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NUTRITION

AZERBAIJAN MEDICAL UNIVERSITY
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NUTRITION

Theoretical and practical course

For foreign students

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THEORETICAL PART

1. Physiological and hygienic bases of nutrition

Nutrition is one of the most active and important factors the external environment, which provides a variety of effects on an organism of the body, provides his growth, development, health preservation, capacity for work and optimum life expectancy. Nutritionology the modern science that tells about nutrition.Nutritionology (from lat. nutritio - "nutrition" and Greek logos - "teaching, science") studies functional, metabolic, hygienic, clinical aspects of the interaction of nutrients and their effect on the body. Nutrition physiology concerned with different types of food and their effects on the metabolism. The importance of nutrition during growth, development, and ageing is appreciated both in animal husbandry and in human medicine. Moreover, it has become increasingly apparent that the health of the body depends on a healthy and functional gut and that many of today's common diseases, such as heart failure, stroke, cancer and diabetes, are related to gut function and to the diet. The physiological basis of nutrition - metabolism processes - dissimilation and assimilation, power inputs and their satisfaction, processes of growth and organism development. Nutrition physiology deals with how the body extracts the nutrients from the food, how we obtain the needed energy, how we utilize nutrients and how all this is related to health and disease. The aim of nutrition concern development of physiological-hygienic bases of ration nutrition for population

Nutrition is the science of food, the materials or nutrients in food, what they do and how they interact - all in relation to health. Proper nutrition is an important factor in health, and malnutrition is an important factor in the etiology of several of the major causes of death and disability in our contemporary society. Atherosclerotic vascular disease, hypertension, obesity, tooth decay, osteoporosis, diabetes, and cancer are common diseases in which nutrition is closely involved.

Nutrition - is the main biological need of the human. Concept about nutrition is a physiological human need, the processes of the physiological effect of foods, biochemical transformation and assimilability. Biological action of food on an organism is specific,

pharmacological, nonspecific, and protective. Wrong nutrition influences on development of an organism, lowers its protective forces, can cause many illnesses. Our bodies require constant supply of energy and raw materials to maintain vital functions and to rebuild cellular structures and tissues worn out in the day-today processes of living. In addition to calories, we need specific nutrients in our diet, such as proteins, vitamins, and minerals. It is possible to have excess food and still suffer from malnourishment, a nutritional imbalance caused by a lack of specific dietary components or an inability to absorb or utilize essential nutrients. Studying and rational correction of nutrition of the population is actual problem as the adequate balanced diet forms a basis of preventive maintenance of initial alimentary diseases and of alimentary caused somatic diseases.The author of the theory «the balanced food»-russian scientist A.A.Pokrovsky. Many kinds of functions of food (figure 1.1).

Physiological functions of food:

1. The first function of the food is to provide energy. The body needs energy to sustain the involuntary processes essential for continuance of life, to carry out professional, household and recreational activities, to convert food ingested into usable nutrients in the body, to grow and to keep warm. The energy needed is supplied by the oxidation of the foods consumed.

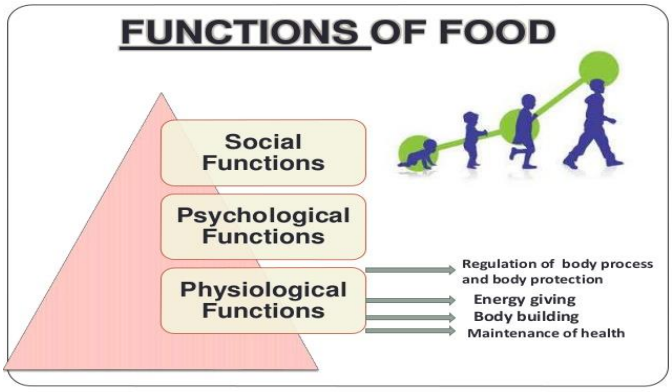


Figure 1.1. Maine functions of food

2. The foods we eat become a part of us. Thus, one of the most important functions of food is building the body. A newborn baby weighing 2.7-3.2 kg can grow to its potential adult size of 55-60 kg if the right kind and amounts of food are eaten from birth to adulthood. The food eaten

each day helps to maintain the structure of the adult body and to replace worn out cells of the body.

3. Third function of food is to regulate activities of the body.

4. Bioregulation-proteins, vitamins, microelements, polyunsaturated fats acids.

5. Adaptive regulation-dietary proteins, water.

6. Immuno-adjusting- irreplaceable for organism matters (the full-fledged proteins, vitamins and others).

7. Reconstructive – rehabilitating function- the foodstuffs of the dietetic feeding with reduced or raised by energy value, modification of carbohydrate component etc.

8. Signal-motivational function- gustatory and extractive matters (the spices, spicy vegetables, greenery.

These are required in varying amounts in different parts of the body for performing specific functions. This means that good nutrition is essential for good health. However, if our diet either provides the important units in incorrect amounts, very less or in excess of what is required, it results in an imbalance of nutrients in your body. The condition is responsible for various deficiency diseases and slow or no growth of the body. In this lesson you will learn about why food is essential, its functions and components.

The purposes of nutrition hygiene are as follows: to give a scientific foundation of sanitary legislation as far as the balanced diet is concerned; to study influence of nutrition on the population health (to carry out social hygienic monitoring); to give a scientific foundation of different types of nutrition: rational, medicinal, dietary, therapeutic, functional, sporting, children's nutrition, etc.);to maintain sanitary epidemiological watch over nutrition hygiene; to give a scientific foundation of nutrition safety and prophylaxis issues; to work out scientific fundamentals of hygienic education and training of the population in the field of the balanced diet.

The objectives of the state policy in the field of healthy nutrition are to keep and improve health of the population, prevent diseases caused by inadequate and unbalanced nutrition.

The main tasks of the state policy in the field of healthy nutrition are: expansion of domestic production of basic primary food products, meeting the modern requirements for quality and safety; development of production of food products enriched with essential components,

specialized baby food, functional food products, dietary (medical and preventive) food products and biologically active food additives, for organized nutrition as well (in the workplace, at educational institutions, etc.); development and implementation in agriculture and food industry of innovative technologies, including bio- and nanotechnologies; improving organized nutrition, ensuring adequate nutrition for pregnant and lactating women and children under the age of 3, by means of special feeding centers and stores, improving dietary nutrition (health and preventive) in health care facilities as an integral part of the treatment process; development of educational programs for different groups of population on healthy nutrition; monitoring nutritional status of the population.

The formula of the healthy diet, according to experts in food hygiene, represents the sum of three equally important components: economic means, a range of food products and the level of education in nutrition issues.

Nutrition may be defined as the science of food and its relationship to health. It is concerned primarily with the part played by nutrients in body growth, development and maintenance. The word nutrient or "food factor" is used for specific dietary constituents such as proteins, vitamins and minerals. Dietetics is the practical application of the principles of nutrition; it includes the planning of meals for the well and the sick. Good nutrition means, "maintaining a nutritional status that enables us to grow well and enjoy good health". Maintaining a healthy diet is the practice of making choices about what to eat with the intent of improving or maintaining good health. Usually this involves consuming necessary nutrients by eating the appropriate amounts from all of the food groups. Since human nutrition is complex, a healthy diet may vary widely subject to an individual's genetic makeup, environment, and health. For around 20% of the planet's population, lack of food and malnutrition are the main impediments to healthy eating.

Generally, a healthy diet will include:

1. Sufficient calories to maintain a person's metabolic and activity needs, but not so excessive as to result in fat storage greater than roughly 12% of body mass;

2. Sufficient fat, consisting mostly of mono- and polyunsaturated fats (avoiding saturated and "trans" fats) and with a balance of omega-6 and long-chain omega-3 lipids;

3. Sufficient essential amino acids ("complete protein") to provide cellular replenishment and transport proteins;

4. Essential micronutrients such as vitamins and certain minerals.

5. Avoiding directly poisonous (e.g. heavy metals) and carcinogenic (e.g. benzene) substances;

6. Avoiding foods contaminated by human pathogens (e.g. e. coli, tapeworm eggs);

7. Avoiding chronic high doses of certain foods that are benign or beneficial in small or occasional doses, such as foods or substances with directly toxic properties at high chronic doses (e.g. ethyl alcohol, vitamin A);foods that may interfere at high doses with other body processes (e.g. table salt); foods that may burden or exhaust normal functions (e.g. refined carbohydrates without adequate dietary fiber).

The Food Guide Pyramid. Good nutrition is important for everyone. The Food Guide Pyramid lists a range for number of servings in each of five food groups based on age, sex, and level of activity (figure 1.2.). Serving sizes are also specifically defined. Use the pyramid as an outline of what to eat each day. A food pyramid is a guide showing how different categories of foods should be utilized to achieve proper health. The foods at the base of the pyramid can be eaten more and those at the tip of the pyramid eaten in small amounts or sparingly. All of these types of foods shown in the pyramid should be eaten but foods at the bottom should be eaten most and those at the top more sparingly.

Figure 1.2. The Food Guide Pyramid

The small tip of the pyramid includes tats, oils, and sweets. These are foods such as salad dressing and cooking oils, butter and margarine, sugar, soft drinks, candy, and most dessert foods.

Foods in this section of the pyramid provide calories but have very little nutritional value. Use them sparingly. The next level of the pyramid contains two food groups that are predominantly animal products. Included in this section are milk, yogurt, cheese, meat, poultry, fish, dry beans, eggs, nuts, and nut butters. These roods are important for the protein, calcium, iron, and zinc they contribute to your diet. Choose skim or low-fat dairy products whenever possible, select lean cuts of meat and poultry without skin and prepare them without added seeds and nut butters are high in fat, so eat them in moderation. Vegetarians must to pay particular1 attention to eating a wide variety of non-animal protein foods to ensure a healthful diet.

The third level or the pyramid includes fruits and vegetables. Most people need to eat more of these foods for the abundance of vitamins, minerals, and fiber they supply. Plain varieties of frozen fruits and vegetables offer nutrition similar to that of fresh produce. Avoid canned or frozen fruits in heavy syrups or vegetables in cream sauce unless you can afford the extra fat and calories they provide.

The base of the pyramid includes breads, cereals, rice, and pasta – all foods from the grain group. You should eat more servings from the grain group than any other level of the pyramid. These nutrient-rich foods provide complex carbohydrates, vitamins, minerals, and fiber. Choose at least several servings each day of whole-grain breads and cereals. Remember that starchy foods are not fattening - unless you top them with butter, cream, cheese, or rich sauces and gravies.

Points to consider while planning a meal: family incomes and lifestyles; individual habits and preferences; nutritional/health status of target consumers; daily routines of family members such as work and school; availability of storage and cooking facilities; the occasion for which meals are required; food availability and season; nutritional needs of targeted consumers; time available for cooking; balance and variety in making food choices; type of fuel available for food preparation; meals are attractive and enjoyable; meals satisfy the appetite; meals are available when needed.

Main rules of rational (healthy) nutrition: eating fruits, vegetables, and grain products that contain fiber may help prevent heart disease; limiting the amount of saturated fat and cholesterol in your diet may reduce your risk of heart disease; limiting the amount of total fat you eat may help reduce your risk for cancer; eating fiber-containing grain products, fruits, and vegetables

may help prevent cancer; eating fruits and vegetables that are "low in fat" and "good sources" of dietary fiber, vitamin A, or vitamin C may help prevent cancer.

What is food? The term *"food"* brings to our mind countless images. We think of items not only that we eat and drink but also how we eat them and the places and people with whom we eat and drink. Food plays an important role in our lives and is closely associated with our existence.Food is anything liquid, semi-solid or solid which contains nutrients and energy and when taken or eaten nourishes the body. Food contains important substances, which provide energy to move, think, work, run our body systems, keep us healthy, help to boost our immune system and protect us from infections. When we eat or take food, our bodies absorb useful nutrients into the blood and they are transported to areas where they are needed or stored. Man needs a wide range of nutrients to perform various functions in the body and to lead a healthy life. The nutrients include proteins, fats, carbohydrates, vitamins and minerals. These nutrients are chemical substances, which are present in the food. Man needs all these nutrients, energy, proteins, vitamins, minerals in different amounts to grow, live and thrive. Since a man derives all the nutrients he needs through the diet, it should be well balanced to provide all the nutrients in proper proportions. While planning a diet for the community, foodstuffs have to be chosen in proper amounts to provide all the required nutrients and considering the dietary habits and availability of foodstuffs.

Nutrients - those components for which, in fact, consumed foods. Nutrients provide biological needs of the organism in the materials and energy, and the taste is not having usually a biological effect, provide certain organoleptic properties of food (its appearance, consistency, color, odor, taste, etc.).

Food products are complex set of chemical substances, comprising:

1) nutrients: proteins, fats, carbohydrates, vitamins, mineral salts; flavoring: organic acids, esters, ketones, dyes, tannins, aromatic compounds and others;

2) anti-nutrients: anti amino-acids; anti-minerals; anti-vitamins;

3) the additional substances (impurities) - residues of pesticides, radioactive substances, salts of heavy metals, nitrosamines, impurities of plant and other origin and others. (table 1.1.).

Table 1.1. Basic classification of foods according to their groups, source and function

<table>
<tr><th colspan="4">Energy-giving foods (carbohydrates and lipids) “GO” foods</th></tr>
<tr><th colspan="4">Carbohydrates</th></tr>
<tr><th colspan="2">Cereals</th><th>Roots</th><th>Starchy fruits and vegetables</th></tr>
<tr><td>WHOLE GRAINS
Millet
Sorghum flour
Whole wheat flour (brown)
Whole maize meal (brown)</td><td>WHOLE GRAINS
Cornflakes
White wheat flour
White maize meal
White rice
White bread</td><td>Cassava
Irish potatoes
Sweet potatoes
Yams</td><td>Matooke
Gonja (plantain)
Pumpkin</td></tr>
<tr><th colspan="2">Fats (solids) saturated</th><th colspan="2">Oils (liquids) unsaturated</th></tr>
<tr><td colspan="2">Animal source: Milk fat (ghee), butter, beef fat, chicken fat, pork fat (lard)
Plant source: Shea nut butter, margarine, kimbo, cowboy, coconut</td><td colspan="2">Plant source: Sunflower, soybean, corn/maize, cottonseed, sesame, groundnut, olive, sunflower and palm oil</td></tr>
<tr><th colspan="4">Body-building foods (proteins) “GROW” foods</th></tr>
<tr><th colspan="2">Animal Source</th><th colspan="2">Plant Source</th></tr>
<tr><td colspan="2">Meats: Beef, mulokony, lamb, pork, veal and game meat (e.g., rabbit, squirrel)
Organ meats: Liver, giblets, offal, kidney
Poultry: Chicken, duck, goose, quails, pigeons, guinea fowl (domesticated and wild/ game) and turkey, eggs
Fish: Silverfish (Makena), Nkejje, Nile perch, tilapia, mudfish, catfish, lungfish
Dairy products: Milk, cheese, sour milk, yoghurt
Edible insects: Grasshoppers, termites, white ants, crickets, bee larvae</td><td colspan="2">Beans and peas (pulses): chickpeas, pigeon peas, common beans, iron-rich beans, French beans, lentils, soybeans, white beans, peas
Processed soy products: soy milk, soy flour, roasted/fried soy snacks
Nuts and seeds: groundnuts, sesame seeds, cashew nuts</td></tr>
</table>

Protective (health-giving) foods (vitamins) "GLOW" foods	
Vegetables	**Fruits**
Dark green leafy vegetables: Spinach, Dodo/ amarantha, sukumawiki, cow pea leaves, pumpkin leaves, cassava leaves, field pea leaves, immature corn, green pea leaves, yam leaves, sweet potato leaves, broccoli, lettuce, hibiscus leaves (Malakwang) **Red and orange vegetables**: Carrots, pumpkin, red peppers, sweet potatoes, tomatoes, red amaranths, red hibiscus **Other vegetables**: Beet roots, cabbage, eggplant, cucumbers, cauliflower, green beans, green peppers, mushrooms, okra, onions, beans sprouts, celery, nswiga (Solanum species)	Bananas, pineapples, papaya (Paw paw), mangoes, guavas, oranges, jack fruit, tangerines, apples, custard fruit (Kitaferi), avocado, passion, orange, apple, melon, grapefruit **Wild fruits**: Tamarinds, berries, wild grapefruits

The food we eat or take is used for growth, maintenance and body functions. Classification of foods according to their functions

Foods may be classified according to their functions in the body:

a) Energy-giving foods-foods rich in carbohydrates and fats are called energy-giving foods or "GO" foods (figure 1.3.). They provide energy to the body and are essential for physical activity and basic functioning of the body. Foods like bakery products, butter products, cereals, pasta, legumes, and sugar are good sources of energy.

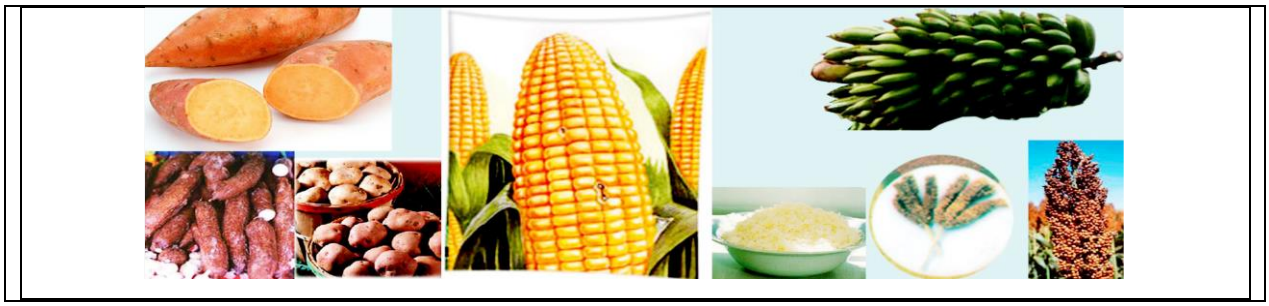


Figure 1.3. Some of the locally available energy-giving foods

b) Body-building (plastic) foods. Foods rich in protein are called bodybuilding foods or “GROW” foods (figure 1.4.). These foods help to maintain life and promote growth, repair worn out and damaged body tissues. “GROW” foods come from animal and plant sources. meat and meat products, milk and dairy products, eggs and egg products, fish and fish products are have mainly plastic value.

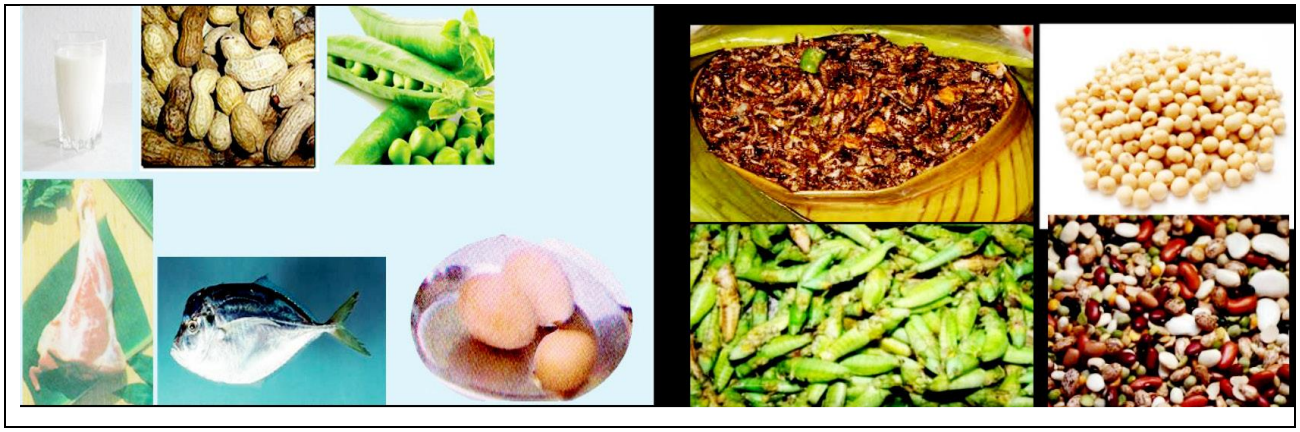


Figure 1.4.Some of the locally available foods that are sources of protein

c) The body-regulators, these are the ones that organize everything inside us, that is to say, the functioning of our complex body. They are like the policemen who regulate traffic. vegetables, fruits, berries and their juices, liver of animals and fish are body-regulating food. Foods rich in minerals and vitamins are known as protective or “GLOW” foods (figure 1.5.). They are essential for promoting body immunity and regulatory functions. Fruits and vegetables are the main sources of “GLOW” foods. Fortified foods, including iodized salt, are also good sources of “GLOW” foods.

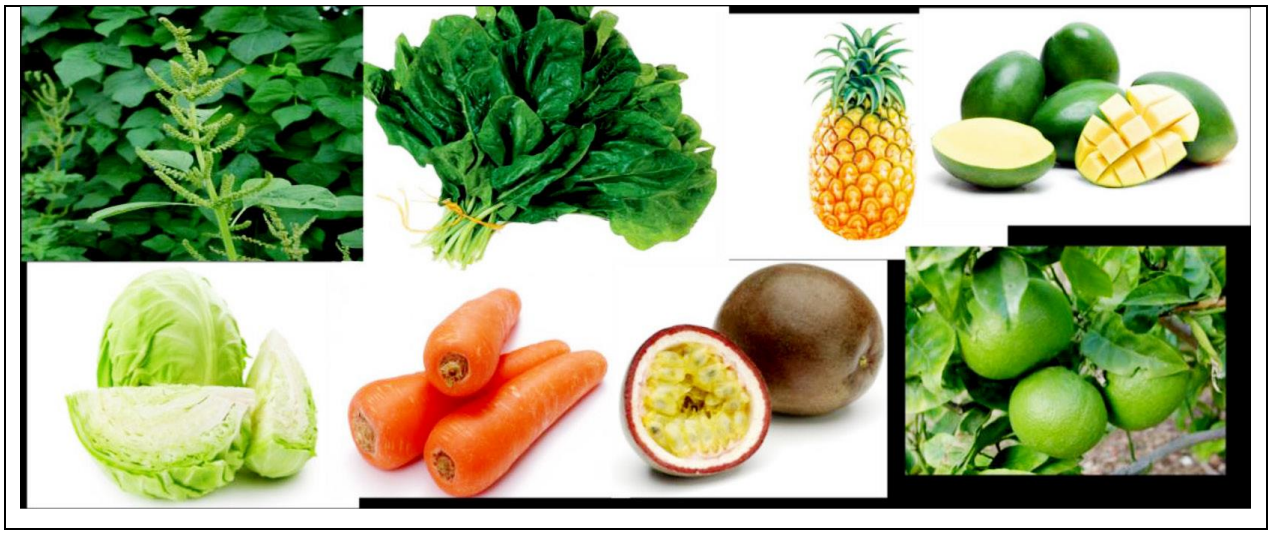
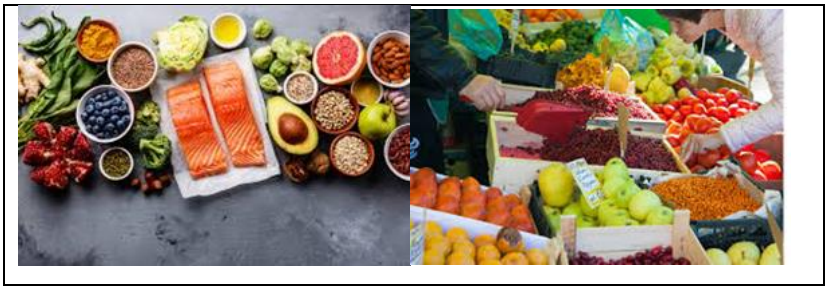


Figure 1.5.Examples of locally available vegetables and fruits, which are rich sources of vitamins and minerals

It is probably one of the most important needs of our lives. The food that we eat is composed of small units that provide nourishment to the body. The main aspects of hygiene of food- food norms, food sanitary.Meaning of communication of a science about a food with other sciences- using achievements and methods of research of other sciences develops the theoretical and applied aspects.



Modern research convincingly argues that the chemical composition of food and pharmacy activity of its components can significantly influence the nature of toxic effects of xenobiotic that enter the human body in different ways. Have been developed and introduced eight diets of treatment nutrition each with a special ethiopathogenetic direction and purpose. Specify the correct option of communication of a science about a food with other medical sciences - biochemistry, physiology, dietology, microbiology.

The food hygiene problems, include the following key issues:

1. The study of the quantitative and qualitative aspects of human nutrition in different conditions of his life and activities (carried out by doctors any profile).
2. Development of measures to improve the usefulness of nutrition and enrichment with biologically active substances - vitamins, amino acids, polyunsaturated fatty acids, and others enrichers (it is carried out by technologists of the food-processing industry on presentation of doctors - experts in the field of hygiene of a nutrition).
3. The development and implementation of effective control methods - preventive and current sanitary inspection (carried out by doctors - hygienists).
4. The implementation of measures to prevent food poisoning and intoxications, and the creation of conditions for their complete elimination as the nosology form (carried by physicians of any profile).
5. Control and organization of preventive nutrition at industrial plants, children's nutrition in schools and child care centers, as well as special meals for all other organized groups (is carried doctors of the corresponding institutions).
6. The power supply on a rational basis in the system of catering and turning them into centers of outreach and practical implementation of nutrition among the population (is carried dietitian and physician of clinics).

2. Types of nutrition

Types of nutrition: rational nutrition, preventive nutrition, therapeutic and preventive nutrition, clinical (dietetic nutrition).

Rational nutrition - a food almost healthy man, built on scientific foundations and promotes: improve the level of health; increase the body's resistance; the preservation of (possibly longer) high of working capacity, cheerfulness and life expectancy; physical and mental development of the younger generation. The importance of rational nutrition- preventive cases of the alimentary diseases, connected with deficiency or over nutrition. Biological effect-non-specific.

Preventive nutrition is a branch of nutrition science with the goal of preventing or delaying or reducing the impacts of disease and disease-related complications. The main effect of preventive nutrition on the body- the protective effect of food on the body (for example: atherosclerosis, obesity, diabetes and others). It is concerned with a high level of personal well-being, disease

prevention, and diagnosis of recurring health problems or symptoms of discomfort, which are often precursors to health issues. Preventive nutrition may assist in prolonging the onset of non-communicable diseases (such as Type 2 diabetes or cardiovascular disease) and may allow adults to experience more "healthy living years" later in life. The need for preventive nutrition continues to grow as the overweight and obese population numbers steadily rise within the childhood to adult populous, as the numbers have increased over the last 40 years. To educate the public about preventive nutrition, each social structure has its own way to communicate what preventive nutrition is within its own society, this is done through either a public health forum, government programs and policies or nutritional education.

Nutrition in the prevention of atherosclerosis. The leading place in the development of atherosclerosis belongs to the increase in the body's cholesterol level. This also contributes to the overstrain of the nervous system, insufficient disintegration of cholesterol due to limited exercise, increased synthesis and its excessive content in food, insufficient elimination from the body. In the prevention of atherosclerosis, it is important to limit the amount of animal fats in the diet, as well as moderate consumption of simple carbohydrates. Observations have shown that in the diet of people with severe forms of atherosclerosis, excessive consumption of animal fats and simple carbohydrates was most often noted with limited consumption of fats of plant origin, excessive energy value and irregular meals. Excess energy value of food also leads to the development of obesity, often associated with atherosclerosis. The risk of atherosclerosis in obese patients is significantly reduced if it is possible to reduce their body weight with the help of diets. Increased blood pressure also favors the progression of atherosclerosis. A close association of smoking with an increase in blood levels of cholesterol and low-density lipoproteins has been established. The diet aimed at preventing atherosclerosis is based on the principle of a moderate restriction of foods containing large amounts of cholesterol, salt and liquid. It is recommended the exclusion of nitrogenous extractive substances, enrichment of food with vitamins, especially ascorbic acid. Food should contain 90 — 100 g of proteins, 80 — 90 g of fats (of which 30 g - vegetable) and 300 — 350 g of carbohydrates. Reduction of fat in the diet should be carried out mainly due to the restriction of fats of animal origin, as well as foods rich in cholesterol (eggs, egg yolks, brains, kidneys, liver). Completely these foods from the diet should not be excluded, because cholesterol is necessary for the synthesis of hormones, bile acids and calciferols. It is necessary to give

preference to fats of plant origin (sunflower, corn, cotton), rich in linoleic acid and phosphatides. Vegetable oils have a choleretic effect, which contributes to the secretion of bile cholesterol. Restriction of carbohydrates in the diet should be carried out by reducing the amount of digestible - sugar, honey, jam, semolina and rice cereal, cookies, muffins. At the same time, the use of complex carbohydrates and plant fibers contained in cereals, vegetables, unsweetened fruits with a large number of pectin's, sitosterols, substances that interfere with the absorption of cholesterol in the intestines, is very useful. p-sitosterol also inhibits the conversion of excess carbohydrates into fats. The development of atherosclerosis is delayed by ingestion of potassium, magnesium, phosphorus and iodine with food. Magnesium ions help to reduce cholesterol in the blood. There is a lot of magnesium in buckwheat groats, bran, carrots, dried apricots, apricots. The positive role of iodine in the prevention of atherosclerosis is associated with the stimulation, under its influence, of the formation of the thyroid gland hormone, thyroxine, which contributes to the breakdown of cholesterol, has anti-sclerotic effect. Iodine is found in seafood, so they are recommended to be included in the diet and consumed daily. Potassium salts contribute to the excretion of sodium, inhibiting the activity of enzymes that break down fats and proteins. The source of potassium are vegetables and fruits, baked potatoes.

Thus, for the prevention of atherosclerosis, it is recommended to include in the diet complete foods that do not aggravate the organs of the digestive system, heart, liver and kidneys and contain moderate amounts of cholesterol: rye bran bread, borscht, beetroot soup, cabbage soup, dairy, fruit, vegetable soups, lean meat soup (once a week), lean beef, lamb, chicken, turkey, mostly boiled; low-fat fish (cod, pike-perch, pike, perch), soaked low-fat herring (once a week), dairy products, cottage cheese from egg whites can cook an omelet. The use of egg yolks should be limited to 4 pieces in week.

Recommended dishes and side dishes of vegetables - vinaigrettes, salads - with vegetable oil. Useful fruits, berries, fresh fruit juices. If you are overweight and tend to obesity pasta dishes should be avoided. Fatty meat soups, fatty meats, caviar, kidneys, liver, beef and mutton fat, baking, spicy and salty snacks, coffee, cocoa, chocolate are limited in the diet. Eating during the day with the anti-sclerotic diet is better four — five times. The last meal (no later than 2 hours before bedtime) should not be abundant. Meals should be prepared mainly boiled and baked. Consumption of salt is limited to 8 — 10 g per day.

The clinical nutrition of sick human. Purpose - is the integral part of complex therapy and of the secondary and tertiary prevention of different diseases, which is intended for restore the homeostasis and activity of organism functional systems back to normal after diseases and must completely satisfy the requirements in nutrients and energy including features of metabolism and state of human organs and systems, restore the energy balance of the body, disturbed due to exposure to toxic substances.

Value of dietary (clinical) nutrition- restores homeostasis and activity of the functional systems of the body, increase the body's resistance against the effects of toxic substances disturbed as a result of diseases. Effect on the body of dietary (medical) nutrition – therapeutic action. This type of nutrition is used in medical-and-preventive and sanatorium-and-spa institutions and sanatoriums-preventoriums and attained by order of special compounded nutrient rations (diets), dietary habits and use of special methods of culinary processing of food. Clinical nutrition - is differentiated nutritional therapy, which takes into account pathogenesis, the clinical picture and dynamics of development of disease. Clinical nutrition should be mandatory background against which used other therapeutic measures. It should be applied for all diseases, as chemical components of the food involved in processes of intermediate metabolism, the violation of which takes place at all diseases.

Therapeutic and preventive nutrition. Treatment is called nutrition, which is issued to workers and employees with harmful working conditions. The main purpose of treatment-and-prophylactic nutrition is to increase the body's defenses and reactivity, to prevent occupational diseases and poisonings, activate or slow down the metabolism of toxic substances in the body, restore the energy balance of the body, disturbed due to exposure to toxic substances. Main goal - to weaken the effect of the harmful factors affecting the body of the worker. For example: in the production of benzene, chlorinated hydrocarbons and arsenic, it is recommended to drink plenty of liquids. Use of milk and vitamins in preventive nutrition: milk and dairy products increase the body's resistance to harmful physical, chemical and biological production factors. These products

improve the overall functional abilities of the body, soften the effect of radioactive and toxic substances on the liver, normalize protein and mineral metabolism.

Natural milk in exceptional cases, in coordination with the medical-sanitary part of the enterprise or with the local sanitary-epidemiological station, can be replaced by an equal amount of kefir, yogurt, acidophilic milk. For a long time, it was not recommended to issue milk to persons who are in contact with lead under production conditions. This was associated with the presence of readily absorbable calcium in milk, the increased intake of which in the body causes a negative effect on the course of lead intoxication. However, as shown by experimental studies in recent years, milk added to food rations, poor animal proteins, contributes to a significant reduction in the severity of lead poisoning and stimulates the removal of lead from the body. The favorable effect of milk is associated, above all, with the presence in it of high-grade animal proteins, sulfur-containing amino acids, lactic calcium, thiamine and ascorbic acid.

In practice, 3 types of therapeutic and preventive nutrition are used:

1) therapeutic and preventive rations (breakfast) when working in particularly harmful working conditions;

2) delivery of milk or dairy products adequately replacing it under harmful working conditions; delivery of pectin and pectin-containing substances;

3) preventive vitaminization.

To prevent poisoning by heavy metals (mercury, lead, cadmium, etc.) are recommended pectin, which are part of vegetables, fruits and berries. Pectin substances bind to the gut of lead, mercury, manganese, and other metals, thereby facilitating their removal from the body and reduction of their concentration in the blood. The positive role of pectin substances in the prevention of lead poisoning, radioactive strontium, and cobalt has been proven. The enrichment of the diet with products containing pectin substances in the experiment helps to remove lead from the body (by 38 — 44%) and reduce toxicity. The use of 2 g of food pectin per day for 2

months prevents mercury poisoning in the corresponding production. At enterprises associated with exposure to inorganic lead compounds, it is recommended that workers produce pectin-enriched canned vegetable foods, fruit juices, and beverages that can be replaced with natural fruit juices with pulp in the amount of 300. Pectin-containing products emit workers before the start of the work shift (fermented milk - during the working day). Pectin is found in large quantities in beetroot, radish, eggplant, pumpkin, carrot, cabbage, baked apples, apricots, plums. Very useful apple jelly with pectin, used in special nutrition. Biological effect-specific.

At present, in connection with the automation and mechanization of production processes, the continuous improvement of working conditions of workers and the increase in the production culture, the expressed forms of occupational diseases and intoxications are very rare. However, the occupational health of workers exposed to occupational hazards arising from the violation of production technology is paid much attention to. This is due to the fact that even the minimal impact of certain production hazards can have an adverse effect on the human body, cause pathological changes to it, as well as adversely affect productivity.

The principles of treatment-and-prophylactic nutrition, substantiated by A. A. Pokrovsky, academician of the Academy of Medical Sciences of the USSR, are reduced to the following provisions:

Slowdown with the help of food substances processes of absorption of toxic substances in the digestive system. Therefore, scientists believe that the speed and strength of the poison that got into the stomach largely depend on its content. Substances taken on an empty stomach are absorbed more quickly, since they are in free contact with the mucous membrane of the stomach, without being diluted by its contents. Absorption of toxic substances entering the stomach and intestines in the presence of a sufficient amount of food, that is, in the case of mechanical difficulty in access of poisons to the mucous membrane, slows down. Therefore, it is important that those who work in hazardous conditions do not start work on an empty stomach. The use of antidote properties of individual components of food in order to neutralize certain toxic substances, for example, the ability of pectin substances and pectin-containing products to bind salts of heavy metals and their compounds in the digestive system. Acceleration or deceleration via neutralization poisons nutrients depending on the starting materials or products of their conversion in the body.

The influence of food factor on the acceleration of the removal of toxic substances from the body (for example, protein with sulfur-containing amino acids). Compensation with the help of food increased costs the body of individual nutrients (amino acids, vitamins, macro-and micronutrients, etc.) associated with exposure to poison.

The impact of food substances on the state of the most affected organs and systems (liver, kidney). The most widespread use of products found - sources of animal protein (milk, cottage cheese, and eggs), sources of vitamins, etc. The increase in the overall resistance of the body to the effects of occupational hazards with the help of food factors (unbalanced nutrition, especially for the protein component and the content of water-soluble vitamins, exacerbates the effects of toxic substances on the body).In the prevention of adverse effects of production factors on the body, the leading role is played by proteins of animal origin, which are a source of essential amino acids, especially sulfur-containing (methionine and cysteine), as well as choline.

Basic rations of therapeutic and preventive nutrition. Treatment-and-prophylactic nutrition is given free of charge to workers, whose nature and working conditions can lead to chronic intoxication and occupational disease.

Rations of preventive nutrition in the form of breakfast should be issued to workers and employees before the start of the work shift, working on the caisson work - after the work shift. Depending on the profession of working breakfast is prepared on one of six rations with the simultaneous issuance of vitamin preparations.

The ration number1 (for those working under the influence of X-rays, radioactive substances, transuranium elements, etc. in the course of production activities) is characterized by the content of foods rich in nutrients (methionine, cystine, and lecithin), stimulating fat metabolism in the liver and increasing its antitoxic function. In addition, the inclusion in this diet of products of high biological value (milk and dairy products, liver, eggs) increases the overall resistance of the body to the action of ionizing radiation. Additionally, 150 mg of ascorbic acid is given.

The ration number 2 (for working with alkali metals, concentrated nitric and sulfuric acids, chlorine, its inorganic compounds and other chemicals) is achieved by including a sufficient amount of vegetables and grains - sources of vitamins and minerals, as well as dairy products, fish, vegetable oils, etc., to ensure the intake of animal protein, calcium and polyunsaturated fatty acids.

The ration number 2a(for those working in conditions of exposure to chromium, its compounds and other chemical allergens that increase the sensitivity of the body) is characterized by a high content of animal proteins, vegetables, ascorbic acid, retinol, nicotinic acid, B-methylmethionine. In addition, the workers are additionally issued mineral water Narzan. The main purpose of the diet number 2a is to reduce the toxic and allergenic effect of chromium and its compounds on the body, that increase the sensitivity of the body

The ration number 3 is compiled in accordance with modern requirements for therapeutic and preventive nutrition for workers in contact with for organic and inorganic lead compounds. This diet includes milk and dairy products - sources of high-value animal protein and calcium. In addition, for this contingent of workers, daily delivery of dishes from vegetables that are not subjected to heat treatment (salads, vinaigrettes), which are good sources of pectin, ascorbic acid, group B vitamins, mineral salts, carotene, is provided for.

Workers and employees engaged in the production of nitro and amino compounds of benzene and its homologues, chlorinated hydrocarbons, arsenic compounds, tellurium, mercury, phosphorus, when working under conditions of high atmospheric pressure, as well as at works on unloading and loading apatite in marine and river ports, issued *treatment-and-prophylactic ration number 4.* The main purpose of this diet is to increase the functional capabilities of the liver and the hematopoietic system. In the treatment-and-prophylactic ration number, 4 include milk and dairy products, vegetable oils as sources of lipotropic factors that have a beneficial effect on liver function. At the same time, it is necessary to limit the use of various fatty dishes, fish, meat and mushroom soups, as well as sauces and gravies. It is necessary to minimize the use of herring, smoked meat and pickles. In the diets of people working with phosphorus, it is necessary to limit the fats, especially refractory ones, since they contribute to the absorption of this substance in the intestines. In order to prevent changes in the function of the nervous system working with compounds of arsenic, mercury, tellurium and phosphorus, an additional 4 mg of thiamine and 150 mg of ascorbic acid are given out.

*The ration number 5 (*for working with tetraethyl lead, brominated hydrocarbons, hydrogen sulfide, thiophos, barium, manganese, organic phosphorus-containing fertilizers and other chemical compounds) include cottage cheese, lean meats, fish, eggs, vegetable oil, fresh vegetables and fruits. The main focus of therapeutic and prophylactic rations number 5 -

protection of the nervous system and liver. The use of fats in therapeutic and prophylactic nutrition should be approached with great care, as they contribute to the absorption of toxic substances soluble in them. In this regard, in all diets of therapeutic and preventive nutrition it is necessary to limit the consumption of fatty products and refractory fats (mutton, beef, and pork). It should also limit the salt and salted foods. In the production of benzene, chlorinated hydrocarbons and arsenic it is recommended to drink plenty of liquids.

Enrichment of diets with vitamins

All of these diets are additionally enriched with vitamins in the following quantities:

Diets No.1 and 3 - 150 mg of vitamin C;

Diet No. 2 - 2 mg of vitamin A and 100 mg of vitamin C (at work with alkali metals, chlorine and its inorganic compounds, cyanides and nitrogen oxides); 2 mg of vitamin A and 150 mg of vitamin C (on fluorine work); 100 mg of vitamin C (for work with phosgene);

Diet No. 2a - 100 mg of vitamin C, 2 mg of vitamin A, 15 mg of vitamin PP, 25 mg of vitamin U;

Diet No. 4 - 150 mg of vitamin C; 4 mg of vitamin B_1 and 150 mg of vitamin C (at work with arsenic, mercury, tellurium compounds);

Diet No. 5 - 4 mg of vitamin B_1 and 150 mg of vitamin C.

For a number of employees, only vitamin preparations are provided:

a) For those exposed to high ambient temperature and intense heat radiation (workers in hot workshops have increased sweating, which leads to a significant loss of water-soluble vitamins. In this regard, when exposed to a high temperature of the production environment and intensive heat radiation, vitamins are provided free of charge to workers in hot shops of the blast furnace, steel-smelting, rolling and pipe production, in the baking industry.) - 2 mg of vitamin A, 3 mg of vitamins B_1 and B_2, 150 mg of vitamin C, 20 mg of vitamin PP;

b) for those employed in the tobacco and tobacco and nicotine industries, exposed to dust containing nicotine - 2 mg of vitamin B_1, 150 mg of vitamin C.

Basic principles of the balanced (rational) diet include:

1.Adequacy of nutrition: compliance of dietary caloric content (caloricity of nutrition) with energy consumption (expenditures) of the human organism.

2.Balanced nutrition: high-quality nutrition, the presence of essential and nonessential components of food in optimal amounts and ratios in the diet.

3.Compliance with the dietary pattern: keeping to diet in a proper way (time and number of meals; intervals between them; distribution of dietary energy value, chemical composition, food sets, weight of meals), its compliance with biosocial rhythms of human life activity.

4.Food variety (animal and vegetal products, various methods of cooking / food processing).

5.Enzymatic adequacy.

6.Biotic adequacy.

The main requirement of rational nutrition *is nutrition should cause a feeling of satiety, should not adversely affect health, fully meet the energy needs of the body, have a dietary habit.* ***Rational nutrition has three links:*** physiological norm, the rules of product consumption, regime of nutrition (see practical part, subject 1-3).

4. Food variety. A variety of food included in the diet is achieved with a wide range of animal and vegetal foodstuffs and various methods of cooking (food processing). Therefore, it is necessary to use different combinations of foodstuffs in a diet.

5.Enzymatic adequacy. The principle of enzymatic adequacy means that nutrition should be adequate for the enzymes of our organism, so most foodstuffs should be cooked (processed) before the intake. Cooking should be sufficient for better assimilation of nutrients, but not excessive, when biologically active substances (vitamins, enzymes, etc.) are destructed. Favorable organoleptic properties of food (in many respects they depend on the quality of cooking) and a variety of foodstuffs and dishes whet the appetite and improve digestion.

6.Biotic adequacy . The principle of biotic adequacy asserts that food, getting into the human organism, should not contain toxic and radioactive substances, pathogenic microorganisms and their toxins. In other words, food should not be dangerous for health. These are the fundamental principles of the rational diet, which determine the span and quality of life.

3.Hunger and appetite.

Hunger is the physiological response by the body to a need for more energy. Appetite is a psychological response to the presence of food or to a particular social or emotional situations.

Regulation of hunger: controlled mostly by the hypothalamus; hypothalamus contains: feeding centers which stimulate food/water intake (ventrolateral nucleus (VLN); satiety center stimulates sensation fullness (ventromedial nucleus (VMN) (figure 3.1.); as activity of the sympathetic nervous system increases hunger decreases; lower energy food cause greater feeling of satiety.

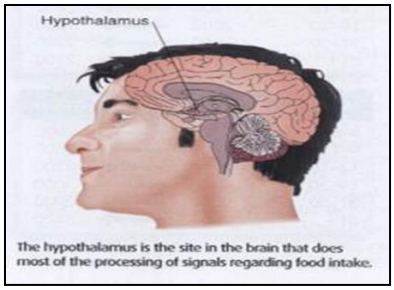


Figure 3.1. Regulation of hunger

Hormones in satiety regulation: leptin-from adipose tissue, affects CNS to stimulate a decrease in food intake, decreases activity of neuropeptide Y; Neuropeptide Y- increases food intake and decreases energy expenditure when injected into brains of experimental animals; endorphins/opioids- increase hunger; cortisol- increases hunger; cholecystokinin and gastric distention decrease hunger; thyroid hormones increase and indirectly increase hunger; ghrelin- from stomach, stimulates eating.

Physiological nutritional standards are the average standard values, which reflect the best needs of specific groups of the population in the major nutrients and energy. Physiological nutritional standards should be used as the initial values: the planning of the development of the national economy, in particular agriculture and food industry; in the calculations necessary for the development of good nutrition in collectives; for the general orientation of medical workers and the public in matters of nutrition; as a criterion for the assessment of actual nutrition.

When comparing the physiological nutritional standards in different countries, there is a significant difference. For example, in countries with relatively cold climate conditioned by the need to increase daily energy by 5% while reducing the average temperature for every 10°C. The qualitative composition of food in the diet is the content of proteins, fats, carbohydrates, minerals and vitamins.

What is digestion? Digestion is the complex process of turning the food you eat into nutrients, which the body uses for energy, growth and cell repair needed to survive. The

factors affecting on process of digestion: the chemical composition of food, the origin of food, cooking food processing,organoleptic properties of food. The digestion process also involves creating waste to be eliminated (figure 3.2.).

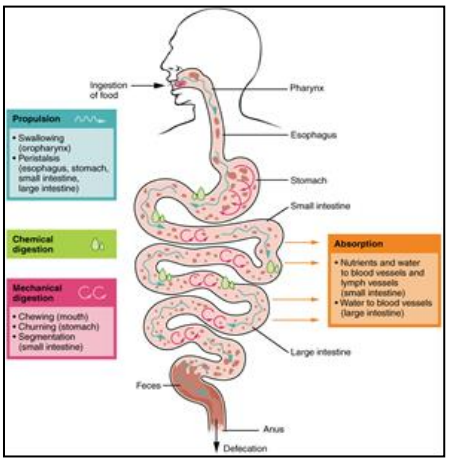


Figure 3.2. The digestive processes are ingestion, propulsion, mechanical digestion, chemical digestion, absorption, and defecation

The digestive tract (or gastrointestinal tract) is a long twisting tube that starts at the mouth and ends at the anus. It is made up of a series of muscles that coordinate the movement of food and other cells that produce enzymes and hormones to aid in the breakdown of food. Along the way are three other organs that are needed for digestion: the liver, gallbladder, and the pancreas.

Nutrition = Eating, Digestion, Absorption, Transportation, Utilization

The first of these processes, digestion, refers to the entry of food into the alimentary canal through the mouth. There, the food is chewed and mixed with saliva, which contains enzymes that begin breaking down the carbohydrates in the food plus some lipid digestion via lingual lipase. Chewing increases, the surface area of the food and allows an appropriately sized bolus to be produced. Food leaves the mouth when the tongue and pharyngeal muscles propel it into the esophagus. This act of swallowing, the last voluntary act until defecation, is an example of propulsion, which refers to the movement of food through the digestive tract. It includes both the voluntary process of swallowing and the involuntary process of peristalsis. Peristalsis consists of sequential, alternating waves of contraction and relaxation of alimentary wall smooth muscles, which act to propel food along. These waves also play a role in mixing food with digestive juices.

Peristalsis is so powerful that foods and liquids you swallow enter your stomach even if you are standing on your head.

Digestion includes both mechanical and chemical processes. Mechanical digestion is a purely physical process that does not change the chemical nature of the food. Instead, it makes the food smaller to increase both surface area and mobility. It includes mastication, or chewing, as well as tongue movements that help break food into smaller bits and mix food with saliva. Although there may be a tendency to think that mechanical digestion is limited to the first steps of the digestive process, it occurs after the food leaves the mouth, as well. The mechanical churning of food in the stomach serves to further break it apart and expose more of its surface area to digestive juices, creating an acidic "soup" called chime. Segmentation, which occurs mainly in the small intestine, consists of localized contractions of circular muscle of the muscular is layer of the alimentary canal. These contractions isolate small sections of the intestine, moving their contents back and forth while continuously subdividing, breaking up, and mixing the contents. By moving food back and forth in the intestinal lumen, segmentation mixes food with digestive juices and facilitates absorption.

In chemical digestion, starting in the mouth, digestive secretions break down complex food molecules into their chemical building blocks (for example, proteins into separate amino acids). These secretions vary in composition, but typically contain water, various enzymes, acids, and salts. The process is completed in the small intestine. Food that has been broken down is of no value to the body unless it enters the blood stream and its nutrients are put to work.The factors affecting on process of digestion- the chemical composition of food, the origin of food, cooking food processing, organoleptic properties of food. The role of the chemical composition of food in its assimilation- high percentage of digestion of food with a large amount of protein, low rate of digestion of food with a lot of carbohydrates. Theproducts of an animal origin are assimilation more, than plants products. For example:time of stay in the stomach of plant origin products 3-4(hour), animal (for example - meat) - 6 -7 hour.

This occurs through the process of absorption, which takes place primarily within the small intestine. There, most nutrients are absorbed from the lumen of the alimentary canal into the bloodstream through the epithelial cells that make up the mucosa. Lipids are absorbed into

lacteals and are transported via the lymphatic vessels to the bloodstream (the subclavian veins near the heart).

In defecation, the final step in digestion, undigested materials are removed from the body as feces. In some cases, a single organ is in charge of a digestive process. For example, ingestion occurs only in the mouth and defecation only in the anus. However, most digestive processes involve the interaction of several organs and occur gradually as food moves through the alimentary canal.

4. Hygienic and biological meaning main nutrients in the nutrition

The human body is made of chemical compounds like carbohydrates, proteins, fats, and nucleic acids. All the chemical compounds occur in various forms such as hormones, vitamins, minerals, phospholipids, etc. These chemical components are constantly being used up and must be regularly supplied in the form of nutrients for the continued growth and survival of a human being.

