitchen tableware. Washing of a cookware is made manually in whole-metal of stainless steel baths starting from mechanical removal of food remnants. Cookware, specifically small equipment (boards, knives, mixers), given removed from food residues are washed in two baths: first in hot water (50ºC) with addition of a detergent, then rinsed with hot water (of no less than 65ºC), and dried on grid shelves upside down.

Cutting tables, chopping blocks after work are cleaned and washed with hot water and a detergent. The chopping block is then poured with

salt and closed with the cover. All metal equipment at the end of the work are washed in warm water, rinsed with boiling water, then dried, and stored covered. Those parts of machines, coming into contact with food are rinsed with boiling water before use.

For manual washing of tableware three-section sink is used for plates and two-section sink for tea ware with hot and cold water provided. The process of tableware washing is carried out in several consequent stages: 1) mechanical removal of food residues; 2) brush washing in the first slot of the sink in hot water (50°C) with degreasing agents (1% solution of soda ash or trisodium phosphate; 5% solution "Progress" - 1 tablespoon per 1 L of water, etc). 3) utensils disinfection by immersion in 0.5% solution of chloramines for 30 minutes or by boiling in a metal tank during 15-30 minutes. Such processing of utensils is done in case of epidemiological indications, as well as routinely after the end of a working day; 4) rinsing in hot running water (65ºC). Dishes then are placed in a wire basket and washed under hot running water for 2-3 minutes; 5) drying. Cleaned and disinfected plates are placed on shelves, hot dishes get dry quickly. Never dry dishes with a towel.

When processing the tea ware firstly they carry out mechanical removal of food remnants. Then immerse the cups etc. in a solution with degreasers and disinfectants; then the ware is rinsed with running hot water and dried.

The washing rags after usage are soaked in 0.5% bleach or 1% chloramines solution for 60 minutes or boiled for 15 minutes, then rinsed, dried and stored in a designated location. The floor cleaning equipment after usage is poured with disinfectant solutions of the same concentration and kept for 60 minutes in the same buckets having been used for floor cleaning, then rinsed in running water and dried.

Health and personal hygiene of the catering staff. The main purpose of medical examination of the staff is a health care and the prevention of admission to work with foods of those workers that are sick or bacteria carriers, and thus can be a source of infectious diseases or food poisoning.

The individuals who were hired to work in hospital nutrition service, supposed to be in contact with food, dishes, tableware, equipment, etc. are subject to medical examination. Prior to joining the catering staff shall be checked for carrying of agents of acute intestinal diseases and tuberculosis.

The usual survey includes mandatory examination by physician, gynecologist, dermatologist; laboratory tests for syphilis and gonorrhea (once

every 3 months), fluoroscopy (once per year); tests for helminthes infections and bacterial carrying (the group of intestinal infections). Results of the medical examinations and laboratory tests are entered in personal medical records of the staff.

Further routine medical examination is carried out once per 3 month while check for bacterial carrying and helminthes infection is done in accordance with the regulations approved by the local Service on Sanitary Surveillance. Examination for tuberculosis is done annually.

People, recovering from typhoid fever, dysentery, people proved to be carriers of these pathogens; the patients with active forms of pulmonary tuberculosis; with extra pulmonary tuberculosis (affecting bones, joints, etc.); those having fistulas, skin pustules, venereal or skin infectious diseases (scabies, and others); the persons who were found to be carriers of pinworm or dwarf tapeworm eggs are not admitted to work. Those suffering from other forms of helminthes-caused diseases are actively treated without job withdrawal.

Persons identified as the bacterial carriers or being recovered from intestinal infectious diseases are admitted to work only having been provided with three time consequent bacteriological tests with negative results.

Those workers having been at home or at the working place in contact with the persons known to be bacterial carriers of typhoid, paratyphoid, dysentery, viral hepatitis, other intestinal infectious diseases, must be withdrawn from work and may be admitted to work in nutrition unit only having been provided with the certificate of hospitalization and special medical tests done.

All catering staff may be admitted to work only having been certified on the sanitary minimum.

All employees of catering service shall use protective clothing, replaced on a regular basis and stored separately from outdoor clothing.

Catering staff must comply with the rules of personal hygiene: 1) to keep clean the skin of the body and hands; 2) to keep clean the sanitary and personal clothing; 3) comply with the sanitary and hygienic regime during fulfillment of the work.

Before working, one should take a shower, put on clean sanitary clothing wash hands thoroughly with soap and brush, ensuring purity of nails, pick up hair under a cap or scarf and then rinse hands.

