Lecture 8.

Nutrition as a factor of health. Biosafety in food hygiene.

The topic basis:

Hygiene of nutrition is the section of hygiene studying influence on an organism of the person factors, connected to nutrition and developing recommendations for a balanced diet. The part of hygiene of nutrition NUTRICIOLOGY is a science about nutrients (food substances). On the data the WHO about 70 % all diseases directly or are indirectly caused by a wrong nutrition or infringements quality of foodstuffs.

THE BASIC SECTIONS HYGIENE of a NUTRITION
- Balanced diet is the nutrition for the healthy person for preservation and strengthening health;
- Medical or dietary nutrition is the nutrition for treatment ill patients;
- Treatment-and-prophylactic nutrition is special diets for working in harmful conditions such as chemical substances, radiation etc.
- Preventive nutrition is the nutrition for people with risk development of disease factors (an atherosclerosis, a diabetes etc.)

CLASSIFICATION ALIMENTARY and ALIMENTARY-CAUSED DISEASES
1. Initial (exogenic) alimentary diseases. They are connected with insufficient or surplus nutrients or energy in diet. The main feature of them is what aetiology, pathogenesis, the clinic, prevention and treatment are only connected to nutrition.
2. Secondary alimentary-caused diseases. They are caused by disease of organism and the systems, bringing to infringements digesting of nutrition, strengthening disintegration and expense nutrients. They are infectious, surgical, oncogenous illnesses; endogenic avitaminosises, cerebral, endocrine adiposity or a dystrophy.

The differentiation between 1 and 2 groups is very important for the doctor, because tactics of treatment is completely various: in the first group it is only correction of nutrition, in the second it is treatment initial disease plus dietetic therapy application biologically active additives (BAA).
3. The diseases multicomponent aetiology, including the alimentary factor. They develop on a background of genetic predisposition, the nervous-emotional reasons and other factors: an atherosclerosis, a hypertension, urine-stone and gallstone illness, a gout, gastric diseases, oncopathology, a diabetes. In occurrence these diseases nutrition is a risk factor, but not the unique reason. Preventive maintenance is preventive nutrition, dietetic therapy at the developed pathology.
4. The diseases connected to presence in food of harmful factors. They are food poisonings, intestinal infections, and helminthisms. Prevention is quality of food products control.
5. Food intolerance is set clinical reactions to a food: a food allergy (immunopathology), a pseudo-allergy (individual reactions to separate substances), food idiocrasy owing to enzymopathies.

CLASSIFICATION ALIMENTARY DISEASES (1 group)
1. Illnesses and syndromes of an insufficient nutrition:
   1. Protein-power insufficiency (PPI) of different degree, alimentary marasmus, delay physical development owing to PPI.
   2. Albuminous insufficiency, including kwashiorkor.
   3. Avitaminosises.
   4. Mineral insufficiency is such as: iron-deficit anaemia, endemic craw (hypothyroidism), caries, hypozincosis, hyposelenosis etc.
2. Illnesses and syndromes of an excessive nutrition.
1 Surplus caloric content - alimentary adiposity 1-4 degrees.
2. Hypervitaminosises A and D.
4. Surplus mineral substances are dental and skeletal fluorosis, selenosis and molybdic gout.

**PRINCIPLES OF THE BALANCED DIET AND METHODS OF THE CONTROL THEIR OBSERVANCE**

Academician A. A. Pokrovski developed principles of the balanced diet in the USSR and they are now recommended the WHO for estimation correctness of an individual nutrition and nutrition of the population of the different countries. It is a scientific basis of hygiene of nutrition.

1. Conformity caloric content of nutrition to the daily energy allowance. The main principle - analysis begins with it by the control of nutrition.

**METHODS of the control:**

Caloric content of nutrition is determined:

- a) A table-settlement way (in view of a diet and under tables of food value of products) with the help of calorimetric factors.

  **Calorimetric factors of nutrients:** 1g proteins and carbohydrates = 4 Kcal, 1g fats = 9 Kcal. Proteins give 14 % daily calories, fats give 30 %, carbohydrates give 56 %.

- b) Laboratory - burning 100 g food product in a calorimetric bomb.

**Daily energy allowance.** Consists from the basic exchange + energy allowance for work + 10 % from the basic exchange on digestion feed.