All nutrients fall into two major classes: macronutrients and micronutrients. Macronutrients are required in large amounts and micronutrients are needed in trace quantities. Minerals and vitamins fall under micronutrients, while the rest of what we eat is classified under macronutrients. Macronutrients provide structure to the organism. The cell is almost entirely made of proteins and phospholipids. Macronutrients also provide energy, primarily in the form of simple carbohydrates.Proteins, fats, carbohydrates are this group of food substances main function - energetic.

Protein.One of the most important components of the food is protein. Sufficient and high quality protein in the diet provides the best conditions for the normal functioning of the body and its high efficiency. Maine processes in the body provided by the proteins- growth, development, cell regeneration. One of the distinguishing features of proteins from other food substances are not deposited in the body, as a reserveFunctions of protein: to build new tissues, for repairing worn out body tissues, a source of energy, a component of enzymes and hormones, for normal osmotic relations among the various body fluids, important role in the resistance of the body against disease, the formation of antigens and antibodies, synthesis G-globulin and properdin. It is the protein part of the diet is a source of growth, repair and renovation of the protoplasm of cells

and tissues. Inadequate intake of protein affects the function of all systems: first of all, suffers enzyme system; closely related to protein synthesis of hormones. Proteins serve as the basic structural material of the body as well as being biochemical catalysts and regulators of genes. Aside from water, protein constitutes the major part of muscles, bones, internal organs, and the skin, nails, and hair. Protein is also an important part of cell membranes and blood (e.g., hemoglobin). Enzymes, which catalyze chemical reactions in the body, are also protein, as are antibodies, collagen in connective tissue, and many hormones, such as insulin.Quantity of energy of 1 gram of proteinsis 4,0 kcal.

Tissues throughout the body require ongoing repair and replacement, and thus the body's protein is turning over constantly, being broken down and then resynthesized as needed. Tissue proteins are in a dynamic equilibrium with proteins in the blood, with input from proteins in the diet and losses through urine, feces, and skin. In a healthy adult, adjustments are made so that the amount of protein lost is in balance with the amount of protein ingested.

However, during periods of rapid growth, pregnancy and lactation, or recuperation after illness or depletion, the body is in positive nitrogen balance, as more protein is being retained than excreted. The opposite is true during illness or wasting, when there is negative nitrogen balance as more tissue is being broken down than synthesized.*The very first changes associated with the proteins insufficiency in the body* is decrease of protective properties of the body's.

*Amino acids.*Amino acids is the main component and structural component of protein molecule. The proteins in food—such as albumin in egg white, casein in dairy products, and gluten in wheat—are broken down during digestion into constituent amino acids, which, when absorbed, contribute to the body's metabolic pool. Amino acids are then joined via peptide linkages to assemble specific proteins, as directed by the genetic material and in response to the body's needs at the time. Each gene makes one or more proteins, each with a unique sequence of amino acids and precise three-dimensional configuration. Amino acids are also required for the synthesis of other important no protein compounds, such as peptide hormones, some neurotransmitters, and creatinine.

Food contains approximately 20 common amino acids, 9 of which are considered essential, or indispensable, for humans; i.e., they cannot be synthesized by the body or cannot be synthesized in sufficient quantities and therefore must be taken in the diet.

The essential amino acids for humans are histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine.How many amino acids do I need? We don't need to eat foods with amino acids at every meal, but it's important to get a balance of them throughout your day. The recommended daily allowance for every 2.2 pounds of body weight for each of the essential amino acids are:Histidine: 14 milligrams; Isoleucine: 19 milligrams; Leucine: 42 milligrams; Lysine: 38 milligrams; Methionine: 19 milligrams; Phenylalanine: 33 milligrams; Threonine: 20 milligrams; Tryptophan: 5 milligrams; Valine: 24 milligrams.

Conditionally indispensable amino acids include arginine, cysteine, and tyrosine, which may need to be provided under special circumstances, such as in premature infants or in people with liver disease, because of impaired conversion from precursors.

Nonessential means that our bodies can produce the amino acid, even if we do not get it from the food we eat. Nonessential amino acids include: alanine, arginine, asparagine, aspartic acid, cysteine, glutamic acid, glutamine, glycine, proline,serine, and tyrosine.Oxyprolineor hydroxyproline is produced by hydroxylation of the amino acid proline by the enzyme prolyl hydroxylase following protein synthesis (as a post-translational modification). Hydroxyproline is a major component of the protein collagen, comprising roughly 13.5% of mammalian collagen. Hydroxyproline and proline play key roles for collagen stability.

Classification of proteinogenic amino acids by radical structure:

- Aliphatic: Monoaminomonocarboxylic: glycine, alanine, valine, isoleucine, leucine;
- Oxymonoaminocarboxylic: serine, threonine;
- Monoaminodicarboxylic: aspartate, glutamate, due to the second carboxyl group carry a negative charge in solution;
- Monoaminodicarboxylic amides: asparagine, glutamine;
- Diaminomonocarboxylic: lysine, arginine, carry a positive charge in solution;
- Sulfur-containing: cysteine, methionine, cysteine.
- Aromatic: phenylalanine, tyrosine, tryptophan, (histidine).
- Heterocyclic: tryptophan, histidine, proline.

The main source of essential amino acids- proteins of animal origin. Foods of animal origin (this is foods optimally balanced in amino acid composition) meat, fish, eggs, and dairy products—are sources of good quality, or complete, protein; i.e., their essential amino acid patterns are similar to

human needs for protein. Gelatin, which lacks the amino acid tryptophan, is an exception. Individual foods of plant origin, with the exception of soybeans, are lower quality, or incomplete, protein sources. Lysine, methionine, and tryptophan are the primary limiting amino acids; i.e., they are in smallest supply and therefore limit the amount of protein that can be synthesized.

However, a varied vegetarian diet can readily fulfill human protein requirements if the protein-containing foods are balanced such that their essential amino acids complement each other. For example, legumes such as beans are high in lysine and low in methionine, while grains have complementary strengths and weaknesses. Thus, if beans and rice are eaten over the course of a day, their joint amino acid patterns will supplement each other and provide a higher quality protein than would either food alone. Traditional food patterns in native cultures have made good use of protein complementarity.However, careful balancing of plant proteins is necessary only for those whose protein intake is marginal or inadequate. In affluent populations, where protein intake is greatly in excess of needs, obtaining sufficient good quality protein is usually only a concern for young children who are not provided with animal proteins.

Among the most important for the human organism are essential amino acids tryptophan, lysine and methionine – this is triad of essential amino acids, in determining the overall nutritional value. The optimal ratio of these amino acids in the daily diet is 1: 3: 3, which corresponds to their ratio in human milk and averaged amino acid composition of the human body. If the amino acids enter in another ratio, the protein synthesis in the human body is at the level of the amino acid, which is less likely, and the remaining unused amino acids excreted (figure 4.1.).

*Essential amino-acids.*There are 9 valuable amino-acids which cannot be formed by the body. The biological role of the three most deficient of essential amino-acids (for example):

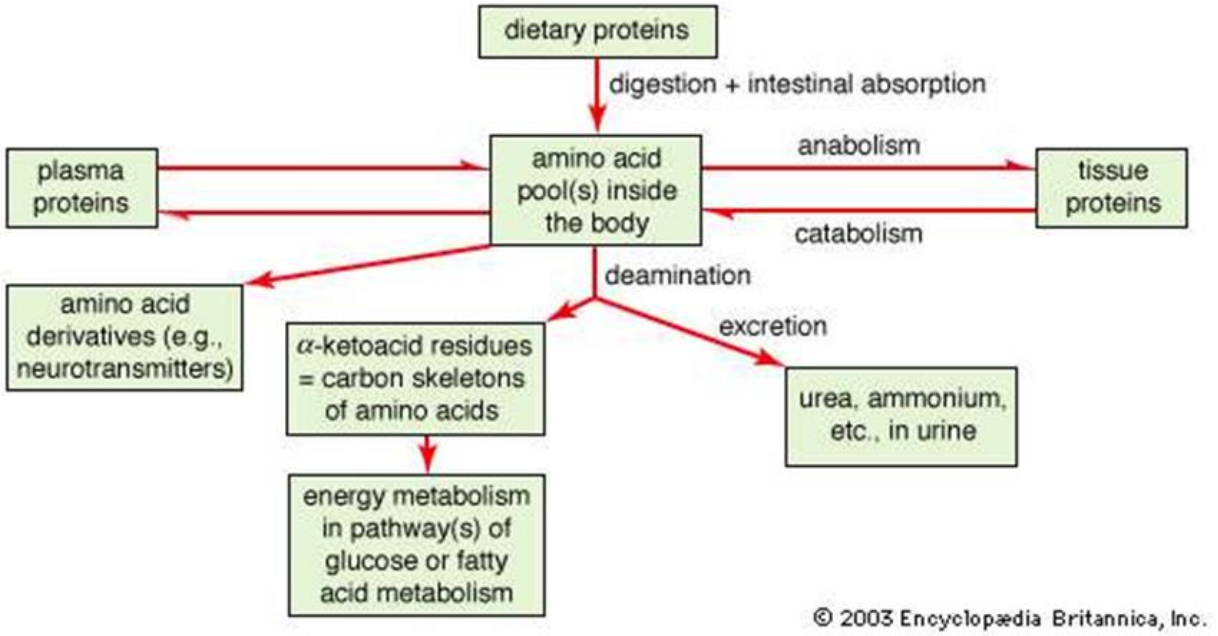


Figure 4.1. Protein and amino acid metabolism. General scheme of protein and amino acid

1. *Methionine* is involved in fat metabolism (controls phosphatides - fat exchange), being one of the best lipotropic substances (prevention of obesity), prevents liver adiposity,atherosclerosis. Methionine is the best donor of methyl groups in the synthesis of choline - ant sclerotic factor. Methionine prevents heavy losses in radiation exposure and the effect of bacterial toxins, contributes to a more complete manifestation of the action of vitamin B_{12}, folic acid. Methionine deficiency in the body cases: disturbance of choline synthesis, the occurrence of fatty infiltration in the liver.

Methionine is a good source of milk protein "casein", which contains up to 3% methionine. Much of it is contained in cod proteins, eggs, and meat, i.e. in proteins of animal products. In nature, the highest content of sulfur-containing amino acids (methionine + cysteine) sunflower beans.

2. *Lysine* - is closely connected with the formation of blood. Lysine is necessary for the growth of young organisms. Lysine is essential amino acid that regulates the growth process and hematopoiesis.Consequences of insufficient lysine in organism: body height retardation,reduces the number of red blood cells and hemoglobin synthesis.In addition, when there is a violation lack of calcification of bone, muscle dystrophy, disturbance of hematopoiesis and nitrogen balance.

The main source of milk protein (cottage cheese) is lysine. Curd it contains 1.5%. There is also in meat and fish.

3. Tryptophan is an amino acid essential for synthesis of nicotinic acid in the body (PP), hemoglobin synthesis, formation of serum proteins. It is a growth factor. The main role of the essential amino acid tryptophan in the body - participation in nitrogen balance. The lower the age, the greater the need for tryptophan. However, tryptophan quite difficult to dial in a sufficient amount because 100 g of meat, eggs it contained only 0.2 gram. In the milk is tryptophan in the albumin, which when heated above 70°C denatures and precipitates on glassware wall thus is lost and the tryptophan. Therefore, it is important to process the milk so that there was no loss of albumin. Ideally, of course, drink raw milk from healthy cows.

4. *Histidine* has the main role in hemoglobin formation and in conditioned reflex activity.

5. *Phenylalanine* is related to goiter and adrenal.

6. *Isoleucine* is a component of all body proteins except hemoglobin.

7. *Threonine* -the lack of it is cause of growth retardation and weight losing of animals.

8. *Leucine* - the lack of it is cause of growth retardation and disorders in kidney and goiter.

9.*Valine*- in addition to promoting muscle growth and tissue repair, another valine function is its ability support both muscle coordination and mental strength while promoting an emotionally calm state. It is also key to optimal growth in children.

It should be noted that some amino acids can be converted in organisms to other amino acids, for example-amino acid that phenylalanine can be converted to in the body in tyrosine; amino acid, into which methionine can be converted in the body incysteine.

Criterion of biological value of proteins is them “amino-acid score” it is percentage of quantity of irreplaceable amino-acid in protein of a product to quantity of the same amino acid in standard protein with ideal amino-acid a scale:

Amino acid score = <u>irreplaceable amino-acid (mg) in 1gram protein of foodstuff x 100%</u>
amino-acid in 1 gram ideal amino-acid(mg)

Especially importance has sufficient protein for a growing organism, as protein belongs to the basic plastic part. The protein deficiency causes:the very first apparent deviation associated with a lack of proteins in the body is the reduction of protective function of the body, also:

1. At protein deficiency in the diet the morphology changes were observed in bone marrow cells and this entails a violation of the process of hematopoiesis and morphological changes in the composition of the blood, as well as reducing the oncotic pressure.
2. Reduce the amount of protein in the diet affects the conditioned reflex activity, causing the weakening of the excitatory and inhibitory processes.
3. Chronic insufficient intake of protein leads deep disturbances of liver function (disturbance of the formation of choline in the liver). It is established that in order to prevent liver diseases choline is needed, which can be supplied ready-made with products (phosphatides) or can be synthesized in the body with the assistance of the amino acid methionine. Methionine also comes with complete proteins of animal origin. The disease most often affects infants (6-8 months). The mortality rate - 40-50%. When administered in the diet the high grade of protein disease cured.
4. Insufficient supply of protein with food is reflected in the course of mineral metabolism. It was found, for example, that a violation of phosphoric calcium metabolism in children may be linked not only to the lack of these salts, vitamin D, and protein deficiency. At the same time there is a decrease bone growth and change their chemical composition. This is due to decreased activity of the enzyme phosphatase - an important factor in bone formation.
5. There is evidence that protein deficiency can lead not only to subsequently stunting in the first years of life, but also to the psychomotor delay of development.
6. With regard to the effect of protein deficiency on vitamin metabolism, in this area there is a lot of work, pointing to the close relationship between the two exchanges. It is known, for example, that with a deficiency of protein disrupted synthesis of vitamin PP in the body, because its synthesis is linked to the amino acid tryptophan. The observations have shown that if people in power a large proportion falls to a product such as corn (maize), a protein that contains a small amount of tryptophan in the diet and if not enough dairy products, the population often appear pellagra disease.

7. Lack of protein in the diet increases the body's excretion of vitamin C. Increased urinary excretion of riboflavin (B_2) and development of a riboflavin's is closely connected with provision in protein body.

8, With long-term insufficient intake of proteins with food in children developing the disease, called Kwashiorkor disease, which translated to Ghanaians language means "the child's illness, weaned from the breast." This disease is common in developing countries of Indo-China, Africa and South America. As the child grows, if conserved protein deficiency Kwashiorkor disease becomes an adult disease - alimentary dystrophy or nutritional marasmus. These diseases are irreversible and lead to the death of such patients already in adolescence and alimentary marasmus.It should be noted thatalimentary dystrophy this is diseases not only resulting from protein - energy deficiency and from deficiency of fats, carbohydrates.

9.Reduction of growth hormone production in the pituitary gland.

10.Reduction of adrenaline production in the adrenal glands.

What is necessary to have the amount of protein in the daily diet? Protein requirements depend on age, sex, nature of work, climatic and national features, etc. A particular difficulty is to determine the optimal protein norms and values of permissible reduce it without compromising human health in a variety of conditions of life and activity.

The most thoroughly studied and developed in detail data is the minimum a person needs in a protein that is associated with the deficit in and specific protein value as a food substance and the presence of proven methodological approaches. For this, purpose a method for determining the ***nitrogen balance***. At certain minimum, receive a protein dietary nitrogen equilibrium is established, i.e. the amount of nitrogen excreted by the different ways it becomes entering with food. If the amount of protein in the diet is not sufficient, then the state is set to a negative nitrogen balance, indicating that the flow rate exceeds the intake of tissue proteins with their food ration.

According to the physiological nutritional standards, the total amount of protein in the diets of children should be twice the number compared to providing nitrogen balance and nitrogen equilibrium, and for adults to 1.5 number.Minimal amount of protein should arrive in an organism for providing only nitrogenous balance -56 gr. For preschool children - 53-69 gr., for school

children - 77- 98 gr., for an adult population: 83-118 gr. (depending on their profession (table 4.1.).

Table 4.1. Requirement in energy and proteins for different groups of the population

Age, gender	Energy, kcal	Proteins, gr.	
		total	animal origin including
0-3 months	115*	2,2*	2,2*
4-6 months	115*	2,6*	2,5*
7-12 months	110	2,9*	2,3*
1-2 year	1200	36	25
2-3 year	1400	42	29
3-7 year	1800	54	35
7-11year	2100	63	38
11-14 year, boys	2500	75	45
11-14 year, girls	2300	69	41
14-18 year, boys	2900	87	52
14-18 year, girls	2500	75	45
18-40 year, men	2700	62	37
18-40year, women	2000	46	29
40-59 year, men	2550	62	37
40-59 year, women	1900	48	29

*Note: *- requirements of children under one year in energy* and *proteins are based gr. / kg of body weight*

In general, at the expense of protein should be provided 11- 13% of the calorie diet. Along with the overall amount of protein and is normalized amounts of animal protein, because they are complete proteins. It contains all of the essential amino acid - valine, histidine, isoleucine, leucine, lysine, methionine, tryptophan, threonine and phenylalanine. Proteins of animal origin is considered adequate by origin.Proteins of animal origin for adults must be at least 50-55%.

Food sources of valuable protein (in percentage): meat - 16-22; fish - 14-20; bird - 16-24; eggs - 12.5; egg powder – 52; milk - 3.4; dietary curd - 17.5; fatty curd – 13.The products consist is more proteins by animal origin is cheese (different cheeses - 18-25 (in 100 qr. of product)). Less than high-grade amino acid composition of proteins are the products of plant origin. However, the inferiority of the amino acid composition of vegetable proteins is compensated with food mixed food, and especially due to the rational selection of a variety of plant and animal products. Moreover, among the plant products have legumes, which contains large amounts of proteins: 1) peas - 19,8 %; 2) beans - 19.6 %; 3) lentils - 20.4 %; 4) pea flour – 22 %; 5) defatted soy flour – 41,4 %. Proteins in these products have sufficient especially valuable amino acids such as tryptophan, lysine, methionine, and soy contains these amino acids, even more than meat, and methionine in it as much in the curd.

The consequences of regular consumption of proteins in excess of physiological norms is strong activation in the cerebral cortex, functional disorder in the liver, in the kidney, overload of the body with protein breakdown products.

Fats.Fats are substances in the body performs mainly energy function. In this respect, fat superior to all other food components (proteins and carbohydrates), as allocated in 2 times more energy when burned (1-gram fat, 9.3 kcal forms).However, the biological significance of fat is not confined only to their energy function. Fats involved in plastic functions, as a structural part of cellular membranes and myelin, membranes of nervous cells.

The structure fats are fats of cells membranes and protoplasm. Fats also contain carbon, hydrogen, and oxygen but in a different configuration, having considerably fewer oxygen atoms than are found in carbohydrates. Fats are soluble in organic solvents (such as acetone or ether) and insoluble in water, a property that is readily seen when an oil-and-vinegar salad dressing separates quickly upon standing.Fats are compounds consisting of esters of glycerin and fatty acids. The same fat content is found in butter.

Fats improves the flavor of food (acting as flavoring substance) and improves its nutritional value (creates a high degree of saturability).They are:monounsaturated fats, polyunsaturated fats, saturated fats, trans fats. However, even more important is the fact that only together with fats in food body receives a number of biologically valuable substance: fat-soluble vitamins, phosphatides (lecithin), polyunsaturated fatty acids, sterols, tocopherols and other substances

having biological activity. Fats in the diet transport the four fat-soluble vitamins (vitamins A, D, E, and K) and assist in their absorption in the small intestine. They also carry with them substances that impart sensory appeal and palatability to food and provide satiety value, the feeling of being full and satisfied after eating a meal.

In the body fat is in two forms: a structural (protoplasmic) and reserve (in the fat depots - in the subcutaneous fat layer in the abdominal cavity - gland, about the kidneys - kidney fat). Adipose (fatty) tissue in the fat depots of the bodyserves as an energy reserve as well as helping to insulate the body and cushion the internal organs.Quantity of protoplasmic fat bodies and supported in tissues at a constant level and is not changed even during starvation. Degree accumulation of reserve of fat depends on the character of food, level of energy consumption, age, gender, activity of the endocrine glands. Heavy physical work, some of the disease, insufficient food may reduce the amount of reserve fat. Moreover, vice versa, excess food, hypodynamia, reduced gonadal function, thyroid gland leads to increased fat reserve.

Food fats. A fat consisting largely of saturated fatty acids, especially long-chain fatty acids, tends to be solid at room temperature; if unsaturated fatty acids predominate, the fat is liquid at room temperature.Fatty acids have important roles in: 1) signal-transduction pathways; 2) cellular fuel sources; 3) the composition of hormones and lipids; 4) the modification of proteins; and 5) energy storage within adipose tissue (specialized fat cells) in the form of triacylglycerol's.Some common examples of saturated fatty acids: butyric acid (contained in butter); lauric acid (contained in coconut oil, palm kernel oil, and breast milk); myristic acid (contained in cow's milk and dairy products); palmitic acid (contained in palm oil and meat); stearic acid (also contained in meat and cocoa butter),caproic (butter, cheddar and other cheeses and in coconut oil).Unsaturated fatty acids that are part of dietary fats is arachidonic, linoleic , linolenic acids.

There are two types of unsaturated fats: polyunsaturated fats and monounsaturated fats. Both kinds can be found in some plant and animal sources and are liquid at room temperature. Both can help lower LDL cholesterol, which is the "bad" type of cholesterol that can clog arteries and play a role in cardiovascular disease. Unsaturated fat examples: monounsaturated. Monounsaturated fats contain only one double bond within the carbon chain. It is believed that they play a role in keeping human cells healthy. Examples: avocadoes, canola oil, cashews, olive oil, peanut butter, peanuts, sesame oil, sesame seeds.

Fats and oils usually contain mixtures of fatty acids, although the type of fatty acid in greatest concentration typically gives the food its characteristics. Butter, beef, goat fats and other animal fats are primarily saturated; olive and canola oils, monounsaturated; and fish, corn, safflower, soybean, and sunflower oils, polyunsaturated. Thus, the fats rich of unsaturated fatty acids is plant origin fats (table 4.2.). Unsaturated fats are the healthiest type of fat that humans consume. As a result, they are often referred to as "good" fats, meaning that there can be health benefits associated with consuming them in moderation. Unsaturated fats are considered more healthful than trans fats and unsaturated fats.

Table 4.2. Fatty acid content of different fats (%)

Fats	Saturated fatty acids	Monounsaturatedfatty acids	Polyunsaturated fatty acids
Coconut oil	92	6	2
Palm oil	46	44	10
Cotton seed oil	25	25	50
Groundnut oil	19	50	31
Safflower oil	10	15	75
Sunflower oil	8	27	65
Corn oil	8	27	65
Soya bean oil	14	24	62
Butter	60	37	63

Although plant oils tend to be largely unsaturated, there are notable exceptions, such as coconut fat, which is highly saturated but semiliquid at room temperature because its fatty acids are of medium chain length (8 to 14 carbons long).Maine parameter of biological value of fatscontents unsaturated fat acids.

Saturated fats tend to be more stable than unsaturated ones. *Differences of unsaturated fatty acids (low-molecular fatty acids) from saturated fatty acids* by biological properties is regulating of fat metabolism, favorable effect on liver function, regulating of cholesterol metabolism.A characteristic feature of saturated fatty acids(this is high-molecular fatty acids)is that they give fatsa solid consistency, increase their melting point. The food industry takes advantage of this

property during hydrogenation, in which hydrogen molecules are added to a point of unsaturation, thereby making the fatty acid more stable and resistant to rancidity (oxidation) as well as more solid and spreadable (as in margarine).

However, a result of the hydrogenation process is a change in the shape of some unsaturated fatty acids from a configuration known as cis to that known as trans. Trans-fatty acids, which behave more like saturated fatty acids, may also have undesirable health consequences'.

The biological role of polyunsaturated fatty acids (PUFA):

1. Participate as structural elements in phosphatides of lipotropic membrane of cell;
2. Composed into the connective tissue and membranes of nerve fibers;
3. PUFA affect cholesterol metabolism by stimulating its oxidation and isolation of the organism, and with it forming esters, which do not fall out of solution;
4. PUFAs have a normalizing effect on the blood vessel walls, increasing their elasticity and strengthening them.
5. PUFA are involved in the metabolism of B vitamins (thiamine and pyridoxine).
6. PUFA stimulate the body's defense mechanisms (increase resistance to infectious diseases and the effects of radiation, etc.).
7. PUFAs possess lipotropic action, i.e., prevent fatty of liver (pangamic acid,methionine,inositol – this islipotropic substances that prevent fatty infiltration of the liver by accelerating the synthesis of lecithin in it).
8. PUFAs are important in the prevention and treatment of diseases of the cardiovascular system.

The biological significance of PUFAs differently. With the largest active-arachidonic acid is less than - linoleic and linolenic. The need for PUFAs is 3-6 gram/day. On the content of PUFA, dietary fats are divided into three groups: 1- fats rich in polyunsaturated fatty acids: fish oil (30% arachidonic), vegetable oils (linseed, hemp, sunflower, cottonseed, corn, soy), *2* - with an average content of polyunsaturated fatty acids fats: pork fat, goose fat, chicken fat, 3 - PUFA content not exceeding 5-6%: mutton and beef fats, some types of margarine.

Especially high biological activity of different liver oil of fish and marine mammals. An indicator of the biological value of fat is also the presence of vitamins A, D, E. Therefore, butter containing these vitamins, despite low levels of polyunsaturated fatty acids, is a product of high biological value.However, dietary fats rich in unsaturated fatty acids content in the olive and corn oils.This

fats is the most of assimilability.Insufficiency of polyunsaturated fatty acids in the body casesatherosclerosis, coronary thrombosis,decrease or disappearance of lipotropic properties of choline.

It is established that when possible changes in the body due to insufficiency of polyunsaturated fatty acids development atherosclerosis and coronary thrombosis.

The fats of nutritional importance are triglycerides (fats and oils), phospholipids (e.g., lecithin), and sterols (e.g., cholesterol).

Triglycerides. The major lipids in food and stored in the body as fat are the triglycerides, which consist of three fatty acids attached to a backbone of glycerol (an alcohol). Fatty acids are essentially hydrocarbon chains with a carboxylic acid group (COOH) at one end, the alpha (α) end, and a methyl group (CH3) at the other, omega (ω), and end. They are classified as saturated or unsaturated according to their chemical structure. A point of unsaturation indicates a double bond between two carbon atoms, rather than the full complement of hydrogen atoms that is present in saturated fatty acids. A monounsaturated fatty acid has one point of unsaturation, while a polyunsaturated fatty acid has two or more.

The common fatty acids in foods are listed in the table. Fatty acids found in the human diet and in body tissues range from a chain length of 4 carbons to 22 or more, each chain having an even number of carbon atoms. Of particular importance for humans are the 18-carbon polyunsaturated fatty acids alpha-linoleic acid (an omega-3 fatty acid) and linoleic acid (an omega-6 fatty acid); these are known as essential fatty acids because they are required in small amounts in the diet. The omega designations (also referred to as n-3 and n-6) indicate the location of the first double bond from the methyl end of the fatty acid. Other fatty acids can be synthesized in the body and are therefore not essential in the diet. About a tablespoon daily of an ordinary vegetable oil such as safflower or corn oil or a varied diet that includes grains, nuts, seeds, and vegetables can fulfill the essential fatty acid requirement. Essential fatty acids are needed for the formation of cell membranes and the synthesis of hormone-like compounds called eicosanoids (e.g., prostaglandins, thromboxane's, and leukotrienes), which are important regulators of blood pressure, blood clotting, and the immune response. The consumption of fish once or twice a week provides an additional source of omega-3 fatty acids that appears to be healthful.

The biological role of phosphatides: the composition of fat includes phosphatides. The highest biological activity has lecithin, cephalin, and sphingomyelin. In complex proteins, they are members of the nerve tissue, liver, cardiac muscle, gonads. Participate in the construction of cell membranes, determine their degree of permeability of fat-soluble substances. Participate in the active transport of specific substances and complex ions in and out of cells. Phospholipids are involved in blood clotting. Contribute to better use of protein and fat in the tissues. Warns fatty infiltration of liver.Differences between lecithin and cephalin is prevents excessive accumulation of cholesterol in the body and greates an opportunity for the splits of cholesterol in the body and its excretion.

Phosphatides, lecithin mostly, play a role in prevention of atherosclerosis (anti-sclerotic effect) - prevents the accumulation of cholesterol in the vessel wall, promote cleavage and removal from the body. Thanks to these properties, phosphatides belong to the lipotropic factors. The need for phosphatides (for adults) is 5 g / day. Phosphatides contain: egg yolk - 9000 mg. /%, brains - 6000 mg%, a liver - 2500 mg. / %, and also in meat, cream, sour cream (table 4.3.). From herbal products by a significant content are characterized largely unrefined oil. Often used as a source of soy lecithin phosphatides or produced phosphatide concentrates - sunflower and soya, used to refined vegetable oils and margarine. An obstacle to the use of these concentrates are unsatisfactory their flavoring properties, rapid oxidation and rancidity.

Table 4.3. The content of phosphatide in vegetable oils

Vegetables oils	Unrefined (phosphatide mg%)	Refined (phosphatide mg %)
Cottonseed	2500 mg%	100-200 mg%
Soya	3000 mg% or more	-
Wheat	2000 mg%	-
Sunflower	1400 mg%	-
Corn	700-1500 mg%	100 mg%

The biological role of sterols: the fat composition comprises fat-like substances - sterols, water-insoluble compound. There are phytosterols (plant origin) and zoosterols (of animal origin). Phytosterols have biological activity and play an important role in normalization of cholesterol and fat metabolism. The most important representative of the phytosterol is sitosterol, especially

β-sitosterol, which forms insoluble complexes with cholesterol, prevents the absorption of cholesterol in the intestine, which is of great importance in the prevention of atherosclerosis. Cytosterol isnormalizes fat metabolism, prevent cholesterolemiya.β-sitosterol is contained in corn and cotton (400 mg%) oils. olive oil (300 mg%), sunflower oil (200 mg%).

*Zoosterols in the human body.*If you carefully analyze the body of an adult healthy person, you can determine that many organs contain some stores of sterols. Most zoosterols were concentrated in the tissues of the brain. Depending on individual characteristics, this indicator can range from 2 to 4 percent of the total body weight. A little less - about 3 percent of the substance contains nervous tissue. The smallest of all zoosterol in a percentage ratio - approximately 0,25% - is stored in the muscles. But it's enough to remember how many muscles are in the body of an adult, as it becomes clear: considerable reserves of sterol are hidden in the muscles.

At the cellular level, zooterols are responsible for the elasticity and strength of the cell. But, interestingly, sterols of animal origin have practically no effect on the body directly, they enter into reactions, the result of which affects the body.Zoosterine is rich: lamb fat tail, goose (bird) fat, offal (brain, liver, kidneys), chicken eggs and meat, red meat, seafood: sea fish (cod, saury, herring).

Important zoosterol's it is cholesterol. It comes into contact with animal products, but can be synthesized from intermediate metabolism of carbohydrates and fats products. Cholesterol plays an important physiological role as a structural component of the cell,participates in the formation of hormones of the adrenal cortex, osmosis and diffusion processes,formation of cholecalciferol, it is the source of bile acids, hormones (sex and adrenal cortex), a precursor of vitamin D_3. However, cholesterol is considered as a factor in the formation and development of atherosclerosis. The blood cholesterol bile is retained in the form of a colloidal solution by binding to phosphatides, unsaturated fatty acids, proteins. At violation of exchanging of these substances or their lack of cholesterol precipitates as small crystals deposited on the walls of blood vessels, bile ducts, which promotes occurrence of atherosclerotic plaques in blood vessels, the formation of gallstones.

However, there are studies that deny the role of cholesterol in atherosclerosis and highlights the increased consumption of animal fats, rich in saturated fatty acids solid. The main cholesterol biosynthesis in the liver. With the predominance of saturated fatty acids, cholesterol

biosynthesis is increased, with the predominance of PUFA - reduced. The cholesterol metabolism is important vitamins C and B_{12}, B_6 and folic acid. The need for cholesterol - 0.5-1.0 g / day. Almost cholesterol is contained in all animal products. The largest number is: in the brain (2000 mg%) chicken egg (570 mg%), duck egg (560 mg%), cheese (520 mg%). Animal fats - sources of vitamins A, D, E and F. factor- butter contains vitamins A and D. Vegetable oils - vitamins E and F. factor.

Differences between cytosterol and cholesterol is normalizes fat metabolism, prevents cholesterolemia.

The biological role of tocopherols: the fat composition comprises tocopherols, which are found in vegetable oils and presents seven kinds (α -, β -, γ-tocopherol, etc.), and of which α -, β - tocopherol possess vitamin E activity and the other are powerful antioxidants. The most important feature of tocopherol is their ability to normalize and stimulate muscle activity. Degree of cover the body tocopherols is important for the normal function of the heart muscle. Increasing use of tocopherols obtained at high physical activity to improve muscle performance. An important feature of tocopherol is their ability to increase the accumulation of the internal organs of the fat-soluble vitamins, especially retinol. They are one of the most active agents that promote the conversion in the body carotene retinol (vitamin A). If we consider that 75% of the demand is covered carotene to retinol and that the latter is difficult to digest, it becomes clear the great importance which have tocopherols to provide retinol body. Sources of vegetable oils are tocopherols, and sunflower oil is particularly valuable because it contains only a-tocopherol (100%), which has vitamin activity. A significant amount of tocopherols found in egg yolk, butter, margarine (figure 4.2.).

Figure 4.2. Foods is fats contents

The value of oil is determined such important indicators as indispensability, digestion, absorption and assimilation. At the mixed nutrition 93-98% of butter, 96-98% of pork fat 80-94% of beef fat, 86-90% of sunflower oil, 94-98% of margarine are digested. The vegetable fats should be store in a sealed container in a dark, cool place. Melted fat at during prolonged storage does not spoil in the refrigerator.

A much shorter expiration date of butter and margarine because they contain water in a larger amount than other fats. The margarine was stored at temperature no more than 10 ° and not more than 15 days, butter - less than 10 days. Excessive consumption of fat (especially animal) leads to the development of atherosclerosis, disorders of lipid metabolism, function of liver and also to increase the frequency cancerous neoplasms. Undesirable to use an excess amount of high-melting fat during dinner (leads to the formation of thrombi). It is not recommended and the excess vegetable oil at which reduced activity of thyroid and is caused deficiency of vitamin E (because PUFAs are antagonists for it). Prolonged heat treatment destroys fat biologically active substance, thus formed toxic products of fatty acid oxidation. When heated above 200 ° C, and repeated heat treatment oils are carcinogenic.

Inadequate intake of fat can lead to a number of CNS disorders (especially in the brain), weakening of the immune-biological mechanisms, pathological changes in the skin, kidneys and eyes, fatty dystrophy of liver. At without fat diet animal stops growth, falling weight, disturbed sexual function and water metabolism, reduces the production of steroid hormones in the adrenal glands, weakens the body's resistance to adverse factors, shortened lifespan. However, for many diseases it is necessary to limit the amount of fat: obesity; pancreatic diseases; chronic colitis; diseases of a liver; diabetes; acidosis.

Fats are normalized under physiological nutrition norms in relation to the protein of 1: 1 (for the pediatric population), and 1: 1.2 (for adults), the content of vegetable fats in the diet necessary to meet the daily requirement of the adult population in polyunsaturated fatty acids it should be 25-30 gram. Daily norm of fats for men of I group on intensity of work - 93-103 gram (table 4.4).According to the principles of balanced diet, the content of fats plant origin in the diet should be 30 %.

Table 4.4. Requirement in fats for different groups of the population

Professional group	Age	Fats, g/day			
		for men		for women	
		total	vegetable fat	total	vegetable fat
I	18-40 40-60	90 81	27 25	77 70	23 21
II	18-40 40-60	97 91	29 27	82 76	25 23
III	18-40 40-60	103 97	31 28	87 81	26 25
IV	18-40 40-60	120 110	36 33	102 94	30 28
Aged	60-70 >70	76 71	27 25	67 63	23 22
Students	-	106	32	90	27

Carbohydrates.From what has been said above, it will be clear that the various digestible carbohydrates of the food, having been split by the digestive enzymes to monosaccharide, are absorbed into the blood. Any surplus is stared temporarily in the form of glycogen, chiefly in the liver, though to some extent in the muscles. The glucose, which circulates in the blood, is burned in the muscles and other active tissues as fuel, the burned glucose being constantly replaced by new glucose derived from the stored glycogen. When more carbohydrate is received than is burned, the surplus is stored as glycogen, but only to a limited extend, the total amount of glycogen which the human body can store being estimated at less than one pound or only about as much carbohydrate as might be contained in the food of one day. A surplus of carbohydrate, in addition to being stored as glycogen, may also be converted into fat, and this transformation of carbohydrate into fat can be carried on to a very large extent and with almost no loss of energy.Energetic cost of 1 gram of carbohydrates is 4,0 kcal.

The biological role. Carbohydrates belongs exclusively important role in nutrition: carbohydrates are a good energetic material; plastic function of carbohydrates is low, but they are part of some tissues and liquids of body; the regulatory function of carbohydrates is that they counteract the accumulation of ketone bodies in the oxidation of fats.The plastic function of carbohydrates in the

body is that they are part of cells and tissues in the form of cerebrosides and nucleoproteins. In case of violation of carbohydrate metabolism (diabetes) develops acidosis; carbohydrates give the food a feeling of sweet taste; tone up the central nervous system; carbohydrates have biological activity this is special function in the body: heparin to prevent blood clotting in the blood vessels, hyaluronic acid prevents bacterial penetration through the cell membrane; the role of carbohydrates in the defense reactions (especially in liver): glucuronic acid connected with toxic substances forming non-toxic esters, which are soluble in water (removed from the urine).So, carbohydrates that perform special functions in the body and have biological activity is heparin, hyaluronic acid,oligosaccharides.

Carbohydrate foods are divided into simple and complex. The simple carbohydrates include monosaccharides (glucose, fructose, galactose) and disaccharides (sucrose, lactose and maltose). For complex carbohydrates are polysaccharides (starch, glycogen, pectin, cellulose). Simple sugars are absorbed very quickly and burn quickly, releasing energy. Complex carbohydrates have a difficult chemical structure,difficult to digest, hardly soluble in water. Athletes to maintain high, but short-term operability successfully use this property (for example, sprint). Simple carbohydrateshave a simple chemical structure,easily soluble in water,easily digestible.Vegetables isthe lowest carbohydrate digestibility coefficient.

The biological role of the monosaccharides. Glucose - the major structural unit, from which it is built polysaccharides (starch, glycogen, cellulose). Glucose is a part of disaccharides - sucrose, lactose, maltose. It is rapidly absorbed into the blood and at high physical activity is used as an energy source. Glucose is involved in the formation of glycogen, at nutrition of brain tissue, working muscles (especially heart muscle). Glucose has a slightly sweet taste, rapidly absorption from the intestine, comparably from fructose. Glucose is easily converted into fat in the body, especially when it is excessive intake.Glucose has a slightly sweet taste.Fruits and berries,disintegration of disaccharides and starchis this processes that occupy the main place in the formation of glucosein the body. Glucose sources: fruits and berries (grapes, persimmons, bananas, apples, peaches, etc.) and honey, where glucose contained up to 37%.

Fructose has the same properties as the glucose, but it is slowly absorbed in the intestine and entering the blood leaves it rapidly, without causing saturation of blood of sugar. It fructose property is used for diseases of diabetes. Fructose is much faster than glucose is converted to

glycogen. There its better tolerability as compared to other sugars. Fructose is almost 2 times sweeter than sucrose 3 times sweeter than glucose. If the sweetness of sucrose taken as 100, the amount of fructose sweetness 173, glucose - 74, xylose - 40, invert sugar – 130, maltose - 32.5, galactose - 32.1, lactose - 16. High fructose sweetness allows using it in a small an amount that is of great importance for food rations with caloric restriction.

Sources of fructose: fructose richest in the apples, black currants, watermelon (table 4.5).

Table 4.5. Sources glucose and fructose in the different fruits (gr)

Products	Glucose	Fructose
Grapes	7,8	7,7
Raspberries	4,4	4,2
Plum and watermelon	3,0	3,9
Cherries	5,5	4,2
Apricot, apple and mandarin	2,0-2,2	5,2,-5,5

The biological role of disaccharides.

Sucrose in the gastrointestinal tract breaks up into glucose and fructose. Excessive amounts of sucrose in the diet of children leads to the development of dental caries. Sucrose - the most common sugar. Sources of sucrose: sugar beet (14-18%) and sugar cane (10-15%). Sucrose content: in the sugar, sand - 99.75%, in refined sugar - 99.9%. Sucrose has the ability to turn into fat.

Lactose - carbohydrate of animal origin. Hydrolysis is cleaved into glucose and galactose. Hydrolysis is slow, limiting the fermentation process, which is of great importance in the diet of infants. Intake of lactose contributes to the development of lactic acid bacteria that suppress the development of putrefactive microorganisms. Lactose is the least used for the formation of fat and excess does not increase blood cholesterol. Lactose is the smallest sweetness. Source lactose: milk and dairy products, in which the content of the disaccharide can reach 4-6%.

Galactose is the product of lactose hydrolysis. Galactose is less sweet than glucose and sucrose. It is considered a nutritive sweetener because it has food energy. Galactose and glucose both play important roles in joining with lipids to form glycolipids and joining with proteins to form glycoproteins. Galactolipids are a major component of the membrane tissues of plants, while

galactose joined in forming the more complex galactocerebrosides acts as an important component of membrane tissues in animal muscles and nerves.Under normal conditions, the intricate coordination in the human body is remarkable, with lactose in food being broken down, via enzymes, into glucose and galactose, and these sugars being further metabolized. Galactose and lactose, which is composed of glucose and galactose, can promote dental caries. However, in rare cases (one per 62,000 births), this harmonious system is compromised by a genetic disorder, affecting an individual's ability to properly metabolize the sugar galactose. This leads to toxic levels of galactose building up in the blood, requiring the elimination of lactose and galactose from the diet. This condition is known as galactosemia.*Galactosemia* or "galactose diabetes," is a rare genetic disease, in which the lack one of the enzymes needed to convert galactose to glucose results in the buildup of galactose in the blood and a subsequent damage of the liver, brain, kidneys and eyes . When infants with galactosemia are fed with breast milk or formula containing galactose or lactose, they may develop lethargy, enlarged liver, hypoglycemia, convulsions or jaundice in the first days of their lives. Galactosemia cannot be treated, but symptoms may be prevented by a strict life-long galactose-free and lactose-free diet.Foods high in galactose include milk-based puddings, sweetened yogurt, cherries, honey, celery, kiwifruit, hamburgers (with condiments), plums, low-fat mozzarella, and avocados.

Starch. Its share in the diet account for about 80% of the total amount of carbohydrates consumed. The starch in the human body is the main source of glucose. Starch is the main part of the carbohydrates of bread and bakery products, flour, various cereals, potatoes.

Glycogen is a reserve carbohydrate of animal tissues. Excess carbohydrates coming from food is converted into glycogen, which is stored in the liver, forming a depot of carbohydrates used for a variety of physiological functions - an important role in the, nutrition of working muscles, energy material for organs and systems, regulation of blood sugar levels. The total content of glycogen of about 500 g. If carbohydrates from food are not available, the stocks are depleted in 12-18 hours. Due to the depletion of reserves of carbohydrates enhanced fatty acid oxidation processes. The depletion of liver glycogen leads to the appearance of fatty infiltration, and further - to the fatty liver. Sources of glycogen: the liver, meat, fish.

Cellulose is the substance that makes up most of a plant's cell walls. For humans, cellulose is also a major source of needed fiber in our diet.Despite the fact that humans (and many other animals)

cannot digest cellulose (meaning that their digestive systems cannot break it down into its basic constituents), cellulose is nonetheless a very important part of the healthy human diet. This is because it forms a major part of the dietary fiber that we know is important for proper digestion. Since we cannot break cellulose down and it passes through our systems basically unchanged, it acts as what we call bulk or roughage that helps the movements of our intestines.Cellulose isincrease absorption and motor function of intestine, remove cholesterol from the body, normalizes the activity of beneficial intestinal microflora. Cellulose encourages movement of food through the intestines, thus helping to prevent constipation and irregularity. All plant foods, such as fruits, vegetables, grains, beans, nuts and seeds contain cellulose. Whole foods, with the skin and seeds intact, have more cellulose than foods that have these removed. While juices do contain types of dietary fiber, they do not provide any cellulose.The quantity of cellulose in the daily diet is 25-30 gram.

Pectin substances. There are pectin's and protopectin. Protopectin - compound pectin and cellulose.The conversion of protopectin to pectin depends from enzyme (ferment) and temperature. It is found in plant cell walls, is insoluble in water. The rigidity of the immature fruit due to the large content of protopectin. In the process of maturation protopectin cleaved and fruits become soft at the same time, they are enriched with pectin. Pectin is a component of the cell sap, and is characterized by good digestibility. Pectin substances have the ability to inhibit the activity of putrefactive intestinal microflora. The pectin's is also helping formation of some amino acids, B group vitamins, create condition of formation useful microflora in intestines, de intoxication effect, excretion cholesterol and heavy metal from organism. Pectin is used in treatment and preventive nutrition for persons working with lead and other toxic substances.The positive value for the body of pectin contained in fruits and vegetables is has bactericidal and detoxifying properties, increasing intestinal peristalsis, it prevents the occurrence of constipation, accelerates the retention and elimination of cholesterol, harmful and carcinogenic substances from the body, depositing pathogenic microorganisms on itself, removes them from the body, increases the normal intestinal flora. Pectin substances contained in apricots, oranges, cherries, plums, apples, pears, quince, pumpkin, carrots, radishes.

Cellular tissue (pulp) forms a cell membrane and a supporting material. The important role of fiber as a stimulator of intestinal peristalsis, the adsorbent of sterols, including cholesterol,

prevents their reverse absorption and excretion from the body. Cellular tissue plays a role in the normalization of the intestinal microflora, reducing putrefactive processes, prevents the absorption of poisonous substances. Cellular tissue contains in: potatoes (1%), fruits and vegetables (0,5-1,3%), vegetables (0,7-2,8%), buckwheat grains (2%).

Dietary fiber. Dietary fiber, the structural parts of plants, cannot be digested by the human intestine because the necessary enzymes are lacking. Even though these no digestible compounds pass through the gut unchanged (except for a small percentage that is fermented by bacteria in the large intestine), they nevertheless contribute to good health. Insoluble fiber does not dissolve in water and provides bulk, or roughage, that helps with bowel function (regularity) and accelerates the exit from the body of potentially carcinogenic or otherwise harmful substances in food. Types of insoluble fiber are cellulose, most hemicelluloses, and lignin (a phenolic polymer, not a carbohydrate). Major food sources of insoluble fiber are whole grain breads and cereals, wheat bran, and vegetables. Soluble fiber, which dissolves or swells in water, slows down the transit time of food through the gut (an undesirable effect) but also helps lower blood cholesterol levels (a desirable effect). Types of soluble fiber are gums, pectin's, some hemicelluloses, and mucilage's; fruits (especially citrus fruits and apples), oats, barley, and legumes are major food sources. Both soluble and insoluble fiber help delay glucose absorption, thus ensuring a slower and more even supply of blood glucose. Dietary fiber is thought to provide important protection against some gastrointestinal diseases and to reduce the risk of other chronic diseases as well

The highest carbohydrate content in granulated sugar, pasta.The norm of carbohydrates for people you can find in the table 4.6. The average need of carbohydrates is 400-500 gram /day for adults. Thus, the total number of carbohydrate starch should fall 350-400 gram, on mono and disaccharides - 50-100 gram, on nutritional ballast substances (cellulose and pectin) -25 gram.

Table 4.6. Requirement in carbohydrates for different groups of the population

Age	Professional Group (gram /day)											
	I		II		III		IV		V		Aged	
	men	wom.	men	wom.	men	wom.	men	wom.	men	wom.	men	wom.
18-29	358	289	411	318	484	378	566	462	562	-	-	-
30-39	335	274	387	311	462	372	528	432	550	-	-	-
40-59	303	257	366	305	432	366	499	417	524	-	-	-
>60	-	-	-	-	-	-	-	-	-	-	335	284

Excessive consumption of sugar promotes tooth decay,increase in the specific weight of putrefactive microorganisms in the intestine,intensity of putrefactive processes, the occurrence of flatulence, disruption of the normal ratio of excitatory and inhibitory processes in the nervous system, supports the inflammatory processes and promotes sensitization of the organism.

It is necessary to limit the carbohydrates in the following diseases: diabetes; obesity;atherosclerosis,allergies, skin diseases.

Vitamins.

Some of the first evidence for the existence of vitamins emerged in the late 19th century with the work of Dutch physician and pathologist Christiaan Eijkman. In 1890 a nerve disease (polyneuritis) broke out among his laboratory chickens. He noticed that the disease was similar to the polyneuritis associated with the nutritional disorder beriberi. In 1897 he demonstrated that polyneuritis was caused by feeding the chickens a diet of polished white rice but that it disappeared when the animals were fed unpolished rice. In 1906–07 British biochemist Sir Frederick Gowland Hopkins observed that animals cannot synthesize certain amino acids and concluded that macronutrients and salts could not by themselves support growth.

In 1912—the same year that Hopkins published his findings about the missing nutrients, which he described as “accessory” factors or substances - a Polish scientist, Casimir Funk, demonstrated that polyneuritis produced in pigeons fed on polished rice could be cured by supplementing the birds’ diet with a concentrate made from rice bran, a component of the outer husk that was removed from rice during polishing. Funk proposed that the polyneuritis arose because of a lack in the birds’ diet of a vital factor (now known to be thiamin) that could be found

in rice bran. Funk believed that some human diseases, particularly beriberi, scurvy, and pellagra, also were caused by deficiencies of factors of the same chemical type. Because each of these factors had a nitrogen-containing component known as an amine, he called the compounds “vital amines,” a term that he later shortened to “vitamins.” The final e was dropped later when it was discovered that not all of the vitamins contain nitrogen and, therefore, not all are amines.

In 1913 American researcher Elmer McCollum divided vitamins into two groups: “fat-soluble A” and “water-soluble B.” As claims for the discovery of other vitamins multiplied, researchers called the new substances C, D, and so on. Later it was realized that the water-soluble growth factor, vitamin B, was not a single entity but at least two - only one of which prevented polyneuritis in pigeons. The factor required by pigeons was called vitamin B_1, and the other factor, essential for rats, was designated vitamin B_2. As chemical structures of the vitamins became known, they were also given chemical names, e.g., thiamin for vitamin B_1 and riboflavin for vitamin B_2.