It is necessary to wash hands when switching from one type of work to another, after a visit to the lavatory, and so on. A visit to the lavatory in

special sanitary clothing is prohibited. After a visit of the lavatory hands should be washed with soap and brush and disinfected with 0.2% bleach solution. When leaving the kitchen the sanitary clothing should be put off and be put on again after return. The cook before the distribution of food should put clean clothes on.

In the water closets the elbow switching water taps for hand washing are used for a catering staff, also the toilet cisterns are equipped with pedal devices.

Below there is a list of documentation used in nutrition units and fixing the records concerning prescription of nutrition for patients, control over the quality of the ready foods, state of health of the staff, etc.:

- List of the diets prescribed (form № 1-84).
- Summary information on the patients on meals.
- Ready food distribution list.
- Nomenclature of dishes – dish cards (form № 1-85).
- Menu-list for the dishes to be cooked.
- Personal medical record book for the catering staff.
- "Health" record book for daily inspection of the catering personnel for the presence of skin pustulas, angina, etc.
- Record book on C-vitaminization of ready meals.
- Record book on the quality control of finished foods.

PRACTICAL PART

SITUATIONAL PROBLEMS

Problem 1. When examining the hospital catering unit, it was found that the following perishable products were found in the refrigerator on the shelves: milk in packs, frozen fish, large-lump meat, cooked sausage and liver, uneaten poultry (chicken), duck meat, pickled cucumbers.

1. *List the products, which are prohibited to take in hospital catering unit.*

Problem 2. For catering in the ward section, 30 patients of the therapeutic department are provided with a pantry and a dining room. The pantry area is 13 m^2, the dining room is 15 m^2.

1. *Assess the adequacy of the pantry and dining area.*

Problem 3. In the buffet room, washing of the tableware is done manually. After the mechanical removal of food residues, the dishes were immersed in a bath (socket) with hot water (95°C) and washed with the addition of a 1% solution of degreasing agent.

In the second bath, according to epidemiological indications, the dishes were disinfected by immersion in 1% chlorine solution. After rinsing the dishes in the third bath with cold water they were taken out and carefully wiped with a towel.

1. Evaluate how appropriate is the dish washing mode.

QUESTIONS FOR SELF-CONTROL

1. Responsibilities of a hospital dietitian.
2. Principle of sequential technological processes in the operation of a hospital nutrition unit.
3. Set and relative dislocation of the areas in a hospital nutrition unit.
4. Terms and conditions of food storage in a nutrition unit.
5. List of food products prohibited from taking in hospital nutrition unit.
6. Rules for distribution and transportation of ready foods in a hospital.
7. Modes of dish washing in a buffet.
8. Control over the state of health of the catering staff.