- The basic exchange pays off under tables on a sex, age, growth and weight.

  **Ways definition energy allowance for work:**
  
a) Table-chronometric method (on time performance of any activity),
  b) Direct calorimetry (in the calorimetric chamber)
  c) Indirect calorimetry (on respiratory factor = 0.2/C0.2)

2. BALANCE of nutrients. The diet should contain all necessary nutrients: proteins, fats, carbohydrates, vitamins, and mineral substances in an optimum ratio. It provides the best absorb and high-grade use of food substances. Examples of balance:

- Ratio proteins: fats: carbohydrates (P:F:C) = 1:1:4 (the adult person), 1:1:5 (heavy physical work), 1:0,8:3 (older persons), 1:1:3 (children).

- Ratio between proteins: animals 60 %, vegetative 40 %,
  Ratio between fats: animals 70-80 %, vegetative 20-30 %
  Ratio between carbohydrates: the unprotected 10-15 %, protected 85-90 %.
  Ratio Ca: P= 1:1,5 etc.

**Ways of the control:** a) table-settlement, b) laboratory (proteins in products are determined on Keildal, fats - on Sokslet).

3. Optimum regimen of diet. The food should be accepted in 4-5 hour (time evacuation function stomach), t.i. 4-5 once a day. Reception feed less, than in 2 hours it is not optimum - gastric secretion is oppressed. Nutrition is harmful less 3-4 time- in view of the big appetite the person eats plenty feed - hypercholesterolemia, hyperlipemia, adiposity etc.

Importance receptions of food in same time + (-) 30 minutes - maintenance conditioned reflex activity of digestion. Recommended distribution daily caloric content on receptions of food is:

- Breakfast - 25-27 %, 2-nd breakfast 10-15 %, dinner 35-45 %, supper 10-20 %.

**WAYS of the CONTROL are:** questioning about a diet and settlement definition of caloric content of each reception of food.

4. Good organoleptic properties of food, its high comprehensibility, favourable conditions reception food. It is maintenance of normal conditioned-reflex activity of digestion (Acad. I. P.
5. Safety nutrition in the chemical and epidemiological attitude. Absence in products chemical substances or microbes is higher than allowable levels - an opportunity food poisonings. Now it is very important principle in view of global pollution of biosphere by heavy metals, pesticides etc. Ways of the control: chemical and bacteriological analyses.

VALUE VARIOUS NUTRIENTS IN A NUTRITION. ROLE PROTEINS, FATS and CARBOHYDRATES IN ORGANISM.

STRUCTURE of FOODSTUFF:
1) **Nutrients** are proteins, fats, carbohydrates, vitamins, mineral substances and water.
2) **Not alimentary substances** are the substances giving to products organoleptic property (colour, smell etc.)
3) **Antialimentary substances** are antitrypsin (protein of wet eggs), antivitamins (ascorbinase, tiaminase), antiminerual substances (phytates, oxalates).
4) **Toxic substances:**
   a) **Inherent in products** is toxins of poisonous mushrooms, solanin in a potato etc.
   b) **Casually got pollutants from environment** are pesticides, heavy metals, dioxines etc.

ROLE of PROTEINS in NUTRITION

Proteins carry out many very important functions in an organism such as: structural is construction fabrics, protective (gamma-globulin etc.), regulative (hormones, enzymes), transport (haemoglobin of blood), energy (14 % daily caloricity).

Classification proteins by full value: high-grade and less high-grade.

Attributes of full value proteins:
1. Presence irreplaceable aminoacids must be in an optimum ratio. By this criterion proteins settle down in the following order: eggs, milk, meat, a fish, a soya, beans.
2. Good comprehensibility them are in an organism. There are 3 groups of proteins:
   a) Good comprehensibility is milk, fish;
   b) Average comprehensibility is meat, eggs (after thermal processing);
   c) Bad comprehensibility is leguminous, bread, and mushrooms.
3. High biological value. After absorption the most part of irreplaceable aminoacids should be used on the main functions of proteins, except for energy.

ROLE FATS in a NUTRITION

Structure of food fats is: neutral fats (ether glycerine and fat acids), fat-like substances such as phosphatides, mineral substances, fat-soluble vitamins (in some fats).