Vitamins are organic substances that are necessary in small quantities for normal health and growth in higher forms of animal life. Vitamins include in the blood, hormones, ferments and other biological structure of organism. In the body presence of small quantities, necessary to correct growth and health, most of them are not produced in the body, but some of vitamin's may formed in the body like vitamins: PP (from tryptophan), and vitamin D (from 7-8 dehydrocholestrol). Vitamins are distinct in several ways from other biologically important compounds such as proteins, carbohydrates, and lipids. Although these latter substances also are indispensable for proper bodily functions, almost all of them can be synthesized by animals in adequate quantities. Vitamins, on the other hand, generally cannot be synthesized in amounts sufficient to meet bodily needs and therefore must be obtained from the diet or from some synthetic source. For this reason, vitamins are called essential nutrients. Vitamins also differ from the other biological compounds in that relatively small quantities are needed to complete their functions. In general, these functions are of a catalytic or regulatory nature, facilitating or controlling vital chemical reactions in the body’s cells. If a vitamin is absent from the diet or is not properly absorbed by the body, a specific deficiency disease may develop.

Classification: the principle of solubility in water and fats is the basis of the modern classification of vitamins (table 4.7.).

Table 4.7. Classification of vitamins

Fats-soluble vitamins	**Water-soluble vitamins**	**Vitamin substances**
Vitamin A (retinol)	Vitamin B_1 (thiamint)	VitaminB_{15}
Provitamin A (carotin)	Vitamin B_2 (riboflavin)	Para-aminobenzoic acid (vitaminH_1)
Vitamin D (calciferol)	Vitamin PP (nicotinic acid)	VitaminB_{13} (orotic acid)
Vitamin K (phyllokinone)	VitaminB_6 (pyridoxine)	Choline (vitaminB_4)
Vitamin E (tocopherol)	Vitamin B_{12} (cyancobalamin)	Inositol (vitaminB_8)
	Folic acid	Carnitine (vitamin B_T)
	VitaminB_c	Polyunsaturated fatty acids (vitamin F)
	VitaminB_3 (pantothenic acid)	S-methylmethionine sulfonium-chloride (vitamin U)
	Vitamin H (biotin)	
	Vitamin N (lipoic acid)	
	Vitamin C (ascorbic acid)	
	Vitamin P (bioflavonoids)	

The main functions of vitamins (table 4.8.): most of them are integral part of coenzymes; they get part in biochemical reactions at tissue level (tissue oxidation); they are involved in metabolic reactions**;** they preserve hormones from destruction; they get part in formation of enzymes.

Table 4.8. Characteristics of vitamins on biological action

Effects caused in organism	**Vitamin**	**Biological action**

Increasing immunity of organism	B_1, B_2, B_6, PP,A, C,D	Stimulation of body resistance
Antihemorrhagic	C, P, K	Provides normal permeability and vessels, resistance, increases of blood coagulability
Antianemic	B_{12}, C	Normalize and stimulation of haemopoiesis
Antiinfection	A, C, B_1, B_2, B_6, PP	Raise stability of the organism to infection, stimulation of formation an antibody, intensify defensive ability an epithelium, neutralize toxin of the incidents to infections
Vision regulation	A, B_2, C	Essential for vision

Clinical situation category:

1) Hypervitaminosis and toxicity;

2) Hypovitaminosis- deficient quantity of vitamin in daily ration (lower than daily requirement);

3) Avitaminosis (the absence of vitamin in daily ration: for example, Beri- Beri disease as result of vitamin B_2 deficiency; scurvy – as result of vitamin C deficiency).

The correct sequence of stages of vitamin deficiency:

latent - hypovitaminosis - clinical signs - avitaminosis

Causes of hypovitaminosis (*etiology*): a) external factors: food problems (storage time, cooking methods, low content of vitamin in food); season (spring and autumn); poor knowledge of food value; b) internal factors: problem with absorption and intercurrent infection (protozoa); the physiological condition of the body (increase of vitamin requirement in pregnancy).

Hypervitaminosis is abnormal state resulting from excessive intake of one or more vitamins.Hypervitaminoses are primarily caused by fat-soluble vitamins (D and A), as these are stored by the body for longer than the water-soluble vitamins. Toxicities of fat-soluble vitamins can also be caused by a large intake of highly fortified foods, but natural food in modest levels rarely deliver extreme or dangerous levels of fat-soluble vitamins. Sings and symptom: frequent urination and/or cloudy urine.Increased urine amount. Eye irritation and/or increased sensitivity to light. Irregular and/or rapid heartbeat. Bone and joint pain (associated with avitaminosis). Muscle pain. Confusion and mood changes (e.g. irritability, inability to focus). Convulsions. Fatigue. Headache. Flushing of skin (associated with niacin (vitamin B_3) overdose). Skin disturbances (e.g. dryness, itching, cracking of skin, rashes, increased sensitivity to sun). Changes of hair texture (e.g. thickening and/or clumping of hair). Appetite loss. Constipation (associated with iron

or calcium overdose). Nausea and vomiting. Diarrhea. Moderate weight loss (more commonly seen in long-term overdose cases).

Causes: with few exceptions, like some vitamins from B-complex, hypervitaminosis usually occurs with the fat-soluble vitamins A and D, which are stored, respectively, in the liver and fatty tissues of the body. These vitamins build up and remain for a longer time in the body than water-soluble vitamins.Conditions include: hypervitaminosis A, hypervitaminosis D, vitamin B_3 and toxicity, megavitamin-B_6 syndrome.Prevention : prevention in healthy individuals not having any periods of avitaminosis or vitamin (vegetables) lack for 2 years at least is by not taking more than the expected normal or recommended amount of vitamin supplements.

*Avitaminosis*is the term used for a group of conditions or diseases caused by the chronic or long-term deficiency of one or more vitamins. The disease is typical for the winter-spring period, when a source of many vitamins, vegetables and fruits are not as accessible and saturated with vitamins as in summer and autumn. However, in summer it is not so easy to get the required amount of vitamins from fruits only. To fill the daily need for vitamins and trace elements, you need to eat at least 1.5-2 kg of fruits, berries and vegetables. Also: unbalanced nutrition, eating poor quality food, smoking, environmental conditions that are far from ideal. These processes, both external and internal, interfere not only with the ingestion of vitamins from food, but in most cases violate the possibility of absorption of vitamins from the digestive system into the blood. Thus, the body, having the necessary amount of vitamins in food, cannot “take” them. In this case, vitamin deficiency develops as a result of dysfunction of the gastrointestinal tract. This is possible in children with malabsorption syndrome, when the process of digestion and absorption of various nutrients contained in food is greatly disturbed, and the absorption of vitamins is also affected. Another cause of vitamin deficiency can be intestinal dysbiosis. Often dysbacteriosis is a consequence of long-term antibiotic treatment.

The ingestion of “antivitamins” is another reason. Antivitamins are substances that have the opposite effect to vitamins. More precisely, antivitamins make it impossible for the function of vitamins and lead to the development of vitamin deficiency even with a normal content of vitamins in the body. One example of the toxic action of antivitamins is vitamin K antagonist poisoning (syncumar, dicumarol) in the treatment of increased blood clotting. At the same time the hemorrhagic syndrome characteristic of classical vitamin K deficiency develops.But the main

reason for the appearance of this disease is the lack of physical ability to obtain all the required vitamins with food.

Types of avitaminosis: vitamin A vitamin deficiency. This vitamin plays an important role in the normal functioning of the organ of vision, therefore its deficiency will cause disturbances in the work of the visual analyzer. Appear "night blindness" (deterioration of twilight vision), dryness of the mucous membrane of the eye (feeling of sand, burning, discomfort), due to the constant scratching which may even form sores. The importance of this vitamin plays out for the skin. If it is not enough, the skin becomes dry, with small boils and inflammations, it can peel off. If a lack of vitamin A is observed in a child, then its development will be slowed down, there may be disturbances in the nervous system. Also, with this type of avitaminosis, immunity will decrease, which is fraught with increased incidence.

Signs of avitaminosis. We are always afraid of vitamin deficiency. How to determine on their own whether we really lack them. As experts say, rarely when the body lacks only one specific vitamin. As a rule, we need a group of these nutrients. If a person refuses animal products, there is usually not enough vitamin A, D, E and biotin. If there are not enough plant products in the diet, then there is a deficiency of vitamins C and group B.

Shelled skin- lack of vitamins makes the skin dry and flaky. And sometimes you can even see the appearance of coarse flaky scales of the epidermis. Watch out if your lips are constantly cracked or peeling off, suddenly there was acne, as well as cracks and sores in the corners of the mouth. The appearance of inflamed areas of skin, large bruises, or an unusual reaction to jewelry or clothing can all be a sign of a lack of vitamins. *Overlapping nails*- with a lack of vitamins, nails become dull, brittle, and even their care products, such as oils or special products, do not save the situation. The lack of vitamins is also indicated by the paleness of the nail plate, the appearance of dimples, stripes or spots on it.

Hair fall out- the main symptom of a lack of vitamins on the part of the hair is their fragility and tendency to loss. But the sudden appearance of dandruff, gray hair, ulcers and pimples on the scalp or its constant itching should also alert.*Blush and watery eyes*- reduced vision, especially at dusk, is the most serious sign of vitamin deficiency. In addition, hypovitaminosis can cause redness and swelling of the eyelids, persistent itching and discharge

from the eyes, and frequent inflammatory diseases. Often the consequence of a lack of vitamins becomes intolerance to bright light, glare, double vision and even a developing cataract.

Gums are bleeding- increased bleeding of the gums, sores on the cheeks and tongue, loose teeth with sensitive enamel and a tendency to crumble, as well as swollen, patchy or discolored language are also obvious signs of a lack of vitamins.*The face swells*, the joints swell- the appearance of edema on the face and hands that are not related to marinades or yesterday's alcohol intake should be wary. Sudden swelling of the joints, numbness, muscle pain, cramps, and poor coordination of movement may also be symptoms of a lack of vitamins.

Smell changes- in addition, muscle weakness, a burning sensation under the skin and in the joints, as well as a constant feeling of cold and even increased or changed body odor indicate a vitamin deficiency.*Apathy*, poor concentration - our nervous system also reacts to the lack of vitamins. Inability to concentrate, insomnia, depression, apathy, irritability, lack of energy, constant irritability - all this may be signs of a lack of vitamins.*Failure in digestion* - constipation, diarrhea, change in taste, weight gain, increased cholesterol in the blood, nausea and intestinal absorption of nutrients are symptoms of vitamin deficiency. And even loss of appetite, smell and taste.*Lack of desire* - in many cases, reducing sexual desire is not to blame for fatigue, and unbalanced diet.

Treatment of avitaminosis: since the main cause of avitaminosis remains an unbalanced diet, the main measure of its treatment is the correction of its diet. Proper nutrition, by the way, will be a measure of prevention of such a condition. So, for a start it should be said that the basis of the diet should be as simple as possible products, culinary processing of which will be minimal. Whole cereal porridge should be eaten, as well as bread made from whole meal flour. Of course, do not forget that there should be as much as possible a variety of fruits and vegetables. And, of course, you cannot exclude meat products from your diet. You can also use synthetic vitamins to correct the condition, but it is still better to give preference to food. Treatment is possible only in the form of replenishing vitamin deficiencies with food intake or in the form of vitamin preparations. But since the latter are not very effective, it may be optimal to use folk remedies to combat vitamin deficiencies. It is also important to lead a healthy lifestyle, if possible to live in a favorable ecological environment and in time to treat diseases that may impair the ability of vitamins to be absorbed in the body.Diet. Treatment of avitaminosis is not difficult if its

appearance is caused only by malnutrition. You just need to adjust your diet: eat as much as possible whole grain cereals (the best option is oatmeal and buckwheat), try to serve foods that are minimally culinary. When eating bakery products, preference should be given to those made from coarse flour. Oil is better to use unrefined. Fresh vegetables and fruits in the diet should be required.In this case, in no case cannot refuse from animal products. The required daily amount of vitamin A is contained in the yolks of chicken eggs, beef liver, fish oil. An excellent source of essential vitamins is fermented milk products (kefir, yogurt), which also contain a lot of calcium.If we are talking about the treatment and prevention of vitamin C deficiency, then more should be consumed products, which include vitamin C contains: citrus fruits, apples, red and black currants, sauerkraut. In fact, with the goal of maximizing the micronutrients necessary for health, each person is fully capable of organizing proper nutrition.

*Vitamins and complexes.*Our ancestors were much more active lifestyle and worked hard, spending energy and strength. If you start eating like this, then the problem with vitamin deficiency will most likely be solved by earning a new one - overweight. That's why it makes sense to use vitamin complexes produced in various dosage forms. If you take such complexes in therapeutic doses, they do not accumulate in the body and do not give side effects. No need to fear the use of synthetic vitamins. They also do not cause side effects and allergic reactions.

Modern multivitamins are harmoniously balanced, chemically pure compounds that do not have the disadvantages that are present in preparations of plant and animal origin. It is only important not to forget that the main part of the vitamins is absorbed only with food intake, that it is impossible to drink coffee, soda water and milk with vitamins in order to avoid insufficient absorption. Today there is a great variety of options for such vitamins: pills, tablets, powders, capsules, liquid form. The most convenient form is a capsule, which, as it moves through the intestine, loses layer after layer, with the result that vitamins are easily absorbed. Take the capsule without chewing, entirely. The best time to take multivitamin complexes is the morning. The use of vitamins should not exceed the daily need for them! Overdose threatens to adversely affect the general condition and lead to new diseases.

Symptoms of child avitaminosis. Often, children suffer from avitaminosis. That is why caring parents must know about how vitamin deficiency manifests itself in children. So, the first sign of lack, may be a decrease in the activity of the baby, deterioration of appetite and a decrease

in immunity. If avitaminosis lasts long enough, then it is quite possible the lag of the baby in development and growth from their peers.

The vitamins are divided into vitamins proper and vitaminoid. The vitaminoids are biologically similar to vitamins, but are required in larger amount. Mostly the main source of vitamins is the food products. Consumption of high doses of any vitamin for a long time may cause toxic effect in the body.

Difference between water-soluble and fat-soluble vitamins. One major difference between water-soluble and fat-soluble vitamins is the way they are absorbed in the body. Water-soluble vitamins are absorbed directly from the small intestine into the bloodstream. Fat-soluble vitamins are first incorporated into chylomicrons, along with fatty acids, and transported through the lymphatic system to the bloodstream and then on to the liver. The bioavailability (i.e., the amount that gets absorbed) of these vitamins is dependent on the food composition of the diet. Because fat-soluble vitamins are absorbed along with dietary fat, if a meal is very low in fat, the absorption of the fat-soluble vitamins in that meal may be impaired.

Fat-soluble and water-soluble vitamins also differ in how they are stored in the body. The fat-soluble vitamins—vitamins A, D, E, and K—can be stored in the liver and the fatty tissues of the body. The ability to store these vitamins allows the body to draw on these stores when dietary intake is low, so deficiencies of fat-soluble vitamins may take months to develop as the body stores become depleted. On the flip side, the body's storage capacity for fat-soluble vitamins increases the risk for toxicity. While toxic levels are typically only achieved through vitamin supplements, if large quantities of fat-soluble vitamins are consumed, either through foods or supplements, vitamin levels can build up in the liver and fatty tissues, leading to symptoms of toxicity.

There is limited storage capacity in the body for water-soluble vitamins, thus making it important to consume these vitamins on a daily basis. Deficiency of water-soluble vitamins is more common than fat-soluble vitamin deficiency because of this lack of storage. That also means toxicity of water-soluble vitamins is rare. Because of their solubility in water, intake of these vitamins in amounts above what is needed by the body can, to some extent, be excreted in the urine, leading to a lower risk of toxicity. Similar to fat-soluble vitamins, a toxic intake of water-

soluble vitamins is not common through food sources, but is most frequently seen due to supplement use.

The water-soluble vitamins. Basic properties.

Although the vitamins included in this classification are all water-soluble, the degree to which they dissolve in water is variable. This property influences the route of absorption, their excretion, and their degree of tissue storage and distinguishes them from fat-soluble vitamins, which are handled and stored differently by the body. The active forms and the accepted nomenclature of individual vitamins in each vitamin group are given in the table. The water-soluble vitamins are vitamin C (ascorbic acid) and the B vitamins, which include thiamin (vitamin B_1), riboflavin (vitamin B_2), vitamin B_6, niacin (nicotinic acid), vitamin B_{12}, folic acid, pantothenic acid, and biotin. These relatively simple molecules contain the elements carbon, hydrogen, and oxygen; some also contain nitrogen, sulfur, or cobalt.

The water-soluble vitamins, inactive in their so-called free states, must be activated to their coenzyme forms; addition of phosphate groups occurs in the activation of thiamin, riboflavin, and vitamin B_6; a shift in structure activates biotin, and formation of a complex between the free vitamin and parts of other molecules is involved in the activation of niacin, pantothenic acid, folic acid, and vitamin B_{12}. After an active coenzyme is formed, it must combine with the proper protein component (called a proenzyme) before enzyme-catalyzed reactions can occur.

Metabolism

The water-soluble vitamins are absorbed in the animal intestine, pass directly to the blood, and are carried to the tissues in which they will be utilized. Vitamin B_{12} requires a substance known as intrinsic factor in order to be absorbed.

Some of the B vitamins can occur in forms that cannot be used by an animal. Most of the niacin in some cereal grains (wheat, corn, rice, barley, bran), for example, is bound to another substance, forming a complex called niacin that cannot be absorbed in the animal intestine. Biotin can be bound by the protein avid in, which is found in raw egg white; this complex also cannot be absorbed or broken down by digestive-tract enzymes, and thus the biotin cannot be utilized. In animal products (e.g., meat), biotin, vitamin B_6, and folic acid are bound to other molecules to form complexes or conjugated molecules; although none is active in the complex form, the three vitamins normally are released from the bound forms by the enzymes of the intestinal tract (for

biotin and vitamin B_6) or in the tissues (for folic acid) and thus can be utilized. The B vitamins are distributed in most metabolizing tissues of plants and animals.

Water-soluble vitamins usually are excreted in the urine of humans. Thiamin, riboflavin, vitamin B_6, vitamin C, pantothenic acid, and biotin appear in urine as free vitamins (rather than as coenzymes); however, little free niacin is excreted in the urine. Products (also called metabolites) that are formed during the metabolism of thiamin, niacin, and vitamin B_6 also appear in the urine. Urinary metabolites of biotin, riboflavin, and pantothenic acid also are formed. Excretion of these vitamins (or their metabolites) is low when intake is sufficient for proper body function. If intake begins to exceed minimal requirements, excess vitamins are stored in the tissues. Tissue storage capacity is limited, however, and, as the tissues become saturated, the rate of excretion increases sharply. Unlike the other water-soluble vitamins, however, vitamin B_{12} is excreted solely in the feces. Some folic acid and biotin also are normally excreted in this way. Although fecal excretion of water-soluble vitamins (other than vitamin B_{12}, folic acid, and biotin) occurs, their source probably is the intestinal bacteria that synthesize the vitamins, rather than vitamins that have been eaten and utilized by the animal. Usually vitamin B group deficiencyleads to the occurrence next symptoms: cheylose, angular stomatitis, “geographical” language and others.

The water-soluble vitamins generally are not considered toxic if taken in excessive amounts. There is, however, one exception in humans: large amounts (50–100 mg; 1 mg = 0.001 gram) of niacin produce dilation of blood vessels; in larger amounts, the effects are more serious and may result in impaired liver function. Thiamin given to animals in amounts 100 times the requirement (i.e., about 100 mg) can cause death from respiratory failure. Therapeutic doses (100–500 mg) of thiamin have no known toxic effects in humans (except rare instances of anaphylactic shock in sensitive individuals). There is no known toxicity for any other B vitamins.

Water soluble vitamins. *Vitamin B_1* (Thiamine). Functions: takes part in the tissue metabolism; thiamine is presented in the nervous cells, is implicated in the synaptic transmission of nervous impulses; takes part in carbohydrate metabolism. Daily requirement is 1 - 3 mg. The daily dose depends on age, sex and type of physical activity. Food sources: flour and bread (especially fortified), cereals, peas and beans, milk product. *Vitamin B_1 deficiency*: thiamine deficiency (TD) is still an endemic problem in certain areas of Asia where rice (especially polished rice) is the main food in diet of population. Quantity of thiamine in polished rice is a poor due to boiling and

drying rice before milling. In the process of cooking about 25% of thiamine is lost. The TD disease is called, as Beri-Beri. The word Beri-beri means weakness and came from Ceylon. TD affects the digestive, cardio-vascular and nervous systems functions. *Clinical picture involves*: weight loss, muscle weakness from limbs to torso, paresthesia, myocardial failure and edema, muscles wasting, foot-drop and wrist-drop, vomiting. Clinical types of Beri-Beri: acute infantile beri- beri, occurs in breast fed babies, when the mother is deficient in thiamine; chronic beri- beri (mainly among adults); cerebral beri -beri (mental and eye disorders).

Vitamin B_2 **(Riboflavin).***Functions*: takes part in reactions of oxidation in the cells; takes part in metabolism of carbohydrate. *Food sources*: liver, kidneys, eggs, curd, green leafy and vegetables. In tropical green leafy vegetables, contain greater quantity of B_2. Daily requirement is 1-3 mg. *Riboflavin deficiency (reasons of Ariboflavinosis)* : the lips and the angles of mouth are often cracked; lesions of the mouth tunica mucosa; cheilosis, angular stomatitis, glossitis, the conjunctiva is dry and inflamed; the patient suffers from photophobia; vascularization of the cornea.

Niacin (vitamin PP, B_3, nicotinamide) plays a role of the electron carrier in redox-flow reactions of the body. It stimulates hemapoiesis, wound regeneration, absorption in the intestine, increases secretion of the stomach mucous membrane and intestinal peristalsis, and is actively involved in the processes of the higher nervous activity regulation. The initial signs of niacin deficiency include disorders of the nervous system and mental changes,prolonged continuous diarrhea, pigmentation on exposed skin areas, formation of ulcers on the skin,fatigue, weakness, irritability, and insomnia. Depressions, a bad breath, a tendency to constipation are also manifestations of niacin deficiency. *At acute niacin deficiency develops pellagra* with persistent *diarrhea*, *dermatitis* of the face skin and the exposed parts of the body, in severe cases accompanied with *dementia**(the "three D").*** The main sources of niacin are yeast, cereals, (whole grained) bread, wheat germs, legumes, by-products, meat, fish, dried wild mushrooms, and coffee beans. Niacin can be synthesized from tryptophan (60 mg of tryptophan form 1 mg of niacin). The physiological need for vitamin B_3 in adults is 20 mg / day.

Bioflavonoids (vitamin P), interacting with the ascorbic acid, reduce the capillary permeability, increase strength, and stimulate tissue respiration. Their lack together with the ascorbic acid deficiency leads to fragility and increased permeability of capillaries, general weakness, and

tendency to hemorrhage. Vitamin P is contained in fruit, berries and vegetables, especially in chokeberry, black currant, oranges, and lemons.

Pantothenic acid (vitamin B_5) is involved in protein, fat, carbohydrate, and cholesterol metabolism, synthesis of some hormones and hemoglobin. It also promotes absorption of amino acids and saccharides in the intestine, supports the function of the adrenal cortex. The insufficiency of pantothenic acid in the body gives rise to disorders of the nervous system,neurotrophic and fats metabolismdisorders. Therefore lack of the pantothenic acid can affect the integument and mucous membranes, promote to hair loss and dermatitis. The main sources of the pantothenic acid are rice, peanuts, liver, and fish. The physiological need for vitamin B_5 in adults is 5 mg / day.

Pyridoxine (vitamin B_6) is water-soluble,is a coenzyme involved in functioning of the enzyme systems of carbohydrate and fat metabolism, maintaining the immune response, formation of erythrocytes and hemoglobin. It takes part in inhibition and excitation processes of the central nervous system, improves the efficiency of the brain, memory and mood, as it is responsible for glucose assimilation by nerve cells. Vitamin pyridoxine deficiency (B_6) sings is dermatitis,convulsions,cheylose,glossit,and also reduced appetite, development of anemia, violation of the integument (inflamed skin of the face, around the eyes, above the eyebrows, in the nasolabial folds). At the deficiency of vitamin B_6 are also possible drowsiness, irritability, fatigue, weakness, edema, nausea, hair loss, depression, sometimes – cracks in the corners of the mouth. Due to this it is easily excreted from the body, so you have to replenish its stocks constantly. Pyridoxine is present in many food products: liver, kidneys, poultry, meat, fish, legumes, cereals (buckwheat, millet, barley), sweet pepper, potatoes, bread (wheat, coarse grinding), pomegranate. The physiological need for vitamin B_6 in adults is 2.0 mg / day. The deficiency of vitamin B_6 is registered in 50–70 % of the Russian population.

Biotin, also called ***vitamin B_7***, (or vitamin H) is one of the B vitamins. It is involved in a wide range of metabolic processes, both in humans and in other organisms, primarily related to the utilization of fats, carbohydrates, and amino acids. The name biotin derives from the Greek word “bios” (to live) and the suffix “-in” (a general chemical suffix used in organic chemistry).Biotin also plays key roles in histone modifications, gene regulation (by modifying the activity of transcription factors), and cell signaling.

Food source: many foods contain some biotin. Foods that contain the most biotin include organ meats, eggs, fish, meat, seeds, nuts, and certain vegetables (such as sweet potatoes). The biotin content of food can vary; for example, plant variety and season can affect the biotin content of cereal grains, and certain processing techniques (e.g., canning) can reduce the biotin content of foods. Dietary avidin, a glycoprotein in raw egg whites, binds tightly to dietary biotin and prevents biotin's absorption in the gastrointestinal tract

Daily requirements: 150-300 micrograms, an amount provided by most diets. *Biotin deficiency*: is rare, and severe biotin deficiency in healthy individuals eating a normal mixed diet has never been reported.The signs and symptoms of biotin deficiency typically appear gradually and can include thinning hair with progression to loss of all hair on the body (circular prolapse of eyebrows and eyelashes); scaly, red rash around body openings (eyes, nose, mouth, and perineum); conjunctivitis; ketolactic acidosis (which occurs when lactate production exceeds lactate clearance) and aciduria (abnormal amounts of acid in urine); seizures; skin infection; brittle nails; neurological findings (e.g., depression, lethargy, hallucinations, and paresthesia's of the extremities) in adults; and hypotonia, lethargy, and developmental delay in infants . The rash and unusual distribution of facial fat in people with biotin deficiency is known as "biotin deficiency faces".

Folate *is a* water-soluble B vitamin that is naturally present in some foods, added to others, and available as a dietary supplement. "Folate," formerly known as "folacin" and sometimes "vitamin B_9," is the generic term for naturally occurring food folates, and folates in dietary supplements and fortified foods, including folic acid. Food folates are in the tetrahydrofolate (THF) form and usually have additional glutamate residues, making them polyglutamates.

Folate functions as a coenzyme or cosubstrate in single-carbon transfers in the synthesis of nucleic acids (DNA and RNA) and metabolism of amino acids. One of the most important folate-dependent reactions is the conversion of homocysteine to methionine in the synthesis of S-adenosyl-methionine, an important methyl donor. Another folate-dependent reaction, the methylation of deoxyuridylate to thymidylate in the formation of DNA, is required for proper cell division. An impairment of this reaction initiates a process that can lead to megaloblastic anemia, one of the hallmarks of folate deficiency.

When consumed, food folates are hydrolyzed to the monoglutamate form in the gut prior to absorption by active transport across the intestinal mucosa. Passive diffusion also occurs when pharmacological doses of folic acid are consumed. Before entering the bloodstream, the enzyme dihydrofolate reductase reduces the monoglutamate form to THF and converts it to either methyl or formyl forms. A combination of serum or erythrocyte folate concentration and indicators of metabolic function can also be used to assess folate status.

Folate deficiency. Isolated folate deficiency is uncommon; folate deficiency usually coexists with other nutrient deficiencies because of its strong association with poor diet, alcoholism, and malabsorptive disorders. Macrocytic anemia is a condition in which red blood cells are too large. The enlarged red blood cells are not fully developed and do not function the way they should. This causes diminished oxygen delivery to all cells of the body, resulting in fatigue and low energy.Macrocytic anemia is characterized by macrocytosis, which is large red blood cells. Types of macrocytic anemia are categorized by the shape of the red blood cells. These types are megaloblastic macrocytic anemia and non-megaloblastic macrocytic anemia, which are:1. Megaloblastic macrocytic anemia occurs when the red blood cells are large, immature, and structurally abnormal. Granulocytes, a type of white blood cell, may also be hyper-segmented. This is typically also associated with vitamin B_{12}deficiency or conditions that interfere with the action of these vitamins.2.Non-megaloblastic macrocytic anemia occurs when the red blood cells are large but don't have the structural abnormalities seen in megaloblastic macrocytic anemia. This type is more often associated with liver conditions, alcohol use disorder, myelodysplastic syndrome (MDS), or hypothyroidism (underactive thyroid). Symptoms:generalized fatigue , overall weakness, dizziness, headaches, lack of motivation or depression , pale skin, foggy thinking , diarrhea, glossitis (inflammation of the tongue).

Sometimes long-term prevention is necessary with diet or supplements or with other lifestyle modifications, such as avoiding alcohol. Low folate status has been linked to increased cancer risk. However, intervention trials with high doses of folic acid have not generally shown any benefit on cancer incidence. (More information). Prospective cohort studies have reported an inverse association between folate status and colorectal cancer (CRC) risk, especially among men. The relationship between folate status and cancer risk is however complex and requires further research.

The adequate level of vitamin B_9 consumption is 400 mg / day. Sources of folate: folate is naturally present in a wide variety of foods, including vegetables (especially dark green leafy vegetables), fruits and fruit juices, nuts, beans, peas, seafood, eggs, dairy products, meat, poultry, and grains. Spinach, liver, asparagus, and Brussels sprouts are among the foods with the highest folate levels.

Cyanocobalamin (vitamin B_{12}) is involved in construction of many enzymes important for protein and fat metabolism. This vitamin inhibits fatty degeneration of the liver, improves hemapoiesis and oxygen assimilation in tissues. Endogenous cases of vitamin B_{12} deficiency is atrophy of the tissues of the glands at the bottom of the stomach, worm infestation in the form of diphyllobothriasis. The vitamin B_{12}deficiencyleads to abnormalities of the central nervous system, development of polyneuritis, anemia, a loss of appetite and a reduced digestive activity. At acute deficiency develops a serious illness that requires a lifelong treatment – deficiency anemia with leucopenia and thrombocytopenia. Development of alimentary deficiency of cyanocobalamin is possible in vegetarians, pregnant women, at chronic alcoholism, abuse of Castle's intrinsic factor synthesis, a hereditary defect in the synthesis of proteins involved in vitamin B_{12} transport. In the development of anemia also importanceof vitaminPyridoxine (B_6)and Folic acid (vitamin B_9) deficiency.

The main sources of vitamin B_{12} are beef, by-products (liver, kidney, heart), mackerel and others. The physiological need for vitamin B_{12} in adults is 3 g / day.

Vitamin C (ascorbic acid). *History.* The history of vitamin C is linked with that of scurvy. This disease was known long before the min era as several centuries ago the anti-scorbutic effects of certain foods were described. In those early days' scurvy was a particular scourge of sailors taking voyages of many weeks without fresh food. It however not until 1747 that James Lind of Scotland demonstrated that scurvy could be cured or prevented by the consumption of citrus fruit. This led, well before the discovery of vitamins, to the inclusion of certain fresh foods and fruits in sailors' diets. In the 19th century, scurvy began to occur for the first time among infants when they were being fed with the newly introduced powdered and canned milks instead of the usual diet of breast milk or fresh cows' milk. The vitamin C had been destroyed when these milk products were heated during preparation. In spite of the value attributed to vitamin C, ascorbic acid wasn't isolated until 1928 and was finally synthesized in 1932.

Biological functions of ascorbic acid: ascorbic acid is a white crystalline substance very highly soluble in water and readily oxidized. The main biological functions of ascorbic acid are redox effect, regulates the elasticity and conductivity of the walls of blood vessels (capillary) in the body, increasing the body's resistance to environmental factors. Ascorbic acid is stable in acid medium, sensitive to oxygen, light, alkaline medium and to high temperature, it is unstable to influence of various factors, not synthesized in the body, does not accumulate in the body, easily oxidized, stored for long time under acidic conditions. Ascorbic acid differs from other water - soluble vitamins in the following properties: absence of coenzyme function, participation in the synthesis of the protein part of all enzymes,absence of endogenous synthesis in the body.

Vitamin C has many functions in the body. The Recommended Dietary Allowances of the Food and Nutrition Board summarizes ascorbic acid's role in the following metabolic systems: a)oxidation of phenylalanine and tyrosine via parahydroxy phenyl private; b)hydroxylation of aromatic compounds; c)conversion of folacin to folic acid; d) regulation of the respiratory cycle in mitochondria and microsomes; e) hydrolysis of alkyl monothioglycosides; f)development of odontoblasts and other specialized cells including collagen and cartilage; g)maintaining the mechanical strength of blood vessels particularly the venues; h) vitamin C takes part in production of fibrous tissue collagen; i)metabolism of amino acids, fats, and carbohydrate; j)biological oxidation; k)calcium metabolism; l) hemoglobin DNA, RNA formation.

*Dietary sources.*High vitamin C foods include dog –rose, blackcurrant, guavas, bell peppers, kiwifruit, strawberries, parsley,oranges, papayas, broccoli, tomatoes, kale .Vitamin C is less widely present in foodstuffs than are the other important water-soluble vitamins (table 4.9.). Foods with low vitamin C is pomegranate,carrot,pear.

Table 4.9. Vitamin C content in food (mg in 100 g of products)

Food products	Vitamin C	Food products	Vitamin C
Dog-roses (dry)	1200	Spring onions	30
Black-currant	200	Tomatoes	25
Parsley	150	Potato	20
Cabbage	50	Apple	13
Citrus	40-60		

Products for which C-vitaminization is allowed in order to prevent the risk of developing a latent form of vitamin C deficiency is p*remium margarine and milk.*

Human daily requirements: children under the age of 1 year – 30 mg., aged 1 to 6 years- -40 mg., aged 6 to 12 years- 50 mg., aged 12 to 17 years -70 mg,

Adult: 70- 80mg, pregnant women: 100 mg, breastfeeding mothers:120 mg.

Deficiency.The main indicators of endogenous deficiency of ascorbic acid is diseases of the gastrointestinal tract, liver and pancreas.

A deficiency of vitamin C leads to the disease scurvy.The initial signs of scurvy: small and large hemorrhages on the skin, bleeding gums,gingival hemorrhage, .

Symptoms and signs.The following symptoms may occur: early symptoms of malaise and lethargy. Shortness of breath, arthralgia and myalgia develop after several months.Skin changes include easy bruising, petechial and poor wound healing.Gum disease and loosening of teeth are common.Emotional changes, including irritability, can be apparent.Dry mouth and dry eyes may occur.In the later stages, jaundice, generalizededema and heart failure, haemopericardium, neuropathy, convulsions and sudden death may occur. On the skin changes can include perifollicular hyperkeratotic papules, perifollicular hemorrhages, purpura and ecchymosis (figure 4.3.). These are seen most commonly on the legs and buttocks. There may be poor wound healing and breakdown of old scars. Alopecia may occur. In the nails, splinter hemorrhages may occur.Gums can bleed and become swollen, friable and infected; petechial can occur on the mucosae.Conjunctival hemorrhage, flame-shaped hemorrhages and cotton-wool spots may be seen. Bleeding into the periorbital area, eyelids and retro bulbar space may occur.

A scorbutic rosary (where the sternum sinks inwards at the cost chondral junctions) may occur in children.High-output heart failure due to anemia can be seen and hypotension may occur late in the disease.Fractures, dislocations, tenderness of bones and bleeding into muscles and joints are possible. Synovitis with joint effusion can occur.Edema may occur late in the disease.Loss of weight secondary to anorexia is common

Therefore, persons undergoing surgery, or following trauma or with persistent ulcers, who are suspected of having a low intake of vitamin C, should have a vitamin C-rich-diet or receive supplemental ascorbic acid tablets. Claims have been made for the efficacy of large doses of

ascorbic acid in preventing the common. Controlled trials have shown that the vitamin has no benefit in this regard.

Figure 4.3. Scurvy diseases

Toxicity. Very high doses of ascorbic acid can be taken without the development of any toxic effects. High doses of vitamin C may cause hypoglycemia, oxalate stones formation in the urinary tract.

The fat-soluble vitamins

Rather than slipping easily into the bloodstream like most water-soluble vitamins, fat-soluble vitamins gain entry to the blood via lymph channels in the intestinal wall (see illustration). Many fat-soluble vitamins travel through the body only under escort by proteins that act as carriers. The four fat-soluble vitamin groups are A, D, E, and K; they are related structurally in that all have as a basic structural unit of the molecule a five-carbon isoprene segment, which is each of the fat-soluble vitamin groups contains several related compounds that have biological activity. The active forms and the accepted nomenclature of individual vitamins in each vitamin group are given in the table. The potency of the active forms in each vitamin group varies, and not all of the active forms now known are available from dietary sources; i.e., some are produced synthetically. The characteristics of each fat-soluble vitamin group are discussed below.

Chemical properties

The chemical properties of fat-soluble vitamins determine their biological activities, functions, metabolism, and excretion. However, while the substances in each group of fat-soluble vitamins are related in structure, indicating that they share similar chemical properties, they do have important differences. These differences impart to the vitamins unique qualities, chemical and biological, that affect attributes ranging from the manner in which the vitamins are stored to the

species in which they are active. Absorption of fat-soluble vitamins in human body (figure 4.4.):1.Food containing fat-soluble vitamins is ingested.

2.The food is digested by stomach acid and then travels to the small intestine, where it is digested further. Bile is needed for the absorption of fat-soluble vitamins. This substance, which is produced in the liver, flows into the small intestine, where it breaks down fats. Nutrients are then absorbed through the wall of the small intestine.

3.Upon absorption, the fat-soluble vitamins enter the lymph vessels before making their way into the bloodstream. In most cases, fat-soluble vitamins must be coupled with a protein in order to travel through the body.

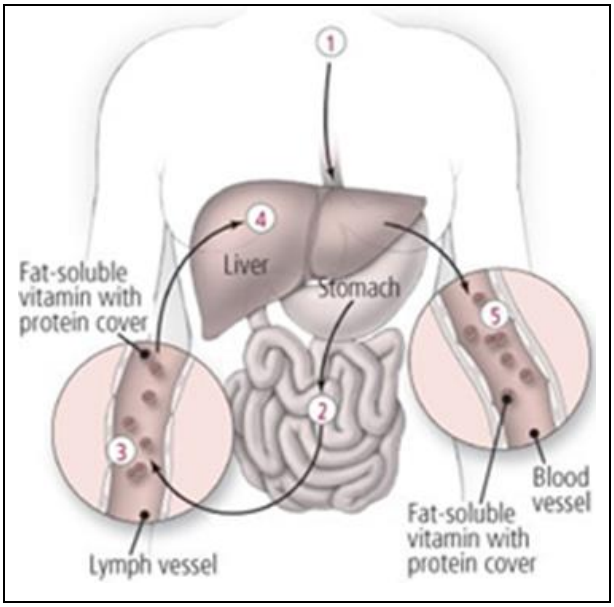


Figure 4.4.Mechanism absorption of fat-soluble vitamins in human body

4.These vitamins are used throughout the body, but excesses are stored in the liver and fat tissues.

5.As additional amounts of these vitamins are needed, your body taps into the reserves, releasing them into the bloodstream from the liver

Fatty foods and oils are reservoirs for the four fat-soluble vitamins. Within your body, fat tissues and the liver act as the main holding pens for these vitamins and release them as needed.

To some extent, you can think of these vitamins as time-release micronutrients. It's possible to consume them every now and again, perhaps in doses weeks or months apart rather than daily, and still get your fill. Your body squirrels away the excess and doles it out gradually to meet your needs. Fat-soluble vitamins: vitamin A, vitamin D, vitamin E, vitamin K.

Together this vitamin quartet helps keep your eyes, skin, lungs, gastrointestinal tract, and nervous system in good repair. Here are some of the other essential roles these vitamins play: build bones. Bone formation would be impossible without vitamins A, D, and K.Protect vision. Vitamin A also helps keep cells healthy and protects your vision.Interact favorably. Without vitamin E, your body would have difficulty absorbing and storing vitamin A.Protect the body. Vitamin E also acts as an antioxidant (a compound that helps protect the body against damage from unstable molecules).

Because fat-soluble vitamins are stored in your body for long periods, toxic levels can build up. This is most likely to happen if you take supplements. It's very rare to get too much of a vitamin just from food.

Vitamin A **(retinol**). It is an alcohol and fat-soluble vitamin. Low pH and light reduce its activity. Vitamin A is stable, if the temperature is below 100°. Low temperature and alkaline medium tends to preserve it, in the same time long term heating and contact with air slowly destroys it.

Function: vitamin A is necessary for night vision (formation of rhodopsin of the retina); improvement of visual function is required for growth and development, (known as vitamin of growth); synthesis of glycoprotein, anti-infectious, for epithelial cells, antixerophthahmic; metabolism of minerals and cholesterol, regulation of barrier functions of organism, positive influence on permeability of cell membrane, activity endocrine glands and immunity formation.

Vitamin A deficiency (VAD) (figure 4.5.):night blindness, softening and keratosis of the cornea of the eyes (*keratomalacia*), follicular hyperkeratosis-"goose bumps,"*xerophthalmia*"(drying and thickening of the cornea), hyperkeratosis of the skin, growth retardation, low birth weight.

With vitamin A deficiency, it can also develophemeralopia.*Hemeralopia* is the inability to see clearly in bright light and is the exact opposite of nyctalopia (night blindness), the inability to see clearly in low light. Hemera was the Greek goddess of day, and Nyx was the goddess of night. However, it has been used in an opposite sense by many non-English-speaking doctors. It can be described as insufficient adaptation to bright light. It is also called "heliophobia" and "day blindness".VAD is often prevalent in developing countries having a food deficits and malnutrition problem.

Hypervitaminosis is available even in cases when vitamin A gets in organism with food (A vitamin enriched products). Acute toxicity symptoms: drowsiness, headache, and irritability. Chronic toxicity symptoms: alopecia, dry skin, cracked lips, headache and weakness.

Figure 4.5. Xerophthalmia

Food sources of A vitamin : animal fat, milk, liver, egg and fish liver. Vegetable (carotene source) - dark green vegetable as spinach and yellow fruit and vegetables as pumpkin, mango and carrot. In human organism carotene converting into vitamin A happens in inside walls of intestines. Six parts of β- carotene are equivalent to one part of vitamin A (table 4.10.).

Daily requirement: children- 400-500 micrograms; adults- 800-1000 micro-grams, pregnant women - 1000-1200 micrograms (1/3 of retinol, and 2/3 - of carotene).

Table 4.10. Vitamin A and β- carotene content in food (mg in 100 g of products)

Food	A vitamin	β- carotene	Food	A vitamin	β- carotene
Carrot	-	9	Cream	0.23	0.1
Tomatoes	-	1.2	Spring onions	-	2.0
Milk	0.02	0 01	Pumpkin	-	1.5
Eggs	0.35	0,6	Spinach	-	4.5
Liver	1.0	3.83	Dog-rose	-	6.7
Butter	0.5	0,34	Cream	0.23	0.1

Vitamin D (ergocalciferol).It had been postulated that rickets was a nutritional deficiency disease and for many years prior to any knowledge of the vitamin, cod-liver oil had been successfully used in its treatment. It was not until 1919 that a British scientist, Sir Edward Mellanby, using puppies, demonstrated conclusively that the disease was of nutritional origin and that it responded

to a vitamin present in cod-liver oil. This led to some confusion because it was already known that cod-liver oil contained vitamin A. In 1922 McCollum isolated a second fat-soluble vitamin from cod-liver oil and called it vitamin D.

Functions: vitamin involved in phosphorus-calcium metabolism, prevention of the rickets (it takes part in absorption of calcium and phosphorus and their storage in the bones); prevention of the osteomalacia (absorption of calcium and phosphorus in the gut, directly participating in bones calcification).

Vitamin D deficiency may cause Rickets in children (bones deformation,delayed teething,excessive sweating,delayed ossification of the fontanel, hair loss in the back of the head) and osteomalacia in adults. Toxicity of vitamin D symptoms: hypervitaminosis is presented by hypercalcaemia (figure 4.6.).

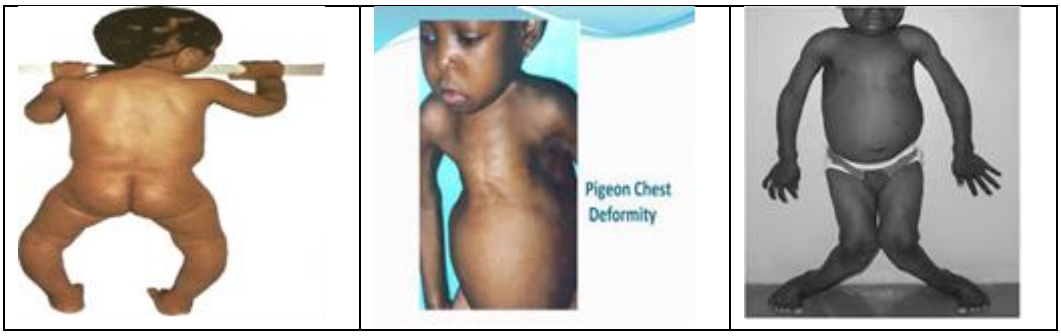


Figure 4.6. Child rickets

Food sources: butter, eggs, liver, milk. The best sources are caviar and fish's fat.*Recommended daily* intake for children is 400 IU, for adults - 100 IU.

Vitamin K (phylloquinone). Vitamin K is a fat-soluble vitamin which is necessary for the maintenance of prothrombin, a key substance in blood clotting. The molecular action of vita-min K remains an enigma but apparently it acts in the liver in the synthesis of proteins concerned with clotting. The vitamin is believed to be active in stimulating oxidative phosphorylation in tissues, possibly between DPNH and a cytochrome in electron transport.

Dietary sources : vitamin K is ubiquitous in human foods though in very small amounts. Most vitamin K is absorbed after being synthesized by human bacterial flora. Dietary deficiency in man rarely occurs. Foods rich in vitamin K: salad, cabbage, spinach.

Human requirements: the Food and Nutrition Board has not established a daily allowance for vitamin K. It is believed that the microgram amounts obtained from the intestinal flora and from good food are sufficient to maintain a normal prothrombin concentration. The exception to this is newborn infants who have vitamin K deficiency in the first few days of life because their intestinal flora is not yet well established and because the mother had been lacking in adequate supplies of the vitamin.

Deficiency: although there has been considerable debate it is now generally believed that vitamin K administration to newborn infants decreases the incidence of neonatal hemorrhage. This is especially true in premature infants or newborns with anoxia. A single parenteral dose of 1-2 mg. of vitamin K or one of its analogues is recommended immediately after delivery. Infants born to mothers on anti-coagulant therapy should receive 2-5 mg. vitamins K or its analogue. The most serious complication of vitamin K deficiency in infancy is cerebral hemorrhage. Some suggest that the incidence could be greatly reduced by the routine administration of vitamin K to women during the last two months of pregnancy. Because vitamin K is fat-soluble any defect in intestinal absorption of fats may lead to vitamin K deficiency. Bile salts are necessary for the absorption and an obstruction of the common bile duct may lead to a deficiency. This has resulted in severe bleeding following surgical intervention to relieve the obstruction. In this situation vitamin K should be given prior to the surgery. In various malabsorption syndromes (sprue, celiac disease, pancreatic fibrosis and idiopathic steatorrhea) there is poor absorption of fat and therefore of vitamin K. A similar though less severe deficiency can result from ulcerative colitis, regional ileitis and surgical operations in which much of the intestinal tract is excised. *Toxicity*: excessive doses of synthetic vitamin K have led to hemolytic anemia and kernicterus in the infant and for this reason a dose above 5 mg. of vitamin K should not be given to the newborn. As 1 mg. is usually adequate, there is no reason to use such large doses (figure 4.7.).

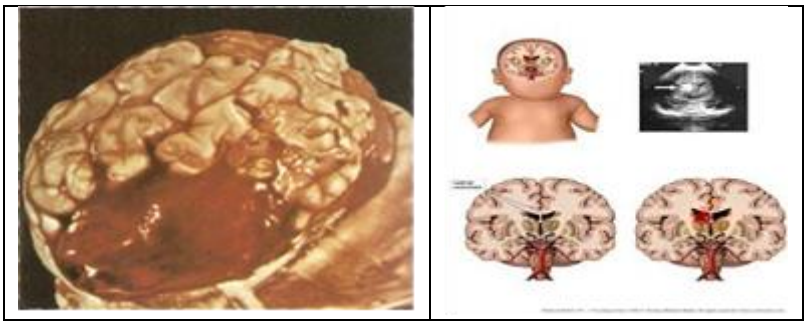


Figure 4.7.Hemorrhagic disease of the newborn, resulting from vitamin K deficiency (subdural hemorrhage)

Tocopherol (vitamin E) is one of the main nutritional antioxidants, preventing strengthening of lipid peroxidation. It is a universal regulator of cell membranes. Tocopherol is necessary for normal development and functioning of the heart muscle, gonads, has an effect on the reproductive organs, both direct and through the hypothalamic-pituitary complex,eliminates muscle fatigue.At vitamin E deficiency the occurrence and cases muscle weakness,muscular dystrophy, hemolysis and neurological disorders are observed.

With food a person receives from 20 to 30 mg of tocopherol absorbed in the intestine, but not more than 50 % of the vitamin. Vitamin E is not synthesized in humans. Assimilation of the vitamin depends on the presence of fats in food, and is violated when there is insufficient secretion of bile. Tocopherol sources are vegetable oils, especially corn, cotton seed and wheat germ, bread and cereals, sea buckthorn, walnuts, mayonnaise. The physiological need for vitamin E in adults is 15 mg ./ day.

Vitamin-like substancesas bio-substances fulfill just as important functions in human metabolism as the vitamins themselves, but in contrast to real vitamins they can be formed in the body.Vitaminoids are therefore not essential like vitamins. Strictly speaking, vitamins A and D also belong in this group. Some vitaminnoids can also be classified as amino acids, phytochemicals or prebiotics, a clear classification is almost impossible. Many vitaminoids are involved in energy metabolism (e.g. L-carnitine), others act as antioxidants (coenzyme Q10). Alpha liposizers. Amygdalin - Vitamin B_{17},Vitamin B_{15}.