TEST TASKS

Choose one correct answer

1. PERIODICITY OF MEDICAL INSPECTION OF HOSPITAL CATERING STAFF CONCERNING SEPTIC DISEASES IN HEALTH CARE ORGANIZATIONS

1) daily
2) weekly
3) monthly
4) quarterly

2. PERMISSION FOR DELIVERY OF READY FOODS FROM THE CATERING INIT TO HOSPITAL DEPARTMENTS IS GIVEN BY

1) cook
2) dietician
3) head physician

4) the doctor on duty

3. THE FOOD PROBE RECORD BOOK IN HOSPITAL CATERING DEPARTMENT REFLECTS

1) list of dietary dishes

2) recipe for meals indicating the main nutrients and caloric content

3) information on the number of patients in the departments, which take food

4) results of organoleptic evaluation of dishes

4. READY FOODS SHOULD BE TAKEN FROM THE CATERING UNIT AND DELIVERED TO HOSPITAL DEPARTMENTS BY

1) nurses

2) senior nurses

3) ward department buffet staff

5. FOR THE MANUAL DISH WASHING IN THE BUFFET THERE SHOULD BE INSTALLED WASHING BATHS WITH THE NUMBER OF CELLS

1) 2

2) 3

3) 4

4) 5

ANSWERS TO TEST TASKS

1. Determination of human energy expenditure. Hygienic assessment of individual nutrition adequacy

No. 1	*No. 2*	*No. 3*	*No. 4*	*No. 5*	*No. 6*
2	1	4	3	3	2

2. Sanitary-hygienic examination of the quality of basic foods

No. 1	*No. 2*	*No. 3*	*No. 4*	*No. 5*
3	1	2	2	1

3. Study of vitamin-C content in certain foods

No. 1	*No. 2*	*No. 3*	*No. 4*	*No. 5*
3	1	1	3	1

4. Food poisoning and its prevention

No. 1	*No. 2*	*No. 3*	*No. 4*	*No. 5*
2	2	2	2	1

5. Hygienic requirements for hospital nutrition unit

No. 1	*No. 2*	*No. 3*	*No. 4*	*No. 5*
1	4	4	3	4

ANSWERS TO SITUATIONAL PROBLEMS

1. Determination of human energy expenditure. Hygienic assessment of individual nutrition adequacy

Problem 1

1. Caloric intake is 2048 kcal [(48 g protein×4 kcal)+(64 g fat×9 kcal)+(320 g carbohydrate×4 kcal)]. The actual caloric content of the student's diet is 802 kcal less than its energy expenditure.

2. Given the energy expenditure of 2850 kcal the norms for nutrients should be as follows:

- proteins – 14% of the daily caloric content, or 399 kcal/4 kcal=99.7 g;
- fats – 30% of daily calories, or 855 kcal/9 kcal=95 g;
- carbohydrates – 56% of daily caloric content, or 1596 kcal/4 kcal=399 g
- the norm for consumption of calcium – 1000 mg, phosphorus 800 mg, vitamin C – 90 mg.

Thus, the diet of the student is deficient in all the nutrients, mineral content and vitamin C.

3. The norm of the animal to total protein proportion should not be less than 55%, whereas in the diet of the student – 31.25%; the vegetable to total fat ratio should not be less than 25%, in the diet of the student – 31.25%. Thus both total and animal protein content is below the recommended ratios.

4. The normative ratio of proteins, fats and carbohydrates constitutes 1:1:4, the actual is: 1:1.3:6.7; normative ratio of calcium and phosphorus is 1:3; 1:5, the actual: 1:1.7.

Thus, the diet is unbalanced as to the ratio of the main nutrients, minerals, animal proteins.

Problem 2

Caloric value of 100 grams of bread contains: 7 grams of protein×4 cal=28 calories; 0.7 g of fat×9 kcal=6.3 calories; carbohydrates: 49.9×4 kcal=199.6 kcal. Total: 233.9 kcal.

Caloric content of 200 g of milk containing 2.8 g of protein in 100 g=2.8×2 (200 g)×4 calories=22.4 calories; 3.5 g of fat (100 g)=3.5×2 (200 g)×9 cal=63 calories; 4.5 g of carbohydrates per 100 g=4.5×2 (200 g)×4 calories=36 kcal. Total: 121.4 kcal.

Caloric content in 20 grams of cheese: 26.8 g of protein×4 kcal=107.2 kcal; divided by 5 (in the table the value is given per 100 g)=21.4 kcal; 27.3 g of fat×9 kcal=245.7 kcal/5=49.4 kcal; 1.8 g of carbohydrate×4 kcal=7.2 kcal/5=1.4 kcal. Total: 72.2 kcal.

Thus, caloric content of the student's lunch is 427.5 kcal.

Problem 3

1. 4-fold, which corresponds to hygienic recommendations.
2. Intervals between meals are ranged from 3 to 6 hours, the norm – no more than 5 hours.
3. The distribution of the caloric content across the meals was 15.9, 10.5, 21.0 and 52.6%. With 4 meals given the caloric distribution should be 20, 15, 45 and 20%, accordingly.

2. Sanitary-hygienic examination of the quality of basic foods

Problem 1

Low porosity of bread, as well as elevated humidity and acidity indicate a low quality of flour and violations of the technological process of bread baking. The product is conditionally good.

Problem 2

The milk is benign and usable without restriction.

Problem 3

Despite the fact that the organoleptic and physic-chemical parameters of the flour comply with hygienic regulations, the presence of pests in the flour makes it unsuitable to use.

3. Study of vitamin C content in certain foods

Problem 1

Discoloration time of the Tillman's reagent drop on the language in case of normal vitamin C content should be less than 23 s. Therefore, in the body of the student there is a deficiency of this vitamin.

Problem 2
Daily requirement for vitamin C for adults is 90 mg. The body would be supplied with 45 mg of the vitamin (50% of the daily need), if a person consumes 300 g of potatoes, because 100 g of boiled potato contains 15 mg of vitamin C.

Problem 3
After cooking of potatoes the content of vitamin C has decreased by 25%: 20 mg% – 100%; 15 mg% - X. Thus, X=75%. 100 – 75=25%.

4. Food poisoning and its prevention

Problem 1
1. Food poisoning of microbial nature, specifically bacterial toxicosis – botulism.
2. Canned homemade garlic.
3. Storing of the canned food at room temperature.