Functions of fats in nutrition are: power (30-32 % daily caloricity, 1g fat makes 9 Kcal), regulatory, plastic, protective (from mechanical and temperature influences) and flavouring.

VALUE OF CARBOHYDRATES IN A NUTRITION

Functions of carbohydrates are power function (56 % caloric content of a diet per day), regulatory (cellular tissue stimulates a motility and secretion of intestines), plastic (they enter in structure of protoplasm and cellular membranes), protective (they connect with heavy metals, cholesterol; glucose inactive cyanide poisons), flavouring (sweet taste).

1. Classification of carbohydrates.
   Chemistry classification is on mono-, di-, polysaccharides.
   In hygiene they share on a degree of digestingting:
   1) The unprotected (refined) carbohydrates.
   2) Protected
   3) Superprotected: a) cellular tissue, b) pectinaceous substances.
**VALUE VITAMINS AND MINERAL SUBSTANCES IN A NUTRITION**

**VALUE VITAMINS IN A NUTRITION**

**Vitamins** are low-molecular organic substances, what are biologically active in very small amounts.

Functions of vitamins: a) regulatory (they form enzymes and adjust in metabolism), b) protective (they raise resistance an organism to the adverse climatic factors, harmful physical and chemical influences, infections etc. (vitamin C - antioxidant).

**CLASSIFICATION VITAMINS:**

a) Water-soluble - C, group B, PP, etc.
b) Fat-soluble - A, D, E, K
c) vitamin-like substances such as: inozit B₈, cholin B₄, orotovic acid B₁₃, pangamic acid B₁₅, etc.

The factors influencing at vitamins requirement of an organism:

**Exogenic:**
- A psycho-emotional and physical overstrain
- Work at high and low temperature
- Work in mines, on Far North
- At contact to industrial poisons, at reception medicines (antibiotics)
- At work with radiation, noise, vibration,
- Smoking
- Seasonal fluctuations - there are not enough vitamins in a diet in the winter and in the spring.

**Endogenic:**
- Age,
- Pregnancy and lactation
- Infectious diseases
- Endocrine diseases - hyperthyroidism – it is strengthening metabolism in an organism
- Intestinal diseases-infringement absorption vitamins

**VALUE OF MINERAL SUBSTANCES IN A NUTRITION**

It is known about 50 elements, which are present in an organism, 26 of them are necessary, thus 12 of them are macroelements, 14 are microelements.

Classification is under the contents in fabrics more than 10 mg / kg (1mg%):
- Macroelements are Ca (calcium), Na (sodium), K (potassium), Mg (magnesium), P (phosphorus), sulphur, chlorine etc.,
- Microelements are iodine, iron, zinc, copper, cobalt, manganese etc.

Functions are regulatory (in themselves and in structure of enzymes), protective (Ca), plastic (Ca, phosphorus etc.).

**FOOD POISONINGS. THE REASONS, CLINIC, PREVENTION.**

Food poisonings - non-contagious, are more often the sharp and mass diseases, caused by the use of substandard food, containing microorganisms or toxins of a various origin.

**CLASSIFICATION FOOD POISONINGS:**

1. Microbe aetiology.
2. Not microbe aetiology.
3. Micotoxicoses.
4. Food poisonings not investigated aetiology.

**FOOD POISONINGS MICROBE AETIOLOGY:**

1. Toxicoinfections are caused by hit in an organism food, containing the alive microorganisms making in organism toxins. Specific activators are salmonelllas, potentially
pathogenic microbes such as intestinal stick (E. Coli), Proteus, etc.

2. **Bacterial toxicoses** (the old name - food intoxications) arise at hit in organism products, containing bacterial toxins. Representatives are staphylococcal toxicosis, botulism.

3. **Mixed aetiology** diseases when in food are both alive microbes and bacterial toxins - for example, salmonellas + staphylococcal toxin.

**TOXICOINFECTIONS.**

Product sources: meat products, especially forcemeat, eggs, fish, lactic products.