There are a number of organic compounds that, although related to the vitamins in activity, cannot be defined as true vitamins; normally they can be synthesized by humans in adequate

amounts and therefore are not required in the diet. These substances usually are classified with the B vitamins, however, because of similarities in biological function or distribution in foods.

Vitamin B_{15}, also commonly referred to as pangamic acid or pangamate, is an incredible nutrient derived from apricot kernels.Significance of pangamic acid for the body is improves tissue respiration,tissue oxygen uptake, participates in oxidation processes.

Our brains need a steady and constant flow of oxygen to perform their normal functions. When the brains' steady flow of oxygen is disrupted due to injury or certain health conditions, it puts our brain into what is called a hypoxic or anoxic state of oxygen depletion. A hypoxic state occurs when the brain partially lacks oxygen supply, while a total lack of oxygen is called an anoxic state.In an experiment conducted on animal subjects, a study found that vitamin B_{15} may support oxidative processes and aid the body in restoring normal function when oxygen depletion is impacting the brain. The animal subjects were exposed to high altitudes, wherein they endured oxygen starvation, and pangamic acid helped restore their bodies to normal functions. These results, if reliable, suggest that vitamin B_{15} may play a role in cell oxidation and could be explored as an option in supporting coronary circulation.

Nutrients with antioxidant properties are those that over a period of time aid in the body's process of ridding cells and organs, especially the liver, of unwanted, toxic substances like alcohol, chlorine, and other unhealthy compounds.As we know, high cholesterol is a serious risk agent for coronary heart disease, heart attacks, liver and kidney disease, and other undesirable health conditions. Vitamin B_{15} may be a supplement you should consider taking if you have been screened for and, in fact, have high cholesterol.Due to its antioxidant properties discussed above, some people claim that vitamin B_{15} can slow down healthy cell death and rid our bodies of the free radicals that cause aging and damage to our skin, hair, and other vital organs. In fact, in Europe and other countries around the world, pangamic acid, or vitamin B_{15}, is popularly used in the treatment and prevention of premature aging.

Because of its potential anti-aging properties, consuming vitamin B_{15} as a supplement or in apricot-infused skincare products may help promote healthy and youthful skin and hair.Pangamic acid is well-known by athletes as a supplement that may improve athletic endurance and performance. Its properties as a methyl donor and antioxidant nutrient may enhance oxygen delivery to the exercising muscles, reduce the accumulation of lactic acid, and delay fatigue and

exhaustion. In doing so, athletes might experience a boost in speed, agility, and energy levels as they perform.

Further, vitamin B_{15} may help athletes recover from overtraining and injury by supporting cellular repair and detoxification. By enhancing the effectiveness of bodily processes, pangamic acid may provide incredible support to athletic activities in pro-athletes and normally active individuals alike.

Our bodies cannot independently manufacture vitamins like vitamin B15 that help us survive and thrive. For that reason, we must explore the best external sources to improve our health and bodily functions. Food rich vitamin B_{15}: liver,apricot, rice and others

Choline. Choline appears to be an essential nutrient for a number of animals and microorganisms that cannot synthesize adequate quantities to satisfy their requirements.Choline is a constituent of an important class of lipids called phospholipids, which form structural elements of cell membranes; it is a component of the acetylcholine molecule, which is important in nerve function and alsolecithin, sphingomyelin. Choline also serves as a source of methyl groups (—CH_3 groups) that are required in various metabolic processes. Choline also functions in the transport of fats from the liver; for this reason, it may be called a lipotropic factor,prevents fatty liver infiltration.

The increase in the activity of choline in the body is influenced by high ascorbic acid content, folic acid,cyanocobalamin.

A deficiency of choline in the rat results in an accumulation of fat in the liver. Disorders resulting from choline deficiency in the body is disturbance of phospholipid metabolism in tissues and cells, fatty infiltration of the liver, the appearance of the body's tendency to tumors.Choline-deficiency symptoms vary among species; it is not known if choline is an essential nutrient for humans since a dietary deficiency has not been demonstrated.

Inositol.Inositol, or more precisely myo-inositol, is a carbocyclic sugar that is abundant in the brain and other mammalian tissues; it mediates cell signal transduction in response to a variety of hormones, neurotransmitters, and growth factors and participates in osmoregulation.Significance of pangamic acid for the body is improves tissue respiration,tissue oxygen uptake,participates in oxidation processes.

Inositol might balance certain chemicals in the body to help with mental conditions such as panic disorder, depression, and obsessive-compulsive disorder. It might also help insulin work better.People use inositol for metabolic syndrome, polycystic ovary syndrome (PCOS), and for reducing the risk of preterm birth. It's also used for insomnia, bipolar disorder, PTSD, and many other conditions, but there is no good scientific evidence to support most of these uses.Inositol also has antioxidant properties that fight the damaging effects of free radicals in the brain, circulatory system, and other body tissues.Inositol is found naturally in cantaloupe, citrus fruit, and many fiber-rich foods (such as grain germ beans, wheat bran, brown rice) and beef heart. It is also sold in supplement form and used as a complementary therapy to treat a wide range of medical conditions, including metabolic and mood disorders.

Para-amino benzoic acid.Para-amino benzoic acid (PABA) is required for the growth of several types of microorganisms; however, a dietary requirement by vertebrates has not been shown. The antimicrobial sulfa drugs (sulfanilamide and related compounds) inhibit the growth of bacteria by competing with PABA for a position in a coenzyme that is necessary for bacterial reproduction. Although a structural unit of folic acid, PABA is not considered a vitamin.

Carnitine.The importance of carnitine for the body is for normal muscle function. The role of carnitine in all organisms is associated with the transfer of fatty acids from the bloodstream to active sites of fatty acid oxidation within muscle cells. Carnitine, therefore, regulates the rate of oxidation of these acids; this function may afford means by which a cell can rapidly shift its metabolic patterns (e.g., from fat synthesis to fat breakdown). Synthesis of carnitine occurs in insects and in higher animals; therefore, it is not considered a true vitamin.Foods that are the main sources of carnitine- meat and meat products.

Lipoic acid.Lipoic acid has a coenzyme function similar to that of thiamin. Although it is apparently an essential nutrient for some microorganisms, no deficiency in mammals has been observed; therefore, lipoic acid is not considered a true vitamin.

Bioflavonoids. The bioflavonoids once were thought to prevent scurvy and were designated as vitamin Pc, but additional evidence refuted this claim.

S-Methylmethionine *(SMM)–Vitamin U*is a derivative of methionine. It is biosynthesized from L-methionine which is first converted to S-adenosylmethionine. The subsequent conversion, involving replacement of the adenosyl group by a methyl group is catalyzed by the enzyme

methionine S-methyltransferase. S-methylmethionine is particularly abundant in plants, being more abundant than methionine.

S-Methyl methionine is sometimes referred to as vitamin U, but it is not considered a true vitamin. The term was coined in 1950 by Garnett Cheney for uncharacterized anti-ulcerogenic factors in raw cabbage juice that may help speed healing of peptic ulcers, also anti-sclerotic, antihistamine. Foods rich ofvitamin U is white cabbage, beets, and is good and long-lasting in chilled products, canned foods.

Insufficiency vitamins and ways of prevention

Food fortification is the process of adding micronutrients (essential trace elements and vitamins) to food as a public health policy which aims to reduce the number of people with dietary deficiencies within a population. Staple foods of a region can lack particular nutrients due to the soil of the region or from inherent inadequacy of a normal diet. Addition of micronutrients to staples and condiments can prevent large-scale deficiency diseases in these cases.

As defined by the World Health Organization (WHO) and the Food and Agriculture Organization of the United Nations (FAO), fortification refers to "the practice of deliberately increasing the content of an essential micronutrient, i.e., vitamins and minerals in a food irrespective of whether the nutrients were originally in the food before processing or not, so as to improve the nutritional quality of the food supply and to provide a public health benefit with minimal risk to health", whereas enrichment is defined as "synonymous with fortification and refers to the addition of micronutrients to a food which are lost during processing". The Food Fortification Initiative lists all countries in the world that conduct fortification programs, and within each country, what nutrients are added to which foods. Vitamin fortification programs exist in one or more countries for folate, niacin, riboflavin, thiamin, vitamin A, vitamin B_6, vitamin B_{12}, vitamin D and vitamin E. As of 21 December 2018, 81 countries required food fortification with one or more vitamins. The most commonly fortified vitamin – as used in 62 countries – is folate; the most commonly fortified food is wheat flour.

Genetic engineering. Starting in 2000, rice was experimentally genetically engineered to produce higher than normal beta-carotene content, giving it a yellow/orange color. The product is referred to as golden rice (Oryza sativa). Bio fortified sweet potato, maize, and cassava were other crops introduced to enhance the content of beta-carotene and certain minerals. When eaten, beta-

carotene is a provitamin, converted to retinol (vitamin A). The concept is that in areas of the world where vitamin A deficiency is common, growing and eating this rice would reduce the rates of vitamin A deficiency, particularly its effect on childhood vision problems. As of 2018, fortified golden crops were still in the process of government approvals, and were being assessed for taste and education about their health benefits to improve acceptance and adoption by consumers in impoverished countries.

Minerals substances.

Minerals are inorganic materials found in rocks and soils, and our bodies wouldn't be able to survive without them. Of the more than 100 known minerals in existence, at least 18 of them are essential to our good health. Seven of them are classified essential minerals, also known as "macro-minerals": calcium, phosphorous, potassium, magnesium, sulfur, sodium and chloride.

Physiological significance of mineral substances: minerals do a lot their roles range from regulating our body's tissue growth to building strong bones to maintaining proper nerve conduction, formation of bone tissue as a plastic material and many other things in between. Participation in maintaining acid-base balance in the body,normalization of water-salt metabolism in the body. The role of minerals in maintaining acid-base balance in the body is provide the necessary concentration of hydrogen ions in cells and tissues, the necessary concentration of hydrogen ions in the intercellular and interstitial fluid, greate the necessary osmoticity for the normal course of metabolic processes in the body.

Minerals cannot produce them on their own.Our bodies depend on us to provide the minerals through our diets, especially a balanced one that includes all seven of the essential minerals as well as about a dozen "trace minerals," such as iron and zinc, which although needed in smaller amounts, still fulfill important functions for our bodies. Where do we get these minerals from? They are among the ingredients in the plants (such as vegetables) that we eat as well as in the meat from animals that we consume, with the animals gathering them for themselves by grazing on plants.

Think of minerals this way, per divinehealthfromthe inside out com: they are "basically the spark plugs of life, or keystones to our heath. Minerals are the catalysts that keep our 'battery' going and hold its charge. Minerals compose about 4 percent (%) of the human body. "Mineral

substances are essential nutrients, which must necessarily arrive in an organism. Criteria for essentiality of minerals and trace elements: present in healthy tissues, concentration must be relatively constant between different organisms, deficiency induces specific biochemical changes, deficiency changes are accompanied by equivalent abnormalities in different species, supplementation corrects the abnormalities.

The value of mineral substances in the human diet is very diverse:

1. In the body mineral substances includes a complex of substances constituting living protoplasm cells in which the basic substance is a protein.
2. Minerals are part of all intercellular and interstitial fluid, providing them with the necessary osmotic properties.
3. Mineral substances in large quantities included in the supporting tissues, bones and skeleton, in the tissues such as teeth, which is necessary and hardness, and special strength.We need strong bones to provide a supportive framework for our skeleton. Although our bones seem to be hard and unyielding, they are constantly being reabsorbed and reformed by our bodies, per healthyeating.sfgate.com. Several minerals are involved with our bones/skeleton – calcium, phosphorous and magnesium, with calcium being the most prevalent mineral in our bodies. Calcium also is important for our teeth.
4. Mineral elements are part of some endocrine glands (iodine – in the thyroid, zinc – in the pancreas and tissues of the gonads).
5. Minerals are part of some complex organic compounds (iron – of hemoglobin, phosphorus – a phosphatide composition, etc.).Oxygen is the key element in this regard in that it is needed to help produce the energy required for every one of our body's functions and processes. In order for that to happen, red blood cells must give oxygen a lift, transporting it to the almost infinite number of cells in our bodies. The mineral iron is what binds to the oxygen as it is being carried through the blood.
6. Minerals as ions involved in the transmission of nerve impulses.Potassium is indispensable in assisting us in properly regulating the water balance in the cells of our nerves and muscles. If lacking potassium, our nerves would be unable to produce the impulses needed to signal our bodies to move, and likewise for the muscles in our heart.
7. Mineral substances provide blood clotting.

8. Immune system: as a trace mineral, zinc is not an abundant mineral in the human body quantitatively speaking, but it is unquestionably an important one. Zinc is vital for maintaining the strength of our immune system, aiding our bodies when it comes to fighting off infections, healing wounds and repairing damaged cells. Good food sources of zinc include meat, beans, peas and lentils.

Especially important are minerals for the growing organism. Increased need for them at children explained by the growth and development processes are accompanied by an increase in cell mass, skeletal mineralization, and this requires systematic supply in child organism a certain amount of mineral salts. Mineral substances enter the body mainly with the food products.

The elements found in food products can be divided into three groups: macroelements, microelements and ultra-microelements. Macroelements– elements that are present in products in large quantities (tens and hundreds of mg %). These include phosphorus, calcium, potassium, magnesium, manganese.

A special role belongs to minerals in maintaining the acid-base balance, which is necessary to ensure the constancy of the internal condition of the body. The currently used classification of minerals provides for their separation according to their effect on shifts in acid-base balance.*Foods rich in cations are alkaline; foods rich in anions are acidic.*The predominance of acidic or alkaline mineral elements in the diet can affect the change in acid-base balance. Foods rich in calcium, magnesium, sodium or potassium are sources of alkaline elements. These are legumes, vegetables, fruits and berries, milk and dairy products. Sources of mineral substances with an acid reaction are food products containing a large amount of sulfur, phosphorus, chlorine. These include meat and fish products, eggs, bread and bakery products, cereals and other cereal products.The diet is often dominated by acidicminerals, which leads to shifts in the acid-base balance towards acidity with the formation of acidosis. The occurrence of acidosis is accompanied by the accumulation of free acids in the body. Under the influence of acidosis, the protective functions of the body are violated - its resistance to infections and various adverse environmental factors decreases.

Depending on the amount of incoming trace elements:Hypomicroelementosis exogenous and endogenous origin:exogenous – found in 20% of the local population in biogeochemical provinces and endogenous – due to hereditary or congenital nature.Hypermicroelementoses are

associated with an excess content of microelements in the environment:natural (geochemical provinces) and artificial (technogenic pollution of the area) origin.

Some microelements can developments different endemic diseases: Fluorosis; is caused by high concentration of fluoride, low concentration – teeth caries. Endemic goiter, as a result of iodine deficiency. High concentration of strontium cases the disorders of bone tissue (disruption of the ossification process) development among children are revealed. It results in retardation of teeth development, in prolongation of terms of fontanel imperforation; in severe cases it is a changes in hip joint and in lumbar part of spinal curvature. For the first time this disease was found out in 50th years of XIX century and it is endemic for mountain-taiga marshy areas and therefore it has got the name as Kashin-Beck diseases. It's often found in territories of South-East Asia. This pathology can be explained by competitive relations between strontium and calcium especially in osteal tissues of organism. Zinc insufficiency cases zinc infantilism. High concentration of molybdenum cases molybdenum gout.

Macroelements. One of the most important mineral is calcium.

Calcium– a constant component of blood, it is involved in the blood clotting , is part of the cellular and tissue fluids, cellular nuclei and plays an important role in the growth and activity of cells of the processes involved in the regulation of the permeability of cell membranes of nerve impulse transmission processes, has a stabilizing effect on the membrane systems of cells, muscle contraction, it controls the activity of some enzymes. Basic calcium importance is its participation in the formation of the skeleton of bones, where it is a major structural element (the calcium content in bone reaches 99% of the total amount in the body), main structural component in the formation of connective tissue.The need for calcium is especially high in children, which take place in the body bone form processes, as well as women – during pregnancy and while breastfeeding.

Prolonged lack of calcium in the diet leads to disruption of bone formation: to the emergence of rickets in children, osteoporosis and osteomalacia in adults. Feature of calcium exchange is that the lack of it in the food it continues to be released from the body in significant quantities from stocks body (bone) than called calcium deficiency (in China, in Shangi province, where theirvicious custom feed mothers during the month after birth only rice porridge, many women turned to cripples due to osteomalacia).

Calcium is hard digestible elements. Moreover, its digestibility depends on the relation with other components of the food and, especially, *phosphorus, magnesium*, as well as protein and fat.Products containing an indigestible calcium complex is spinach,sorrel.

1. On the absorption of calcium, primarily affects its correlation with phosphorus. The most favorable ratio of calcium and phosphorus is 1: 1.5, are formed when small soluble and well absorbed calcium phosphate salt. If the food has a significant excess of phosphorus as compared to calcium then formed tribasic calcium phosphate, which is poorly absorbed.

2. The negative influence on the absorption of calcium has an excess of fat in the diet, because while a large amount of calcium soap, i.e. calcium with fatty acids. In such cases, the normal amount of cholic acids is insufficient for the transfer of calcium soaps in the soluble complex compound and the calcium soaps in the form of indigestible excreted with feces. The favorable ratio of calcium to fat: 1 g fat should account for 10 mg of calcium.

3. Negative impact on the absorption of calcium has an excess of magnesium in the diet. This is explained by the fact that the dissolution of salts of magnesium (as well as calcium) required their connection to bile acids. The optimum ratio of Ca: Mg – 1: 0.5.

4. The adverse impact on calcium absorption and has oxalic and inositol phosphoric acids which form insoluble salts. The large amount of oxalic acid contained in spinach, sorrel, cocoa. Many inositol phosphoric acids contained in grains (table 4.11.).

The favorable influence on calcium absorption has enough content in the diet of proteins and lactose. One of the decisive factors contributing to good calcium absorption (especially in infants), is vitamin D. When taking into account all the factors affecting the absorption of calcium is best absorbed calcium contained in milk, dairy products. However, even if 80% of the body's calcium needs are satisfied by the products, its absorption in the intestine usually does not exceed 50%.

Calcium is founding in the green onions, parsley, beans. Much less in eggs, meat, fish, vegetables, fruits, berries. The source of calcium may be bone meal, which has good digestibility (90%) and can be added in small amounts once or personal dishes and culinary products (cereal, flour products).

Table 4.11. The content of Ca and P in some foods (mg %)

Products	Ca	P	Products	Ca	P

Rye bread	32	180	Milk fresh	115	87
Wheat bread	27	194	Curd	306	235
Buckwheat groats	39	226	Cheese	885	650
Oat groats	69	392	Condensed milk	307	219
Wheat	30	186	Beef	10	188
Potato	10	35	Pork	8	170
Tomatoes	10	23	Chickens	15	201
Cabbage	43	28	Eggs	55	215

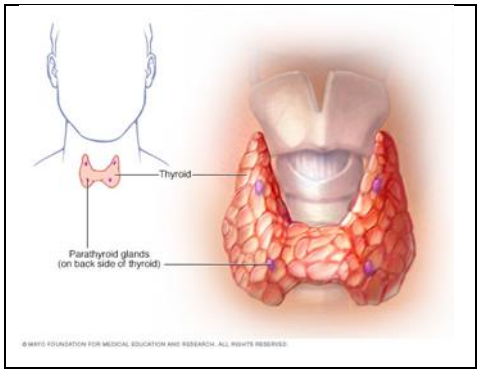
Especially great need for calcium observed in patients with bone injuries and patients with tuberculosis. In patients with tuberculosis, along with the disintegration of the protein, the body loses a large amount of calcium. Therefore, tuberculosis patient needs a lot of calcium entering the body.*Daily requirements:* adults-800mg.: school- age children-1100-1200 mg. (depend age), pregnant and lactating women – 1500 mg.

*Calcium deficiency (causes hypocalcemia).*Symptoms : confusion,, fatigue, anxiety, brittle nails, impaired concentration, poor memory, dry skin, coarse hair, alopecia, muscle cramps and muscle weakness.Hypocalcemia may be caused by several factors. These include inadequate calcium in the diet, lack of sunlight exposure, chronic kidney disease, liver disease or liver cirrhosis, and reduced intestinal absorption of calcium. Vitamin D deficiency can also lead to hypocalcemia.

Individuals at risk of calcium deficiency include postmenopausal women, individuals with lactose intolerance, and vegetarians. Treatment for hypocalcemia usually involves oral calcium and vitamin D in the form of supplements.Plain, low-fat yogurt is the richest source of calcium. Eight ounces of the yogurt contains 415 milligrams of calcium, meeting 42% of the daily requirement. Eight ounces of non-fat milk contains 299 milligrams of calcium, meeting 30% of the daily requirement. Calcium-fortified orange juice is another good option.

*Hypercalcemia.*Hypercalcemia is a condition in which the calcium level in your blood is above normal. Too much calcium in your blood can weaken your bones, create kidney stones, and

interfere with how your heart and brain work. Hypercalcemia is usually a result of overactive parathyroid glands. These four tiny glands are situated in the neck, near the thyroid gland. The parathyroid glands, which lie behind the thyroid, manufacture the parathyroid hormone, which plays a role in regulating your body's levels of the minerals calcium and phosphorus.



Causes: besides building strong bones and teeth, calcium helps muscles contract and nerves transmit signals. Normally, if there isn't enough calcium in your blood, your parathyroid glands secrete a hormone that triggers: your bones to release calcium into your blood, your digestive tract to absorb more calcium, your kidneys to excrete less calcium and activate more vitamin D, which plays a vital role in calcium absorption.

This delicate balance between too little calcium in your blood and hypercalcemia can be disrupted by a variety of factors. Hypercalcemia is caused by:

- *Overactive parathyroid glands (hyperparathyroidism).* This most common cause of hypercalcemia can stem from a small, noncancerous (benign) tumor or enlargement of one or more of the four parathyroid glands.
- *Cancer.* Lung cancer and breast cancer, as well as some blood cancers, can increase your risk of hypercalcemia. Spread of cancer (metastasis) to your bones also increases your risk.
- *Other diseases.* Certain diseases, such as tuberculosis and sarcoidosis, can raise blood levels of vitamin D, which stimulates your digestive tract to absorb more calcium.
- *Hereditary factors***.** A rare genetic disorder known as familial hypocalciuric hypercalcemia causes an increase of calcium in your blood because of faulty calcium receptors in your body. This condition doesn't cause symptoms or complications of hypercalcemia.

- *Immobility.* People who have a condition that causes them to spend a lot of time sitting or lying down can develop hypercalcemia. Over time, bones that don't bear weight release calcium into the blood.
- *Severe dehydration.* A common cause of mild or transient hypercalcemia is dehydration. Having less fluid in your blood causes a rise in calcium concentrations.
- *Medications***.** Certain drugs — such as lithium, used to treat bipolar disorder — might increase the release of parathyroid hormone.
- *Supplements.* Taking excessive amounts of calcium or vitamin D supplements over time can raise calcium levels in your blood above normal.

Complications can include:

- Osteoporosis. If your bones continue to release calcium into your blood, you can develop the bone-thinning disease osteoporosis, which could lead to bone fractures, spinal column curvature and loss of height.
- Kidney stones. If your urine contains too much calcium, crystals might form in your kidneys. Over time, the crystals can combine to form kidney stones. Passing a stone can be extremely painful.
- Kidney failure. Severe hypercalcemia can damage your kidneys, limiting their ability to cleanse the blood and eliminate fluid.
- Nervous system problems. Severe hypercalcemia can lead to confusion, dementia and coma, which can be fatal.
- Abnormal heart rhythm (arrhythmia). Hypercalcemia can affect the electrical impulses that regulate your heartbeat, causing your heart to beat irregularly.

  Symptoms: you might not have signs or symptoms if your hypercalcemia is mild. More-severe cases produce signs and symptoms related to the parts of your body affected by the high calcium levels in your blood. Examples include: kidneys. Excess calcium makes your kidneys work harder to filter it. This can cause excessive thirst and frequent urination. Digestive system. Hypercalcemia can cause stomach upset, nausea, vomiting and constipation. Bones and muscles. In most cases, the excess calcium in your blood was leached from your bones, which weakens them. This can cause bone pain and muscle weakness. Brain. Hypercalcemia can interfere with how your brain works, resulting in

confusion, lethargy and fatigue. It can also cause depression. Heart. Rarely, severe hypercalcemia can interfere with your heart function, causing palpitations and fainting, indications of cardiac arrhythmia, and other heart problems.

Phosphorus.This is one of the most important chemical elements for the health and wellbeing of the person. Phosphorus involved in metabolism processes of carbohydrates, fats and proteins. It is an element within the structure of the major organic compounds and plants of the nucleic acid and some enzymes, essential for the formation of ATP. About 80% of the phosphorus is included in the bone, about 10% is in the muscle tissue. Phosphorus is needed for most of the bio-chemical processes in the body, such as cell growth and conversion of food to the energy that fuels every action and function of the body.In the nervous and muscular tissue phosphorus as the macrocell, participates in basal metabolism.

Recent studies show that calcium needs phosphorus to build strong bones. Calcium alone is insufficient. Taking calcium supplements on its own would therefore be not much use if there is not enough phosphorus in the body.Requires 1200 mg per day. The body's need for phosphorus is increasing in low protein arrives with food and especially with an increase in physical activity. The need for phosphorus at athletes increases to 2.5 mg, and sometimes up to 3-4.5 mg per day in foods of both animal and vegetable origin. Phosphorus is in the form of various salts and derivatives of phosphoric acid, and mainly in the form of organic phosphoric acid compounds – in the form of phytin, which does not split in the human intestine (no enzyme). Minor splitting it occurs in the lower parts at the expense bacteria. In the form of phytin phosphorus in cereal products it is (50%). Splitting of phytin contributes to the production of bread yeast dough and increase recovery time. The number of grains phytin reduced by preliminary soaking is them overnight in warm water. Sources of phosphorus: Most of the phosphate comes from grains and legumes, but the latter option refers to poorly digestible fidinam. Animal products left in the body about 70% of the original phosphorus, while the plant foods with fiber accounts for about 40%. For best results, soak grains – this contributes to increased preservation of phosphorus.


Deficiency. Unusually low blood phosphate levels is called hypophosphatemia. Severe forms of it can result in death. However, a deficiency of phosphorus is rare as it is present in most foods.It happens mainly in cases of anorexia or near-starvation. Other people at risk include alcoholics and diabetics. A diet high in fructose, especially if it is low in magnesium, increases loss of phosphorus in urine and depletes the body of it as well.Also, certain medications, for example antacids with calcium or magnesium or aluminum, can bind with phosphorus in the intestine, and interfere with its absorption. Some anti-convulsions may lower phosphate levels too.

Chronic use of these medications increases the risk of hypophosphatemia. It is best to separate consumption of high phosphorus foods from such medication by at least an hour.Deficiency is unusual, but in the unlikely event that it occurs, a number of phosphorus deficiency symptoms can be identified.

Many foods contain phosphorus naturally. Processed food and soft drinks are high in added phosphates but these are in a form best avoided as they appear to cause de-calcification of bones.

Phosphorus in seeds like nuts, peas, beans and grains, is in a form known as phytic acid or phytate which hinders its absorbability so that only about half the phosphorus can be taken in by the body.

Foods high in phosphorus are: cheese, milk , meat , legumes (adzuki beans, chickpeas or garbanzo beans, yellow beans, lentils) . whole grains (wheat, oats, millet, quinoa, brown rice, corn, rye).

Moderately high phosphorus foods include , asparagus , brewer's yeast , dried fruit ,eggs , fish , garlic , nuts (almonds, brazil nuts, cashews, pine nuts, walnuts) , pumpkin, sesame, and sunflower seeds , rice bran.

*Phosphorus overdose symptoms, toxicity level.*Excess phosphorus can cause hyperphosphatemia or high blood phosphate levels.A common reason for this is over-consumption of foods high in phosphorus, such as canned, processed, or fast foods, or soft drinks. Many of these have phosphates added to extend shelf life or enhance flavors, especially in baked products, cheeses, meats, and drinks.A deficiency in calcium or magnesium may lead to excess blood phosphate. At the same time, high levels of phosphorus interfere with calcium uptake, which, if coupled with a low calcium diet over a long period, increases the risks of bone density loss, hypertension, and bowel cancer.Hyperphosphatemia can also occur in people with impaired kidney function. Healthy kidneys remove excess phosphorus from the blood. People with chronic kidney diseases

are unable to get rid of extra phosphorus, and are at risk of heart and bone diseases, and even death.

Magnesium. *Function:*1) is required for the activity of some key enzymes providing metabolism; 2) participates in maintaining the normal function of the nervous system and the heart muscle, an antispasmodic effect; 3) has a vasodilator effects; 4) stimulates bile secretion; 5) increases the motor activity of the intestine; 6) helps to eliminate toxins from the body;7) promotes the excretion of cholesterol. Assimilate of magnesium prevented the presence of phytin, excess fat and calcium in the diet.

Magnesium rich mostly plant foods. A large number of magnesium contains in wheat bran,buckwheat groats, beans, prunes,peas, black bread, whole grains (oat, etc.), dried apricots, prunes. Few magnesium in dairy products, meat, fish, pasta (table 7.8 gram /day).

Table 4.12. The content of Mg in some foods (mg %)

Products	Mg
Bread	25-51
Rice and kidney beans	60-90
Sea fish	12-33
Milk	9-13
Green salad	150-170
Banana	25-30

Magnesium deficiency (causes hypomagnesemia).

Symptoms: vomiting, nausea, fatigue, weakness, loss of appetite, numbness, seizures, abnormal heart rhythms, tingling, muscle cramps.The primary cause of magnesium is dietary inadequacy. Malabsorption could also be another cause. Excess alcohol intake and prolonged diarrhea may also cause magnesium deficiency.People at high risk of this deficiency include those who are addicted to alcohol, individuals with diabetes or gastrointestinal issues, and older adults.

At deficiency of magnesium in nutrition increased calcium content on the walls of arteries, in the heart and muscles, the development of degenerative changes in the kidneys, accompanied by manifestations of nephrosis, impaired digestion, delayed growth.

Peas, beans, buckwheat groats, prunes are among the richest sources of magnesium. Other sources include spinach, peanuts, and brown rice.

The daily requirement of 400 mg per day (table 4.12.). Pregnant and lactating increased need 50 mg per day.

Microelements– elements present in food products in amounts of less than 1mg. %: fluorine, iodine, cobalt, and iron. Their plays important role in the human organism: for example: iron, copper, cobalt involved in hematopoiesis. Strontium, Manganese in the process of ossification. Ultra-microelements– their content in products in mg%: gold, lead, mercury, radium and etc.

Iron.The average iron content of a healthy adult is only about 4 grams and yet this relatively small quantity is vitally important. About two-thirds of the iron in the body is present in the blood mainly as hemoglobin and approximately 3% is present as myoglobin. The majority of the remainder is storage iron which is found in the liver, spleen, bone marrow and muscle in the form of ferritin or hemosiderin. Additional minute quantities exist in the respiratory enzymes and in iron-binding protein of the plasma. The main function of iron is its vital role in the transfer of oxygen at various sites in the body (oxidation processes). Participates in hematopoiesis. Stimulates intracellular metabolic processes. Iron is an essential component of hemoglobin, the pigment in the red blood cells which carries oxygen from the lungs to the tissues. Iron is present as myoglobin in skeletal and heart muscle where it functions by accepting the oxygen from the hemoglobin and also in peroxidase, catalase and the cytochromes. Iron is not an element which tends to be either used up or destroyed in the properly functioning body. Unlike some minerals it is not required for excretion and only very small amounts appear in the urine and sweat. Minute quantities are lost in desquamated cells from the skin and intestine, in shed hair and nails and in the bile and other body secretions. The body is however, efficiently economical and conservative in the use of iron. Iron, which is released when the erythrocytes are old and broken down, is taken up and utilized again and again for the manufacture of new red blood cells.

Deficiency.Is anemia formation.Anemia happens when you do not have enough red blood cells. The cells travel with iron and hemoglobin, which is a protein that helps carry oxygen through the bloodstream to your organs all through the body. When someone develops anemia, they are said to be “anemic.” Being anemic might mean that you feel more tired or cold than you

usually do, or if your skin seems too pale. This is due to your organs not receiving the oxygen they need to do their jobs. Some people find out they are low in iron when they go to donate blood.

Fe deficiency anemia (IDA) is the most common nutritional deficiency in the world. It is estimated that up to 30% of women have IDA, with prevalence of 78% in developed countries. Up to 15% of pregnant women are Fe deficient. Physical signs include: pallor of finger nails and mucous membranes in the mouth and under eyelids; tachycardia and in severe cases edema; fatigue, breathlessness on exertion, insomnia, giddiness, anorexia; paresthesia of fingers and toes. *What causes anemia?*The most common cause of anemia is low levels of iron in the body. This type of anemia is called iron-deficiency anemia. Your body needs a certain amount of iron to make hemoglobin, the substance that moves oxygen throughout your body. However, iron-deficiency anemia is just one type. Other types are caused by: diets lacking in vitamin B_{12}, or you can't use or absorb Vitamin B_{12} (like pernicious anemia).Diets lacking in folic acid, also called folate, or your body can't use folic acid correctly (like folate-deficiency anemia).Inherited blood disorders (like sickle cell anemia or thalassemia).Conditions that cause red blood cells to break down too fast (like hemolytic anemia).Chronic conditions causing your body to not have enough hormones to create red blood cells. These include hyperthyroidism, hypothyroidism, advanced kidney disease, lupus and other long-term diseases.Blood loss related to other conditions such as ulcers, hemorrhoids or gastritis.

There are several different types of anemia, but each of them causes the number of red blood cells in circulation to drop. Red blood cell levels are low due to one of the following reasons: your body cannot make enough hemoglobin (low hemoglobin).Your body makes hemoglobin, but the hemoglobin doesn't work correctly.Your body does not make enough red blood cells.Your body breaks down red blood cells too quickly.

Some types of anemia that you may have heard of include iron-deficiency anemia and sickle cell anemia.Anemia affects more than two billion people globally, which is more than 30% of the total population. It is especially common in countries with few resources, but it also affects many people in the industrialized world. Within the U.S., anemia is the most common blood condition. An estimated three million Americans have the disorder.Several signs and symptoms occur in all types of anemia, such as fatigue, shortness of breath and feeling cold. Others include: dizziness

or weakness.Headache.Sore tongue.Pale skin, dry skin, or easily bruised skin.Unintended movement in the lower leg (restless legs syndrome). Fast heartbeat.

*Who is most likely to develop anemia?*Anyone can develop anemia, although the following groups have a higher risk:

- Women: Blood loss during monthly periods and childbirth can lead to anemia. This is especially true if you have heavy periods or a condition like fibroids.
- Children: ages 1 to 2: The body needs more iron during growth spurts.
- Infants: Infants may get less iron when they are weaned from breast milk or formula to solid food. Iron from solid food is not as easily taken up by the body.
- People over 65: People over 65 are more likely to have iron-poor diets and certain chronic diseases.
- People on blood thinners: these medications include drugs include aspirin, clopidogrel (Plavix®), warfarin (Coumadin®), and heparin products.

Effect of body.Anemia can have other effects on your body in addition to feeling tired or cold. Other signs that you might be lacking in iron include having brittle or spoon-shaped nails and possible hair loss. You might find that your sense of taste has changed, or you might experience ringing in your ears.Different types of anemia may lead to other serious problems. People with sickle cell anemia often have heart and lung complications.If you have anemia that is not treated, it could lead to an arrhythmia (irregular heartbeat), an enlarged heart or heart failure. You are also at greater risk of getting infections and becoming depressed.You might have heard that iron deficiency is linked to chewing ice, which does happen. Chewing ice is a sign of pica, a condition that includes eating things that are not really food, like chalk or dirt. So pica is also a sign of iron deficiency. It is often seen in children with anemia.

How else does anemia affect children?It is important for children to have enough iron and other nutrients in their diets to prevent anemia and the related problems with lack of attention, delayed development of motor skills and problems with learning. In older children, you need to pay more attention to signs of anemia during growth spurts and menstrual cycles.

How does anemia affect older adults?In older adults, anemia might have even more impact in causing confusion or depression. Weakness may make walking more difficult. Anemia may shorten your lifespan if you are older and it is not treated.

This economy with iron is important. In normal circumstances, only about 1 milligram of iron is lost to the body daily by excretion into the intestines, in urine, in sweat or through loss of hair or surface epithelial cells. Because of the preservation of iron, the nutritional needs of healthy males and post-menopausal females are very small. Women of childbearing age must however, make good the iron lost during menstruation and childbirth and meet the additional requirements of pregnancy and lactation. Children have relatively high needs because of their rapid growth, which not only increases their body size but also their blood volume.

*Sources of iron- i*ron is present in a great variety of foods, of both plant and animal origin. In many individual foods: here is a considerable variation in the value of iron content according to the soil and other conditions in which the food is raised. Rich food sources for iron include meat, especially liver, egg yolk and pulses such as beans and peas. However, many other common foods such as green leafy vegetables, whole grain and enriched cereals, vegetables and fish are good sources of iron. Milk, both human and cow's, contrary to the notion that it is the "perfect food," is a poor source of iron. For example: chess-60-400 mg. eggs-210-215 mg. bread-108-222mg.; meat and fish-140-230mg. Daily requirements*:* for men-10-30 mg. for wormen-20-30 mg. (table 4.13).

Table 4.13. The content of iron in some foods (mg %)

Products	Iron
Bread	108-222
Eggs	210-215
Meat and fish	140-230
Wheat	220-330
Chees	60-400

Toxicity. Due to the tight metabolic control dietary excess does not occur. Fe poisoning can occur due to overdose of supplements: the lethal dose in children is 200–300 mg/kg body weight and approximately 100 g in adults. High doses of Fe supplements cause gastrointestinal symptoms especially constipation although nausea, vomiting, and diarrhea may occur. The absorption of other micronutrients, e.g. Zn, are reduced by high dose Fe supplements. The hereditary disease primary idiopathic haemochromatosis is characterized by high levels of Fe

being absorbed. Fe deposits in the liver and heart and may l cirrhosis, liver cancer, congestive heart failure, and eventually death. Treatment requires regular blood removal.

Iodine.The body of an average adult contains about 40 mg. of iodine of which about half is present in the thyroid gland. Iodine is essential for the formation of thyroxin and triiodothyronine, the hormones of this gland.Iodine is present in rocks and soils but through the ages, much has been washed into the sea. Man gets his iodine from food and from water, which vary in amount according to the iodine content of their source.Thus, there are waters with a high content of iodine and others with negligible amounts, and the same foodstuff grown in different soils has a different iodine content sea food on the whole are rich in iodine and dairy products, eggs, and some vegetables may be good sources (table 4.14.). Iodized salt is sold in the United States but housewives are frequently unaware as to whether they are buying iodized or non-iodized salt and even institutions such as hospitals and schools are frequently found to be using non-iodized salt, a most unfortunate situation.

Table 4.14. The content of iodine in some foods (mg %)

Products	Iodine
Bread	3,3-5,1
Eggs	20
Sea fish	up to 3000
Liver	6,3
Milk	16

The Food and Nutrition Board of our National Research Council has recommended federal legislation making mandatory the iodization of all salt put up for sale for human consumption. However, there is as yet no federal legislation concerning salt, and state laws are not uniform. A suitable iodine level is 0.5 gram of potassium iodide in 1 kilogram of purified salt.

In normal people, iodine is readily absorbed from the intestinal tract and about one third is utilized by the thyroid gland while two thirds is excreted in the urine. Iodine nurture can be studied by determining the avidity of the thyroid gland to take up radioactive iodine, by measurement of the stable iodine content of the urine, and by determination of the protein bound iodine. Iodine in the feces comes mainly from the bile. Daily requirementit has been suggested that 1 microgram of iodine per kilogram body weight is an adequate intake in the human. However, growing children and women during pregnancy and lactation have increased needs.

Deficiency-a deficiency of iodine leads to the development of goiter but there are several other causes of goiter besides iodine deficiency. Endemic goiter which is discussed on page 48 occurs where population groups have dietary sources of iodine below normal requirements. Iodine lack is a major public health problem in many parts of the world 35 as well as in the U.S. due to our laxness in using iodized salt. Iodine deficiency goiter is really a defense mechanism designed to keep thyroid hormones at an optimal level. A decrease in the circulating iodine-containing thyroid hormones triggers a release of thyroid-stimulating hormone (TSH) from the pituitary gland. This eventually causes a thyroid hypertrophy and an increase in the number of thyroid epithelial cells. Goitrogens in brassica plants such as cabbage have been shown to increase the needs of iodine in certain laboratory animals. As a result, iodine intakes which would be adequate under normal circumstances failed to prevent goiter in those animals consuming large quantities of goitrogens. There is little evidence to show that goitrogens in normal diets have been important in the production of goiter in man.

Sulfur.Sulfur occurs in the food, as it does in the body, chiefly as a constituent of proteins. Since sulfur is essential to the constitution of the body proteins, it is obviously important that sufficient of this element shall be supplied by the food; but all food proteins contain sulfur, and though the percentages of sulfur in individual proteins show considerable differences, the different proteins of the same food material usually tend to balance each other in this respect so that the sulfur content of the total protein is about the same for most staple foods as for the body.

Zinc. Zinc is an essential mineral that stimulates the activity of about 100 enzymes in the body.Participates in the function of removing carbon dioxide from the,the realization of the biological action of insulin, the normalization of fat metabolism in the body. It also: supports your healthy immune system, is necessary to synthesize DNA, is essential for wound healing, supports

the healthy growth and development of the body during adolescence, childhood and pregnancy. Though the actual amount of zinc necessary to support the human body is quite small, its effects on the body are astronomical.

In an average human body, there is about 2 to 3 grams of zinc. Most of this is found in the muscle tissue and the bone. Generally, most adults do not require zinc supplementation if they eat a healthy diet with vegetables, fruit and some protein sources. Males require more zinc than women, as the mineral is released when a man ejaculates. The more sexually active a male, the more zinc that is required, as semen has the highest levels of zinc in the body.

Zinc recommendations. An average adult woman should consume about 7 milligrams of zinc daily, while an average male should be consuming 9.5 milligrams daily. The risk for women to have a zinc deficiency is much greater than a man, especially if they are malnourished because of an eating disorder or when they are breastfeeding. If you are concerned about your zinc intake, taking a good multivitamin should be sufficient. Be sure to only take the recommended daily dose, as zinc overdoses can also occur, which can be toxic to the body. Consuming too much zinc can cause nausea, vomiting and fever because too much of the mineral can interfere with how the body processes other minerals.

Sources of zinc (figure 4.8.). Zinc is present in a variety of foods that many people consume daily. The food with the most zinc per serving is oysters, but most Americans receive the greatest portion of their zinc intake from red meat and poultry. Some other food sources that contain zinc are some seafood, whole grains, fortified cereals, beans, nuts and dairy products.

The absorption of zinc tends to be higher in diets high in animal protein, as opposed to those rich in plant protein. An element present in whole grains, breads, cereals and legumes called phytate can also work to decrease zinc absorption.

Figure 4.8. Foods contents is zinc

Zinc deficiencies. Generally, when someone is suffering from a zinc deficiency, it is because the intake is inadequate, because it is being poorly absorbed into the body or their need for zinc increases. Maine reasons hypozincosis: predominant consumption of carbohydrate foods, while reducing the consumption of animal origin products and animal origin fats . A zinc deficiency can be identified by: growth retardation, diarrhea, hair loss, delayed sexual maturation and impotence, loss of appetite, eye and skin lesions, white spots on the fingernails. Because many of these symptoms are general and can be associated with so many medical conditions, you should consult with your doctor if you are suffering from any or a combination of these symptoms.

Selenium. Acts as an electrolyte (regulates the electrical communication between cells). Acts as an antioxidant to combat free radicals. Protects cell membranes and reduces the generation of free radicals. Decreases the risk of contracting several types of cancer and heart disease. Assists in the preservation of tissue elasticity. Slows down the aging process and the hardening of tissue caused by oxidation. Vital to the proper function of your pancreas and thyroid gland. Assists in the prevention of dandruff.

Deficiency. Deficiency of Se is associated with two endemic causes: Keshan disease and Kashin–Beck disease.

- *Keshan disease*—outbreaks in Russia and several parts of Asia; it is a selenium-deficient condition characterized primarily by a dilated cardiomyopathy, resulting in congestive cardiac failure, cardiomegaly, and, on occasion, fulminant cardiogenic shock. It most commonly presents in young children and menstruating women.Keshan disease is a congestive cardiomyopathy caused by a combination of dietary deficiency of selenium and the presence of a mutated strain of Coxsackievirus, named after Keshan County of Heilongjiang province, Northeast China, where symptoms were first noted (figure 4.9.). These symptoms were later found prevalent in a wide belt extending from northeast to southwest China, all due to selenium-deficient soil. The disease peaked in 1960–1970, killing thousands of people. Often fatal, the disease afflicts children and women of child-bearing age, characterized by heart failure and pulmonary edema. Over decades, supplementation with selenium reduced this affliction. It had been linked to the coxsackie B virus. Current research suggests that the lack of selenium results in

a more virulent strain of the coxsackievirus becoming the dominant viral species present in the population of virus, but the mechanism of this selection event is unclear.

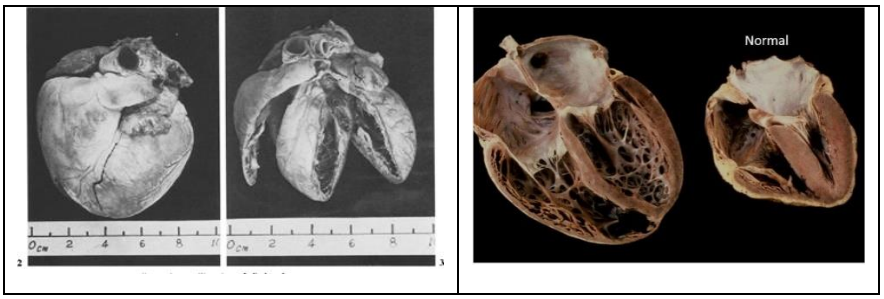


Figure 4.9.Keshan disease

Keshan disease can also lead to higher rates of cancer, cardiovascular disease, hypertension, and strokes. In addition, an individual can experience eczema, psoriasis, arthritis, cataracts, alcoholism, and infections.

- Kashin–Beck disease is an endemic musculoskeletal disorder that has occurred in parts of Siberia and Asia.Kashin–Beck disease (KBD) is a chronic, endemic type of osteochondropathy (disease of the bone) that is mainly distributed from northeastern to southwestern China, including 15 provinces (figure 4.10.). Tibet currently has the highest incidence rate of KBD in China. Southeast Siberia and North Korea are other affected areas. KBD usually involves children ages 5–15. To date, more than a million individuals have suffered from KBD. The symptoms of KBD include joint pain, morning stiffness in the joints, disturbances of flexion and extension in the elbows, enlarged inter-phalangeal joints, and limited motion in many joints of the body.

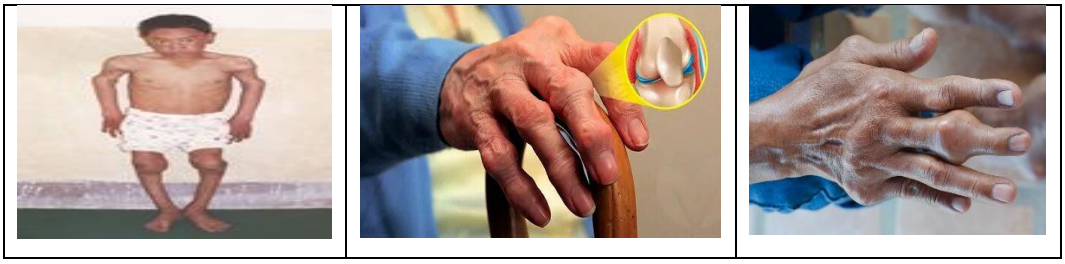


Figure 4.10.Kashin–Beck disease

Death of cartilage cells in the growth plate and articular surface is the basic pathologic feature; this can result in growth retardation and secondary osteoarthrosis. Histological diagnosis of KBD is particularly difficult; clinical and radiological examinations have proved to be the best

means for identifying KBD. Little is known about the early stages of KBD before the visible appearance of the disease becomes evident in the destruction of the joints.

This disease has been recognized for over 150 years but its cause has not yet been completely defined. Currently, the accepted potential causes of KBD include mycotoxins present in grain, trace mineral deficiency in nutrition, and high levels of fulvic acid in drinking water. Selenium and iodine have been considered the major deficiencies associated with KBD. Mycotoxins produced by fungi can contaminate grain, which may cause KBD because mycotoxins cause the production of free radicals. T-2 is the mycotoxin implicated with KBD, produced by members of several fungal genera. T-2 toxin can cause lesions in hematopoietic, lymphoid, gastrointestinal, and cartilage tissues, especially in physical cartilage. Fulvic acid present in drinking water damages cartilage cells. Selenium supplementation in selenium deficient areas has been shown to prevent this disease. However, selenium supplementation in some areas showed no significant effect, meaning that deficiency of selenium may not be the dominant cause in KBD.

- Iatrogenic causes of Se deficiency include patients receiving TPN, phenylketonuria patients receiving a semi-synthetic diet. Patients exhibit symptoms of cardiomyopathy and/or musculoskeletal disorders.

Requirement and intake.Recommended Dietary Allowances (RDAs) for selenium: birth to 6 months - 15 mcg ; 7–12 months– 20 mcg; 1–3 years -20 mcg;4–8 years - 30 mcg; 9–13 years– 40 mcg;14–18 years–55 mcg; 19–50 years – 55 mcg; 51+ years - 55 mcg.

Sources in the diet. Brazil nuts, seafood's, and organ meats are the richest food sources of selenium. Other sources include muscle meats, cereals and other grains, and dairy products. The amount of selenium in drinking water is not nutritionally significant in most geographic regions. The major food sources of selenium in the American diet are breads, grains, meat, poultry, fish, and eggs.

The amount of selenium in a given type of plant-based food depends on the amount of selenium in the soil and several other factors, such as soil pH, amount of organic matter in the soil, and whether the selenium is in a form that is amenable to plant uptake. As a result, selenium concentrations in plant-based foods vary widely by geographic location. For example, according

to the U.S. Department of Agriculture Food Composition Database, Brazil nuts have 544 mcg selenium/ounce, but values from other analyses vary widely.

The selenium content of soil affects the amounts of selenium in the plants that animals eat, so the quantities of selenium in animal products also vary. However, selenium concentration in soil has a smaller effect on selenium levels in animal products than in plant-based foods because animals maintain predictable tissue concentrations of selenium through homeostatic mechanisms. Furthermore, formulated livestock feeds generally contain the same levels of selenium.