Problem 2
1. Food poisoning of microbial nature, specifically - staphylococcal toxicosis.
2. Possible source of the microbial agent caused the food poisoning – the cooker with arm abscess; the path of transmission – contact; factors of transmission: primary – septic content of the abscess; intermediate – equipment of the nutrition unit; the final – the cakes.
3. Daily inspection of the staff of the pastry shop for presence of pustular diseases of the skin; keeping off the work of staff persons with skin lesions of hands, inflammatory diseases of the upper respiratory tract. Adherence to the recipe of making cream as sugar is a preservative agent. Observance of the proper temperature conditions (not above +2ºC) and terms of storage as to both semi-finished and ready foods.

Problem 3
1. Alimentary toxic aleukia (fusariotoxins).
2. Alimentary toxic aleukia is the result of eating of the foods made of grains overwintered in the field and infected by fungi of the genus Fusarium.

3. Prevention is in the timely harvesting of wheat and withdrawal from further economic implementation of the grain overwintered in a field.

5. Hygienic requirements for hospital nutrition unit

Problem 1
According to the requirements of SanPiN 2.1.3.1375-02, in order to prevent the emergence of infectious diseases and food poisoning among patients, it is not allowed to take in a hospital nutrition unit liver sausages, ungutted bird, duck, home canning cucumbers.

Problem 2
Pantry area should be not less than 14 m^2; kitchen area is calculated as not less than 1.2 m^2 per seat. The number of seats is calculated as 50-60% of the patients in the ward section. Thus, the dining room area needs to be 18-21.6 m^2.

Problem 3
The violations of dishwashing were as follows: if you are rinsing utensils in the third bath, the water temperature should be no lower than 65ºC; it is prohibited to wipe the dishes with a towel.

RECOMMENDED READING

1. Guide to practical lessons on hygiene: Tutorial: in 2 parts. Part I: / L.P. Volkotrub, T.V. Andropova, O.V. Safronova. - Tomsk: Siberian State Medical University, 2013. - 285 p.
2. Hygiene: Textbook for students of medical faculties of medical universities / ed. G.I. Rumyantsev. - M.: GEOTAR Medicine, 2005. - 608 p.
3. Hygiene with the basics of human ecology: Textbook for students of higher professional education, trained in specialties 060101.65 "Medicine", 0601104.65 "Medical Prevention" in the discipline "Hygiene with the basics of human ecology. Military hygiene"/ ed. P.I. Melnichenko. - M.: GEOTAR-Media, 2010. - 752 p.
4. Mazaev V.T. Municipal hygiene: Textbook / V.T. Mazaev, M.M. Gimadeev, A.A. Korolev, T.G. Shlepnina / ed. V.T. Mazaeva. - M.: GEOTAR-Media, 2006. - Part 2. - 336 p.
5. MR 2.3.1.1915-04. Methodical recommendations "Recommended amounts of consumption of food and biologically active substances".
6. Norms of physiological needs in energy and nutrients for various groups of the population of Russian Federation. MR 2.3.1.24.32-08.
7. Nutrient Value of Some Common Foods. The Minister of Health Canada, 2008. Access online: https://www.canada.ca/content/dam/hc-sc/migration/hc-sc/fn-an/alt_formats/pdf/nutrition/fiche-nutri-data/nvscf-vnqau-eng.pdf
8. Order of the Ministry of Health of Russian Federation of 5.08.2003, No. 330 "On efforts for improvement of therapeutic nutrition in health care institutions of Russian Federation".
9. Pivovarov Yu.P. Hygiene with the basics of human ecology: Textbook for students of medical faculties of medical universities / Yu.P. Pivovarov, V.V. Korolik, L.S. Zinevich. - Rostov-on-Don: Phoenix, 2004. - 512 p.
10. SanPiN 2.1.3.1375-03. Sanitary-epidemiological rules and standards "Hygienic requirements for safety and nutritional value of food products".
11. SanPiN 2.1.3.2630-10. Sanitary-epidemiological rules and standards "Sanitary-epidemiological requirements for organizations engaged in medical activities".
12. SanPiN 2.3.2.1324-03. Sanitary-epidemiological rules and standards "Hygienic requirements for shelf life and food storage".

13. SP 2.2.6.1066-01. Sanitary and epidemiological requirements to trade organizations and turnover in them of food products and raw food materials.
14. SP 2.3.6.1079-01. Sanitary and epidemiological requirements to organization of public catering, manufacturing and turnover of food products and raw food materials.

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FOOD HYGIENE

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