Conditions when products become dangerous for Toxicoinfections:
1) The reasons of hit activators in products:
a) Using ill and tired animals, wrong cutting animal carcass,
b) Wrong storage and transportation products, processing of crude and ready products on one board, one knife etc.,
c) Non-observance by the personnel food objects rules of personal hygiene, absence regular physical examinations of the personnel, attraction to work casual people,
2) The reasons of duplication and preservation activators in products:
a) Wrong storage - non-observance temperature and terms of realisation,
b) Insufficient thermal processing

Clinic of Toxicoinfections. There are 5 clinical forms:
1) Gastroenteritic form, 2) Typhoid form, 3) Choleric form, 4) Dysentery form, 5) Grippe form.

The main causes of Toxicoinfections

Sources of infectivity of food products
1. Sick animal
2. Polluted water
3. Polluted utensils
4. Polluted equipment
5. Polluted apparatus
6. Polluted transport
7. Polluted rooms of food department
8. Infected food products
9. Carriers of bacilli: man, cast, dogs, poultry
10. Carriers of microbes - flies, etc.
11. Non-observance of the rules of personal hygiene

Disturbances of technological processes in food cooking
1. Insufficient thermal treatment of food products (meat, fish and so on).
2. Insufficient sterilisation of tinned food.
3. Insufficient pasteurisation.
4. A small quantity of preservative (antiseptics, sugar, vinegar, salt and others).

Disturbances of sanitary and hygienic conditions of storing and realisation of food products
1. Delay in realisation of ready food storing.
2. Storing of ready food.
3. Under high temperature conditions.
4. Storing of boiled food in thick layers.

Prevention of Toxicoinfections.
Elimination the reasons of hit and duplication activators of Toxicoinfections in products (see higher).

**BACTERIAL TOXICOSES**
Group of food poisonings microbe aetiology caused by the microbe toxins, which have collected in products.

1) **Staphylococcal toxicosis.**
The reason is golden staphylococcus it is capable to produce exotoxin in feed. Products are as sources: dairy products, creams, pies, cakes, dairy, fish and meat products.

Conditions of hit staphylococcus and forming by it toxin in products:
a) Staphylococcal diseases of the personnel of eating establishments -quinsy, pustular diseases of a skin of hands,
b) Wrong storage - at room temperature, non-observance terms of realisation.

Clinic: gastroenteritis at high temperature, diarrhoea seldom, in heavy cases - infringement cardiac system, dehydration of organism.

Prevention: physical examinations the personnel correct storage products, it is especial for cakes and pies in a hot season.

2) **BOTULISM**
The reason is formation in food product exotoxin of botulinum stick - Clostridium botulinum. Features of the activator:
a) Spore-making - spores maintain boiling 4-5 hours, (in the vegetative form - only 15 minutes), maintain action preservatives - salts, vinegar, sugar long time,
b) Obligate anaerobe microbe - develops without access of oxygen (canned food),
c) Under certain conditions (+ 10 - + 30° C without oxygen) is formed the strongest neurotropic exotoxin - a fatal doze for person 35 micrograms.

Products are as sources: earlier in Germany in 19 century - cooked and blood sausages ("sausage poison"), dry-cured and cold smoked fish, now it is especial frequently - canned food (mushroom, vegetable domestic preparation - it is difficult to destroy spores in domestic conditions), sometimes - dry-cured and smoked meat, a canned meat.

Clinic of botulism.
Toxin amazes central nervous system - in oblong brain-nucleus skull-brain nerves. Are amazed more often:
- Nucleus of nerve oculomotorius - squint, ptosis, anisocoria, frustration of accommodation,
- Nucleus of an optic nerve - fog, "grid" before eyes,
- Nucleus of glossopharyngeal and hypoglossal nerve - infringements of speech up to aphonia, infringements of swallowing,
- Nucleus of facial nerve - disappearance tonus of mimic and chewing muscles,
- Nucleus of vagus nerve - increase pulse at the normal or lowered temperature, defecation is normal or propensity to locks (as against other microbe food poisonings!).

Then are spasms, pains in muscles, defeat vessel, respiratory centres of central nervous system - death. The mortality at not treatment botulism is up to 70 %, at treatment - up to 30 %.

Treatment of botulism.
This is introduction of antibotulinic serum or antitoxin (doze at once 15000 IU, repetition in doze 5000 IU in 5 hours). At the use suspicious product preventive doze is 2000 IU.

Prevention of botulism.
Strict observance temperature technology preparation canned food, dry-cured fishes, and meat. Domestic conservation - in small banks at long time of boiling, storage canned food at temperature less than 10 degrees.