Health risks from excessive selenium. Chronically high intakes of the organic and inorganic forms of selenium have similar effects. Early indicators of excess intake are a garlic odor in the breath and a metallic taste in the mouth. The most common clinical signs of chronically high selenium intakes, or selenosis, are hair and nail loss or brittleness. Other symptoms include lesions of the skin and nervous system, nausea, diarrhea, skin rashes, mottled teeth, fatigue, irritability, and nervous system abnormalities. Acute Se poisoning is characterized by hypersalivation, nau- sea, vomiting, and garlic-smelling breath. This may be accompanied by diarrhea, hair loss, restlessness, tachycardia, and fatigue. Chronic poisoning (selenosis) is associated with nail and hair changes, skin lesions, and neurological, effects; numbness, pain, and paralysis may follow. Early nail changes have been observed at intakes of 900 µg/d and the recommended maximum safe intake is 6 µg/kg/day.

Copper (Cu). Copper is an essential trace mineral necessary for survival.Participates in hematopoiesis.Has an insulin-like effect. It is found in all body tissues and plays a role in making red blood cells and maintaining nerve cells and the immune system. It also helps the body form collagen and absorb iron, and plays a role in energy production. Has an insulin-like effect. Most copper in the body is found in the liver, brain, heart, kidneys, and skeletal muscle. Both too much and too little copper can affect how the brain works. Impairments have been linked to Menkes, Wilson's, and Alzheimer's disease

Health benefits. Copper is an essential nutrient for the body. Together with iron, it enables the body to form red blood cells. It helps maintain healthy bones, blood vessels, nerves, and immune function, and it contributes to iron absorption. Sufficient copper in the diet may help prevent cardiovascular disease and osteoporosis, too.

Cardiovascular health. Low copper levels have been linked to high cholesterol and high blood pressure. One group of researchers has suggested that some patients with heart failure may benefit from copper supplements. Animal studies have linked low copper levels to CVD, but it remains unclear if a deficiency would have the same impact on humans.

Neuron signaling. In 2016, Prof. Chris Chang, a chemist who is part of the Sackler Sabbatical Exchange Program at Berkeley, CA, devised and used a fluorescent probe to track the movement of copper in and out of nerve cells. Prof. Chang says: “Copper is like a brake or dimmer switch, one for each nerve cell.” His team found that, if high amounts of copper enter a cell, this appears to reduce neuron signaling. When copper levels in that cell fall, signaling resumes.

Immune function. Too little copper can lead to neutropenia. This is a deficiency of white blood cells, or neutrophils, which fight off infection. A person with a low level of neutrophils is more likely to get an infectious disease.

Osteoporosis. Severe copper deficiency is associated with lower bone mineral density and a higher risk of osteoporosis. More research is needed on how marginal copper deficiency may affect bone health, and how copper supplementation might help prevent and manage osteoporosis.

Collagen production. Copper plays an important role in maintaining collagen and elastin, major structural components of our bodies. Scientists have hypothesized that Trusted Source copper may have antioxidant properties, and that, together with other antioxidants, a healthful intake may help prevent skin aging. Without sufficient copper, the body cannot replace damaged connective tissue or the collagen that makes up the scaffolding for bone. This can lead to a range of problems, including joint dysfunction, as bodily tissues begin to break down.

Arthritis. Animal studies have indicated that copper may help prevent or delay arthritis, and people wear copper bracelets for this purpose. However, no human studies have confirmed this.

Antioxidant action. Copper may also have an antioxidant function. It may help reduce the production of free radicals. Free radicals can damage cells and DNA, leading to cancer and other diseases.

Requirements: the recommended daily allowance (RDA) is around 900 micrograms Trusted Source (mcg) a day for adolescents and adults. The upper limit for adults aged 19 years and above is 10,000 mcg, or 10 milligrams (mg) a day. An intake above this level could be toxic. Both copper deficiency and copper toxicity are rare in the United States (U.S).

Deficiency. While a copper deficiency is rare, some health conditions and other factors can increase the risk. These include: genetic defects of copper metabolism, absorption problems, too high an intake of zinc or vitamin C supplements, some conditions, such as central nervous system (CNS) demyelination, polyneuropathy, myelopathy, and inflammation of the optic nerve, since copper is stored in the liver, deficiencies develop slowly over time.

Zinc and vitamin C: a high intake of zinc (150 mg a day or above) and vitamin C (over 1,500 mg a day) may induce copper deficiency by competing with copper for absorption in the intestine.

Causes of deficiency in infants: copper deficiency has been seen in infants Trusted Source who consume cow's milk instead of formula. Cow's milk has a low copper content. Children under 1 year should be ideally breast fed and if not, fed manufactured formula. Cow's milk does not have the required nutrients for a human infant. Effects of deficiency: low levels of copper can lead to: anemia, low body temperature, bone fractures, osteoporosis, loss of skin pigmentation, thyroid problems.

Metabolic diseases can affect the way the body absorbs vitamins and minerals: Menkes disease (figure 4.11.). Menkes disease, an X-linked recessive disorder, adversely affects how the brain metabolizes copper. This can result in failure to thrive and neurodevelopmental delays in infants from around 6 to 8 weeks of age. A child with this disease may not survive to the age of 3 years. Subcutaneous copper injections can help normalize blood copper levels, but whether these help to normalize brain copper levels depends on the type of genetic mutation involved. One clinical trial has found that treating infants before symptoms begin may help to improve gross motor skills, fine motor and adaptive skills, personal and social skills, and language neurodevelopment in children. It also improved growth.

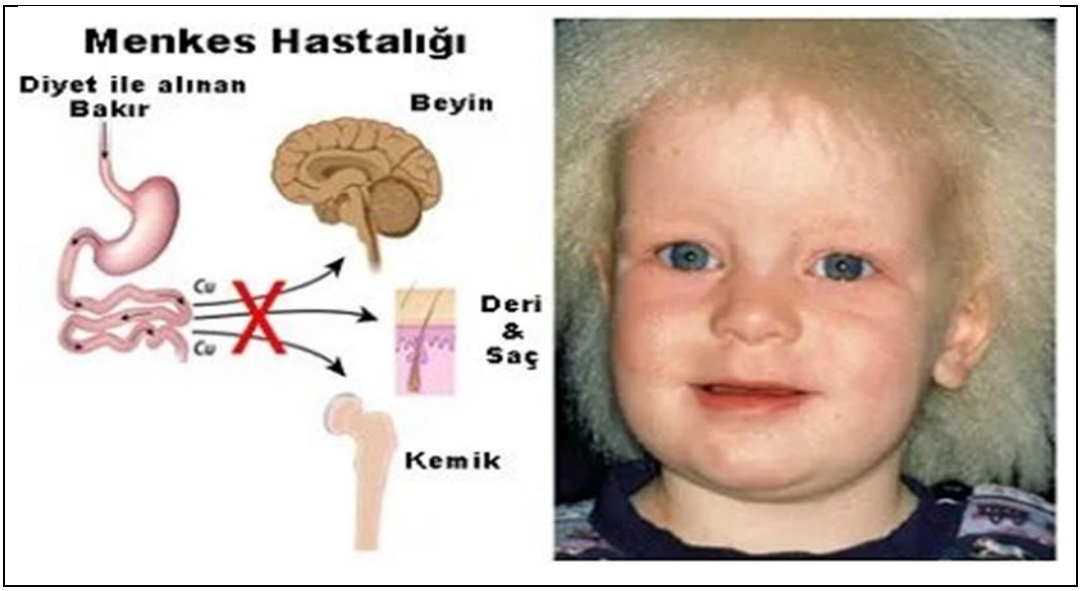


Figure 4.11. Menkes disease

Other effects of copper deficiency: copper deficiency has also been linked to: an increased risk of infection, osteoporosis, depigmentation of the hair and skin, anemia, as copper contributes to the creation of red blood cells, The brain and the nervous system. Too little or too much copper can damage brain tissue. In adults, neurodegeneration has been observed as a result of a copper imbalance. This may be due to a problem with the mechanisms involved in metabolizing copper for use in the brain.

High levels of copper can lead to oxidative damage in the brain. In Wilson's disease, for example, high levels of copper collect in the liver, brain, and other vital organs. Possible link with Alzheimer's. An excessive accumulation of copper has also been associated with Alzheimer's disease. Prof. Chang and colleagues have hypothesized that when copper accumulates in unusual ways, this may cause amyloid plaques to build up on a nerve cell. A buildup of amyloid plaques can lead to Alzheimer's and other neurodegenerative disorders.

Food sources: copper is found in a wide variety of foods. Good sources include: oysters and other shellfish, whole grains, beans, potatoes, yeast, dark leafy greens, cocoa, dried fruits, black pepper organ meats, such as kidneys and liver, nuts, such as cashews and almonds. Most fruits and vegetables are low in copper, but it is present in wholegrains, and it is added to some breakfast cereals and other fortified foods.

Supplements: copper supplements are available, but it is best to first try to obtain essential vitamins and minerals through food in order to reduce the risk of an imbalance. Very few people need to take a copper supplement. Additionally, the nutrients in food work together to create an effect that is more significant than that achieved by taking individual nutrients in isolation. Most multivitamin supplements contain 2 mg Trusted Source of copper, which is halfway along the Safe and Adequate Range of Intake fixed by the Food and Nutrition Board (FNB). Risks: copper supplements can interact with the following: birth control pills and hormone therapy, non-steroidal anti-inflammatories (NSAIDS), such as aspirin and ibuprofen, penicillamine, used to reduce copper levels in Wilson's disease, allopurinol, a gout treatment, cimetidine, or Tagamet, use for gastric ulcers and gastric reflux, zinc supplements. These products may reduce or increase levels of copper in the blood, leading to an imbalance.

Copper toxicity: no adverse effects have been reported from normal dietary consumption of copper, but symptoms can appear if there is: excessive supplementation, high levels of copper in drinking water, such as well water or water that is stored in copper pipes, exposure to chemicals containing high levels of copper, use of copper cooking pots. Signs of copper toxicity include: nausea, vomiting, diarrhea, and stomach pain, headache, dizziness, weakness, a metallic taste in the mouth. More serious effects are rare, but they include: cirrhosis and jaundice, abnormalities in red blood cells and heart problems. Increased serum copper levels have been linked with a higher risk of cardiovascular disease. Water that contains more than 6 mg of copper per liter may cause stomach problems. If drinking water appears to trigger symptoms, the individual should see about getting it tested.

Molybdenum (Mo)

Molybdenum is an essential trace element that is naturally present in many foods and is also available as a dietary supplement. Molybdenum is a structural constituent of molybdopterin, a cofactor synthesized by the body and required for the function of four enzymes: sulfite oxidase, xanthine oxidase, aldehyde oxidase, and mitochondrial amidoxime reducing component (mARC). These enzymes metabolize sulfur-containing amino acids and heterocyclic compounds including purines and pyrimidines. Xanthine oxidase, aldehyde oxidase, and mARC are also involved in metabolizing drugs and toxins.

Recommended intakes. There are no RNIs but safe intakes are believed to be between 50 and 400 µg/d in adults and 0.5 and 1.5 µg/d in children. Mean intakes in adults are reported as 0.12 mg/d.

Sources of molybdenum. Legumes are the richest sources of molybdenum. Other foods high in molybdenum include whole grains, nuts, and beef liver. The top sources of molybdenum in U.S. diets are legumes, cereal grains, leafy vegetables, beef liver, and milk. Milk and cheese products are the main sources of molybdenum for teens and children. The amount of molybdenum in food depends on the amount of molybdenum in the soil and in the water used for irrigation. Drinking water generally contains only small amounts of molybdenum. However, according to 2017 data from the U.S. Environmental Protection Agency, 0.8% of drinking water samples had molybdenum levels above 40 mcg/L. Therefore, the amount of information on molybdenum levels in foods is quite limited.

Deficiency. Dietary deficiency of Mo has been reported in farm animals but has not been observed in humans, although there is a single case reported following prolonged TPN. The symptoms included defects in 106emmate metabolism, mental disturbance, and coma. An inborn error of metabolism results in abnormal production of the coenzyme. It is characterized by abnormal urinary metabolites, neurological and ocular problems, and failure to thrive. The genetic expression and symptoms are varied and in the most severe cases can be fatal at 2–3 years.

Toxicity. Little data are available for dietary excess, although intakes>100 mg/kg/d have been reported to cause diarrhea, anemia, and high blood uric acid levels; this is associated with gout.

Chromium is among the essential minerals that the body requires to function its best physiologically. It's an essential mineral that we must get from our diets, though our bodies only require small amounts. Studies show that chromium plays an important role in blood sugar regulation, brain function, and breaking down fats and carbohydrates.

Scientists continue to study chromium to understand its health benefits and determine if supplementation could help treat certain conditions. While this research is ongoing, it suggests that getting enough chromium is a vital part of a balanced diet.

Chromium used for: chromium supplements are often used as a weight-loss aid and to control blood sugar. Chromium works by aiding the action of insulin in the body. Insulin is essential for metabolism and storage of carbs, fats, and proteins in the body.

Type 2 diabetes: reviews of multiple studies show that chromium supplements significantly decreased blood sugar and triglyceride levels in people with type 2 diabetes. A systematic review of 25 studies found that supplementation with 200 micrograms (mcg) of chromium picolinate improved glycemic control without increased side effects compared to placebo.

Weight loss: although the benefits of using chromium for weight loss are inconclusive, the theory that it could help with weight loss is based on the idea that regulated blood sugar will result in reduced cravings. Claims that it helps to reduce body fat and increase lean muscle mass have not been supported by scientific studies.

Lowers cholesterol: bad cholesterol is absorbed by stomach lining which flows later inside arteries and other blood vessels. It could create huge burden on metabolic rate of the body and causes chronic illnesses. Chromium facilitates break down of fats and prevent storage of bad fats and cholesterol in the body. It enhances healthy metabolic rate which efficiently break down fats. Study conducted on 42-day period on patients with cholesterol spikes proved reduction in bad cholesterol level with supplement of chromium continuously.

Cardiovascular health: atherosclerosis is the cause for various issues which suffice in cardiovascular system. Chromium is beneficial for heart health in combination with other trace minerals found in sources of food. Cholesterol reduction is a bonus to clear arteries and blood vessels from any fat or cholesterol accumulation. It promotes blood flow.

*Skin health: u*sually chromium is present in foods containing other phytonutrients which works together for promoting skin health. Supplements of chromium helps the body to maintain

balanced levels of blood sugars and fluctuation of blood sugar levels could be the cause for unhealthy, dull skin and acne.

Absorb nutrients: body requires proper absorption of nutrients for effective functioning. It enhance efficient absorption of nutrient by promoting metabolic rate and breaking down complex carbohydrates and fats.

Protects bone density: chromium helps to retain calcium in bone. It is useful for women with osteoporosis. It increases intake of chromium that is beneficial for bone health for long term and maintains bones strong even in old age.

*Possible side effects:*There are few known side effects of chromium supplements. In reasonable doses, there does not appear to be any concern for serious side effects.There have been some reports that chromium supplements can cause pain and bloating, kidney damage, muscular problems, and skin reactions when taken in large doses.Pregnancy and breastfeeding: chromium does pass through the breastmilk but is typically not considered harmful in typical doses. It is a necessary element that is also included in baby formula. If you are pregnant or breastfeeding, talk to your healthcare provider prior to taking any supplements or medications.

A wide variety of foods contain chromium and most researchers agree that a majority of the population gets enough through food, including: broccoli, grape juice, whole wheat bread, garlic, basil, beef, orange juice, turkey, red wine, apple, banana, green beans.

*Signs of deficiency and toxicity.*A chromium deficiency is rare, even though the mineral is poorly absorbed, with only about 5% or less absorbed in the gut. Diets high in refined sugars can cause more chromium to be excreted in the urine. Pregnancy and lactation, strenuous exercise, and physical stress from infections and trauma can also increase chromium losses. A risk of chromium deficiency increases with these scenarios if the diet is also low in chromium (most

commonly seen with general malnutrition or acute illness that causes a deficiency of many nutrients).

Harmful side effects linked to high intakes of chromium from food or supplements exist but are rare. This may be because chromium is poorly absorbed in the gut. Therefore, a Tolerable Upper Intake Level has not been established by the Institute of Medicine. This is a level set as a maximum intake that is unlikely to cause adverse health effects. However, caution should be used with high dose supplements of any trace mineral; a few case studies found an association with chromium supplements and kidney and liver damage.

Manganese is a vital nutrient that contributes to your health. Unfortunately, it is not as popular as other nutrients and is less talked about. In this article, we bring you a list of foods high in manganese and explain how you can get enough of this nutrient. Manganese trace mineral, manganese is found mostly in the bones, kidneys, liver, and pancreas. The mineral helps the body form the connective tissue, bones, and sex hormones. It also plays an important role in calcium absorption and blood sugar regulation in addition to aiding carbohydrate and fat metabolism.The mineral is also necessary for optimal brain and nerve function. It even helps prevent osteoporosis and inflammation. More importantly, manganese is vital for numerous bodily functions like the production of digestive enzymes, nutrient absorption, immune system defenses, and even bone development.

1. Strengthens bones-manganese is vital for the normal development of the human bone structure (ossification processes). It helps to boost the mineral density of the spine. It has also proved to be beneficial for post-menopausal women. Manganese deficiency in women after menopause can increase the amount of trace minerals and cause minor fractures. Research is going on to establish a concrete evidence that manganese may help prevent osteoporosis and many other diseases.

2. Scavenges free radicals. Manganese has antioxidant properties, which help it to monitor the activity of free radicals in our body. These free radicals can damage human cells and lead to cancer and other harmful diseases. Hence, it is vital to add manganese-rich food sources or supplements to your diet to avert the risk of inflammatory diseases.

3. Controls sugar levels.Manganese can control the blood sugar levels in our body and help prevent diabetes. Manganese can normalize the synthesis and secretion of insulin in the blood to

control the level of sugar. This also helps to regulate unpredictable drops in the blood sugar, which makes life easier for diabetics.

4. Treats epilepsy. Epilepsy is a troublesome disorder, and the deficiency of manganese can trigger epileptic seizures. Manganese can act as a vasodilator and plays a key in treating seizures due to its anti-epileptic qualities. Manganese supplements may control minor and major epileptic seizures.

5. Controls metabolism rate. Regulating our body's metabolism is an essential function of manganese. Manganese-activated enzymes are useful to metabolize cholesterol, amino acids, carbohydrates, and vitamins such as vitamin E and vitamin B_1. It also helps in proper functioning of the liver. It has a lipotropic effect. Manganese can help in the metabolism of glutamine (amino acid) and is an integral part of DNA polymerase.

6. Treats inflammation and sprains.Manganese enhances the healing of sprains and inflammation by increasing the superoxide dismutase level. This happens due to its antioxidant properties. Superoxide dismutase (SOD) deficiency is also observed in patients with arthritis. SOD has anti-inflammatory properties that can alleviate arthritis. Manganese can help to increase the synthesis and functioning of SOD, thus helping reduce the symptoms of the condition.

7. Prevents osteoporosis. Manganese supplements can give you relief from osteoporosis and osteoarthritis since this essential mineral can add to the bone density and mineral density. With all minerals, balance is key and not only supplementing with one mineral. However, further research is needed to specifically explore the impact of manganese on bone health.

8. Good for thyroid health. You may not be aware of many other mineral supplements for thyroid disorder other iodine, right? But, manganese is also very much essential for thyroid health.

Manganese is an essential co-factor for various enzymes like thyroxine, a vital hormone in the thyroid gland. It is important to maintain proper functioning of the thyroid gland to avoid health issues. This can be useful to maintain proper appetite, metabolism, weight, and organ system efficiency.

9. Many women can suffer from premenstrual syndrome (PMS). Manganese helps to manage mood swings and reduce headaches, depression, and irritability. Women who suffer from severe PMS symptoms are advised to consume manganese supplements.

10. Aids vitamin absorption.Participates in vitamin metabolism. Manganese can be useful in the absorption of essential vitamins such as vitamin B, vitamin E, and minerals. It plays an important role in enzymatic reactions required for the absorption and utilization of vitamins obtained from food.

11. Good for brain health. Manganese is found to be an essential component in treating many nervous system disorders. This property of manganese is due to the availability of superoxide dismutase, which scavenges free radicals from the neural pathways. Manganese also binds with neurotransmitters, thus regulating the transmission of electrical impulses throughout the body and enhancing the cognitive function.

12. Increases energy and functional efficiency in the body. Manganese can also provide instant energy and ensure proper working of the body. It regulates glucose metabolism, thus ensuring proper energy distribution in each and every cell of the body. It also ensures proper absorption of glucose in the muscles and organs.

A deficiency of manganese can lead to the following symptoms:anemia, hormonal imbalances, low immunity, changes in digestion and appetite, infertility, weak bones, chronic fatigue syndrome.

The effects of excessive manganese intake. Although manganese is necessary for humans to survive, health problems will also occur when the uptake exceeds the normal level. Increased manganese intake can cause the following harmful effects: mental confusion, ataxia, impaired memory, loss of appetite, mask-like facial expression and monotonous voice, spastic gait, neurologicalproblems, impaired thiamin (B_1) metabolism, reduced immune function, increased demand for vitamin C and copper (figure 4.12).Long-term exposure to excess levels may result in manganese poisoning which can cause kidney failure, hallucinations, as well as diseases of the central nervous system.

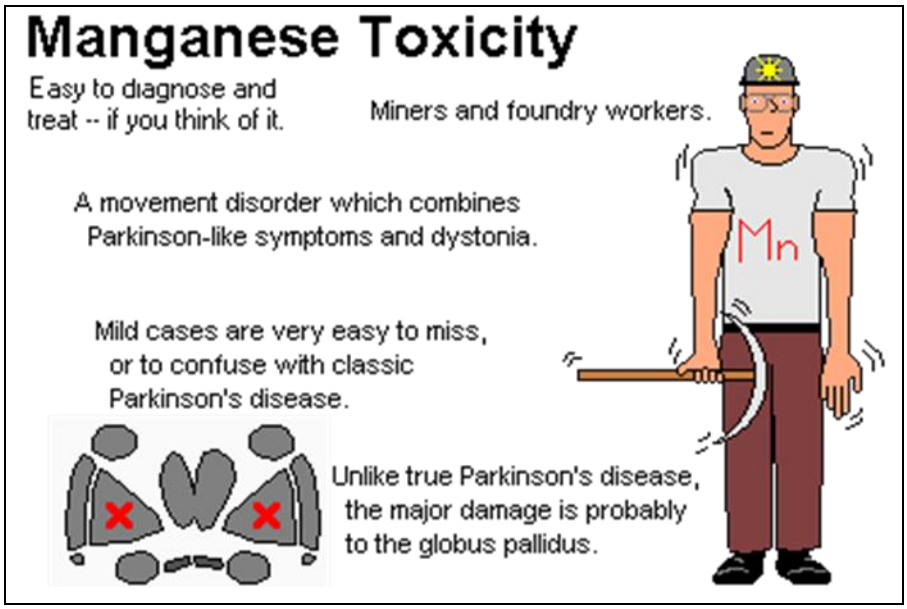


Figure 4.12.Manganese toxicity effects

Some of the richest *sources* of manganese are: oats, wheat, pecans, soybeans, rye, barley, quinoa, garlic, cloves, brown rice.

*Public health recommendations.*The dietary intakes recommended by the National Academy of Sciences for common masses are as follows.0-6 months–0.003 mg; 7-12 months–0.6 mg; 1-3 years–1.2 mg; 4-8 years–1.5 mg; 9-13 years, female and male –1.6 mg; 14-18 years, female and male –1.6 mg; 19+ years, female and male –1.8 mg; 2.3 mg. Pregnant women–2.0 mg. Lactating women - 2.6 mg.

Cobalt. Cobalt likewise assists regulate and promote the production of some enzymes, such as thyroxine, a thyroid hormone.Promotes RBC formation participates in hematopoiesis, endogenous synthesis of vitamin B_{12} , formation of insulin. It contributes in maintaining your health.It is not easily assimilated in the body and is stored in red blood cells, liver, plasma, spleen, kidney, and pancreas.

Deficiency: a deficiency of cobalt is equivalent to a deficiency of vitamin B12, and can cause anemia, nerve conditions, and irregularities in cell development. Also, “scaly” skin and atrophy.

Food sources: beet greens, buckwheat, cabbage, dulse, figs, goldenseal, Irish moss, kelp, lettuce, mushroom, pau d’Arco, sarsaparilla, spinach, watercress. All sea veggie and green leafy vegetable.

Radioactive strontium belongs to biologically significant radionuclides and is characterized by high toxicity. Its share in the global radioactive contamination of the environment and exposure of the population is significant. Exposure doses in the vast majority of cases can be classified as small with a low dose rate.

The study of the properties and biological effects of strontium is relevant, because. its content in all plant and animal organisms in the amount of 10-2-10-3% dry weight; daily intake with food and water is about 1.9 mg. Excessive content in the body becomes a real threat to the development of Urov's disease (Kashin-Beck's disease), which manifests itself in joint disease, increased fragility and deformity of bones. The main sources of Sr^{90} environmental pollution are nuclear weapons tests and accidents at nuclear fuel cycle enterprises. The population receives the nuclide with contaminated products, inhalation, through wound and burn surfaces. Soluble strontium compounds are well absorbed in the intestine. Resorption depends on the age of the person, the physiological state, the nature of the diet, and especially the content of calcium in the diet.Unfavorable consequence of excessive intake of strontium into the body is disruption of the ossification process. Radioactive strontium belongs to osteotropic biologically hazardous radionuclides.It is selectively deposited in the bones and thereby exposes the bone marrow to constant radiation. Strontium accumulates unevenly in the bones. In the epiphysis, the initial concentration of the nuclide is 2.5 times higher than in the diaphysis. Strontium is deposited in other organs and tissues in much smaller quantities.

Electrolytes. The monovalent electrolytes are Na, Cl, and K.

Sodium (Na). An adult male (70 kg) has total body Na of 4 mol (92 g); 2000 mmol is in extracellular fluid (ECF), 1500 mmol in bone, and 500 mmol in intracellular fluid.Function: cation in extracellular fluid, regulation of blood pressure and transmembrane gradients, provides an acid-base state in the body by creating buffer systems,provides stabilization of osmotic

pressure in biological fluids and protoplasm of the body, participating in water exchange through swelling of tissue colloids, it retains bound fluid in the body , electrophysiological control of muscles and nerves.

Deficiency. Na losses requiring repletion can result from excess sweating in extreme conditions of heat and exertion.

Sources in the diet. Na is present in many food additives, e.g. monosodium glutamate, but most Na in the diet is present as salt (NaCl). Levels are comparatively low in unprocessed foods. Salt is added to food as a preservative and flavor enhancer; it can also be used as a fermentation control agent in bread making, texturizer, binder, and color developer. 3 g salt 8 1.2 g Na.

Toxicity It is a strong emetic but excessive oral loads of Na are potentially fatal. Artificial intravenous load has severe and rapid effects.

Potassium. Acts as an electrolyte (regulates the electrical communication between cells). Works in conjunction with sodium to regulate waste. Regulation of the osmotic pressure, increases the excretion of fluid from the body, the excretion of sodium from the body , Participates in the processes of intracellular metabolism, formation of blood buffer system. Regulates and normalizes heart rhythm. Assists your body in maintaining a proper balance of water-salt. Promotes clear thinking by sending oxygen to the brain. Has been shown to lower and regulate blood pressure. Maintains correct alkalinity levels in bodily fluids. Stimulates kidneys to eliminate poisonous waste material. Has also been shown to alleviate muscle cramps and prevent them from occurring. Improves and promotes healthy skin. Alsostrengthens the excretion of fluid and sodium from the body,participates in the processes of intracellular metabolism.

Water.

Although often overlooked as a nutrient, water (H_2O) is actually the most critical nutrient of all. Humans can survive weeks without food but only a matter of days without water.

Water provides the medium in which nutrients and waste products are transported throughout the body and the myriad biochemical reactions of metabolism occur. Water allows for temperature regulation, the maintenance of blood pressure and blood volume, the structure of large molecules, and the rigidity of body tissues. It also acts as a solvent, a lubricant (as in joints), and a protective cushion (as inside the eyes and in spinal fluid and amniotic fluid). The flow of water in and out of cells is precisely controlled by shifting electrolyte concentrations on either side of the cell

membrane. Potassium, magnesium, phosphate, and sulfate are primarily intracellular electrolytes; sodium and chloride are major extracellular ones.

Water makes up about 50 to 70 % of body weight, approximately 60 percent in healthy adults and an even higher percentage in children. Because lean tissue is about three-quarters water, and fatty tissue is only about one-fifth water, body composition—the amount of fat in particular—determines the percentage of body water. In general, men have more lean tissue than women, and therefore a higher percentage of their body weight is water.

Water is consumed not only as water itself and as a constituent of other beverages but also as a major component of many foods, particularly fruits and vegetables, which may contain from 85 to 95 percent water. Water also is manufactured in the body as an end product of metabolism. About 2.5 liters (about 2.6 quarts) of water are turned over daily, with water excretion (primarily in urine, water vapor from lungs, sweat loss from skin, and feces) balancing intake from all sources. Because water requirements vary with climate, level of activity, dietary composition, and other factors, there is no one recommendation for daily water intake. However, adults typically need at least 2 liters (8 cups) of water a day, from all sources. Thirst is not reliable as a register for dehydration, which typically occurs before the body is prompted to replace fluid. Therefore, water intake is advised throughout the day, especially with increased sweat loss in hot climates or during vigorous physical activity, during illness, or in a dehydrating situation such as an airplane flight.

5. Hygienic characteristics of animal and plant origin food products

Food materials and foodstuffs. The tern food materials are synonymous with the expression articles of food. Thus bread, meat, eggs, milk are spoken of as food materials. The tern foodstuffs is sometimes popularly or commercially used as synonymous with articles of food; but, also, it is used in a somewhat different sense to mean the stuffs that foods are made of, or, in the terns which we have been using, the substances of which the food materials are composed. Thus, the proteins foods, and carbohydrates, and the various organic and inorganic compounds of phosphorus, potassium, iron, ets. Which occur in food materials are foodstuffs in this sense which is synonymous with nutrients.

Basic requirements for food products: food products should provide the body with nutrients: proteins, lipids, carbohydrates, vitamins, mineral salts. Products must have a certain calorie content. The food you eat should be safe and harmless.

Difference between animal and plant proteins?

Protein is an essential part of the diet. It helps to build, repair, and maintain the body's structures. Foods derived from plants and animals can both provide protein, but there are some differences.Protein exists throughout the body, in everything from the muscles and organs to the bones, skin, and hair. The body does not store protein like it does other macronutrients, so this protein has to come from the diet. Proteins are made up of amino acids. A person's body needs a balance of all 22 types of amino acids to function correctly.

The body cannot produce nine of these acids, called essential amino acids.A complete protein source refers to a type of food that contains all nine.Having the right balance of amino acids can build muscle and help the body to recover from exercise quickly. Understanding the differences between plant and animal proteins is important for anyone who wants to ensure that their diet is healthful.One of the main differences between plant and animal proteins involves their amino acid contents. Amino acids are the building blocks of protein. The basic advantages foods of animal origin over plants origin: foods of animal origin of high-grade proteins it is more.When the body digests the proteins in food, it breaks them down into amino acids. The body may need different amino acids at different times. Many people believe that the diet should include complete sources of protein, which contain all nine essential amino acids.

Some animal products are complete sources of protein, such as:fish, various types of eggs, dairy products, such as cheese, milk, and whey, red meat from cows, bison, and deer, poultry from sources such as chickens, turkeys, and quails, meat from less common sources, including boars, hares, and horses.

Most plant proteins are incomplete, which means that they are missing at least one of the essential amino acids.However, some plant-based foods, such as quinoa and buckwheat, are complete sources of protein.It is important for vegetarians and vegans to mix their protein sources and ensure that they are getting all of the essential amino acids.Also, keep in mind that some sources of plant protein may take longer for the body to digest and use.The following are examples of plant-based foods rich in protein:grains, lentils, nuts, beans, legumes, certain fruits, such as avocados, soy, hemp, rice, peas. Many other nuts, grains, and vegetables also contain high amounts of protein.

Which is better for health?When choosing between plant and animal sources of protein, it is important to factor in the other nutrients that the foods provide.Foods rich in protein can have widely ranging nutritional profiles.Certain sources of animal protein can contain high levels of iron and vitamin B_{12}, while some plant-based foods lack these nutrients. On the other hand, plant-specific nutrients, called phytonutrients, and some antioxidants are absent from sources of animal protein.

Animal products contain saturated fat and higher levels of cholesterol than sources of plant protein. A person may wish to avoid animal products for these reasons.Many used to believe that dietary cholesterol was associated with cardiovascular disease. The results also indicated that eating more plant protein may help to reduce this risk and others. In general, the best way to cover a person's dietary needs is to eat a wide variety of foods.

Which is better for building muscle?Athletes and others looking to increase muscle mass and reduce the amount of time it takes to recover from exercise often pay close attention to their protein intake.Protein helps repair and build up the muscles after a rigorous workout.Many athletes turn to whey protein for building muscle. This type of protein is easier for the body to break down and absorb, which can give whey an edge over other sources, such as meat, eggs, and vegetables.

Regarding plant-based sources, one study Trusted Source suggests that that rice protein isolate may offer similar benefits to whey protein.Many people recommend consuming a combination of plant-derived proteins after a workout. This can provide the body with a range of amino acids.

Hygienic characteristics of animalfood products. Products of an animal origin concern meat and meat products, fish and fish products, milk and dairy products, egg, etc.

Meat is an important source of biologically valuable proteins in human nutrition.Meat food increases excitation of the brain cortex, stimulates working capacity. Chemical composition, organoleptic properties and food value of meat moderately vary depending upon the type of animals, their age and character of their fodder, as well as on the part of carcass.

Quantity of proteins in meat is 13-18%, and quantity of fat fluctuates depending upon the feed of the animal, for example from 3 to 23% in beef and up to 37% in pork. Carbohydrates (glycogen) in meat are less than 1%. Meat muscle tissue contains myosin and myogen 50 %. The connective tissue protein of meat is collagen and eastin.Phosphors, potassium, sodium and iron (3 mg per 100 gm) are sufficiently more, as well as small quantity of vitamins of B group. Nitrogenous extract substances give meat especial aroma and taste, exciting secretion of digestive glands. Meat food increases excitation of the brain cortex, stimulates working capacity.Thus the person with animal meat receives is complete proteins, fats,extractives substance.

Differences between beef meat from fish meat is high content of connective tissue,low methionine content,high content of saturated fatty acids.

However, meat products may be the cause of food intoxication, few infectious diseases and bio helminthiasis. Protection of consumers health from these diseases is provided by veterinary and sanitary inspection at all steps of movement of meat from slaughter to realization by consumers. Possibility of meat use of those animals, sick with brucellosis, foot and mouth disease, erysipelas, enteritis, septicemia, as well as of those animals, which are subjected to slaughter, is solved by veterinary-sanitary service, and such meat is considered as conditionally edible and is subjected to disinfection at the place of slaughter.




After wards slaughter veterinary inspection of carcass and investigation of internal organs is compulsorily conducted with the purpose of revealing diseases, difficult to diagnose while alive: tuberculosis, measles, trichinosis and others. On observation of single finna in the meat of pigs, it is considered to be conditionally edible and is subjected to realization only after disinfection at the slaughter house by boiling or freezing it up to -12°C with further keeping at this temperature for a period of 10 days (figure 5.1.). In high contamination with finna (more than 3 finna in the area of 40 cm^2) meat is subjected for technical utilization. In case of detection of at least one trichina meat is considered as non-edible (figure 5.2.).

Figure 5.1.Trichina is a bio helminth in meat

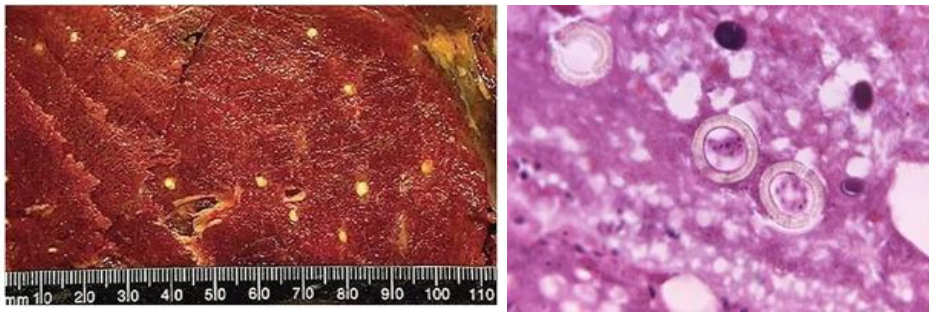


Figure 5.2.Cysticercus is a cystic phase of tapeworm: pork tapeworm (Taenia solium) or beef tapeworm Taenia saginata

Fish. There are 8–25% of protein and what's more, they are biologically well-balanced, rich with essential amino acids. The protein in the muscle tissue of fish meat is ichthulin. Content of fats fluctuates from 0.1to 29% and more. Fat is of semiliquid consistency and contains large

quantities of mono- and polyunsaturated fatty acids, which are easily oxidized by air oxygen, giving the product with unpleasant smell and taste during long preservation. Quantity of thiamin and riboflavin is 0.0005–0.001 g/kg and niacin — 0.001–0.05 g/kg. There are retinol and calcipherol present in fatty fish. Particularly livers of sea fish is rich in them. Meat of the latter is richer than beef in mineral substances and microelements, particularly in iodine, zinc. In100 gram of sea fish, shellfish, crayfish 30 to 300 mg of iodine is present, and in seaweed — up to 1,000 mg and more. Inclusion of sea food in the diet enriches nutrition in microelements up to physiological optimum. Fish is rich in extractive substances, easily changing into broth. Therefore fish broth, more than meat, excites secretion of the digestive glands. Fish broths useful in conditions of hot climate, and as an element of prophylactic nutrition. In the flesh of fish connective tissue is up to 5 times less than in beef, due to this fish boils sooner and the nutrients contained in it are absorbed by 95–97% and more. Due to unique food properties of fish it is widely used in clinical dietology.

In nutrition shellfish (mussels, oysters, squid, octopuses, etc.) are used. In shellfish there are 10–17% of biologically valuable proteins, 0.6–1.6% of fats, 1.5–4% of glycogen. Mollusks are the sources of mineral substances, bio microelements, vitamins of B group. Edible tissues of mussels and ousters are boiled, salted, dried, frizzed, processed into different tinned food. Oysters are widely consumed in raw (unconditional-ally fresh). Mollusks are eaten in raw, boiled, salted, dried, marinated, baked and fried form. High food properties are characteristic of crabs and shrimps. Products from krill are rich in fluorine and therefore their inclusion in ration stimulates osteogenesis and mineralization of the bones, which may be used in prophylaxis and treatment of senile osteoporosis, fractures and teeth decay.

Fish and other hydrobiontes belong to easily spoil-able products. They spoil faster than meat. Therefore fish should be freeze soon after fishing. Fish and other hydrobiontes may be the cause of food intoxication, as well as mechanism of transfer of infectious diseases (typhus, paratyphus, and others) as well as of helminthes (diphyllabotheuriosis),opisthorciasis, clonorchiasis, paragonimiasis and others. Diphyllobo-theuriosis develops after consumption of insufficiently boiled, fried or raw fish, infected with larvae of broad tapeworm,-by plerocercoids with length of 10 mm and width of 2–3 mm. Tape warm mature in the human intestines, its length reaches several meters. Segments of the tapeworm filled with eggs burst out and are brought out into

external environment by fecal matter. Further eggs may get in to the organism of intermediate host (cyclopes, fish) and they develop up to the invasive stage.

Disease of human often leads to pernicious anemia as a result of disorder of endogenic synthesis of cyanocobalamins. Taking into account, that larva dies at the temperature of 50–55°C within 5 min, consumption of well boiled or fried fish totally prevents development of this disease, as well as of other helminthes. Opisthorchis feline us – bio helminthes, basic host of which is a human, a cat, a dog, a pig and other animals, the first intermediate host – fresh water mollusk and the second –carp fishes. In hydro dermic cellulose and spine muscles of infected fish they found matercaria – insisted larva of oval form with the length up to 0.3 mm developed. The human is infected during consumption of poorly boiled or fried, as well as of less salted jerk or raw fish. Larvae of helminthes enter the liver, pancreas, causing serious damage. For the prophylaxis fish should be fried in small pieces during no less than 15–20 min, boiled during 15–20min from the moment of boiling, with salt using no less than 14% of the fish mass, after that the latter is kept at the temperature of 16–20°C for 2 weeks. Measures of social prophylaxis of helminthiasis transferred through fish and water is protection of reservoirs from contamination by fecal matters, prohibition of letting non-disinfected waters.

Eggs. Eggs are good food products containing biologically valuable proteins (12.5%), fats (12%), vitamins (thiamin, retinol, nicotinic acid, calcepherol, tocoyeast, made up of 80% of non-mucous and 20% of mucous culture. The yolk of egg consists natural vitamin D. Also very importance for the child's body substancevitellin (protein contained in the egg yolk). Functions:it is used as a plastic material for the structure of nervous tissue,used as a plastic material for the formation of memory cells.

Delicious, nutritious and simply the perfect element for adding nutritional value into any meal – at any time of day. Not only are they readily accessible and easy to prepare, but eggs are also jam-packed with an impressive variety of vital nutrients – making them one of the healthiest foods to eat on the planet.

Naturally low in fat with just 310 kilojoules squeezed into a standard egg – a serving of eggs contains 13 different essential vitamins and nutrients, alongside one of the greatest sources of choline available. Still not convinced? We agree. It's hard to believe all these incredible health benefits. So here's the full breakdown below of our favorite vitamin-packed superfood.


Vitamin D plays an important role in calcium and phosphorus absorption, making it essential for the maintenance of healthy bones and teeth. More than just the 'sunshine vitamin', it also contributes to maintaining regular muscle function and supporting your immune system.Now, egg yolks are one of the few foods that contain naturally high amounts of vitamin D, with a serving of two eggs providing 82% of your recommended daily intake.

Vitamin B_{12} is essential in the formation of red blood cells and DNA, repairing body tissue, and maintaining the healthy function of the immune and nervous systems.Unfortunately, B12 deficiency is common, especially in the elderly, sometimes leading to fatigue, weakness, weight loss, decreased appetite, dizziness, constipation, and more. As the human body is incapable of producing vitamin B_{12} on its own, it's necessary to be active in consuming foods that are a rich source of this vitamin. The recommended daily intake of B_{12} is about 2µg, with a serving of two eggs satisfying 15% of your everyday requirements.

Choline is a little-known yet important nutrient that plays a vital role in brain development and function – essential in prenatal human health as well as adulthood. Choline is also used by the body to assist with liver and nerve function. The human body can produce choline but not in the sufficient amounts needed daily by your body, meaning the rest of those needs can only be satisfied through diet. Eggs, in particular, are a major source of choline. Two eggs can provide 77% of women's recommended daily intake and 59% of RDI for men.

Iron is an essential dietary mineral that is involved in various primary functions, including the transport of oxygen throughout the body and providing energy for daily life. Despite its importance, an estimated one in eight Australians is iron deficient, which can lead to a limited supply of oxygen to tissues and organs, fatigue, headaches, insomnia, and appetite loss. With your body absorbing only a fraction of the iron within the food you eat, the case for actively

consuming iron-rich meals is even more important. One large egg contains 0.9mg of iron, found predominantly in the yolk. An average serving of two eggs provides 14% of your RDI for iron.

Lutein and Zeaxanthin are vital antioxidants, which protect your cells from damage. Most notably, they support the clearance of free radicals and serve in protecting against eye conditions.As carotenoids, they are naturally present in foods, especially in dark green leafy vegetables, such as spinach and kale – as well as in egg yolks. However, due to their high bioavailability and not being subject to seasonal variation, the consumption of eggs is a favorable source of lutein and zeaxanthin in the diet. There is currently insufficient research to indicate an exact level of recommended dietary intake for lutein and zeaxanthin, although some researchers have recommended levels as high as 6mg per day. One serve of two eggs contains around 530µg of lutein and zeaxanthin, alongside being an effective vehicle for increased and site-specific antioxidant uptake.

Riboflavin (Vitamin B_2) – also known as vitamin B_2 – is necessary for cell growth, energy metabolism, red blood cell development, healthy vision, and the sound functioning of the nervous system. It also serves as an antioxidant nutrient, fighting damaging particles in the body known as free radicals.Bacteria in your gut can produce small amounts of riboflavin, but not enough to meet sufficient dietary needs or store any as a backup – making the case to incorporate effective amounts in your diet even more important. To make it easy, a serving of two eggs contains 24% of your RDI of Riboflavin.

Pantothenic acid (Vitamin B_5) commonly known as vitamin B_5, plays a significant role in converting the food you consume into active energy and breaking down fats. It also aids in the making of vitamin D and the production of red blood cells that carry oxygen around the body. Though uncommon when following a healthy and balanced diet, a deficiency in vitamin B5 may result in fatigue, irritability, numbness, and muscle cramps, among other symptoms. A serving of two eggs provides you with 22% of the RDI of Pantothenic acid.

Vitamin A is vital in sustaining healthy skin, supporting immune function, maintaining good vision and promoting general reproductive health .Drawing sufficient vitamin A from within your diet should prevent any symptoms of deficiency, including hair loss, skin problems, dry eyes and an increased risk of infections. With the recommended daily intake for vitamin A set at 750µg, a serving of two eggs delivers 14% of the advisable amount.

Vitamin E has beneficial antioxidant properties that play a pivotal role in maintaining good general health – including heart health – with studies linking it to lower rates of heart disease.Studies have also found significant links between vitamin E and immune function, helping the prevention of certain cancers, a reduction in age-related eye disorders, and slowing cognitive decline associated with ageing. An average serving of two eggs provides 20% of the RDI of vitamin E.

Phosphorus is essential for the development and maintenance of healthy bones and teeth, filtering waste and repairing tissue and cell membranes. It also contributes to supporting energy metabolism and muscle growth. Low levels of phosphorus can result in a loss of appetite or joint pain, and irritability or anxiety. With adults needing around 1000mg of phosphorus per day, a modest serving of two eggs provides 21% of this daily requirement.

Folate is an important nutrient for people of all ages, playing a significant part in promoting red blood cell growth, the formation of DNA and supporting an effective immune system. In particular for pregnant women, folate helps in the production of new cells, protecting against serious birth defects, such as spina bifida. It's recommended that an average adult consume about 200µg of folate daily (more in pregnancy), and a serving of two eggs will provide 49% of your RDI.

Iodine is an important mineral in helping your thyroid to produce hormones to regulate your body's metabolic rate. It also serves in promoting cognitive function, optimal brain development and maintaining healthy skin. Iodine deficiency can be quite common, leading to various health conditions such as swelling of the thyroid gland and ongoing fatigue. Eating just two eggs a day helps you reach 29% of your daily recommended iodine intake.

*Selenium*although only required in trace amounts compared to other vitamins and minerals, selenium is an important antioxidant that helps prevent free radical damage to cells in the body. Selenium supports the immune system, thyroid gland function, and the maintenance of healthy hair and nails.

Eggs are an excellent source of selenium, with an average serving of two eggs meeting 41% of your daily recommended intake.

Diseases transmitted to eggs. There are many infectious organisms that can be transferred from the hen to the egg that may cause the egg to die. In some cases, the infectious organism may

infect the egg, yet the embryo may continue developing, and may even hatch, carrying the organism at hatch time. If an organism is passed from an infected hen directly into an egg, and then into the developing embryo, this is called vertical transmission. *Bacterial diseases:* Chlamydia psittaci is a primitive bacteria that can be vertically transmitted from an infected hen through the egg to the embryo. Depending on the pathogenicity of the strain and the number of organisms that are passed into the egg, the embryo may die during incubation, or it may actually hatch as a baby bird with *chlamydiosis.* It should be noted that trans ovarian transmission of chlamydiosis has not yet been confirmed by researchers, so it may be that the eggs are contaminated with the organism by some other vertical method.The eggs, much to our surprise, all continued to develop, and all five actually hatched on schedule. As soon as the eggs hatched, I instructed the owners to begin medicating the hatchlings with oral doxycycline, which would be continued for 45 days total. Because all baby birds receiving antibiotic therapy should also be prescribed antifungal medication to prevent infection with Candida sp., we also started the babies on a combination of oral nystatin suspension and 125emmate125125co. The babies were also prescribed avian lactobacillus and acidophilus to give them some normal, good bacterial flora.

Bacteria of the genus *Salmonella* can also cause embryos to die in the shell, or if a very small number of bacteria contaminates the egg, Salmonella can cause weak hatch babies that may die shortly after breaking out of the egg. The bacteria may cause yolk material to coagulate in the egg, and dead embryos may show hemorrhagic streaks on the liver. The spleen and kidneys may be congested. Pinpoint areas of the liver may be necrotic. Inflammation of the pericardium may also be seen. Salmonella are motile bacteria that can penetrate the eggshell and can be transmitted vertically. Culture of the infected embryo will prove diagnostic.

Some *Staphylococcus bacteria* can kill embryos. The avian embryo can be resistant to some strains of staphylococci, but can be highly susceptible to other strains. Infected wounds on parent birds can infect eggs, as can staph infections found on the hands of aviculturists, if the egg comes in contact with lesions. Artificial incubators will grow staph readily, and it can spread horizontally in this manner. An embryo can die within 48 hours of exposure to some strains of staff, especially Staph. Aureus. The older the embryo is at time of first exposure to staph, the less chance of embryonic mortality. Hemorrhages may be found on various internal organs. A laying

hen can develop an ovary infected with Staph. Faecalis, which can contaminate the forming egg. Contaminated eggs will have up to 50% mortality. Culturing the egg is important for diagnosis.

E. coli is a common bacteria normally found in the GI tract of mammals, and some birds, as well. It can enter the egg from an infected reproductive tract of a hen. E. coli can also penetrate through the eggshell if the egg is contaminated with fecal material. E. coli commonly causes yolk sac infection, causing the yolk sac contents to appear watery and yellow-green or yellow-brown. Dirty nests and cages can serve as sources of contamination to eggs. The use of water bottles can reduce the amount of E. coli that builds up in the GI tract of birds. In my experience, aviaries that use a watering system and not water bowls will have fewer problems with sub-clinical bacterial infections in their breeder birds and their offspring.

Many embryos infected with E. coli will die late in incubation or shortly after hatching. If an E. coli infection is acquired during incubation, the hatchling may develop an umbilical and yolk sac infection (omphalitis) and they may have poor weight gain. Cracked eggs are more easily infected and may serve as a source of infection for other eggs in the incubator. Cracked eggs should be repaired as soon as the damage is discovered, or they should be discarded.

*Mycoplasma.*Mycoplamatales are one order of microscopic organisms that replicate by binary fission. They have no cell wall, but have a three-layer membrane. They are more primitive than bacteria, and must live and grow inside the host. In the environment they live only for a short time. Although we have much to learn about mycoplasmas, they can be involved in problems with cockatiel conjunctivitis and respiratory infections, and also respiratory/eye problems in other species of pet and breeder birds. The organism is spread by the respiratory excretions and by the gonads of both sexes, and infection in the air sacs can lead to contact transmission of the ovary and developing follicle. Trans ovarian transmission can occur. Mycoplasma can spread to the egg from an infected oviduct or from the semen of infected male birds.

*Viral diseases.*Some adenoviruses, REO viruses, and reticuloendotheliosis viruses can be vertically transmitted. Influenza A may be vertically transmitted, as well.

*Parasites.*Oddly enough, some parasites have been documented to occur within eggs. Adult ascarids (roundworms) have been found within eggs. These worms get into the egg by moving from the cloaca up into the oviduct, where the eggshell is then placed around the aberrant parasite. The fluke, Prosthogonimus ovatus can be found in the oviduct of Galliformes and Anseriformes,

and may also be trapped within an egg, but the flukes are more likely to result in abnormal eggshell formation.

Milkcontain all necessary food substances for the growing organism, present in soluble or slightly dispersed state, as a result of which it is easily digested and well absorbed (95–98%). Milk and milk products are irreplaceable in child nutrition, in patient and elderly people nutrition.

The most widespread in the world is cow's milk. It contains about 3.2% of biologically valuable proteins (2.7% of casein and 0.5% of albumin and lactoglobulin), from 3 to 5% of fat and from 4 to 5% (on average 4.8%) of carbohydrates — lactose.Lipids determine value of milk fat and soluble retinol and calcipherol, contents of which is more in summer and autumn.

Milk contains all necessary mineral salts, but particularly rich in absorbable calcium (1.2 g/kg). Out of water-soluble vitamins riboflavin, pyridoxine and pantothenic acid are the most common. Milk causes weak secretion of gastric glands and therefore it is recommended to patients with peptic ulcer and hyperacid gastritis. Lactose promotes formation of normal intestinal microflora with prevalence of bifidobacteria preventing putrefaction.Sodium chloride is very less in milk and therefore it is recommended to patients, suffering from nephritis and edema. Considering absence of nucleonic compounds in it, milk is indicated to those with disorders of purine metabolism.



Many components of milk (methionine, choline, tocopherol, vitamins of B group) are decreasing quantity of cholesterol in blood. Milk is an ideal medium for multiplication of microorganisms. Development of streptococci and lactobacilli, decomposing lactose with formation of lactic acid, leads to sowing of milk.

In spreading of pathogenic microflora milk may be a cause of infectious diseases: intestinal infections, polio, diphtheria, scarlet fever, viral hepatitis. Milk and milk products occupy an important place among the causes of spreading of brucellosis, which not infrequently takes place

in hot countries, particularlythe countries, where sheep milk is widely consumed. Milk and milk products may be the source of tuberculous infection.

To provide the epidemiological safety of milk, decrease bacterial growth and increase its quantity it is necessary to conduct the following steps: strict veterinary control for sanitary conditions, health of animals; prevention of contamination of milk during milking, preservation, transportation, cooking etc (cleanliness of the udder and skin of animals, hands and clothes of personnel, mechanized milking, filtration of milk through a cloth, observation of health and personal hygiene of milkers and other working people in contact with milk); cooling of milk up to the temperature less than8°C and its fast delivery to consumers; consumption of disinfected milk in food.

Pesticides, antibiotics, aphlotoxins and other toxicants may get into the organism of lactating animals through milk along with food, feed supplements, stimulators of growth as well as during condition of prophylactic and therapeutic measures.

Since milk is a basic product of child nutrition, it should not contain any toxic admixtures and this is a very important element of sanitary-hygienic control.If milk is obtained from healthy cows with keeping all hygienic rules, it is safe from the epidemic point. But if there are any doubt, disinfection of milk should be conducted by 4 methods: boiling, pasteurization, complete sterilization or drying.

During boiling pathogenic microorganisms and part of lactobacilli microflora die but at the same time milk properties become worse; part of albumin and potassium salts falls down into sediments, vitamins and ferments are destroyed, disperseness of fat decreases, taste worsens. So to minimize the indicated changes boiling of milk is substituted by pasteurization.

Dry milk (or milk powder) — wide spread product of processing of milk. Food value of dry milk is less than of the whole milk, but it’s widely used in nutrition. Food and biological properties of dry milk depend upon the method of its preparation — film or pulverization. During the film method of drying milk comes in contact with hot (90–120°C) metallic surface of shaft dryers for a short duration (less than a minute). Formed film of milk with thickness of 0.14–0.2 mm is extracted automatically by special knife. However, this method essentially changes a composite part of milk particularly proteins, worsens biological properties and solubility of obtained product. Undoubted fully milk has advantages, which is received by pulverization

method. Drying is conducted by hot air (145–160°C) in special tanks by scattering of milk in fine particles. During this composite parts of milk in chemical relation nearly doesn't change and solubility reaches 98%. Content of moisture in dry milk in hermetic package shouldnot exceed 4%, in non-hermetic — 7%. The total content of microorganisms in dry milk of high quality should not exceed 50,000, in dry milk of the I sort — 70,000, in dry milk for children — 25,000–30,000 in 1g of milk. The period of preservation of dry milk is 8 months in a hermetic package and 3 months in a non-hermetic one.

Tinned condensed milk capable of being preserved for a long period. To them we refer condensed and sterilized milk, cocoa and coffee with condensed milk and others. Condensed milk with sugar contains water no more than 16.5%, sugar — no less than 43.5%, fat — 8.5%. Acidity is no more than 48°C .

The best and most used method of making milk safe is pasteurization. They use also sterilization. Several pasteurization techniques are used with different combinations of time and temperature to kill pathogens without altering the flavor or consistency of the milk. The pasteurization temperature for homogenized, pasteurized milk is usually 72–75°C. In Ukraine the following regime is the most suitable for pasteurization: heating of milk at the temperature of 63–65°C for a period of 30 minutes. Last years new method of complete sterilization of milk, called uperisation is used: through milk vapors are inflated until temperature does not rise up to 150°C. Such milk mountains natural properties, as after pasteurization and if it is powered into sterile packets, may be preserved up to 30 days. The pasteurization process may vary from one country to another according to national regulations.

Pasteurization is often combined with other processes such as homogenization to improve the appearance and ostensibly the flavor of milk. Other ways to safe-guard milk products include freeze-drying and condensing. Sweetened condensed milk like other sweet preparations relies on the high sugar concentration to kill pathogens.

Dry milk (milk powder) is a valuable product, obtained by drying of spilt whole-pasteurized milk in vacuum chambers. Solution of dried milk in the corresponding quantity of boiled water is called reduced milk. The latter may replace natural milk even in nutrition of children. Dry milk is often used in many tropical countries, in particular for realization of programs of provision of children with milk and milk products.

Sour cream. It's prepared of pasteurized cream by addition of special ferments from mixed culture of lactobacilli. Content of fat of high quality is 36%,acidity — 65–90°T, in sour cream of the I sort —30% and 65–110°T, in sour cream of the II sort —25% and 65–125°T.

Curd (cottage cheese). It is prepared of pasteurized milk by mixing it with pure culture of lactic acid streptococci with further processing of clot for extraction of serum. Curds of 20% and 9% of fatness, and fatless with acidity of 20º–22,5°T, 21º–24,0°T and 22,0–27,0°T correspondingly are available at the market. In curd basic components of milk — protein and calcium — are represented in moderately high quantities. Fatty curds and hard cheeses are peculiar concentrates of milk.

They are prepared by curding of preliminary pasteurized milk. Fatty curds contain up to 14% of casein and 18% of milk fats. Fatty curds are prepared of fattiest milk. Low fat curd contains up to 18% of casein and only 0.5% of fat. Large quantity of methionine is present in casein of curds out of which choline is synthesized, which prevents adipose infiltration of the liver. Curd is reach in calcium (up to 150 mg per 100 g).


Therefore, it is very important to include these products in the diet of patients with liver pathology, elderly patients, pregnant women, lactating mothers and children. Therefore curds are considered as natural milk concentrate, possessing high biological value. It is enough of 200–300

g of this product so as to provide daily need of the organism in irreplaceable amino acids and calcium. Particularly curds, rich with labile methyl groups, which are easily used in the organism for synthesis of choline, are of great importance. They avoid adipose infiltration of bile. Curd promotes excretion of cholesterol from the organism, hence it may be considered as therapeutically remedy in atherosclerosis. It also possesses diuretic action and is recommended in diets during disturbed nitrogen excretory function of kidneys, decompensated diseases of heart, hypertonic disease.

Kefir and koumiss as products of mixed fermentation with medicinal properties are obtained from milk.

Kefir is prepared of pasteurized whole milk or fatless natural or redacted cow's milk with the use of yeast, prepared on kefir fungi or on pure cultures of specially selected microorganisms, causing lactic acid and alcoholic fermentation. Fatty kefir from whole milk and fatless kefir are differentiated, and depend upon the period of maturation — weak (one day), medium (two days) and strong (three days). In fatty kefir content of fat should not exceed 9,0°T, and content of alcohol —0.2%, in medium kefir — 10,5°T and 0,4% in strong— 12,0°T and 0.6% accordingly. Kefir is widely used in daily and therapeutically nourishment. It renders favorable influence on digestion, stimulates motor function of the intestine (light kefir), decreases intensity of decaying processes in the intestine, increases diuresis.

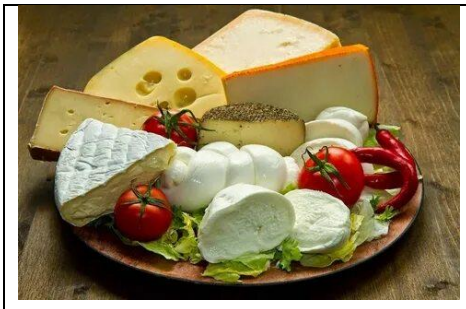
Koumiss is widely used in Bashkiria, Buryatia, Yakytia and Tataria (Russia), as well as in Kyrgystan and Kazakhstan. Koumiss is prepared of primarily pasteurized milk of mare or cow by way of mixing it with pure culture of lactobacilli (Bulgarian coli and other) and lactic yeast. Koumiss from mare's milk is considered to be better, chemical content of which favors in moderate degree those processes necessary for obtaining this excellent product. Depending upon degree of maturation (ripening)koumiss, like kefir is divided into light, medium and strong. Content of fat in all categories of product composes no less than 0.8%. In weak koumiss alcohol is no more than 1%, acidity — 6,0–8,0°T, in medium — accordingly 1.75% and 8,1°T –10,5°T, in strong 2.5 and 10,6°T –12,0°T. As for content of carbon dioxide koumiss is very good aerated drink. Koumiss renders general (overall) strengthening action, improves process of digestion and absorption of food substances, and stimulates oxidative-reduction processes in the organism. It is

successfully used since many years during treatment of pulmonary tuberculosis, indicated during chronic bronchitis, enterocolitis, anaclitic gastritis and other diseases.

Cheeses. Basic substances of milk, highly valued proteins, fats, calcium and phosphor are represented in a higher degree in cheeses rather than in curds (cottage cheese). Therefore these products can be considered as highly valuable milk concentrates. Depending upon method of preparation they are divided into chimosinic and lactic acidic. Original raw product for them is pasteurized milk. Rennet cheeses are prepared by method of coagulation of milk with digestive ferment (chimosineor pepsin) with further processing of clot. Processing consists in splitting of proteins under influence of chimosine (or pepsin) into albumoses and peptones which further are splitted by ferments, excreted by specific microorganisms (lactobacilli and others) up to amino acids, which in its turn are subjected to splitting. Characteristic peculiarity of such splitting in cheeses is absence of formation of any harmful combinations during this (indole, scatole and others), which is characteristic of splitting of proteins during their decaying. Indicated splitting of proteins positively acts on their absorption by the organism and their use for tissue synthesis. The major role during preparation of cheeses belongs to biochemical transformation of lactose in lactic acid. Cheeses differ by high content of protein (20–25%), fat (25–30%) and what is also important —calcium and phosphor. Looking upon contents and on level of balance of irreplaceable amino acids cheeses are considered to be excellent products of nourishment. Methionine is 2 times, tryptophan 3–4times more in cheeses than in meat. Cheeses differ by exclusively high content of absorptive calcium (up to 100 mg in 100 g of product, which 100 times more than in meat and 8 times more than in curds).

Content of phosphor in cheeses 500 mg or 100 g of product. Moreover calcium and phosphor in cheeses are present in condition of optimal balance (1:0.5), which provides high absorption of both macroelements. Therefore cheeses provide reliable possibility to fulfill

demands of the organism in calcium and phosphor in any age groups of population. For this daily intake of 80–100 g of this product is enough. Although the value of lactic acid bacteria(LAB) in food fermentations has been recognized for centuries, development of the probiotic idea is attributed to I. liter. Metchnikoff, who observed that the consumption of fermented milk could reverse putrefactive effects of the gut microflora (Metchnikoff, 1907). From these beginnings the probiotic concept has progressed considerably and now is the focus of great research attention worldwide. Significant advances have been made in the selection and characterization of specific cultures and substantiation of health claims relating to their consumption. Consequently, the area of probiotics has advanced from anecdotal reports, with scientific evidence now accumulating to back up nutritional and therapeutic properties of certain strains. Probiotics are microbial cell preparations or components of microbial cells that have a beneficial effect on health and wellbeing of the host. The health effects attributed to probiotic consumption which have been best substantiated with scientific evidence include alleviation of lactose maldigestion, cancer prevention, prevention/treatment of infections, se-rum cholesterol reduction and modulation of the immune system. While the exact mechanism by which probiotics exert specific health effects is not completely understood, given the range of health benefits attributed to probiotic consumption, it is unlikely that each strain will act in the same way. In general, health effects are related to intestinal microflora modification and strengthening of the gut mucosal barrier. Foodstuffs containing probiotic bacteria fall within the functional food-stuffs category and increased commercial interest in exploiting the proposed health attributes of probiotics has contributed in a significant way to the rapid growth and expansion of this sector of the market. In addition to probiotics some dairy yogurts now also contain prebiotics which are non-digestible food ingredients that beneficially affect the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon, and thus improve host health.



Many dairy products containing pro- and prebiotics with associated health claims have been launched onto the market and in some countries these are an established market segment. The trend is towards exploitation of the synergistic effect of combining probiotics with prebiotics, while some of the earlier products contained probiotic cultures alone. Recently it was shown that milk protein and milk fat also contain bioactive components that can exert specific physiological effects. These effects include aiding calcium absorption (casein phosphopeptides), prevention of hypertension (ACE-inhibitory peptides) and ant carcinogenicity (CLA, Butyric acid, Vitamin A, D, β-carotene).

Milk of other animals besides cow's milk, milk of other animals is also used in different countries. Goat milk according to its composition is nearly the same as cow's milk, but its biological value is even higher, as it contains more high-dispersed protein and during condensation in the stomach more soft clots are formed. It is held in the stomach of a child of breast age for a period which is 2 times less than that for cow's milk. Goat's milk contains albumins and methionine more than in cow's milk and by this index surpasses even breast milk. Size of fat drops in goat's milk is moderately less than in cow's milk, that's why lipids in the intestine are easily emulgated and absorbed better. The amount of mineral salts and vitamins in goat's milk is also a little higher. All facts explain why during some diseases (hypotrophy, anemia, tuberculosis, infections, and hepatitis) pediatricians observe better effect in treatment of children who receive goat's milk. Sheep milk contains nearly 1.5 times more proteins, fats, many vitamins and mineral substances, than the cow's milk, its food value is higher. It should be noted that sheep more often, than other animals get sick with brucellosis, but rarely with tuberculosis. Therefore this milk should be compulsorily boiled, and curds and brynza (sheep's milk cheese) — should be held for no less than 2 months after their preparation. In countries of the Middle East and many other hot countries population often consumes goat's and sheep's milk. In some regions with hot and dry climate where cows are poorly acclimatized, basic milk animal is buffalo (Indonesia, Egypt, India and others). Milk of buffalo is richer in fats, proteins, calcium and water-soluble vitamins than the cow¹smilk. High fatness of milk defines its high energy value. Consumption of the whole milk buffalo may cause diarrhea. Therefore in some countries (for example, in India) its mixing with fatness or whole cow's milk is practiced. Milk of camels by its

composition and energetic value is similar to cow's milk, but it is richer in ascorbic acid (up to 25 mg per 100 g).

The role of milk in infants feeding. The best food for infants is breast milk, which is evolutionary adapted towards particularities of digestion and metabolism at this age. This concerns composition of nutrients and the form, in which they are in the milk, as well as presence of substances promoting digestion (ferments, phospholipids and others) in the breast milk. Besides, breast milk is not subjected to thermal treatment and consequently to denaturation. Breast milk contains many components of defensive importance: lactoferin, antibodies, phagocytes, and macrophages. Observations conducted in India, China and other countries have shown that in children fed with breast milk in comparison with those fed with formula, disorders of growth, obesity, respiratory infections, otitis, diarrhea, septicemia occur rarely. Infant formulas initially were based on cow's milk composition, but have evolved somewhat to reflect human milk composition. This is still an area of concern. Infant formulas generally are made from cow's milk or soybean ingredients. The casein protein ratio for cow's milk is 80:20 compared to human milk with 40:60 ratio. Human milk does not form a hard clot in the stomach of the infant as cow's milk does. The presence of β-lacto globulin (not present in human milk) or soy proteins in formula scan lead to a dietary protein allergy .Human milk has a very high lactose content 7 g. per deciliter or about 200 ml and lactose provides about 40% of the calories available to the infant.

The adaptive significance of this high lactose content (the highest of any species currently known) is probably two-fold: 1). The infant brain is large and requires glucose as a metabolic substrate; lactose is broken down into glucose and galactose prior to intestinal absorption; 2) from an osmotic standpoint, the secretion of lactose obligates the concomitant secretion of a large amount of water. This water is sufficient to meet the infant's needs for sweating and evaporation water loss, high in a warm climate, as well as for urine formation. Because lactose can be synthesized only from glucose, maternal glucose utilization is increased by about 30% in the fully

lactating woman. More than50 oligosaccharides of different structure also have been identified in human milk, these compounds comprise up to 1.2% of mature human milk (compared to about 0.1% of cow's milk). The components of these complex sugars include glucose, galactose, fructose, N-acetyl glucosamine, and silica acid and represent a significant proportion of the non-protein nitrogen found in human milk. Some of these may act as growth factors for lactobacillus which populates the gastrointestinal tract of the breastfed infants, or as protective factors against certain bacterial toxins. However, their real function is not understood. Human milk has a relatively low casein content as compared to other mammals, approximately 0.2g/dl in mature milk, probably reflecting the relative-ly slow growth rate of the human infant. Most of the casein in human milk is bound in micelle form. The casein micelle also contains most of the calcium and phosphate. The other major milk proteins that are synthesized in the mammary gland are α-lactalbumin and lactoferrin, both are present at a concentration of about 0.2 g/dl in mature human milk. Lactoferrin is an iron-binding protein found in high concentration in human colostrum and milk. It is considered to be a protective factor in milk because of its antibacterial properties. Only about 5–10% of its iron-binding capacity is occupied so that one mechanism of bacteriostatic is thought to be binding of iron needed by bacteria to multiply. Lactoferrin concentration in the mammary secretion is increased in colostrum, during mastitis, and following involution. The fourth major milk protein is secretory immunoglobulin A (IgA), also present in mature milk at a concentration of about 0.2 g/dl. This protein is synthesized by cells of the immune system and transported into milk by a specific mechanism described below. It is also thought to act as a protective factor; its concentration is much higher in colostrum (up to 10 g/dl) and in postinvolutional secretion than in mature milk.

Other proteins in human milk include lysozyme (which has a particularly high activity in human milk), lipases, growth factors and many others. Although the fat content is highly variable, on the average milk lipids comprise about 4% of human milk. The majority of these lipids are triglycerides. About 20% of the triglycerides are synthesized from medium chain fatty acids made in the mammary gland itself, the remaining 80% are de-rived from plasma. The medium chain fatty acids are unique to mammary secretions. Milk also contains phospholipids and cholesterol in much smaller, but apparently regulated quantities. Compared to the mineral content of most kinds of milk, human milk contains very small amounts of macro minerals such as sodium (8 mg.),

potassium (15 mg.), chloride (14 mg.), calcium (7 mg.) and magnesium (about 1 mg.). The low concentrations of these substances reflect both the high con-centration of lactose (leaving little residual osmotic activity for monovalent ions) and the low concentration of casein providing little binding activity for calcium. Several amino acid differences exist between human and cow's milk that can present problems in feeding cow's milk-based formulas to certain infants. Human milk has a high cysteine: methionine ratio and some taurine. Cow's milk has a lower cysteine: methionine ratio and essentially no taurine. The human infant's liver and brain have only low levels of cystathionine, the enzyme that converts methionine to cysteine (the fetus and pre-term infant are completely lacking this enzyme). Cysteine's important for central nervous system development. Taurine is made from cysteine (the enzyme is cysteine sulfonic acid decarboxylase), and taurine is needed in the infant for brain development and function, retinal development and function, and conjugation of bile salts.

Cow's milk-based formulas may not contain optimal levels of cysteine or taurine. Another amino acid problem in human milk cow's milk-based formulas is the concentration of phenylalanine and tyrosine. Human milk is low in Ph and Tyr (particularly milk from mothers of pre-term infants). Infants have limited ability to metabolize these amino acids, which can build up and cause Phenylalanine Ketone Urea (PKU babies).Cow's milk has lower lactose than human milk. Lactose may be particularly important as a glucose (energy) source for the rapidly developing brain of the human infant. Generally, cholesterol is very low in formulas (1–3 mg/dl) compared to human milk (7–47 mg/dl) or cow's milk (10–35 mg/dl). Cholesterol is needed by the infant in challenging the development of cholesterol metabolizing enzymes and it contributes to synthesis of nerve tissue and bile salts. The Ca:P ratio is 2.29 for human milk vs. 1.26 for cow's milk. Formulas low in cow's milk can cause hypocalcemia and tetany. High P in formulas may lead to hypophosphatemia and low serum Ca. Iron is low in human and cow's milk, and most formulas are fortified with iron. Both iron and zinc are more efficiently absorbed from human milk than from cow's milk. Most lipophilic and many hydrophilic com-pounds will pass into the milk of the mother. Many antibiotics, anticoagulants, ant thyroid drugs, alcohol, nicotine, and caffeine will be transferred to the milk. Many lipophilic environmental contaminants which are stored in the body adipose tissue of the mother are mobilized during lactation and end up in the milk (such as pesticides, industrial contaminants like PCBs, and many known carcinogens.

All types of animal milk according to their com-position differ from the breast milk. Goat's milk is the nearest to the breast milk by its composition of nutrients and biological properties. At present formulas are widely used (in form of powder). The composition of nutrients of these mixtures is close to the composition of breast milk even in amino acidic composition of proteins. Nutrients are present in them in such forms, which can be easily absorbed. It was shown that growth of children, feeded by formula is moderately better than those, who received animal milk. In few people diarrhea is observed after drinking milk. Their percentage raises with age. The reaction could be caused by:1) low activeness of intestinal lactase (β-galactosidase) congenital or acquired in ontogenesis;2) intolerance of lactose or the whole milk. In literature data there is information about low activeness of intestinal lactase within big groups of population of many developing countries. In relation to this it is necessary to introduce correctives in program of provision of child population with milk and milk products, partly by substituting it for other products, containing proteins of animal origin.

Hygienic characteristics of plants origin food products.

Plant-based foods are generally classified into fruits, vegetables, legumes, grains, nuts, and seeds; their derived processed counterparts such as breads, pasta, breakfast cereals, cooked and fermented vegetables and legumes, and fruit purées, juices, and jams; and their derived ingredients such as oleaginous seed–derived oils, sugars, and some herbs and spices. What differentiates them from animal-based foods is that their fiber fraction is made of indigestible compounds, mainly cellulose, hemicellulose, pectin's, and/or resistant starch. Among grain products, legumes, cereals/pseudo cereals, and nuts/seeds are characterized by their high carbohydrate, protein, and lipid contents, respectively. In addition to fiber, plant-based foods all possess macro- (proteins, lipids, and carbohydrates), micro- (minerals, trace elements, and vitamins), and phytonutrients (e.g., polyphenols and carotenoids). Each of them helps the plant to survive within its environment and reproduce itself.

By definition, a bioactive compound has biological effect within a human organism, tissues, or cells, being likely to have preventive effects toward pathophysiological processes. In plant-based foods, all compounds or nutrients are therefore potentially bioactive within human organisms, but their protective effect will depend on several factors such as the health status or

physiological state, the degree of food processing, the presence of other compounds within the food matrix, and the quantity consumed.

Plant-based foods may be eaten raw, but most of the time, they undergo processing to render them secure, edible, and/or more palatable, especially grain-based foods. Processing may be minimal, such as soaking of leguminous seeds, to very drastic, such as extrusion-cooking of white cereal flour. Processing may also include the blending of plant-based foods with ingredients such as fats and cooking agents. In all cases, the potential package of bioactive compounds is obviously modified in different ways, either positively or negatively, notably when refining removes most of the minerals and vitamins in cereal products .

For most of the common disorders and diseases that afflict man, including obesity, type 2 diabetes, CVD and many cancers, diets that are rich in fruits and vegetables are associated with lower risk (World Health Organization/ Food and Agriculture Organization, 2003). There is also evidence that diets rich in plant foods may increase longevity.

Natural bioactive compounds of plants

Bioactive components of food which are of special interest include the following groups: polyphenols, phytoestrogens, phytosterols, phytates, lectins, oligosaccharides and polyunsaturated fatty acids (PUFA) .These groups consist of many related compounds, each with slightly different properties. It is important to stress that the protection against cancer and cardiovascular disease is undoubtedly the result of the cumulative action of many natural substances present in the diet. Since each plant contains different bioactive components, the eating of various foods seems to be important but needs further evidence. Taking this into account, we may enjoy a lower risk of occurrence of modern diseases.

Cereals. The cereals are all grasses that have been bred over millennia to bear large seeds (i.e., grain). The most important cereals for human consumption are rice, wheat, rye and corn (maize). Others include barley, oats, and millet. The carbohydrate-rich cereals compare favorably with the protein-rich foods in energy value; in addition, the cost of production (per calorie) of cereals is less than that of almost all other foods and they can be stored dry for many years. Therefore, most of the world's diets are arranged to meet main calorie requirements from the cheaper carbohydrate foods. The major component of all grains is starch.

Cereals contain little fat, with oats having an exceptional 9 %. The amount of protein in cereals ranges from 6 to 16 % but does not have as high a nutritive value as that of many animal foods because of the low lysine content.

Grain products are the main source of B group vitamins.Controversy exists as to the relative merits of white bread and bread made from whole-wheat flour. White flour consists of about 72 % of the grain but contains little of the germ (embryo) and of the outer coverings (bran). Since the B vitamins are concentrated mainly in the scutellum (covering of the germ), and to a lesser extent in the bran, the vitamin B content of white flour, unless artificially enriched, is less than that of brown flour. Dietary fiber is located mostly in the bran, so that white flour contains only about one-third of that in whole wheat flour. B vitamins are also lost when brown rice is polished to yield white rice. People living on white rice and little else are at risk for developing the disease beriberi, which is caused by a deficiency of thiamin (vitamin B1). Beri-beri was formerly common in poor Asian communities in which a large proportion of the diet consisted of polished rice. The disease has almost completely disappeared from Asia with the advent of greater availability of other foods and, in some areas, fortification of the rice with thiamin.

Yellow corn differs from other cereals in that it contains carotenoids with vitamin A activity. (Another exception is a genetically modified so-called golden rice, which contains carotene, the precursor for vitamin A.) Corn is also lower in the amino acid tryptophan than other cereals. The niacin in corn is in a bound form that cannot be digested or absorbed by humans unless pretreated with lime (calcium hydroxide) or unless immature grains are eaten at the so-called milky stage (usually as sweet corn). Niacin is also formed in the body as a metabolite of the amino acid tryptophan, but this alternative source is not available when the tryptophan content is too low.

Rice. This plant is mainly grown in subtropical zone and other zones. Its production is 400 mln of tons per year. In many countries (Japan, India and others) rice is the main cultivating plant. Because of lack of gluten rice is used for production of cereal. For this purpose the grain is separated from external coating and embryonic membranes. In such condition food substances are well preserved. It contains up to 75% of starch, 12% of proteins, 2.5% of fats and only 0.65–0.9% of gluten. Proteins of rice are mostly biological valuable vegetable fats. It contains sufficient amount of vitamins and mineral substances. While producing of polished rice all the membranes,

embryonic layer and germ are removed from the rice. That's why polished rice is by 2–4%of starch richer but there is low contents of proteins, fats, gluten, mineral substances and vitamins. Earlier such rice was the cause of development of B_1avitaminosis (Beri-beri disease) and B_1 hypovitaminosis in South-Eastern Asian and other countries in which rice was the main grain plant.

Maize. It is one of the ancient grain plants. It was grown in Mexico in the VI century B. C. It is one of the widely spread grain plant, annual production of which is 450 mln. Of tons. Maize grain is consumed cooked. The following products are made from maize: maize flour, cereal grains.


The germ of maize grain contains 30% of fat which is used for preparing maize oil. Endosperm contains up to 78% of starch, 7% of proteins, 1.5% of fats; it is used for preparation of flour. Flour is used for cooking jelly-like products (such as hominy), bread. But bread is slightly porous and has small quantity of cellulose. Maize grains have small amount of tryptophan and nicotinamide. That's why these proteins are not biologically valuable as wheat and rice proteins. Low niacin coefficient was the cause of pellagra in many countries among poor people who eat mostly maize. At present in the world there have been conducted the selection program to optimize amino acid structure of maize by the way of increasing tryptophan and lysine content.

Barley oats are widely spread in the world; millet and sorghum cultures – in tropic countries. Barley, oats and millet are consumed in the form of flour and cereal. Peculiarities of oats products are high amount of fat — 6% in cereal and 7% in flour. Proteins amount is 12–15%, carbohydrates — 56–65%, cellulose — 1% (flour) and 2.5% (oatmeal).

Sorghumand sorghum cultures (gaolan, durra, cafire, siallu, pearl millet, rag) attract a special attention. Sorghum cultures are stable against drought, their motherland is Africa. They have 10–13% of proteins, 71–72% of carbohydrates, 3–45 of fats. Sugar content in the stem of some sorts is high. In spite of the fact that sorghum does not contain large amount of cellulose (2%), it is a more rough food for a man that other grain cultures. They are used for nutrition of poor people of countries of Africa and Asia. It is being substituted by wheat and rice; sorghum is used as forage for poultry cattle.

After rice and wheat, *millet* is the third most used grain. Two varieties are widely cultivated — pearl millet (Bajra) and finger millet (Ragi).The most attractive features are crop capacity, resistance again stun favorable soil, climate conditions and diseases, and also good food qualities. Amount of proteins is 142emmate. 11.7–22.5%, starch — 73.8%, fats —2.24%, mineral substances — 0.43%. Proteins are rich in lysine (more than wheat ones), their common biological value is higher than that of other grain cultures. But bread qualities of the flour from triticale is worse than that of wheat flour.

Bean seeds which are rich in proteins are considerable part of the food ration of people in a number of agrarian countries. Bean cultures contain from 15 to 37% of proteins, 26–63% of starch-containing substances, from 1 to 6% of fats. The only exception is soy-bean which contains 18–20% of fats. Bean cultures are rich in cellulose — 3–7%. But because of big content of cellulose they are digested worse than grain cultures. Biological value of proteins is lower than that of grain-cultures. Soy-bean is only exception.

Bean cultures can contain ant- alimentary factors (substances which blockade tripsin and chemotripsin) and sometimes — small amount of toxicsubstances, e.g. white haricot bean contains thermicaly unstable agent with haemagglutination ability— fasin. After prolonged thermal treatment which decompose cellulose food biological value of beans increases. The most spread leguminous are soy-bean (world production is 143emmate. 90 mln of tons), haricot bean, pea, horse bean, china, mash and others. In many developing countries where there is a deficit of animal proteins beans proteins are valuable addition to grain cultures in the diet.

Soy-beans. By the chemical composition they take a unique place among grain and bean cultures. Soy-beans contain 37% of proteins. It is more than in any other food product. Their proteins are characterized by high content of essential amino acids and that's why they have the greatest biological value in comparison with other vegetable proteins. As compared to wheat flour content of lysine in soy-bean flour is 1.5 times more, tryptophan and methionine —3 times. Soy-beans are the source of oil, flour, soy-bean milk and cheese. Isolated and concentrated soy-bean protein obtained from the flour is used as a nutritional addition, for example, to sausage-meat. In addition to high biological value and comparatively low price proteins have high functional qualities.

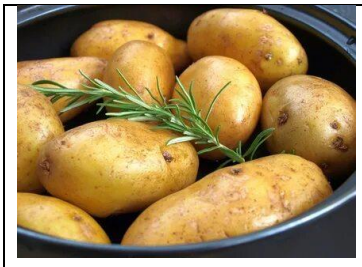
That's why soy-bean is used for preparing different artificial products including those which imitate meat products. From ancient time people use vegetable products with high content of fats. These products are different sorts of nuts, seeds of oil cultures. Vegetable oils are obtained from seeds of cotton, sunflowers, crucifers (mustard, winter-cress and others), cacao, oil palm, sesame, hazelnuts, coconuts, olives and others. As for containing of PUFA (Poly-Unsaturated Fatty Acids) and tocopherols the most valuable are oils gotten from germs of maize, seeds of sunflowers and cotton. Refined cotton oil contains 33–50% of linoleic and 29–44% of oleic acid.

Peanut is an important oil culture. It contains60% of fats, 15–20% of nitrogen-free substances, 2–4% of cellulose. Peanut is rich in vitamins of B group, tocopherols, choline. Peanut oil has palatable taste and contains 7–26% of linoleic, 51–80% of oleic fat acids. Oilcake is the product which remains after the extraction of oil. It is rich in proteins and vitamins and it is used for production flour which is primary used as forage. In tropical climate conditions peanut and peanut flour are often damaged by moldy fungi include in gasper gills which produce aflatoxin — toxic and cancerogenous substance. Taking into consideration the fact that peanut is widely cultivated in tropic countries prophylaxis of aflatoxicosis in such countries is to be an urgent problem.

Coconut palm growths in tropic regions. Coconut is the source of coconut milk and nucleus crumb which is dried out (copra). Coconut milk contains0.13% of proteins, 0.4% of glucose, 0.13% of fats. It is used as fresh drink. Coconut oil is produced from copra which is after refining is used in food. In contrast to other vegetable oils it contains up to85% of saturated fatty acids and poor in tocopherols. Coconut oil is important part in producing of margarine. Oil palm grows in tropics of Africa and Asia. Oil which is obtained from stones of the palm is directly consumed in food and also is used in production of margarine. It is close to coconut one by its qualities: it contains 80–85% of saturated fatty ac-ids, 1–2% of linole and 16–19% of olein acids. The first place among all root-plants is taken by potato (more than 300 mln of tons per year). It contains up to 14% of starch, 15% of proteins, 1–2% of sugar, 20–30 mg% of vitamin C, and vitamins of B group.

Potato is mostly spread in tropics of Central and North America. Manioc takes important place in this group (production more than 100 mln tons per year). It is cultivated in the whole tropic zone. The mass of root is 0.8–2 kg. It contains 24% of carbohydrates (including 1.2% of sugar), 1% of proteins, 0.5% of fats,3% of cellulose. Amount of mineral substances and vitamins in manioc is less than in batata and potato. It is important to emphasize that some sorts of manioc contain toxic cianogenous glycoside (144emmate. 30–67 mg/kg). Concentration of glycoside is more in the peel (15–20 times) than in pulp. If concentration of glycoside is above 80 mg/kg, such roots are considered poisonous. It is recommended to eat only root-plant which contain no more than 50 mg/kg of glycoside. It is a thermally stable substance; so, it cannot be

completely destructed during cooking. In the process of drying out 75%of glycoside are destructed. Starch washed out of the pulp is free from this glycoside.



The root-plants free from the peel are boiled as potato. Boiled manioc contains 80–85% of starch,0.4–4.2% of sugars, 1–2.5% of proteins, 0.5–1.2%of fats. Besides population of tropical zone prepare the product which is called hari from manioc. For that purpose roots are peeled out, pulverized and squeezed out the juice of this mass. Then this mass must be boiled and dried out. Prepared hari (1/4 of roots mass) contains 10–15% of water, 80–85% of carbohydrates, 0.5–1.4% of proteins and 1% of fats. There are almost no glycosides in hari. Manioc flour can be sifted on the hot stove. This granulated product is called tapioca which is widely used in pastry-cook production. Tapioca contains12.6% of water, 80% of carbohydrates, 0.7% of proteins and 0.2% of fats. Tapioca is poor in mineral substances and vitamins. Energy value of 100 g of tapioca is 345 kcal. Important starch-containing root-plant culture is batata (sweet potato). Its annual production is more than 75 mln.Of tons. The mass of root-plant is 4–945 kg. It contains 24% of carbohydrates, 2% of proteins 1. 5% of fats, 3% of cellulose. Besides of starch, there are other carbohydrates which add sweet taste to batata. Mineral and vitamin composition is close to that of potato but batata has more carotene (0.36–1.0 mg/100 g).Yams and taro are also related to this group of cultures which are gradually substituted by manioc. Yams contains to 29% of carbohydrates, 2% of proteins, 0.03% of fats and 1% of cellulose. Root-plant of yams and taro are eaten uncooked.

Whether consumption of potatoes, which are rich in potassium and have a high glycemic index and glycemic load, is associated with the risk of cardiovascular disease (CVD) is unknown. Potatoes have been related to increased risks of obesity, type 2 diabetes (T2D), and cardiovascular disease (CVD) mainly because of their high glycemic index.

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Fruit and vegetables.A diet rich in vegetables and fruits can lower blood pressure, reduce the risk of heart disease and stroke, prevent some types of cancer, lower risk of eye and digestive problems, and have a positive effect upon blood sugar, which can help keep appetite in check. Eating non-starchy vegetables and fruits like apples, pears, and green leafy vegetables may even promote weight loss. Their low glycemic loads prevent blood sugar spikes that can increase hunger. The most spread vegetables in the world are cabbage, carrot, beet, onion, garlic, dill, parsley, turnip, radish, cucumber, aubergine, pepper, spinach and others. In the regions with hot climate water-melon cultures are cultivated. An important part of food ration of a modern man is fruit. Energy value is not high (it is 146gemmate. 60 kcal per 100g) but they have good taste. They are rich in different sugars, organic acids and vitamins.

*Vegetables, fruits, and disease: c*ardiovascular disease. There is compelling evidence that a diet rich in fruits and vegetables can lower the risk of heart disease and stroke.A meta-analysis of cohort studies following 469,551 participants found that a higher intake of fruits and vegetables is associated with a reduced risk of death from cardiovascular disease, with an average reduction in risk of 4% for each additional serving per day of fruit and vegetables. The largest and longest study to date, done as part of the Harvard-based Nurses' Health Study and Health Professionals Follow-up Study, included almost 110,000 men and women whose health and dietary habits were followed for 14 years. The higher the average daily intake of fruits and vegetables, the lower the chances of developing cardiovascular disease. Compared with those in the lowest category of fruit

and vegetable intake (less than 1.5 servings a day), those who averaged 8 or more servings a day were 30% less likely to have had a heart attack or stroke. Although all fruits and vegetables likely contributed to this benefit, green leafy vegetables, such as lettuce, spinach, Swiss chard, and mustard greens, were most strongly associated with decreased risk of cardiovascular disease. Cruciferous vegetables such as broccoli, cauliflower, cabbage, Brussels sprouts, kale; and citrus fruits such as oranges, lemons, limes, and grapefruit (and their juices) also made important contributions. When researchers combined findings from the Harvard studies with several other long-term studies in the U.S. and Europe, and looked at coronary heart disease and stroke separately, they found a similar protective effect: Individuals who ate more than 5 servings of fruits and vegetables per day had roughly a 20% lower risk of coronary heart disease and stroke, compared with individuals who ate less than 3 servings per day.

Blood pressure. The Dietary Approaches to Stop Hypertension (DASH) study examined the effect on blood pressure of a diet that was rich in fruits, vegetables, and low-fat dairy products and that restricted the amount of saturated and total fat. The researchers found that people with high blood pressure who followed this diet reduced their systolic blood pressure (the upper number of a blood pressure reading) by about 11 mm Hg and their diastolic blood pressure (the lower number) by almost 6 mm Hg—as much as medications can achieve.A randomized trial known as the Optimal Macronutrient Intake Trial for Heart Health (OmniHeart) showed that this fruit and vegetable-rich diet lowered blood pressure even more when some of the carbohydrate was replaced with healthy unsaturated fat or protein. In 2014 a meta-analysis of clinical trials and observational studies found that consumption of a vegetarian diet was associated with lower blood pressure.

Cancer.Numerous early studies revealed what appeared to be a strong link between eating fruits and vegetables and protection against cancer. Unlike case-control studies, cohort studies, which follow large groups of initially healthy individuals for years, generally provide more reliable information than case-control studies because they don’t rely on information from the past. And, in general, data from cohort studies have not consistently shown that a diet rich in fruits and vegetables prevents cancer.

*Diabetes.*Some research looks specifically at whether individual fruits are associated with risk of type 2 diabetes. While there isn't an abundance of research into this area yet, preliminary results are compelling.

*Weight.*Data from the Nurses' Health Studies and the Health Professional's Follow-up Study show that women and men who increased their intakes of fruits and vegetables over a 24-year period were more likely to have lost weight than those who ate the same amount or those who decreased their intake. Berries, apples, pears, soy, and cauliflower were associated with weight loss while starchier vegetables like potatoes, corn, and peas were linked with weight gain. However, keep in mind that adding more produce into the diet won't necessarily help with weight loss unless it replaces another food, such as refined carbohydrates of white bread and crackers.

Gastrointestinal health. Fruits and vegetables contain indigestible fiber, which absorbs water and expands as it passes through the digestive system. This can calm symptoms of an irritable bowel and, by triggering regular bowel movements, can relieve or prevent constipation. The bulking and softening action of insoluble fiber also decreases pressure inside the intestinal tract and may help prevent diverticulosis.

Vision. Eating fruits and vegetables can also keep your eyes healthy, and may help prevent two common aging-related eye diseases—cataracts and macular degeneration—which afflict millions of Americans over age 65. Lutein and zeaxanthin, in particular, seem to reduce risk of cataracts.

Citrus plants widely spread in tropical countries include several tens of sorts of fruit which have good taste and dietetic qualities. Every year production of citrus fruit is more than 40 mln tons. They are such fruit as oranges, tangerines, grape-fruit, lemons, limes, citrons and others. Citrus fruit has a great significance in dietary of sick people. There are 5% of inverted sugar, 3% of sacharose, 1% of citric acid in the pulp of sweet orange.

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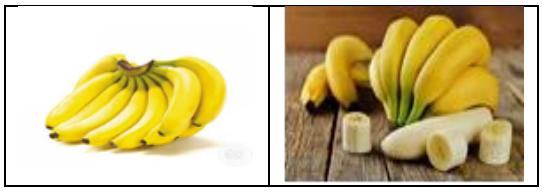
They are such fruit as oranges, tangerines, grape-fruit, lemons, limes, citrons and others. Citrus fruit has a great significance in dietary of sick people. There are 5% of inverted sugar, 3% of sacharose, 1% of citric acid in the pulp of sweet orange. Because of thick peel and acidity of its juice different vitamins (including vitamin C) are well preserved in orange. Citrus fruit are rich in substances which have properties of vitamin P. Orange, tangerines, grape-fruits, pampelmus are eaten in raw. They are also used in pastry-cook production. Other citrus fruit (lemon, lime) contain great amount of citric acid in the pulp. The amount of organic acids in the lemon is 6–8%, inverted sugars— 2–3%, sacharose — 0.5%. Juice of this citrus fruit are used for preparing fresh drinks, culinary products and confectionery. People often prefer tea with lemon from all the hot drinks. Lemon peel contains vitamin C 2–3 times more than the pulp. Lemon juice stimulates immunity of the organism, 149emmate149149corbutic, antianaemia and other curable qualities.

Banana is an important vegetable culture. It is considered that banana is one of the first food products and one of the first plants which is started to be cultivated. It grows primary in tropical zone with increased humidity. Harvests of bananas from one hectare is approximately 100 times more than wheat and 40 times — than potato. Bananas must be unripe because only in artificial conditions (in rooms with temperature 16–17°C, humidity 85–90%during 7–8 days) they get good gustatory and food qualities. During this process of ripening starch turns into sugar (changing of the taste), protopectin —into water soluble pectin (changing of consistence, formation of aromatic substances) and other chemical processes. All sorts of bananas are divided into two groups according to the character of their possible use. The largest part of them are bananas of the group of plentins which contains a large amount of starch. They are used in boiled state or dried and pulverized into flour. They contain about 64% of water,12% of starch, 19% of sugars, 1.2% of proteins,0.8% of fats, 0.8% of cellulose. Bananas are not rich in vitamin C (149emmate. 0.7 mg per 100 g) but contain a number of α-carotins (0.7 mg per 100 g) and vitamins of B group, especially riboflavin (0.6 mg per100 g).



Those sorts of bananas are consumed by local population. In some regions of India, Indonesia, Malaysia and especially tropical Africa importance of bananas in the nourishment of

population can be compared with importance of bread in conditions of moderate climate. The second group consists of sweet bananas which are usually exported. Content of water is 72–76%, carbohydrates — 22–27% (16% of sacharose, 11% of reduced sugars), proteins — 1.3–1.5%, fats— 0.1–0.6%, other substances — 0.8–0.9%. Be-sides, they are used for preparation of jams, can-died bananas, banana flour, dried bananas. In South-West Asia, North America and Sahara there are regions where the date-palm is cultivated. Dates are a good food product ("bread of deserts"). They contain about 72% of carbohydrates(including 60% of sugars among which sacharose prevails), 7.5% of proteins, 2.5% of fats, 3–6% of cellulose. They contain vitamins of B group especially niacin and pantothenic acid (0.8 mg of each per 100 g). They can be kept for a long period. In ancient times dates were the most popular food for sailors and travelers in deserts. Bread-fruit tree is spread in Indonesia, Polynesia and nearly located regions. Fruit of this tree is round or oval of 10–12 cm in diameter. Their pulp has many fibers and yellow color, the signs of a ripe fruit. Fruit are eaten raw, boiled, baked and they are used for bread baking. Fruit contain 65% of water, 19% of starch, 12% of sugars, 1.5% of proteins, 0.2–0. 5% of fats and 1% of cellulose.

Mango is one of the best Indian fruit-delicacy. Average mass of fruit is 300–400 g (sometimes up to 2–4 kg). The pulp is of yellow color and has palatable sweet taste, strong aroma which reminds smell of apricot, melon or lemon. The pulp contains75–85% of water, 11–20% of sugars (mostly sacharose), 0.2–0.6% of organic acids, 0.5–1% of proteins, small amount of mineral substances but a lot of ascorbic acid (150emmate. 25 mg per 100 g), α-carotins, vitamins of B group. They are often used in juices, jams and other products. In India the fruit are used for preparation of marinades, Indian dishes: cari and chashni. Mango juice is used in popular medicine as a remedy against a lot of diseases including cholera and plague. Avocado is a fruit tree which grows in American tropics.

The fruit's size is from 7 to 20 cm. The pulp is of a yellow-green color, butter consistence and the same taste but with smack of walnut and smell of bay leaf. Seeds of avocado are uneatable.

Composition: 60–70% of water, 1.2–1.8% of proteins, 10–29% of fats, 5–10% of carbohydrates; energy value is 218 kcal per 100 g. Oil contains 77%of oleic and 10% of linoleic acids. Pulp of the fruit contains many water soluble fat-soluble vitamins. Avocado is used for preparing of canned products.

Papaya (melon tree). Fruit are from 0.4 to20 kg of weight. Taste depends on the sort of papaya. Some sorts have sweet taste, the others are with-out taste, the others have bitter smack. Pulp is of dark-yellow or orange color. It contains 85–88%of water, 0.4–0.7% of proteins, 0.25% of fats, 8–12% of sugars (mostly monosaccharides), sufficient amount of vitamins (ascorbic acid — up to 46 mg/100 g, carotene — up to 2 mg/100 g).

The pulp of papaya (specially unripe fruit) contains enzyme pa-pain which is similar to pepsin. This fact allows to use papaya in curative diet. Tropical zone is rich in different plants. So, any country depending on its climate conditions and food needs can choose optimum from hygienic positions, plants to be cultivated. It's important to emphasize that the role of fruit of tropic and moderate zones as the source of vitamins is almost similar.

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6. Alimentary diseases

*What is malnutrition?*Malnutrition is a condition that develops when the body does not get the right amount of the nutrients it needs to maintain healthy tissues and organ function. It includes conditions, such as undernutrition, over nutrition and micronutrient deficiency diseases (like

vitamin A deficiency, iron deficiency anemia, iodine deficiency disorders and zinc deficiency).Types of nutrition disorders by the World Health Organization's classification is malnutrition, specific form of malnutrition, obesity, unbalanced diet. Malnutrition affects mostly people of the following categories: infants and children from pregnancy to two (2) years of age, non-breastfed children, pregnant and lactating women, people suffering from chronic or infectious disease, people are food insecure.