**FOOD POISONINGS NOT MICROBE AETIOLOGY.**
1. **Poisonings with poisonous mushrooms.**
Between many mushrooms, which people can collect in forests, some kinds are very poisonous and can give heavy intoxication.
Poisoning by Amanita phalloides.
Contains amanitotoxin and amonitohemolysin. Block all kinds of metabolism, first of all carbohydrate and water. Sharp gastroenteritis is cholera-like diarrhoea - dehydration of organism - infringements of central nervous system and cardiac system (sharp falling the blood pressure). Hemolysis of erythrocytes is displayed pallor of skin and sharp hepatic insufficiency - jaundice of skin. Death is from collapse.

Poisoning by fly agaric (Amanita muscaria). Atypical appearance - sometimes mask under edible mushrooms. It contains muscarine what causes changes of nervous system. There are in clinic: gastroenteritis, perspiration, tearing and salivation, expansion of pupils. Defeat central nervous system as alcoholic poisoning. Death is from paralysis of the respiratory centre.

Prevention poisonings by poisonous mushrooms.
1) Acquaintance of the population to poisonous mushrooms by sanitary-educational work: lectures, conversations, and posters use mass media (radio, TV).
2) The control at the sale places (in the markets) - sale mushrooms must be only under the sanction of the sanitary medical assistant.

2. Poisonings by poisonous wild growing plants are most typical at children's age.
Reason is usage of plants with m-cholinolytics such as atropine, scopolamine - belladonna, and dope. On background of gastroenteritis - expansion of pupils (belladonna - the beautiful woman), spasm of accommodation (infringement of sight on close distance), dryness and reddening skin and mucous, hoarse voice, lock. At poisoning dope human is arisen hallucinations and oppression central nervous system (CNS). After recovery human may have the remote effects on CNS such as amnesia etc.

Prevention poisonings by poisonous plants.
1) Destruction it at territory of children's pre-school establishments.
2) Control children in parks. Sanitary educational work with tutors.

3. Poisonings with products sometimes or in part poisonous.
Solanine in potato. It is in growing and become green potatoes. It has irritating and haemolytic action. Gastroenteritis may be easy and average degree of weight.

Phasin in string beans. Its toxin gives irritation and hemagglutination action. Destruction toxin may be at long thermal processing. In case of this food poisoning gastroenteritis are easy and average degree of weight.

Amygdalin in stone fruits. Most of all are in bitter almonds, in stones of apricots, peaches, cherries etc. In an organism breaks up with allocation prussic acid - blockade of fabric breath. In heavy cases it may be loss of consciousness, short wind, plentiful vomiting, diarrhoea, spasms, death in 2-9 hours from paralysis of the respiratory centre.

4. Poisonings by heavy metals. The reasons are:
a) From utensils (the zinc buckets, copper utensils, glaze on pottery),
b) From the ground polluted with heavy metal lead (about highways)

Zinc and copper (cuprum). Basically act from utensils at storage in it sour products. Not heavy gastroenteritis - in intestines are formed albuminates of copper and zinc - are not soaked up in organism - ulcerating, irritating action at intestines.

Lead. It does from utensils (glaze) and ground. Poisonings are usually chronic. Clinic is lead triad: lead encephalopathy and polyneuritis, lead pains, lead border on gums. In blood - basophilic granularity in erythrocytes, reticulocytosis, increase contents of lead in blood and urine (more than 0.04 mg /1).

Prevention: a) hygienic standardisation heavy metals in products and the control observance maximum permissible concentration, b) prevention transition metals from container, utensils.
5. Food poisonings by agrochemicals.

5.1 Food poisonings by pesticides.

Pesticides are chemical means for protection plants from wreckers, illnesses and weeds. Without application of them is loss 50 % of crop. Their accumulation in products is sometimes possible above maximum permissible concentration and development poisonings.

The reasons accumulation pesticides in products:

a) Application the non-authorised preparations (very proof or toxic),
b) Excess the established norms of the charge or frequency rate of processing,
c) Non-observance term of expectation - time between last processing of plants and harvesting.

The clinic poisonings depends on group of pesticides - chlorine-organic, phosphorus-organic, carbamates, etc. They blockade enzymes such as cytochrome oxidase, cholinesterase).