Types of malnutrition*(figure 6.1,).*

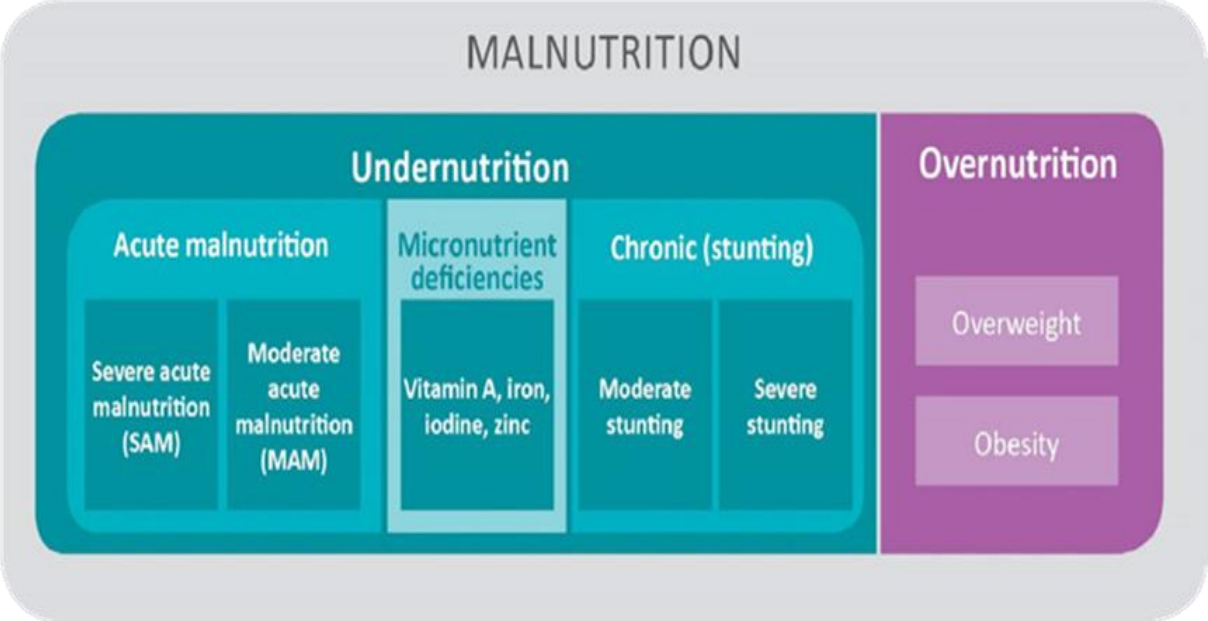


Figure 6.1.Types and categories' malnutrition

6) Undernutrition

This is a nutrition a deficiency resulting from inadequate intake of food or inability of the body to convert or absorb food.Undernutrition is the most common and easily observable type of malnutrition. Undernutrition often presents itself in two forms: acute and chronic.

6. ***Acute malnutrition: Underweight/wasting***

Acute malnutrition takes place within a short time and can present loss of muscles in bulk. When severe, presents with visible wasting (prominence of bones) and/or symmetrical swelling of the body starting from both feet.

2.Chronic malnutrition: Stunting

A child's height is one of the most important indicator of his/her wellbeing. Height reflects the accumulated total of early-life health and diseases. The problems that prevent children from growing tall also prevent them from growing into healthy, productive, smart adults. Height predicts adult economic outcomes. Chronic undernutrition that affects children right from pregnancy to 5 years of age affects their growth and leads to reduced growth in stature (short-for-age). Chronic malnutrition is due to prolonged long term deprivation of proper nutrients/foods to children (figure6.2.).

b) Micronutrient malnutrition (lack of minerals and vitamins). This type of malnutrition is called "hidden hunger;" and is due to inadequate intake of dietary mineral salts and vitamins leading to vitamin mineral deficiencies (VMDs). This form of malnutrition cannot be identified easily except in advanced stages when clinical signs appear. Minerals and vitamins are required by the body in very small quantities, they are very important in protecting the body against infections. Usually, their absence in the diet does not cause a person to "feel hungry."

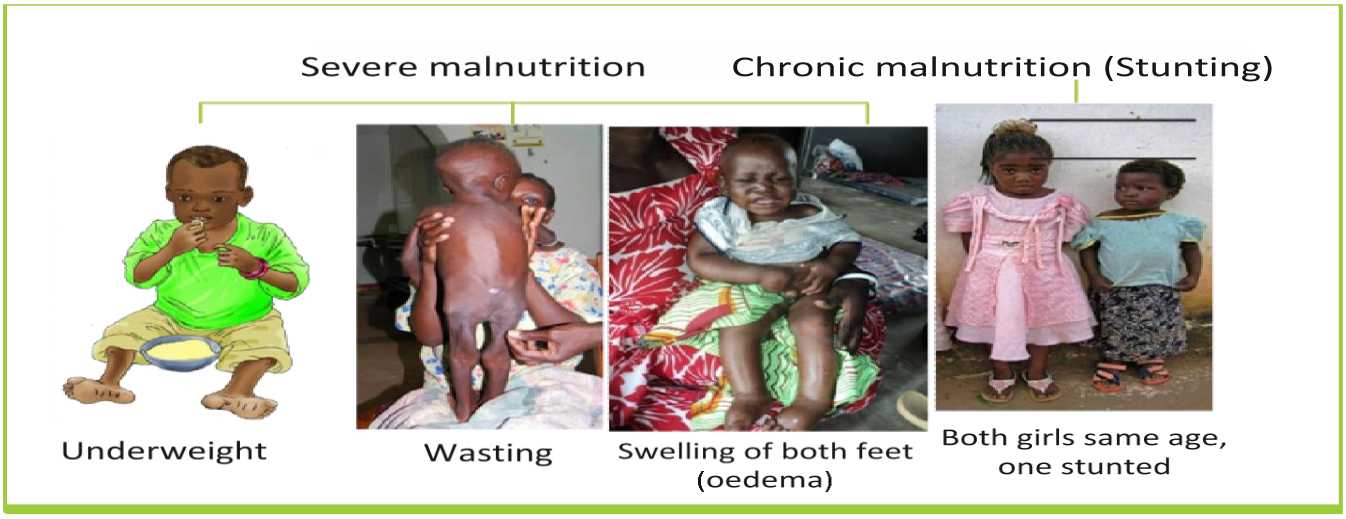


Figure 6.2. Common forms of undernutrition (Source: Integrating Nutrition Assessment, Counselling and Support into Health Service Delivery 2015)

c) Over nutrition

This is the excessive intake of nutrients in foods over a given period of time exposing individuals to poor health. Over nutrition results in cardiovascular diseases, hypertension, diabetes, cholelithiasis overweight, obesity, vitamin toxicity. Over nutrition may be caused

by any of the following factors: eating habits (overeating), health conditions taking too many prescribed dietary supplements, lack of physical activity (sedentary lifestyle), psychological factors (stress), environmental factors (unsafe foods, e.g., heavy metals in food, peer pressure), medication, genetic factors.

*Causes of malnutrition?*There are several interconnected causes of malnutrition, ranging from policy issues to underlying community and cultural situations to house hold conditions and are commonly categorized into immediate causes, underlying cause and basic causes (figure 6.3.).

*Immediate causes include:*inadequate dietary intake including poor quality and quantity of food in the diet (poor dietary diversity), infection and diseases such as malaria, diarrheal diseases, acute respiratory infections, measles and worm infestations, low intake of foods rich in appropriate nutrients, low intake of substances like vitamin C that enhance nutrient absorption, high intake of factors like phytates and tannins that inhibit nutrient absorption, food insecurity.

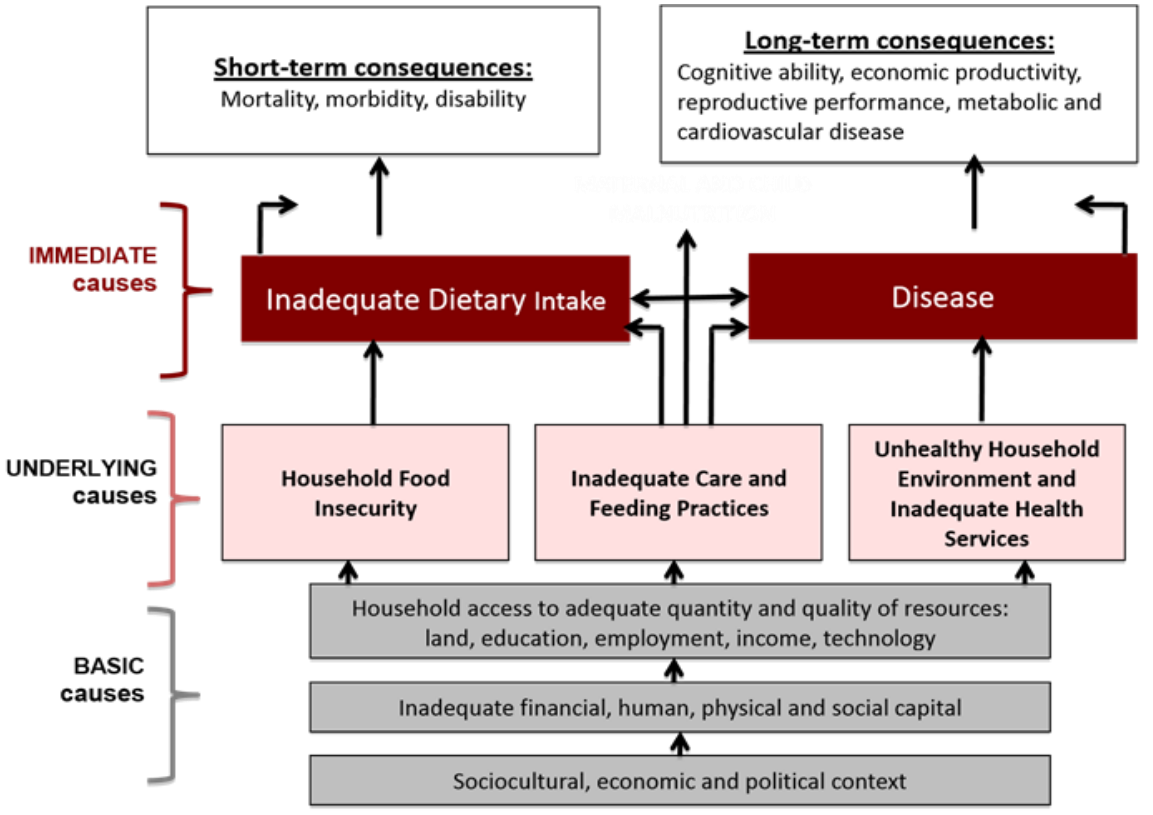


Figure 6.3.Theconceptual framework showing the causes of malnutrition (Source: Adopted from the UNICEF conceptual framework 1990)

*Underlying causes include:*household food insecurity including poor access to a diverse diet, inadequate quantity of food available and accessible, and seasonal fluctuations in food availability.Inadequate maternal and childcare, including suboptimal maternal nutrition and infant feeding practices, often a result of heavy workloads for women and frequent births.Poor access to healthcare and inadequate water and sanitation, leading to increased illness.Inadequate and/or incorrect feeding practices.Inadequate caring capacity for example inadequate time, inadequate knowledge.Low levels of family education, awareness, knowledge and motivation.Intrahousehold maldistribution of access to food, health services and care.Poor food preparation, storage, preservation and processing practices at household levels.Beliefs and practices that restrict access to certain foods for some family members (food taboos).Poor health services and/or agricultural infrastructure.Lack of institutional capacity in nutrition and/or personnel trained in the various components of community nutrition programs.Low production of diversified nutritious foods.Lack of household level gardening.Insufficient marketing infrastructure for key food.Poorly developed commercial food processing industry.

*Basic causes include:*limited livelihood opportunities and unequal economic structure.Inadequate educational opportunities.Priorities guiding the allocation of public funding and other resources.Quality of social and political leadership, e.g., poor economic or physical access to markets.Little or no productive land.High prevalence of certain endemic diseases, e.g., tuberculosis and HIV/AIDS.Low status of and lack of resource control by women.Failure to consider nutrition needs in agriculture and health policy-making.Lack of resources to produce nutrient-rich foods.Poor economic or physical access to markets.Little or no productive land.Lack of access to safe water for drinking, hygiene and/or irrigation.Seasonality of food availability.Low status of and lack of resource control by women.

*Consequences (cost) of malnutrition.*Consequences of malnutrition: reduce the body's resistance, slowing the anthropometric indicators of growth anddevelopment, weight loss. Also

c*hild deaths, diseases and disability:* newborns who are born small (low birth weight, that is less than 2.5 kg) for their gestational age are more likely to die than children born with a healthy weight.A severely stunted child is four times more likely to die than a healthy child (Lancet 2008).A severely wasted child is nine times more likely to die than a healthy child (Lancet 2008).Micronutrient deficiencies—including vitamin A, zinc and iron—impair the immune

system, increasing risk of illness and death.Anemia increases risk of maternal and perinatal deaths (death of infant in the womb and during the first 6 weeks of birth).Vitamin A deficiency causes blindness.Malnutrition has negative consequence on physical productivity, health and education outcomes with consequential negative impacts on socioeconomic development.

Malnutrition weakens brain development and nervous system: impaired brain development, poor school achievement, absenteeism (stunting, iron deficiency, anemia, iodine deficiency), neural tube defects: undeveloped back bone and the nervous system (folic acid deficiency), impaired fetal brain development, brain damage, severe mental retardation, or congenital abnormalities (iodine deficiency in pregnancy), diminished income: earning capacity in adulthood. Malnutrition decreases productivity and economic growth, when malnourished individuals are sick, they are weak and cannot perform their daily work for example sick farmers, individuals with iron deficiency anemia (particularly women) become tired easily and cannot work for longer hours, shortage of iodine decreases IQ and causes a productivity loss, farmers with low literacy levels are less likely to adopt improved agricultural practices hence leading to poor agricultural production and productivity, people with low literacy levels are bound to have poor health seeking behaviors and access to quality health services, mothers with low education level are likely to follow poor feeding practices hence affecting the nutritional and health status of family members, contributes to poverty, cost of treating illnesses attributable to malnutrition, cost of caring for sick, lost care for other (not sick) household members.

*b) Consequences of over nutrition.*Malnutrition can lead to multiple medical conditions including: coronary heart disease (heart attack), diabetes (high blood sugar), gout (swollen painful joints), hypertension (high blood pressure), overweight, obesity, death.

Malnutrition increases the risk of death and illnesses: malnutrition weakens immunity and predisposes individuals to different infections, more than half of infant deaths are associated with malnutrition, marasmus and kwashiorkor and finally death is caused by severe malnutrition, goiter due to iodine deficiency, night blindness to complete blindness from vitamin A deficiency, anemia from iron deficiency.

By 2050 about 6 billion people will live in countries that have food deficits today. Many developing countries have problems of under nutrition. About 3,8 billion people- nearly two-

thirds of the world's population – live in low-income food- deficit countries. In these countries millions experience hunger, malnutrition, and even starvation, about 825 million people are chronically malnourished, according to recent estimate by FAO. Many low-income food-deficit countries have among the worlds the highest population growth rates. Asia has the largest number of malnourished children in the world. WHO also determined three basic directions in micronutrients deficiencies: iodine deficiency disorders (IDD), iron deficiency and iron deficiency anemia (ID and IDA), vitamin A deficiency (VAD). The micronutrient deficiency problem is a very actual for Azerbaijan as well: 85% of children 8-14 years are experienced the iodine deficiency, 32% of children under 5 have iron deficiency anemia.

There are some nutritional components of meal-which do not have a nutritive value. Up to one third of the world's population goes hungry for much or most of the time. Majority of people who do not get enough to eat live in the dry savannah country of Africa, in the overcrowded nations of Asia and in the urban slums of Latin America (table 6.1). In the 1980s there were wide spread famines in Africa and in the 1990s largely associated with war and genocide further localized and regional famines have occurred again but in different regions, notable southern Sudan and in the refugee communities on the Rwanda-Burundi-Zaire borders. In the after-math of the Gulf War and the imposition of sanctions, very severe food shortage approaching famine affected many of people of Iraq.Also in the early1990s the economic and political disruption of parts of the former Soviet Union and the conflicts in the former Yugoslavia causes several very severe localized periods of food shortage. A series of natural disasters mainly floods probably aggravated by inefficient production distribution caused famine in North Korea in 1995–1996. At any time small numbers of undernourished or starving people can be found almost anywhere even in the richest cities in the affluent industrial nations. They may starve be-cause of inadequacies in the social services.

Table 6. 1.Prevalence of chronic under nutrition in developing country's

Regions	1979-1981	1990-1992	1979-1981	1990-1992
Latin America and the Caribbean	13	14	46	61
Near Eastand North Africa	10	10	24	32
Sub-Saharan Africa	39	41	140	204
Eastand Southeast Asia	27	16	317	262
South Asia	33	22	297	250

Continental Africa	33	34	148	211
Developing regions	27	20	878	809

Definition of the alimentary status. The alimentary status is the physiological state of human organism determined by the dietary pattern. The alimentary status could be estimated by the correspondence of body weight to age and gender, somatic constitution, biochemical indices of metabolism, presence of the signs of alimentary deficiency.

Classification of alimentary status:

1.*Optimum* (physiological indices and body weight correspond to height, age, gender and intensity of labor).

2. *Superfluous* (may be determined by congenital predisposition, overeating, poor physical loading) that is characterized with increased body weight (obesity).

3. *Insufficient*, or hypotrophy when weight is lower than standard (could be determined by malnutrition, vigorous physical work, psycho-emotional stress).

Victims of this situation are elderly people on inadequate pensions; children of low-income parents, especially single parents. Under nutrition can result from inadequate intake, malabsorption, abnormal systemic loss of nutrients due to diarrhea, hemorrhage, renal failure, or excessive sweating, infection, or addiction to drugs. Under nutrition is associated with poverty and social deprivation, occurring among the poor. The risk of under nutrition is also greater at certain times in a person's life, i.e. infancy, early childhood, adolescence, pregnancy and lactation, and old age. Because of the high demand for energy and essential nutrients, infants and children are at particular risk of under nutrition. Protein-energy malnutrition in children consuming inadequate amounts of protein, calories, and other nutrients is a particularly severe form of under nutrition that retards growth and development. Hemorrhagic disease of the newborn, a life-threatening disorder, is due to inadequate vitamin K intake.

Deficiencies of iron, folic acid, vitamin C, copper, zinc, and vitamin A may occur in inadequately fed infants and children. In adolescence, nutritional requirements increase because the growth rate increases. Anorexia nervosa, a form of starvation, may affect adolescent girls. Requirements for all nutrients are increased during pregnancy and lactation. Aberrations of diet, including pica (the consumption of nonnutritive substances, such as clay and charcoal), are

common in pregnancy. Anemia due to folic acid deficiency is common in pregnant women, especially those who have taken oral contraceptives. Folic acid supplements are now recommended for pregnant women to prevent neural tube defects (spine bifida) in their children. An exclusively breastfed infant can develop vitamin B_{12} deficiency if the mother is a vegetarian. An alcoholic mother may have a handicapped and stunted child with fetal alcohol syndrome, which is due to the effects of ethanol and malnutrition on fetal development. A diminished sense of taste and smell, loneliness, physical and mental handicaps, immobility, and chronic illness can militate against adequate dietary intake in the elderly people. Absorption is reduced, possibly contributing to iron deficiency, osteoporosis (also related to calcium deficiency), and osteomalacia due to lack of vitamin D and absence of exposure to sunshine. Irrespective of the age, disease or dietary deficiency there is progressive loss of lean body mass, amounting to about 10 kg in men and 5 kg in women (figure 6.4.). In patients with chronic disease, malabsorption states (including those resulting from surgery) tend to impair the absorption of fat-soluble vitamins, vitamin B_{12}, calcium, and iron. Liver disease impairs the storage of vitamins A and B_{12} and interferes in the metabolism of protein and energy sources. Patients with kidney disease, including those on dialysis, are prone to develop deficiencies of protein, iron, and vitamin D. Some patients with cancer and many with AIDS have anorexia, which complicates treatment.

Figure 6.4. Hypotrophy

In patients receiving long-term home parenteral nutrition most commonly after total or near total resection of the gut, vitamin and trace mineral deficiencies must be especially guarded against. A physician should be sure that biotin, vitamin K, selenium, molybdenum, manganese, and zinc are adequately supplied.

If the factice weight is 10-19% less than the ideal weight, I degree deficiency, if it is 20-29% less, II degree deficiency, if it is 30-39% less, III degree deficiency, and if the underweight is more than 40%, IV degree deficiency – more considered as weight loss

Vegetarian diets. The most common form of vegetarianism is ovolacto-vegetarianism, in which meat and fish are eschewed but eggs and dairy products are eaten. Iron deficiency is the only risk. Ovolacto vegetarians tend to live longer and to develop fewer chronic disabling conditions than their meat eating peers. Vegans consume no animal products and are susceptible to vitamin B_{12} deficiency. Yeast extracts and oriental-style fermented foodstuffs provide this vitamin. Intake of calcium, iron, and zinc also tends to be low. A fruitarian diet, which consists solely of fruit, is deficient in protein, salt, and many micronutrients and is not recommended. "Fad" Diets. Many commercial diets are claimed to enhance well-being or reduce weight. A physician should be alert to early evidence of nutrient deficiency or toxicity in patients adhering to them. Such diets have resulted in frank vitamin, mineral, and protein deficiency states and cardiac, renal, and metabolic disorders as well as some deaths. Very low calorie diets (more than 400 kcal/day) cannot sustain health for long. Some trace mineral supplements have induced toxicity.

Alcohol or drug dependency. Patients with alcohol or drug problems are notoriously unreliable when questioned about their eating habits, so making judicious inquiries of relatives or acquaintances may be necessary. Addiction leads to a disturbance of lifestyle in which adequate nourishment is neglected. Absorption and metabolism of nutrients are also impaired. High levels of alcohol are poisonous and can cause tissue injury, particularly of the GI tract, liver, pancreas, brain, and peripheral nervous system. Beer drinkers who continue to consume food may gain weight, but alcoholics who consume more than 300 ml of hard liquor per day lose weight and become undernourished. Drug addicts are usually emaciated. Alcoholism is the most common cause of thiamine deficiency in the developed country and may lead to deficiencies of magnesium, zinc, and other vitamins.

Anorexia (an-o-REK-see-uh) nervosa - often simply called anorexia – is an eating disorder characterized by an abnormally low body weight, an intense fear of gaining weight and a distorted perception of weight. People with anorexia place a high value on controlling their weight and shape, using extreme efforts that tend to significantly interfere with their lives. To prevent weight, gain or to continue losing weight, people with anorexia usually severely restrict the amount of

food they eat. They may control calorie intake by vomiting after eating or by misusing laxatives, diet aids, diuretics or enemas. They may also try to lose weight by exercising excessively. No matter how much weight is lost, the person continues to fear weight gain.

Anorexia isn't really about food. It's an extremely unhealthy and sometimes life-threatening way to try to cope with emotional problems. When you have anorexia, you often equate thinness with self-worth. Anorexia, like other eating disorders, can take over your life and can be very difficult to overcome. But with treatment, you can gain a better sense of who you are, return to healthier eating habits and reverse some of anorexia's serious complications. The physical signs and symptoms of anorexia nervosa are related to starvation. Anorexia also includes emotional and behavioral issues involving an unrealistic perception of body weight and an extremely strong fear of gaining weight or becoming fat. It may be difficult to notice signs and symptoms because what is considered a low body weight is different for each person, and some individuals may not appear extremely thin. Also, people with anorexia often disguise their thinness, eating habits or physical problems. Physical signs and symptoms of anorexia may include: extreme weight loss or not making expected developmental weight gains; thin appearance; abnormal blood counts; fatigue; insomnia; dizziness or fainting; bluish discoloration of the fingers; hair that thins, breaks or falls out; soft, downy hair covering the body; absence of menstruation; constipation and abdominal pain; dry or yellowish skin; intolerance of cold; irregular heart rhythms; low blood pressure; dehydration. Some people who have anorexia binge and purge, similar to individuals who have bulimia. But people with anorexia generally struggle with an abnormally low body weight, while individuals with bulimia typically are normal to above normal weight.

Behavioral symptoms of anorexia may include attempts to lose weight by: severely restricting food intake through dieting or fasting; exercising excessively; bingeing and self-induced vomiting to get rid of food, which may include the use of laxatives, enemas, diet aids or herbal products. Emotional and behavioral signs and symptoms may include: preoccupation with food, which sometimes includes cooking elaborate meals for others but not eating them; frequently skipping meals or refusing to eat; denial of hunger or making excuses for not eating; eating only a few certain "safe" foods, usually those low in fat and calories; adopting rigid meal or eating rituals, such as spitting food out after chewing; not wanting to eat in public; lying about how much food has been eaten; fear of gaining weight that may include repeated weighing or

measuring the body; frequent checking in the mirror for perceived flaws; complaining about being fat or having parts of the body that are fat; covering up in layers of clothing and others.

Protein-Energy Malnutrition (PEM). Meeting energy requirements is basic to survival, and the way in which this is accomplished from protein or non-protein sources determines the type of severe PEM produced. A diet with excessive non-protein calories from starch or sugar, but deficient in total protein and essential amino acids, results eventually in kwashiorkor.

Three (3) type of PEM distinguish.According to the degree of severity, of the first, second and third degrees are distinguished.

I – mild degree of PEM (protein-energy malnutrition): with a body weight of **75-90%** from normal.

II – the average degree of PEM (protein-energy malnutrition): with a body weight of **60-75%** from normal.

Iil– the hard degree of PEM (protein-energy malnutrition) : with a body weight of below 60 from normal.

Severe discrepancy of energy and nutrients causes total inanition, which in the young child is called marasmus. Intermediate forms are termed marasmic-kwashiorkor (figure 6.5.).

Marasmus is the predominant form of PEM throughout most developing countries. It is associated with the early abandonment or failure of breast-feeding and with consequent infections, most notably those causing infantile gastroenteritis. Kwashiorkor is less common and is usually manifested as the intermediate marasmic-kwashiorkor state. Intends to be confined to those parts of the world (rural Africa, the Caribbean and Pacific islands) where staple and weaning food-stuffs such as yam, cassava, sweet potato, or green banana are protein deficient and excessively starchy.

Figure 6.5. Marasmic-kwashiorkor of child

In marasmus, energy intake is insufficient to match requirements and the body draws on its own stores. In kwashiorkor, increased carbohydrate intake with decreased protein intake leads to decreased visceral protein synthesis. The resulting hypoalbuminemia causes dependent edema; and the impaired β-lipoprotein synthesis produces fatty liver. Marasmic infants show hunger, gross weight loss, growth retardation and wasting of subcutaneous fat and muscle (figure 6.6.).

Figure 6.6.. Kwashiorkor of child

Kwashiorkor is characterized by generalized edema, moon face,pigmentation of the skin,"flaky paint" dermatosis, thinning and discoloration of the hair, enlarged fatty liver, and petulant apathy in addition to retarded growth. In developing countries, severely malnourished children may also be HIV positive. Differential diagnosis incudes secondary growth failure due to malabsorption, congenital defects, or deprivation. Skin changes in kwashiorkor differ from those of pellagra where they occur on parts exposed to light and are symmetrical.

Edema in nephritis, nephrosis and cardiac failure is accompanied by features of these diseases. Hepatomegaly from disorders of glycogen metabolism and cystic fibrosis must be differentiated. Mortality varies between 15 and 40%. Death in the first days of treatment is usually duet electrolyte imbalance, infection, hypothermia, or heart failure. Long-term effects of malnutrition in childhood are not fully understood. In the adequately treated case the liver probably recovers fully without subsequent cirrhosis. Humoral immunity is usually unimpaired. Cell-mediated immune competencies markedly compromised in the acute phase but is restored with recovery. Behavioraldevelopment maybe markedly retarded in the severely malnourished child. The degree of mental impairment is related to the duration of malnutrition and age of onset. The infant with marasmus is affected most severely than the other child with kwashiorkor. Prospective studies suggest that a relatively mild degree or mental retardation persists into school age. Starvation is

the most severe form of malnutrition. It may result from fasting, famine, anorexia nervosa, catastrophic disease of the GI tract, stroke, or coma. The basic metabolic response to starvation is conservation of energy and body tissues. However, the body will mobilize its own tissues as a source of energy, which results in the destruction of visceral organs and muscle and in extreme shrinkage of adipose tissue. Total starvation is fatal in 8 to 12 weeks. In adult volunteers who fasted for 30 to 40 days, weight loss was marked (25% of initial weight),metabolic rate decreased, and the rate and amount of tissue protein breakdown decreased by about 30%.

In more prolonged starvation, weight loss may reach 50% in adults and possibly more in children. Loss of organ weight is greatest in the liver and intestine, moderate in the heart and kidneys, and least in the nervous system. Emaciation is most obvious in areas where prominent fat depots normally exist. Muscle mass shrinks and bones protrude. The skin becomes thin, dry, inelastic, pale, and cold. The hairs dry and sparse and falls out easily. Most body systems are affected. Achlorhydria and diarrhea are common. Heart size and cardiac output are reduced; the pulse slows and blood pressure falls. Respiratory rate and vital capacity decrease. The main endocrine disturbance is gonadal atrophy with loss of libido in men and women and amenorrhea in women. Intellect remains clear, but apathy and irritability are common. The patient feels weak. Work capacity is diminished because of muscle destruction and, eventually, is worsened by cardiorespiratory failure. The anemia is usually mild, normochromic, and normocytic. Reduction in body temperature frequently contributes to death. In famine edema, serum proteins are usually normal, but loss of fat and muscle results in increased extracellular water, low tissue tension, and inelastic skin. Cell-mediated immunity is compromised, and wound healing is impaired.

So, symptoms commonly registered in kwashiorkor is moon face, changing the color and shape of the hair, skin pigmentation.

Symptoms that are constantly occurring with kwashiorkor ispuffiness and hypotension of muscles,growth retardation and weight loss, psychomotor changes.

Prophylactic measures and recommendations:

1.Efforts to reduce poverty and increase incomes of the population.

2.Provide health education about the danger of malnutrition and the important of safety and enough nutrition, food hygiene and food handlers.

3.Promoting appropriate diet and healthy lifestyles.

4.Control the quality of the food and its safe.

5.Food must contain all vitamins and micronutrient needed by the body to increase the resistant and the immune system of the body.

*Obesity.*A type of malnutrition which is highly prevalent and readily visible, is obesity, the by product of affluence and of a way of life in which the levels of caloric intake and energy expenditure are unbalanced. Aside from the often serious social and psychological stigma created by obesity, it is also associated with an increased risk of many diseases and of aggravating others; gross obesity generally shortens the life span itself. Cardiovascular and pulmonary diseases, hypertension, diabetes, cholelithiasis, peripheral vascular and orthopedic disorders are among the medical hazards linked to or aggravated by adiposity. Within the present capacity of the physician, the treatment of obesity is often discouraging. It is the nature of obesity to perpetuate itself. Thus, it may well be that prevention of excessive weight gain will offer the most effective and practical approach to the problem (figure 6.7.).

Assessment of overweight*:overweight is the weight of a person if it does not exceed 10%, this does not lead to any physiological disorders in his body and the occurrence of diseases that are recorded in obesity.*

Grades of the obesity*:*

I — adipopexis exceeds from normal weight to 10-29 % ;

II — adipopexis exceeds from normal weight to 30-49 %;

III— adipopexis exceeds from normal weight to 50-99 % ;

IV — adipopexis exceeds from normal weight to 100 % and more.

In cases of high physical development, if the BMI is between *25-30,* it is considered obesity of **the *first degree,*** if it is between *30-35,* it is considered as obesity of **the *second degree***, and if it is higher than *40*, it is considered as obesity of **the *third degree***.

For example:according to the height-weight index of a 25-year-old boy, his normal weight should be 70kg. Calculate the degree of obesity in this young man if the body weight is 115 kg.

Calculation:115-70= 40 kg.So, simple calculation of degree of obesity, you must 40:70=0,6 or 60%,this is III grades obesity (BMI— higher than 40, it is considered as obesity of the third degree).

Clinical types of obesity:

1. Stable type. In this case body weight is constant high.

2. Progressive type, when body weight constantly increases.

3. Retrogressive type of obesity accompanies by decrease of body weight.

Figure 6.7. Obesity

Factors affecting obesity: nature- is it genetically determined. Thrifty metabolism- stores fat more readily than others due to cellular programming do. Fraternal twins often vary less in weight than less closely related individuals do. Set Point- is weight closely regulated at a certain level by body. Appears that it is much harder for some people to gain or lose weight. Body monitors thyroxin levels, BG, and triglycerides. Maybe after certain point body adapts to new weight and resists change.

7.3. Food poisonings

Food poisoning has been common in all periods of human society. Numerous restrictions on the consumption of certain products mentioned in many ancient documents indicate that at the cost of a large number of victims, people came to the correct definition of the harmfulness of a product or type of food. Even at the dawn of modern civilization, it became necessary to distinguish sick from healthy animals during slaughter in order to prevent the use of low-quality meat for nutrition. With the development of scientific knowledge in explaining the causes of food poisoning, various theories were created, among which the theory of the chemical nature of poisoning became the most widespread.

In the last century, theory dominated the explanation of food poisoning. This term “ptomains” was introduced by the Italian scientist Selmi, 1872. The doctrine of ptomains as the cause of food poisoning was generally accepted (ptomains are poisonous substances formed in products when they rot – cadaverine, putrenine, etc.).

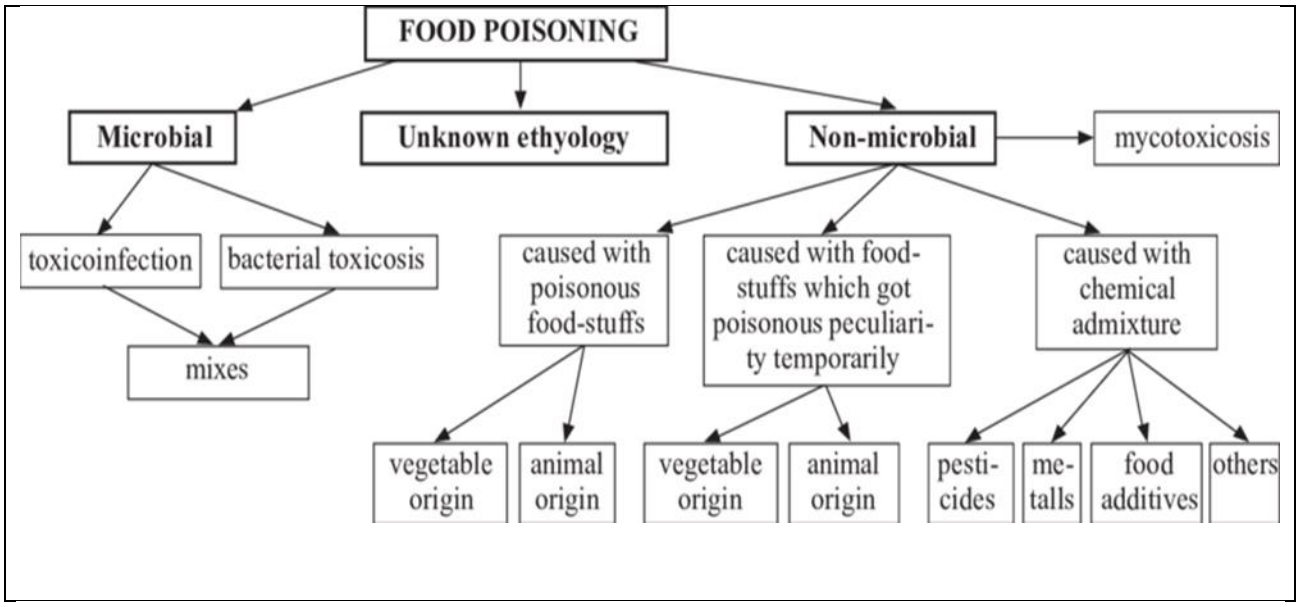
The rapid development of bacteriology at the end of the last century fundamentally undermined the theory of ptomains and allowed us to find the right way to determine the etiology

of food poisoning. Since this period, the bacterial nature of food poisoning (toxicoinfections) has been generally recognized.

Bollinger was the first to establish a link between food poisoning and the consumption of meat from sick animals. In 1876, based on the study of a large amount of factual material (17 outbreaks with 2400 victims), he showed an undoubted correlation between the occurrence of poisoning with diseases of slaughter animals. However, Bollinger failed to reveal the nature and essence of this connection. This was completed in 1888 by A. Gertner, who for the first time revealed the bacterial nature of food poisoning. He isolated, during an outbreak of food poisoning in Frankenhausen, from the organs of a deceased person and from the meat of a cow with enteritis, a microorganism of the same species.

A significant contribution to the study of human food poisoning was made by Van Ermengam, who in 1897 deciphered the cause of the most dangerous poisoning of people – botulism, isolating a microbe called botulism, which means sausage. Thus, the etiological (causal) role of microorganisms in most food poisoning of people has become increasingly obvious. This scientifically based experience made it possible to subsequently decipher many outbreaks of diseases in humans caused by microorganisms found in food.*Thus, in the development of the doctrine of food poisoning, 5 periods are distinguished.*

Foodborne illnesses are infections or irritations of the gastrointestinal (GI) tract caused by food or beverages that contain harmful bacteria, parasites, viruses, or chemicals. Foodpoisonclassification: ***microbial, non-microbial, unknown etiology (scheme 7.3.1)***. Most foodborne illnesses are acute, meaning they happen suddenly and last a short time, and most people recover on their own without treatment.



Scheme 7.3.1.Food poison classification

Rarely, foodborne illnesses may lead to complications that are more serious. Range 20 – 80 million cases a year (U.S.), 325,00 hospitalizations, 5,000 deaths (U.S.), 10 – 83 billion cost from absence from work or school, medical costs.

Anyone can get a foodborne illness. However, some people are more likely to develop foodborne illnesses than others, include: infants and children; pregnant women and their fetuses; older adults; people with weak immune systems.

Risk group– infants and the elderly are at greater risk for food poisoning. A person is also at greater risk if any of the following is true: pre-existing medical condition, such as chronic kidney failure or diabetes; antibiotic or histamine-blocking medicines; sickle-cell anemia and other problems with red blood cells; weakened immune system; travel in an area where contamination is more likely; food shortage. These groups also have a greater risk of developing severe symptoms or complications of foodborne illnesses.

Symptoms of foodborne illnesses depend on the cause. Common symptoms of many foodborne illnesses include: vomiting, diarrhea or bloody diarrhea, abdominal pain, fever, chills. Symptoms can range from mild to serious and can last from a few hours to several days. Foodborne illnesses may lead to dehydration, hemolytic uremic syndrome (HUS), and other complications. Acute foodborne illnesses may also lead to chronic or long lasting health problems.

Dehydration when someone does not drink enough fluids to replace those that are lost through vomiting and diarrhea, dehydration can result. When dehydrated, the body lacks enough fluid and electrolytes-minerals in salts, including sodium, potassium, and chloride-to function properly.

Infants, children, older adults, and people with weak immune systems have the greatest risk of becoming dehydrated.

Signs of dehydration are – excessive thirst, infrequent urination, dark-colored urine, lethargy, dizziness, or faintness. Signs of dehydration in infants and young children are-dry mouth and tongue, lack of tears when crying, no wet diapers for 3 hours or more, high fever, unusually cranky or drowsy behavior, sunken eyes, cheeks, or soft spot in the skull. Also, when people are dehydrated, their skin does not flatten back to normal right away after being gently pinched and released.

To diagnose foodborne illnesses, health care providers ask about symptoms, foods and beverages recently consumed, and medical history. Health care providers will also perform a physical examination to look for signs of illness. Diagnostic tests for foodborne illnesses may include a stool culture, in which a sample of stool is analyzed in a laboratory to check for signs of infections or diseases. A sample of vomit or a sample of the suspected food, if available, may also be tested. A health care provider may perform additional medical tests to rule out diseases and disorders that cause symptoms similar to the symptoms of foodborne illnesses. If symptoms of foodborne illnesses are mild and last only a short time, diagnostic tests are usually not necessary. Severe dehydration may require intravenous fluids and hospitalization. Untreated severe dehydration can cause serious health problems such as organ damage, shock, or coma—a sleeplike state in which a person is not conscious.

HUS. Hemolytic uremic syndrome is a rare disease that mostly affects children younger than 10 years of age. HUS develops when *E. coli* bacteria lodged in the digestive tract make toxins that enter the bloodstream. The toxins start to destroy red blood cells, which help the blood to clot, and the lining of the blood vessels. The severity of clinical feature depends on type and quantity of the causal agents, age of the individual and his body weight, physiological condition of the body.***Microbial food poisonings***.This group poising divided on the 3 groups*:toxicoinfection, toxicosis, mixed.*The group of food poisoning – toxicosis is also divided on 2 groups*: bacterial toxicosis, mycotoxicosis.*Bacteria are tiny organisms that can cause infections of the GI tract. Not all bacteria are harmful to humans. Some harmful bacteria may already be present in foods when they are purchased. Raw foods including meat, poultry, fish and shellfish, eggs, unpasteurized milk and dairy products, and fresh produce often contain bacteria that cause foodborne illnesses. Bacteria can contaminate food making it harmful to eat-at any time during growth, harvesting or slaughter, processing, storage, and shipping (figure 7.12).

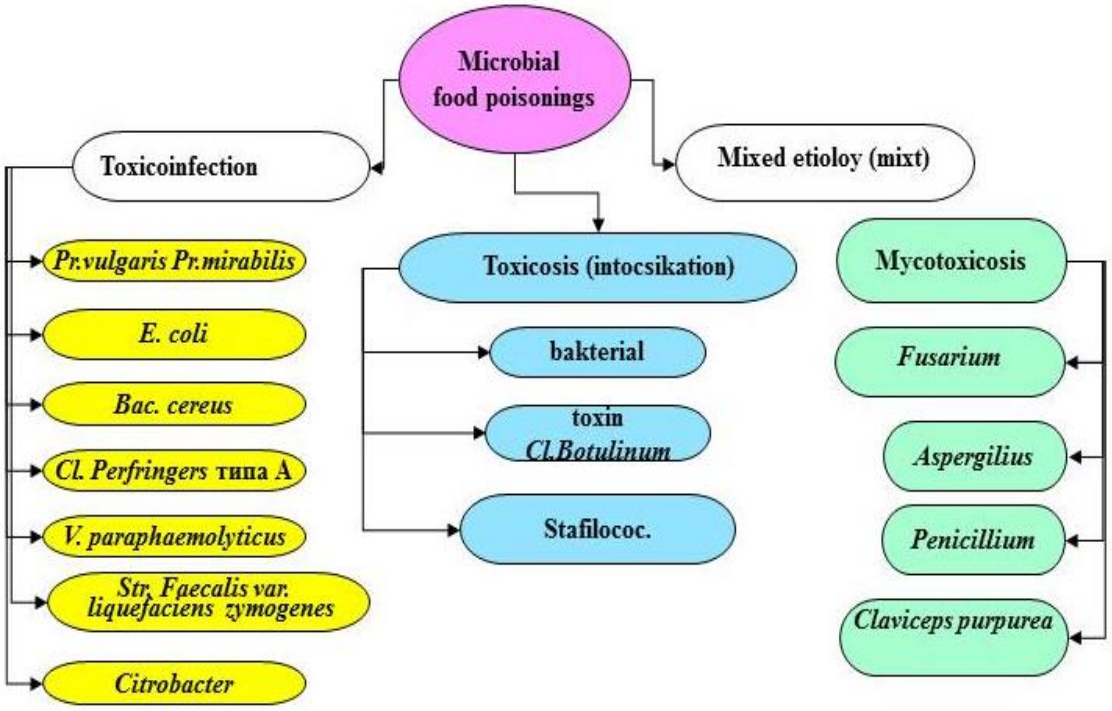


Figure 7.12. Microbial food poisonings

Foods may also be contaminated with bacteria during food preparation in a restaurant or home kitchen. If food preparers do not thoroughly wash their hands, kitchen utensils, cutting boards, and other kitchen surfaces that come into contact with raw foods, cross-contamination—the spread of bacteria from contaminated food to uncontaminated food—may occur. If hot food is not kept hot enough or cold food is not kept cold enough, bacteria may multiply. Bacteria multiply quickly when the temperature of food is between 40 and 140 degrees. Cold food should be kept below 40 degrees and hot food should be kept above 140 degrees.

Bacteria multiply more slowly when food is refrigerated, and freezing food can further slow or even stop the spread of bacteria. However, bacteria in refrigerated or frozen foods become active again when food is brought to room temperature. Thoroughly cooking food kills bacteria. Many types of ***bacteria*** cause foodborne illnesses. Examples include: bacteria multiply more slowly when food is refrigerated, and freezing food can further slow or even stop the spread of bacteria. However, bacteria in refrigerated or frozen foods become active again when food is brought to room temperature. Thoroughly cooking food kills bacteria. Many types of ***bacteria*** cause foodborne illnesses.

Characteristic features of toxic infections: suddenly development of the disease with a short incubation period,the simultaneous onset of the disease in all people consuming food

contaminated with pathogenic microorganisms, short-term stopped of the disease after the discontinuation of the epidemiologically dangerous product.

Salmonella, a bacterium found in many foods, including raw and undercooked meat, poultry, dairy products, and seafood. Salmonellamay also be present on eggshells and inside eggs. This is a classic example of a food-borne infection. There are more than 1000 different serotypes but the common one is salmonella typhimurium. Incubation period: usually 12-14 hours. Clinical symptoms: diarrhea, fever, vomiting and abdominal pain.Prevention: in salmonella food poisoning the carrier state persists on the average for about 14 days after infection but may be much longer, and the patient must not be allowed to handle food until he has stopped excreting the organism. A reduction in the high incidence of food poisoning can best be achieved by improving the standards of personal hygiene, especially in those handling food, and by stressing the importance of hand-washing after using the lavatory. Increasing facilities for low temperature storage of food which has to be kept for some hours or days before being consumed is of the greatest importance. It is essential to keep frozen poultry at room temperature for at least eight hours before cooking or pathogens at the center may survive unharmed.

Clostridium perfringens is an anaerobic, gram-positive, spore forming rod (anaerobic means unable to grow in the presence of free oxygen). It is widely distributed in the environment and frequently occurs in the intestines of humans and many domestic and feral animals. Spores of the organism persist in soil, sediments, and areas subjected to human or animal fecal pollution. Perfringens food poisoning is the term used to describe the common foodborne illness caused by C. perfringens. A more serious but rare illness is also caused by ingesting food contaminated with type C strains. The latter illness is known as enteritis necroticans or pigbel disease. The common form of perfringens poisoning is characterized by intense abdominal cramps and diarrhea which begin 8–22 h after consumption of food-stuffs containing 100 large numbers of those C. perfringens bacteria capable of producing the food poisoning toxin. The illness is usually over within 24 hour but less severe symptoms may persist in some individuals for 1 or 2 weeks. A few deaths have been reported as a result of dehydration and other complications. Necrotic enteritis caused by C. perfringens is often fatal. This disease also begins as a result of ingesting large numbers of the causative bacteria in contaminated food-stuffs. Deaths from necrotic enteritis pigbel syndrome are caused by infection and necrosis of the intestines and from resulting septicemia. This disease is very rare. In most instances, the actual cause of poisoning by C. perfringens is temperature abuse of prepared foodstuffs. Small numbers of the organisms are often present after cooking and multiply to food poisoning levels during cool down and storage of pre-pared foodstuffs. Meat, meat products, and gravy are the food-stuffs most frequently implicated. Institutional feeding (such as school cafeterias, hospitals, nursing homes, prisons, etc.)

where large quantities of food are prepared several h before serving is the most common circumstance in which perfringens poisoning occurs. The young and elderly people are the most frequent victims of perfringens poisoning. Except the case of pigbel syndrome, complications are few in persons under 30 years of age. Elderly persons are more likely to experience prolonged or severe symptoms. Standard bacteriological culturing procedures are used to detect the organism in implicated food-stuffs and in feces of patients.

Serological assays are used for detecting enterotoxin in the feces of patients and for testing the ability of strains to produce toxin. The procedures take 1–3 days.

Bacillus cereus is a gram-positive, facultative aerobic spore former which cells are large rods and whose spores do not swell the sporangium. B. cereus food poisoning is the general description, although two recognized types of illness are caused by two distinct metabolites. The diarrheal type of illness is caused by a large molecular weight protein, while the vomiting (emetic) type of illness is believed to be caused by a low molecular weight, heat-stable peptide. The symptoms of B. cereus diarrheal type food poisoning mimic those of *Campylobacter jejuni*.

C. jejun, found in raw or undercooked chicken and unpasteurized milk. Campylobacter jejune is a gram-negative slender, curved, and motile rod. It is a microaerophilic organism, which means it has a requirement for reduced levels of oxygen. It is relatively fragile, and sensitive to environmental stresses (21% oxygen, drying, heating, disinfectants, and acidic conditions). Because of its microaerophilic characteristics the organism requires 3 to 5% oxygen and 2 to10% carbon dioxide for optimal growth conditions. This bacterium is now recognized as an important enteric pathogen. Illness generally lasts for 7–10 days, but relapses are often (about 25% of cases).

Shigella, a bacterium spread from person to person. These bacteria are present in the stools of people who are infected. If people who are infected do not wash their hands thoroughly after using the bathroom, they can contaminate food that they handle or prepare. Water contaminated with infected stools can also contaminate produce in the field.

Escherichia coli (E. coli), which includes several different strains, only a few of which cause illness in humans. *E. coli O157:H7* is the strain that causes the most severe illness. Common sources of *E. coli* include raw or undercooked hamburger, unpasteurized fruit juices and milk, and fresh produce.The illness is usually self-limited and lasts for an average of 8 days. Some individuals exhibit watery diarrhea only. Infective dose is unknown, but from a compilation of outbreak data, including the organism's ability to be passed person-to-person in the day-care setting and nursing homes, the dose may be similar to that of Shigella spp. (as few as 10 organisms).

Listeria monocytogenes (L. monocytogenes), which has been found in raw and undercooked meats, unpasteurized milk, soft cheeses, and ready-to-eat deli meats and hot dogs.

The group of food poisoning –bacterial toxicosis is botulism and staphylococcal toxicosis.

Staphylococcal food poisoning .Food borne illness due to staphylococci depends on the presence of sufficient toxin in the food. The source of the staphylococci is often food handlers with skin infections (boils), spread through pustules of fingertips and nasal infections of foodstuff. Concentration of sodium chloride 12% helps for stopped the development of staphylococcus and the formation of a toxin.

Symptoms: incubation period is very short- 2 – 4 hours; symptoms – include nausea, vomiting, abdominal pain, prostration, dehydration, and subnormal body temperature. Incriminated foods include ham, poultry, egg salads, meat, fish, vegetables, milk and its products.

Clostridium botulinum (C. botulinum). It is a very serious disease with high percentage of mortality. Human botulism is a serious but relatively rare disease. The disease is an intoxication caused by extremely potent toxins preformed in foods. The toxins are produced by the bacterium Clostridium botulinum. Person to person transmission of botulism does not occur. There are seven recognized types of botulism. Four of these (types A, B, E and rarely F) cause human botulism.*Types of botulism is A and E toxin have a higher toxicity*. Types C, D and E cause illness in mammals, birds and fish. The sporulated form of the bacterium is commonly found in soils, aquatic sediments and fish. The spores are heat-resistant. Under anaerobic conditions, botulinum spores can germinate, and the bacterium grow and produce the toxin. Ingestion of the toxin present in improperly prepared food is dangerous and may be fatal. Botulism is mainly a food borne intoxication but it can also be transmitted through wound infections or intestinal infection in infants. Food borne botulism that occurs when the organism Clostridium botulinum is allowed to grow and produce toxin in food which is then eaten without sufficient cooking to inactivate the toxin. Clostridium botulinum is an "anaerobic bacterium", which means it can only grow in the absence of oxygen. Therefore, the growth of the bacteria and the formation of toxin tend to occur in products with low oxygen content and the right combination of storage temperature and preservative parameters. This happens most often in lightly preserved foods such as fermented, salted or smoked fish and meat products and in inadequately processed home canned or home bottled low acid foods such as vegetables.