5.2 Food poisonings by fertilisers.

Fertilisers - substances for increase productivity plants. Nitric fertilisers are most of all applied. Thus can collect in plants nitrates (salts of HNO₃) - in organism they are restored in nitrites (salts of HNO₃), connect with haemoglobin and make methemoglobin in blood (methemoglobinemia) and absence transport of oxygen in blood - in organism there is hypoxia. Are especially dangerous to children of first 3 months.

At high levels of nitrates in products can arise problem nitrozo-combinations (NS) - has cancerigenic effects.

6. Food poisonings by food additives.

More than 5000 chemical substances are now use as food additives – dyes, aromatics, emulgents, preservatives, flutters etc. Poisonings occur at application the non-authorised additives or excess their permissible amount.

Mycotoxicoses.

The food poisonings caused by toxins microscopic mould mushrooms on bakeries (grain, flour) at storage in crude conditions.

Ergotism. It is at hit in organism grain with ergot. Toxins are ergotoxine, ergotamine, and ergometrine. They cause spasm smooth, then they cause another muscles.

In clinic distinguish 3 forms:

a) Convulsive, b) Gangrenous, c) Mixed - combination of 1 and 2 forms.

Ergotism it is especially dangerous for pregnant - spasm of smooth muscles of uterus - abortions, premature birth.

Fusariotoxicosis. This is a poisoning with "drunk bread". Microscopic mould mushroom kind Fusarium graminearum. In clinic - gastroenteritis + defeat CNS as alcohol intoxication.

Alimentary toxic aleukia. Up to 1944 year it is "septic quinsy": microscopic mould mushroom sort Fusarium - develops in the grain, which has wintered under snow. Deep infringements of blood forming, leuko- and trombocytopenia. The main attribute is aleukia (in 1-2 weeks) sharp decreases leukocytes, increases lymphocytes. It is heavy necrotic quinsy and sepsis. Mortality is 50-80 %.

Aflotoxicoses. Microscopic mould mushroom Sort Aspergillis. On peanut and peanut flour, on grain, corn, nuts, rice at storage in damp conditions at the increased temperature. Cause heavy defeat of liver and have cancerigenic effect on liver - initial cancer of liver (earlier they are basically in Africa and Asia). Now they are often in Crimea and on South Ukraine (in conditions hot climate).

FOOD POISONINGS NOT INVESTIGATED AETHIOLOGY

Urov illness (Kashin - Beck illness). Now it is established, that it is hyperpolymicroelementosis (many strontium, manganese and fluorine in ground, water and feed). Endemic disease is registrated near the river Urova in Eastern Siberia and some other
territories on the Earth. In clinic it is deformation skeleton during growth, heavy exchange infringements.

**Gaffen illness.** Gaffen gulf in Holland. It is at use fish from some reservoirs in some periods. The official diagnosis is alimentary paroxysmal -toxic myoglobinuria. Attacks of sharp muscular pains + sharp renal insufficiency in view of Myoglobinemia. It is necessary hemodialysis.

**Poisoning with meat of female quail.** Sometimes it is gastroenteritis different degree of weight. The reason is not established.

**TACTICS OF THE DOCTOR AT SUSPICION ABOUT FOOD POISONING**

1. Statement the preliminary diagnosis on the basis:
   a) Gathering the food anamnesis at the victim or relatives,
   b) Clinic with characteristic symptoms
2. Rendering emergency medical service under vital indications -cardiacs, respiratory analeptics, etc.
3. Confirmation the diagnosis: gathering and sending in laboratory SES (department Hygiene of feed) with "Accompanying direction on laboratory investigating" the rests of food, washing waters of stomach, emetic weights, faeces, blood, urine.
4. Desintoxication therapy: washing stomach, plentiful drink, antibiotics, and droppers. At botulism it is necessary antibotulinic serum, antitoxin.
5. Prevention spreading flashes of food poisoning - "Emergency notice on food poisoning" - doctor send to SES and inform SES by the phone. After reception of the emergency notice doctors SES within 24 hours will carry out investigation of food poisoning - sanitary inspection public eating establishment, honey.
6. At the appropriate indications it is necessary hospitalisation patient in infectious department of hospital by first aid.