Source: the botulin toxin has been found in a variety of foods, including low-acid preserved vegetables, such as green beans, spinach, mushrooms, and beets; fish, including canned tuna, fennented, smoked and salted fish; and meat products, such as ham, chicken and sausage. The toxin is destroyed by normal cooking processes (heating at 85°C for five minutes or boiling for a few minutes). Clostridium botulin will not grow, and therefore the toxin will not be formed in

acidic foods (pH less than 4.6). However, the low pH will not inactivate any preformed toxin. Adverse effects of the pure toxin have been reported as a result of its medical and/or cosmetic use in patients. Lethal amount of botulinum toxin for humans is equal *35 mcg.*Infant botulism is rare. It occurs when infants ingest spores, which germinate to produce bacteria that reproduce in the gut and release the toxin.

Clinical feature: diplopia, blurring of vision, paralysis of crania's nerves, respiratory paralysis (figure 7.13). The symptoms are not caused by the organism itself, but by the toxin that the bacterium releases. Incidence of botulism is low, but the mortality rate is high if treatment is not immediate and proper. The disease can be fatal in 5 to 10% of cases. The characteristic early symptoms and signs are marked fatigue, weakness, and vertigo, usually followed by blurred vision, dry mouth, and difficulty in swallowing and speaking. Vomiting, diarrhea, constipation and abdominal swelling may

Figure 7.13. Clinical feature on botulism diseases

occur. The disease can progress to weakness in the neck and arms, after which the respiratory muscles and muscles of the lower body are affected. The paralysis may make breathing difficult. Similar symptoms usually appear in individuals who shared the same food. Most cases recover, if given proper and immediate treatment, including prompt diagnosis, early administration of antitoxin and intensive respiratory care.

Viruses. Viruses are tiny capsules, much smaller than bacteria, that contain genetic material. Viruses cause infections that can lead to sickness. People can pass viruses to each other. Viruses are present in the stool or vomit of people who are infected. People who are infected with a virus may contaminate food and drinks, especially if they do not wash their hands thoroughly after using the bathroom. Common sources of foodborne viruses include: food prepared by a person infected with a virus; shellfish from contaminated water; produce irrigated with contaminated water.

Mycotoxicosis. In addition to causing food losses, contamination of foods by moulds such as Aspergilium spp. Can lead to the presence of aflatoxin (figure 7.14) and Fusarium. The aflatoxins,

Figure 7.14. Wheat and corn contaminated by Aflatoxins

now regards as the most important mycotoxins, are produced by the molds Aspergillus flavus and A parasitic us. *Aflatoxins, patulin, fumanisinreveal high carcinogenic activity.* Before they are biologically active, they have to be metabolized. Aflatoxin is causes a decrease in body weight in the nutritional status elderly, and delay in the development of growth in children.

Consequently, recent data show lower aflatoxin concentrations. Better analytical methods and increasing analytical quality control have also contributed to more accurate and reliable data.Aflatoxins have been reported in a range of tree nutsand in groundnuts (peanuts), in grains such as rice, millet and maize, and in pulses, spices and figs. Peanut butter may contain aflatoxins, and breakfast foods prepared from contaminated grain may, on occasion, contain measurable concentrations. Aflatoxins have also been reported in fermented beverages and even in dried fish.The concentration of aflatoxin varies markedly with farming practices, storage conditions, insect damage and climate, as well as with crop species and cultivar. There is a substance, *chlorophyll,* weakens the effect of aflatoxin in vegetables and greens.WHO, FAO and UNEP, either singly or in association, have ongoing programmers dealing with mycotoxin prevention and control in agricultural crops.

The mycotoxin ochratoxin A, produced by some Penicillium and Aspergillus strains, is being increasingly recorded in human food, especially cereals such as rye and wheat, and in imported coffee beans. The fungi are found on growing crops but develop particularly on crops in storage. Toxin production depends on such factors as temperature and humidity, especially during harvest. From a climatological point of view Denmark, Germany, Norway, Sweden and the United Kingdom are at risk, as are also the Danube lowlands, Bulgaria, Romania and the former Yugoslavia. In Denmark during the wet autumn of 1987, higher concentrations of ochratoxin A were reported in grain compared with harvests in other years and with grain imported from drier

climates. Ochratoxin A is also found in foods of animal origin, such as those from poultry and pigs that have been fed contaminated feed.

Ergotizm. Source: bread and flour contaminated by Calvicep purpurea (figure 7.15).

Clinical picture: vomiting, diarrhea, disorders of nervous system (convolutions).The infested grain can be easily removed from healthy grain by floating in 20% salt water.

Figure 7.15. Wheat contaminated by Calvicep purpurea

*Fusarius.*Sources :bread and wheat contaminated by Fusarium graminearum (figure 7.16). Clinical picture:gastrointestinal disorders, disorders of nervous system.

Figure 7.16. Wheat contaminated by Fusarium graminearum

Septic tonsillitis (alikia). Sources: cereal and wheat contaminated by Fusarium Sporotrichiodes.

Clinical picture: bleeding of the internal organs, hemorrhagic tonsillitis, and high fever.

*The main principles of prevention of microbial food poisoning:*isolation of the source of infection, cutting the path of contamination of food products with agents that can cause poisoning, preventing the growth of microorganisms and the formation of toxins in food.

Non-microbial food poisonings.Plants that are poisonous in nature (wild flowers, berries, toxic plants, mushrooms). Components of the product, parts of the product that are toxic (milk, caviar of some fish species). Products that have become toxic due to storage conditions (bones of cherries, apricots, almonds, honey poisoning, potatoes lying in the sun, sprouted potato tubers, raw fresh beans (white), beech nuts,fish eggs stored in inadequate conditions). Poisoning by poisonous substances that are part of the kitchen utensils (copper, zinc, lead). This applies to pots,

frying pans, plastic dishes.They are not spread so widely as microbial food poisonings but can have high incidence in the regions with poor sanitary control on food safety.

Shellfish Poisoning. Shellfish poisoning is caused by a group of toxins elaborated by planktonic algae (dinoflagellatesin most cases) upon which the shellfish feed. The toxins are accumulated and sometimes metabolized by the shellfish (figure 7.17). The 20 toxins responsible for paralytic shellfish poisonings (PSP) are all derivatives of saxitoxin. Diarrheic shellfish poisoning (DSP) is presumably caused by a group of high molecular weight polyether's, including okadaic acid. Neurotoxic shellfish poisoning (NSP) is the result of exposure to a group of polyether's called breve-toxins. Amnesic shellfish poisoning (ASP) is caused by the unusual amino acid, domoic acid, as the contaminant of shellfish.

Ingestion of contaminated shellfish results in a wide variety of symptoms, depending upon the toxin present, their concentrations in the shell-fish and the amount of contaminated shellfish consumed. In the case of PSP, the effects are predominantly neurological and include tingling, burning, numbness, drowsiness, incoherent speech, and respiratory paralysis. Worse characterized are the symptoms associated with DSP, NSP, and ASP. DSP is primarily observed as a generally mild gastrointestinal disorder, nausea, vomiting, diarrhea, and abdominal pain accompanied by chills, headache, and fever.

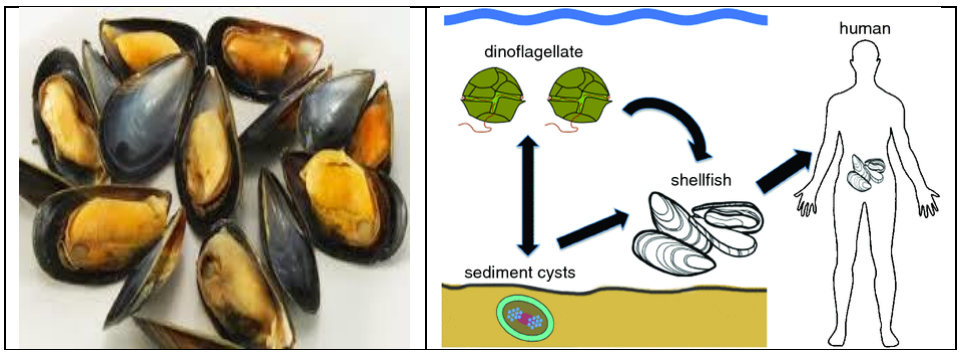


Figure 7.17. Scheme of Shellfish poisoning

Both gastrointestinal and neurological symptoms characterize NSP, including tingling and numbness of lips, tongue, and throat, muscular aches, dizziness, reversal of the sensations of hot and cold, diarrhea, and vomiting. ASP is characterized by gastrointestinal disorders (vomiting, diarrhea, abdominal pain) and neurological problems (confusion, memory loss, disorientation, seizure, coma). Diagnosis of shellfish poisoning is based entirely on observed symptomatology and recent dietary history. All shellfish (filter-feeding mollusks) are potentially toxic. Symptoms of the PSP develop fairly rapidly, within 0.5 to 2 hour after ingestion of the shellfish, depending on the amount of toxin consumed. In severe cases respiratory paralysis is common, and death may

occur if respiratory support is not provided. When such support is applied within 12 hour of exposure, recovery usually is complete without side effects. In un-usual cases, because of the weak hypotensive action of the toxin, death may occur from cardiovascular collapse despite respiratory support.

NSP: The onset of this disease occurs within a few minutes to a few hour; duration is fairly short, from a few hour to several days. Recovery is complete with few after effects; no fatalities have been reported.

DSP: The onset of the disease, depending on the dose of toxin ingested, may be as little as 30 min to 2 to 3 hour, with symptoms of the illness lasting as long as 2 to 3 days. Recovery is complete with no after effects; the disease is generally not life threatening.

ASP: the toxicosis is characterized by the onset of gastrointestinal symptoms within 24 hour; neurological symptoms occur within 48 hour. The toxicosis is particularly serious in elderly patients, and includes symptoms reminiscent of Alzheimer's disease. All fatalities to date have involved elderly patients. All humans are susceptible to shellfish poisoning. Elderly people are apparently predisposed to the severe neurological effects of the ASP toxin.

Scombroid Poisoning (Histamine Poisoning). Scombroid poisoning is caused by the ingestion of food-stuffs that contain high levels of histamine and possibly other vasoactive amines and compounds. Histamine and other amines are formed by the growth of certain bacteria and the subsequent action of their decarboxylase enzymes on histidine and other amino acids in food, either during the production of a product such as Swiss cheese or by spoilage of foodstuffs such as fishery products, particularly tuna or mahi-mahi. However, any food that contains the appropriate amino acids and is subjected to certain bacterial contamination and growth may lead to scombroid poisoning when ingested.

Initial symptoms may include a tingling or burning sensation in the mouth, a rash on the upper body and a drop in blood pressure. Frequently, headache sand itching of the skin are encountered. The symptoms may progress to nausea, vomiting, and diarrhea and may require hospitalization, particularly in the case of elderly or impaired patients. Diagnosis of the illness is usually based on the patient's symptoms, time of the onset, and the effect of treatment with antihistamine medication. The suspected food must be analyzed within a few h fore valuating levels of histamine to confirm a diagnosis. The onset of intoxication symptoms is rapid, ranging from immediate to 30 min. The duration of the illness is usually 3 hour, but may last for several days. All humans are susceptible to scombroid poisoning; however, the symptoms can be severe for the elderlies and for those taking medications such as isoniazid (figure 7.18).

6. 2.

Figure 7.18. Toxic and dangerous fish:1.Yellow margin Triggerfish; 2.Black spotted Puffer fish

Non-microbial food poisoning by fungi is associated with the season, in winter they practically do not occur. There is a well-known list of poisonous mushrooms, which includes fly agarics, morels, pale toadstool, false honey agarics and other species.. Bone fruit can also be poisoned if consumed in food in unlimited quantities.

Mushroom Poisoning (Toadstool Poisoning).Mushroom poisoning is caused by the consumption of raw or cooked fruiting bodies (mushrooms, toadstools) of a number of species of higher fungi. The most dangerous toadstool, it provokes acute poisoning, which ends in 50- 90% with a lethal outcome The term toadstool (from the German Todesstuhl, death's stool) is commonly given to poisonous mushrooms, but for individuals who are not experts in mushroom identification there are generally no easily recognizable differences between poisonous and nonpoisonous species. Old wives' tales notwithstanding, there is no general rule of thumb for distinguishing edible mushrooms and poisonous toadstools.

The toxins (*amanitin, phalloidin)* involved in mushroom poisoning are produced naturally by the fungi themselves, and each individual specimen of a toxic species should be considered equally poisonous. Most mushrooms that cause human poisoning cannot be made non-toxic by cooking, canning, freezing, or any other means of processing.

Mushroom poisonings are generally acute and are manifested by a variety of symptoms and prognoses, depending on the amount and species consumed. Because the chemistry of many of the mushroom toxins (especially the less deadly ones) is still unknown and positive identification of the mush-rooms is often difficult or impossible, mushroom poisonings are generally categorized by their physiological effects. There are four categories of mushroom toxins: protoplasmic poisons (poisons that result in generalized destruction of cells, followed by organ failure); neurotoxins (compounds that cause neurological symptoms such as profuse sweating, coma, convulsions, hallucinations, excitement, depression, spastic colon); gastrointestinal irritants(compounds that produce rapid, transient nausea, vomiting, abdominal cramping, and

diarrhea); and disulfiram like toxins. Mushrooms in this last category are generally nontoxic and produce no symptoms unless alcohol is consumed within 72 hour after eating them, in this case a short-lived acute toxic syndrome is produced.

Mushroom poisonings are almost always caused by ingestion of wild mushrooms that have been collected by no specialists (although specialists have also been poisoned) (figure 7.19). Poisoning by the amanitins is characterized by a long latent period (range 6-48 hour, average 6-15 hour) during which the patient shows no symptoms.

1. 2. 3.

Figure 7.20. Dangerous mushroom:
1.Amanita muscaria; 2.Amanita gemmate; 3.Tricholoma saponaceum

Symptoms appear at the end of the latent period in the form of sudden, severe seizures of abdominal pain, persistent vomiting and watery diarrhea, extreme thirst, and lack of urine production. If this early phase is survived, the patient may appear to recover for a short time, but this period will generally be followed by a rapid and severe loss of strength, prostration, and pain-caused restlessness. Death in 50–90% of the cases from progressive and irreversible liver, kidney, cardiac, and skeletal muscle damage may follow within 48 h (large dose), but the disease more typically lasts for 6 to 8 days in adult sand 4 to 6 days in children.

Two or three days after the onset of the later phase, jaundice, cyanosis, and coldness of the skin occur. Death usually follows a period of coma and occasionally convulsions. If recovery occurs, it generally requires at least a month and is accompanied by enlargement of the liver. Autopsy will usually reveal fatty degeneration and necrosis of the liver and kidney.

Nonbacterial food poisoning alsoSolanine poisoig. Solanine poisoig. is an alkaloid found in plants of the nightshade family (Solanaceae), specifically tomatoes, eggplant, and most significantly, potatoes. The majority of solanine poisoning reported has arisen from the ingestion of greened potatoes. When exposed to light and allowed to turn green and/or sprout, potatoes produce a number of alkaloid glycosides containing the cholesterol derivativesolanidine. Two of these glycosides, α-solanine and α-chaconine, are found in highest concentration in the peels and

sprouts. Some solanine can be removed by boiling but not by baking. The major effect of α-solanine and α-chaconine is the reversible inhibition of cholinesterase. Cardiotoxic and teratogenic effects have also been reported. Solanine glucoside accumulates the most in the potato, eggplant and tomato.

Clinical manifestations of solanine and chaconine poisoning intoxication occur within 7-19 hour after ingestion. The most common symptoms are vomiting, abdominal pain, and diarrhea; in more severe instances of poisoning, neurologic symptoms, including drowsiness, apathy, confusion, weakness, and vision disturbances, are rarely followed by coma or death.Treatment of solanine poisoning is largely supportive. In the most severe cases, symptoms resolve within 1-2 week.

Honey intoxication. Honey intoxication is caused by the consumption of honey produced from the nectar of rhododendrons.

The grayanotoxins cause the intoxication. The specific grayanotoxins vary with the plant species. These compounds are diterpenes, polyhydroxylated cyclic hydrocarbons that do not contain nitrogen. Other names associated with the disease is rhododendron poisoning, mad honey intoxication orgrayanotoxin poisoning. The intoxication is rarely fatal and generally lasts for no more than 24 h. Generally the disease induc-es dizziness, weakness, excessive perspiration, nausea, and vomiting shortly after the toxic honey is ingested. Other symptoms that can occur are low blood pressure or shock, bradyarrhythmia (slowness of the heart beat associated with an irregularity in the heart rhythm), sinus bradycardia (a slow sinus rhythm, with a heart rate less than 60), nodal rhythm(pertaining to a node, particularly the atrioventricular node), Wolff — Parkinson — White syndrome (anomalous atrioventricular excitation) and complete atrioventricular block.Grayanotoxin poisoning most commonly results from the ingestion of grayanotoxin-contaminated honey, but although it may result from the ingestion of the leaves, flowers, and nectar of rhododendron.

Pyrrolizidine Alkaloids Poisoning. Pyrrolizidine alkaloid intoxication is caused by consumption of plant material containing these alkaloids. The plants may be consumed as food, for medicinal purposes, or as contaminants of other agricultural crops (figure 7.21). Cereal crops and forage crops are sometimes contaminated with pyrrolizidine producing weeds, and the

alkaloids find their way into flour and other food-stuffs, including milk from cows feeding on these plants. Many plants from the Boraginaceae, Compositae, and Leguminosae families contain well over 100 hepatotoxic pyrrolizidine alkaloids. Most cases of pyrrolizidine alkaloid toxicity result in moderate to severe liver damage. Gastrointestinal symptoms are usually the first sign of intoxication, and consist predominantly of abdominal pain with vomiting and the development of ascites.

Death may ensue from 2 weeks to more than 2 years after poisoning, but patients may recover almost completely if the alkaloid intake is discontinued and the liver damage has not been too severe. Evidence of toxicity may not become apparent until sometime after the alkaloid is ingested. The acute illness has been compared to the Budd – Chiari syndrome (thrombosis of hepatic veins, leading to liver enlargement, portal hypertension, and ascites). Early clinical signs include nausea and acute upper gastric pain, acute abdominal distension with prominent dilated veins on the abdominal wall, fever, and biochemical evidence of liver dysfunction. Fever and jaundice may be present. In some cases, the lungs are affected; pulmonary edema and pleural effusions have been observed.

1. **2.** **3.**

Figure 7.21.Toxic plants: 1. Black Elder 2. Bag Arum 3. Dragon S-Teeth

Lung damage maybe prominent and has been fatal. Chronic illness from ingestion of small amounts of the alkaloids over a long period proceeds through fibrosis of the liver to cirrhosis, which is indistinguishable from cirrhosis of other etiology. Reports of acute poisoning among humans are relatively rare. Most result from the use of medicinal preparations as home remedies. However, intoxications of range animals sometimes occur in are asunder drought stress, where plants containing alkaloids are common. Milk from dairy animals can become contaminated with the alkaloids, and alkaloids have been found in the honey collected by bees for-aging on toxic plants. Mass human poisonings have occurred in other countries when cereal crops used to prepare food were contaminated with seeds containing pyrrolizidine alkaloid. All humans are

believed to be susceptible to the hepatotoxic pyrrolizidine alkaloids. Home remedies and consumption of herbal teas in large quantities can be a risk factor and are the most likely causes of alkaloid poisonings in the developed countries.

Chemicals. Harmful chemicals that cause illness may contaminate foods such as:fish or shellfish, which may feed on algae that produce toxins, leading to high concentrations of toxins in their bodies. Some types of fish, including tuna and mahi- mahi, may be contaminated with bacteria that produce toxins if the fish are not properly refrigerated before they are cooked or served;certain types of wild mushrooms;unwashed fruits and vegetables that contain high concentrations of pesticides.

Metals. *Cadmium.* As food is the main exposure pathway for cadmium, much attention has been given to this element from areas where industrial contamination and the use of cadmium-containing phosphate fertilizers and sewage sludge have been extensively used. Analysis of archived soil samples has shown that cadmium concentrations in topsoil have increased during the last century (table 7.15). Plant uptake of cadmium depends on soil factors such as acidity and on the plant cultivar. The lowest cadmium levels are in milk, eggs, fruit and meat muscle. Levels in potatoes and other vegetables are higher, together with cereals and grains (although considerably higher values have been found in grains grown in areas with high metal emissions in the former German Democratic Republic). Levels of cadmium in shellfish are appreciably higher than in fish. High levels are also found in animal kidneys.

Table 7.15. Admissible level of different elements in food
(Russian Federation 2.3.2.560-96) (not more than mg/ kg**)**

Element	Meat	Milk	Fish	Bread
Lead	0,5	11,1	1,0	0.35
Mercury	0,03	0,005	0,3	0,015
Copper	5	1	10	7
Zinc	70	5	40	35
Cadmium	0,05	0.03	0,2	0,07

Lead. Lead is one of the most frequently monitored contaminants in food. Emphasis has been placed on monitoring staple foods such as potatoes, wheat and rice, leaf vegetables, canned foods and shellfish. Monitoring of infant foods is also important, since lead levels are of special health concern at this age. Lead concentrations in food items vary markedly depending on location (crops from urban areas generally contain higher concentrations of lead than those from rural

areas), emission sources (surface lead deposition can contaminate leaf vegetables) and processing methods. Levels of lead are generally low in milk, higher in cereals, vegetables and meat muscle, higher again in kidney, liver and fish, and highest in shellfish. Where vegetables are grown in industrial and mining areas, or close to roads where leaded petrol is used in automobiles, very high levels (around two orders of magnitude greater than normal) can be detected mainly from atmospheric deposition of particulates. Food in lead-soldered cans can contribute substantially to intake, although an increasing number of countries have changed to using non-leaded cans. Lead in tap water may also add a consider-able amount of lead to the dietary intake, where soft (acidic) water is supplied through lead piping.

Mercury. Mercury concentrations in food have been extensively studied because of the adverse effects of methyl- mercury on the central nervous system. Fish and shellfish are the main sources of methyl-mercury intake by humans.

Polychlorinated biphenyls. Polychlorinated biphenyls are characterized by environmental persistence. As these compounds are fat soluble, they are widely detected in food, milk, human milk and human tissues. Relatively high concentrations of total PCBs have been routinely reported in a number of food products, especially fish, shellfish, meat and milk, predominantly from industrial countries. Concentrations are elevated in cod liver oil, which is usually not included in consumption or dietary intake studies. The GEMS/Food data bank contains an extensive collection of data illustrating differences in PCB levels among foods and between countries. Production of PCBs only ceased in the former Czechoslovakia in the 1980s. Data from the Czech Republic for 1991a show that just over 24 % of more than 20 000 samples tested exceeded the regulatory limits for PCBs. However, concentrations in foodstuffs are decreasing.

Nitrates. Vegetables and fruit may contain high nitrate concentrations, which are partly influenced by available soil nitrogen, crop variety and growth conditions, including season (nitrate can only be metabolized by plants in the presence of sunlight). Nitrate levels are also high in some meats, and may be comparable to nitrite levels. Nitrate in drinking-water also adds to the nitrate intake. With the large local, national and regional variations, its significance can be small (where nitrate levels are low) or considerable, exceeding the intake from vegetables when levels are high (exceeding guideline values).

Pesticides. *DDT,* of the organ chlorine pesticides, DDT has attracted much attention in the past. Interest has declined in recent years, however, especially in western Europe, as concentrations have declined. DDT is fat soluble, and concentrations in pork, beef and chicken fat and in milk and milk products are still reported by some countries. Comparable reductions have been shown in Denmark and elsewhere .

Hexacholorobenzene. The widespread use of HCB as a fungicide on cereals, coupled with its fat solubility, has led to its widespread occurrence in dairy milk, milk products and human milk. Industrial discharges may also lead to the contamination of seafood products.

Hexachlorocyctohexane. Technical grade HCH consists of a mixture of isomers that have been used as a pesticide in some countries. Gamma-HCH, commonly known as Handan, is the most biologically active isomer and is used more widely. Residues of this and other isomers have been measured in a range of animal fats, dairy milk, fish and vegetables.

Radionuclides. All food contents natural radionuclides. In the context of radiation exposure, the most important is potassium-40, a long-lived radio-nuclide with a half-life of 1.28 x 109 years. Throughout the natural environment, radioactive potassium occurs as a constant proportion of the total potassium. Thus the mean potassium-40 activity can be calculated from typical potassium concentrations in foodstuffs. As potassium is an essential element of all organisms, its concentration is subject to self-regulation by plants and animals. The potassium-40 activity therefore lies in a fairly narrow range and results in a dose of about 0.2 mSv/year.

The radioactive isotope carbon-14 (C^{14}) is created in the upper atmosphere at a constant rate. The activity does not change during assimilation of carbon dioxide in photosynthesis and remains constant throughout the whole food-chain up to man. The total activities of potassium-40 and carbon-14 in humans are comparable, but the dose of carbon-14 is lower at 0.01 mSv/year.

Thorium and natural uranium have only trace activities in food, as they are very immobile elements in soil. Their rate of uptake by plants is low, as is their absorption by the gut. Enhanced activities in food are found in areas with higher soil levels of uranium and thorium, but intakes usually result in doses below 0.01 mSv/year. The daughter products, radium-226 and radium-228, are of interest because these isotopes behave much like calcium. Radium is much more mobile in soil and is therefore more available to plants. The activity in Brazil nuts may be up to three orders of magnitude greater than that present in foods such as vegetables, fruit, meat and milk.

While potassium-40, thorium, uranium and radium are for the most part taken up by the roots, the main contamination pathway for polonium-210 and lead-210 is direct deposition. Both are daughter nuclides of the gas radon-222 and aggregate in the air as aerosols, which become deposited on the surface of plants. Higher activities are therefore found in leafy vegetables than in cereals or root vegetables. High activity is found in pork and beef liver and in kidneys, and extreme values have been measured in reindeer as a result of their eating lichen, which accumulates heavy metals such as lead and polonium. The normal annual dose resulting from intake of these radionuclides is estimated to be in the order of 0.13 mSv . Some 30 other natural

radionuclides such as tritium and beryllium occur in food, though their activities are so low that the resulting dose is usually negligible.

*The basic principles prevention of non-microbial food poisoning***:**prevention of various harmful extraneous mixtures falling into food, prevention of the use of products that are toxic by nature or toxic under certain conditions.

Unstated etiology.

Disease of Kashin-Bek (Level disease). The disease has a clear territorial location – Priamurye and the Transbaikal zone. Single cases were diagnosed in China, in the central part of Russia. The disease was first described by Kashin at the end of the 19th century, his findings were confirmed decades later, when in the valley of the small river Eve Dr. Beck treated a whole settlement suffering from degenerative changes in the bone system. Most often, the level of the disease affects children and adolescents aged 5-6 to 14-16 years. Obviously, in the period of rapid formation of the bone system and the restructuring of the body due to a lack of calcium in food in children, the spine and limbs are deformed. Also one of the causes of the disease, according to modern microbiologists, may be an imbalance in the content of trace elements in local water sources (an overabundance of silver, magnesium and a lack of selenium).

Haff disease, Yuksovskaya or Sartlan disease or paroxysmal-toxic myoglobinuria (ATPM). Judging by the variety of name variants, the disease has not yet been fully studied. The disease is also clearly localized in the territorial epidemiological picture and is found most often in the coastal zones of the lakes of Western Siberia, the Urals, in some water areas of St. Petersburg, the Baltic countries and Ukraine. Symptoms of Gaffian disease are characterized by sudden, paroxysmal pains in the muscles. The pain is so intense that it leads to a person being temporarily immobilized. Attacks can last up to 4-5 days and cause asphyxia as a result of paralysis of the diaphragm and intercostal muscles. The source of infection is the fish, which in turn becomes toxic due to pollution of the aquatic environment, due to the growth of a poisonous plant – ergot in the area of water bodies, and also because of water contamination with toxins of blue-green and brown algae.

Sigwatera is a toxicoinfection that occurs in peoples living on the coasts of the Indian, Pacific, Central American countries. Toxin produces about 300 varieties of marine and oceanic inhabitants consumed as food. People can poison themselves with octopus, marlin, tuna, mackerel. According to one version, fish accumulate toxin (ichthyosarcotoxin) because they feed on poisonous small organisms. Sigwatera flows extremely hard, causing itching, which is similar to allergic, then the persistent numbness of the tongue and lips is formed. Vomiting and diarrhea, photosensitivity, rash are possible, but the danger is paralysis of the respiratory system. Mortality is 7-10% of the total number of diseases, recovering the victims is difficult and long.

Bovine Spongiform Encephalopathy (BSE) – a fatal, transmissible, neurodegenerative disease of cattle, was first discovered in the United Kingdom in 1985. The cause of the disease was traced to an agent related to scrappier in sheep. The agent affects the brain and spinal cord of cattle and lesions are characterized by sponge-like changes visible in a microscope.

To diagnose foodborne illnesses, health care providers ask about symptoms, foods and beverages recently consumed, and medical history. Health care providers will also perform a physical examination to look for signs of illness.Diagnostic tests for foodborne illnesses may include a stool culture, in which a sample of stool is analyzed in a laboratory to check for signs of infections or diseases. A sample of vomit or a sample of the suspected food, if available, may also be tested. A health care provider may perform additional medical tests to rule out diseases and disorders that cause symptoms similar to the symptoms of foodborne illnesses. If symptoms of foodborne illnesses are mild and last only a short time, diagnostic tests are usually not necessary.

The only treatment needed for most foodborne illnesses is replacing lost fluids and electrolytes to prevent dehydration. Over-the-counter medications such as loperamide (Imodium) and bismuth subsalicylate (Pepto-Bismol and Kaopectate) may help stop diarrhea in adults. However, people with bloody diarrhea-a sign of bacterial or parasitic infection-should not use these medications. If diarrhea is caused by bacteria or parasites, over-the-counter medications may prolong the problem. Medications to treat diarrhea in adults can be dangerous for infants and children and should only be given with a health care provider's guidance.

If the specific cause of the foodborne illness is diagnosed, a health care provider may prescribe medications, such as antibiotics, to treat the illness.

Hospitalization may be required to treat life threatening symptoms and complications, such as paralysis, severe dehydration, and HUS.

Eating, diet, and nutrition. The following steps may help relieve the symptoms of foodborne illnesses and prevent dehydration in adults:

•drinking plenty of liquids such as fruit juices, sports drinks, caffeine-free soft drinks, and broths to replace fluids and electrolytes;

•sipping small amounts of clear liquids or sucking on ice chips if vomiting is still a problem;

•gradually reintroducing food, starting with bland, easy-to-digest foods such as rice, potatoes, toast or bread, cereal, lean meat, applesauce, and bananas;

•avoiding fatty foods, sugary foods, dairy products, caffeine, and alcohol until recovery is complete.

Infants and children present special concerns. Infants and children are likely to become dehydrated more quickly from diarrhea and vomiting because of their smaller body size. The following steps may help relieve symptoms and prevent dehydration in infants and children:

•giving oral rehydration solutions such as Pedialyte, Naturalyte, Infalyte, and CeraLyte to prevent dehydration;
•giving food as soon as the child is hungry;
•giving infants breast milk or full-strength formula, as usual, along with oral rehydration solutions. Older adults and adults with weak immune systems should also drink oral rehydration solutions to prevent dehydration.

Prevention of food poisoning. Today next main method prevention of food poisoning are using: legistation, control the health of the food staff, qualified inspection of slaughter houses and food markets, environmental sanitation, health education, periodic hygienic examinations of all foodstuffs group (figure 7.19). Foodborne illnesses can be prevented by properly storing, cooking, cleaning, and handling foods. Raw and cooked perishable foods-foods that can spoil-should be refrigerated or frozen promptly. If perishable foods stand at room temperature for more than 2 hours, they may not be safe to eat. Refrigerators should be set at 40 degrees or lower and freezers should be set at 0 degrees.

Foods should be cooked long enough and at a high enough temperature to kill the harmful bacteria that cause illnesses. A meat thermometer should be used to ensure foods are cooked to the appropriate internal temperature: 145 degrees for roasts, steaks, and chops of beef, veal, pork, and lamb, followed by 3 minutes of rest time after the meat is removed from the heat source, 160 degrees for ground beef, veal, pork, and lamb,165 degrees for poultry, cold foods should be kept cold and hot foods should be kept hot.

Fruits and vegetables should be washed under running water just before eating, cutting, or cooking. A produce brush can be used under running water to clean fruits and vegetables with firm skin. Raw meat, poultry, seafood, and their juices should be kept away from other foods. People should wash their hands for at least 20 seconds with warm, soapy water before and after handling raw meat, poultry, fish, shellfish, produce, or eggs. People should also wash their hands after using the bathroom, changing diapers, or touching animals. Utensils and surfaces should be washed with hot, soapy water before and after they are used to prepare food. Diluted bleach-1 teaspoon of bleach to 1 quart of hot water-can also be used to sanitize utensils and surfaces.

Genetic modification. While significant changes can occur as a result of the modification of animal genomes, it would appear, on the basis of the current review of known or suspected hazards, that such transgenic animals should not cause any significant concern from the point of view of food safety. It should be emphasized that, at least in mammals, food derived from a healthy animal should generally be considered safe. The exact gene product that may result from transgenic modification should be fully characterized as either an existing substance or one that is

new to the particular animal species concerned. The safety of gene products in food can be assessed in the same manner as veterinary drug residues and food additives .

Implications of biotechnology. Biotechnology can potentially result in significant changes in the nutritional quality of food and, in some instances, is specifically intended to alter the composition of food. Apart from nutritional implications, biotechnological alteration of food may in

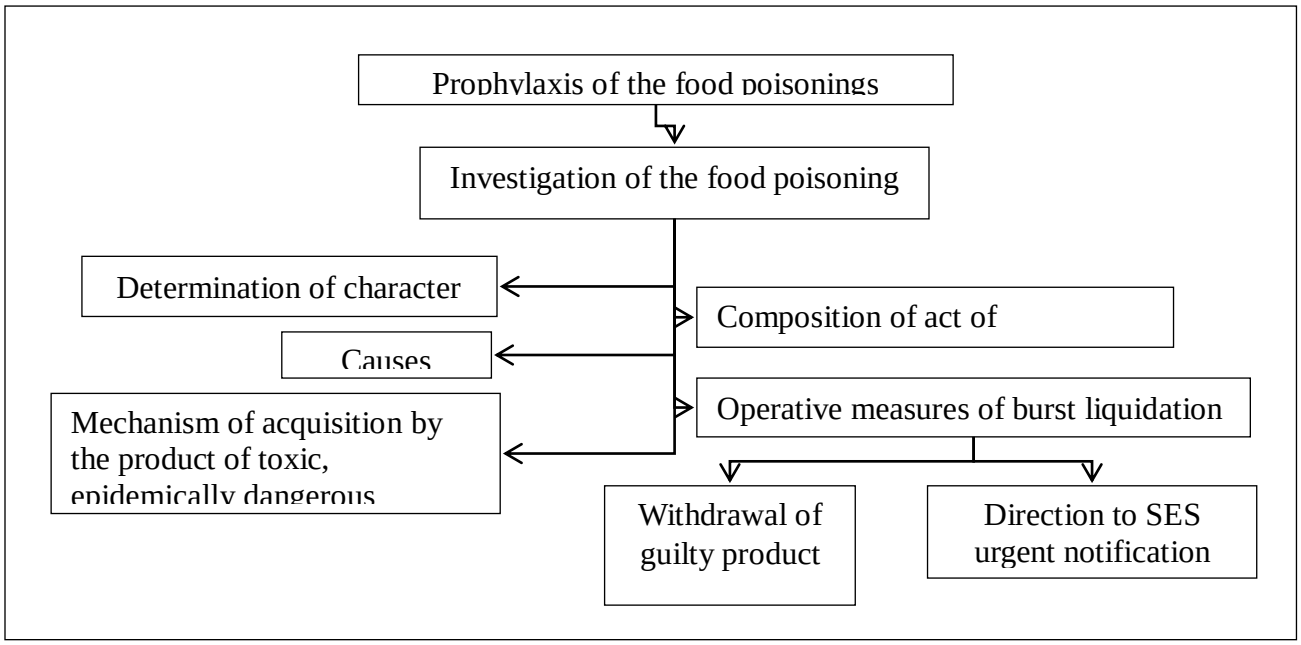


Figure 7.22.Prevention and investigation of food poisoning

rare cases present a potential hazard in terms of food intolerances and food allergies, particularly with interspecies modifications or the production of new hybrid proteins. While these possibilities need to be kept in mind, it is highly unlikely that they will be a problem in the overall population. However, current methods for assessing potential allergen city have serious limitations in predicting a problem in sensitive individuals.

8.Features of nutrition of various population groups

8.1. Nutrition to support optimal growth and development infants and preschool children

8.1. Infant growth and development

Good nutrition is essential during childhood, as it is a time of rapid growth, development and activity,increases body’s resistance to the effects of various diseases,decrease in child

mortality.This is also a vital time for healthy tooth development and prevention of decay. General eating habits and patterns are formed in the first few years of life. The importance of rational nutrition of children is increases the body's resistance to the effects of various diseases,decrease in child mortality, is effective impact on brain and mental development, functional state of the central nervous system.

The reasons for the negative impact of nutrition on the physical and neuropsychic develop-ment of children is insufficient food intake,disorders of regime of nutrition, qualitative malnutrition. Poor nutrition during these years is associated with an increased risk of obesity, hypertension, diabetes and coronary heart disease. Childcare providers therefore have a key role to play in introducing children to a wide variety of foods and establishing a pattern of regular meals and healthy snacks.*Correct regime* for preschool children is 5 times a day for school age- 4 times a day.

When providing food for young children, consideration must be given to the following points:

•Children's appetites may vary, not only from day to day, but also from one meal to the next.

•Young children are very active and have high energy (calorie) and nutrient needs in proportion to their small body size.

•Children have smaller stomachs than adults so it is important to consider portion size when plating food.

•Children should be encouraged to drink adequate amounts of fluids.

•A frequent intake of sugar and sugary foods and drinks between meals causes tooth decay. Snacks and drinks taken between meals should be sugar-free.Foods and drinks containing sugar should only be given occasionally and should be limited to mealtimes. Sugar may also appear on labels as sucrose, glucose, syrup, fructose or dextrose.

- Avoid low fat or diet products, as young children need the extra calories from fat to grow and develop properly. Full fat spreads and whole milk dairy products are recommended. A diet high in fiber is not suitable for young children. It can fill them up without providing all the nutrients they require. Foods of varying fiber content should be offered, egg both white and whole meal breads and pasta; a variety of breakfast cereals, egg, Corn Flakes, Rice Krispies, Weetabix, porridge, etc. Dry, unprocessed bran should never be used as it can reduce the absorption of important nutrients and can cause bloating, wind and loss of appetite.

- Do not add salt to food either in cooking or at the table, as babies' kidneys are not fully developed. Too much salt is linked with high blood pressure later in life and may encourage a preference for salty food, which is difficult to change. Salty snacks such as crisps should be avoided for babies and young children, and given only very occasionally for older children.

In the first year of life birth weight increases by 300%, doubling in the first 4–6 months, and height increases by 50%. Growth then slows down. This rapid growth involves tissue and organ maturation that mean that energy and nutrient requirements are high relative to body size during the first 5 years of life.

*Growth reference charts.*Monitoring child's growth is essential to identify any faltering growth. Length/height, weight, and head circumference should be plotted on a growth reference curve. An infant's growth should follow the direction of the growth curves. Serial measurements are necessary to determine adequacy of growth as a one-off measurement is only a reflection of size. The chart can be a useful tool for communicating with parents so that they understand the importance of monitoring growth. Parents with naturally short children will need reassuring that s/he is growing well if progressing in parallel with the same centile throughout infancy and childhood.

Dietary recommendations for infants and preschool children. Children <5 y need a diet that is proteins. Importance of *proteins* in the nutrition of children – used for plastic purposes,for growth and physical development of the body,to generate energy during muscle work. Especially important are essential amino acids- tryptophan, lysine, histidine, thereare important for increasing the growth indicators of children. Food products that provide the child's body with growth factors this is essential amino acids is meat,fish,eggs.

Fats applied for plastic purposes and as sources and solvents of vitamins A and D.In addition to being energy-dense, fats provide essential fatty acids and have important structural and functional roles. Fatty acids are needed for the development of nervous system myelination in younger children less than two years of age. Fats also facilitate absorption of fat-soluble vitamins.The functions of fats are important for neurological and ocular development. Adverse effects of excess fat in the diet on the child's body is disturbance of metabolism, deterioration of protein digestibility,disturbance of digestion. Food products that occupy the main place in meeting the

needs of the child's body for phospholipids, vitamins A and D is eggs, butter.The amount of fat in the daily diet of children should be 30%.

Carbohydrates provide the energy that fuels children's metabolism, used to generate energy during muscle activity, supports growth, keeps their brain and nervous system working and maintains overall health. *Sugar and starch.*When sugar is added to foods, such as sweets and soda, it supplies calories for energy but has no nutritional value. Added sugar also causes an unhealthy spike in blood sugar that can lead to weight gain and diabetes. When the same sugar comes from whole food, it provides energy together with vitamins, minerals, phytochemicals, starch and fiber. The presence of fiber, especially the soluble type, is vital because it helps limit sugar's impact on blood sugar levels. Starches are healthy complex carbohydrates found in whole grains, vegetables, beans and fruits. They break down more slowly during digestion, so they provide long-term energy and have less impact on blood sugar.Adverse effects on the child's body of excessive consumption of carbohydrates is tendency to frequent diseases, weakening of the body's resistance to infections, contributes to the development of obesity. Fruits and berries are the foodsproducts rich in the most easily digestible carbohydrates that provide the child's body with quickly and easily used glucose and fructose for the formation of glycogen.

Going "*Gluten Free"*? Gluten-free eating is not the goal for everyone, but for kids with celiac disease or non-celiac gluten sensitivity, all sources of gluten must be avoided. Gluten is a protein, but it is found in certain grains, such as wheat, rye, barley, and oats that are not processed in a gluten-free facility. Gluten-free products are available in many grocery stores and restaurants, making it easier for individuals who must comply with gluten-free eating.Some people cut out gluten for the same reason they cut out carbohydrates, but unless your child has been diagnosed with a condition like celiac disease or non-celiac gluten sensitivity, it is not necessary.

Vitamins for children. The government recommends all children aged 6 months to 5 years are given vitamin supplements containing vitamins A, C and D every day.Babies who are having more than 500ml (about a pint) of infant formula a day should not be given vitamin supplements. This is because formula is fortified with vitamins A, C and D and other nutrients. Babies who are being breastfed should be given a daily vitamin D supplement from birth, whether or not you are taking a supplement containing vitamin D yourself.

Vitamin A is important for babies and young children, and some may not be getting enough.It's needed for to satisfy the needs of the child's body in phospholipids, a healthy immune system,impact on the intensity of skeletal development,on pituitary function, provides normal condition and protective properties of the tissue, can help their vision in dim light, and keeps skin healthy.Good sources of vitamin A include:sour cream, butter,dairy products, fortified fat spreads, carrots, sweet potatoes, swede and mangoes, dark green vegetables, such as spinach, cabbage and broccoli.

Vitamin C is important for your child's general health and immune system. It can also help their body absorb iron.Good sources of vitamin C include:oranges, kiwi fruit, strawberries, broccoli tomatoes, peppers.

Vitamin D helps regulate the amount of calcium and phosphate in the body.The primary importance of vitamin D in the nutrition of children is regulates calcium-phosphorus metabolism, greates conditions for normal development and ossification of the skeleton, keep bones, teeth and muscles healthy.A lack of vitamin D can lead to bone deformities such as rickets in children, and bone pain caused by a condition called osteomalacia in adults. Vitamin D is only found in a few foods, such as oily fish and eggs. It is also added to some foods, such as fat spreads and breakfast cereals. But it's difficult to get enough vitamin D from food alone.The main source of vitamin D is summer sunlight on our skin. However,it is important to keep your child's skin safe in the sun.Children should not be out in the sun too long in hot weather. Remember to cover up or protect their skin before it turns red or burns. Young children should still have vitamin drops, even if they get out in the sun.

Vitamin E helps fight against germs and ensures free blood flow through the vessels, boosts the immune system, greatest conditions for the accumulation of vitamins A and D in internal organs and tissues,stimulating effect on the conversion of beta-carotene into vitamin A in the body, helps in the development of eyes and healthy skin. Daily amount: 1 to 3 years old – 6 milligrams; 4 years and above – 7 milligrams. Sources: sunflower and canola oils, margarine and nuts are some Vitamin E rich foods. Deficiency: severe deficiency of Vitamin E in toddlers can cause chronic liver disease, slow growth, mild anemia, muscle weakness dryness of skin and hair, drooping upper eyelid, leg cramps etc.

*Mineral*sis participate in plastic processes,the process of normalization of water-salt metabolism,participate in the functions of the endocrine glands. Minerals in baby food involved in hematopoiesis to ensure complete hematopoiesis is iron, copper, cobalt.

Calcium is the most abundant mineral in the body with 98% in the bones, 1% in the teeth and 1% circulating in the blood. While it's essential for healthy bones and teeth, calcium also helps normal blood function and to send messages along nerves.When it's deficient: Calcium deficiency is becoming increasingly prevalent and can result in brittle bones, teeth problems and eventually osteoporosis.Best sources: Dairy food, green leafy vegetables, and legumes.RDI: 700mg/day (1-3 years); 800mg/day (4+ years).What to eat: 1 cup of milk provides 300mg of calcium.

Iodine is essential to make the thyroid hormones which play a big role in growth, cell reproduction, nerve functions and metabolism regulation.When it's deficient: Deficiency is becoming far more common and in pregnant women can cause major retardation in their babies.

Best sources: seafood, yoghurt, eggs and dairy.RDI: 70 micrograms/day (1-3 years); 150 micrograms/day (4+ years).What to eat: 1g of iodized salt provides 77mcg of iodine.

*Iron*is essential to carry oxygen in the blood. Babies are born with about six months' supply of iron. When solid food is introduced, it is suggested they eat iron-rich foods. Babies and toddlers need plenty of iron they grow so rapidly.When it's deficient: about 25% of the population are at risk of iron deficiency, which can result in iron deficiency anemia. Symptoms of iron deficiency include fatigue, poor immunity, behavioral problems and memory problems. Children and pre-menopausal women are most prone to iron deficiency anemia.Foods rich in iron:red meat, oatmeal,chicken meat,peanut butter sandwiches, fortified breakfast cereals, dried apricots and raisins, pork, lamb, lean mincemeat, ham, egg yolk, leafy green vegetables, tinned tuna and salmon.RDI: 6mg/day (1-3 years); 12mg/day (4+ years). What to eat: 1 cup of chickpeas provides 3.2mg of iron.

Magnesium. Every cell in the body needs magnesium to produce energy. It helps with making protein and sending messages along the nerves. It is necessary for normal electrolyte balance, and nerve and muscle function. It can even help to reduce tiredness and fatigue.Adverse effects of magnesium salt deficiency in the child's body is the occurrence of trophic changes on the skin, symptoms of tetany (seizures), deterioration of the digestibility of food. Best sources: green leafy

vegetables, whole grains and some legumes.RDI: 80mg/day (1-3 years); 320mg/day (4+ years).What to eat: ½ cup cooked frozen spinach provides 75mg of magnesium.

Phosphorus. This mineral is found in every cell in the body and is essential for growth and bone and teeth formation. Phosphorus works with the B vitamins and is important for healthy teeth and bone structure, as well as normal energy metabolism.When it's deficient: As phosphorus is found in most food, dietary phosphorus deficiency is usually seen only in cases of near starvation.

Best sources: Fish, meat, poultry, dairy products, eggs, peas, beans, and nuts.RDI: 500mg/day (1-3 years); 1000mg/day (4+ years). What to eat: 1 cup plain non-fat yoghurt provides 383mg of phosphorus.

Zinc helps the immune system fight off invading bacteria and viruses. It also helps heal wounds and is important for the senses of taste and smell. The body needs zinc to make the genetic material in all cells.When it's deficient: deficiency is rare but if it occurs it can cause slow growth in babies and children.Best sources: oysters, red meat, whole grains, beans and nuts.RDI: 4.5mg/day (1-3 years); 12mg/day (4+ years). What to eat: ¼ cup wheat germ provides 3.6mg of zinc.

However, by the age of 5 they can follow the dietary guidelines presented. If children are growing normally then >2 years, parents can gradually start introducing low fat/high fiber choices towards 'Balance of good health' recommendations at age.Total energy intake should not be restricted.

Breastmilk is the best choice for infant feeding for many reasons. Infant formulae have a different composition to breastmilk and do not provide all the same benefits, particularly the

immunological active components, nor the same nutritional profile and bioavailability. The composition of breastmilk is not homogeneous: colostrum is produced 1–3 days postpartum, eventually becoming mature milk after 3 weeks. The immunological factors are not only present in colostrum produced during the first few days of lactation, but continue throughout breastfeeding.

Protective factors in breastmilk:

- *Immunological active components:* lactoferrin; cytokines; T- and B- lymphocytes; neutrophils; macrophages; immunoglobulins; lysozymes; growth factors; thyroxin; antiviral lipids; antiprotozoal factors; and bifidus factor (promotes growth of protective *Lactobacillus bifidus* in infant's GI tract)
- *Essential long chain fatty acids:* important for cell membrane structure, especially CNS development. Most infant formulae only contain precursors, i.e. linoleic and alpha linolenic acid
- *Nutrients:* rich in vitamins A, D, E, PUFA, and free amino acids compared with infant formula
- *Oligosaccharides:* breastmilk contains >100 different oligosaccharides that help normal brain development. The difference between mothers milk oligosaccharides from blood heteropolysaccharides according to the function performed in the body is slows down the development of a number of putrefactive intestinal bacteria, to make stools easier to pass reducing constipation (can be a problem in formula fed infants).The difference between blood heteropolysaccharides and mothers milk oligosaccharides according to the function performed in the bodyis determines the specificity of blood groups.

  <u>Benefits of breastfeeding.</u>*For the mother:* encourages bonding between mother and infant.Helps women lose excess weight gained during pregnancy. Breastfeeding stimulates uterine contractions that help return the uterus to normal size.Exclusive breastfeeding suppresses ovulation, helping iron stores return to normal.Breastmilk is free, except that the mother needs extra nourishment. Convenience; no preparation required.Reduces mother's risk of developing pre-menopausal breast cancer.

  For the infant: breastmilk offers complete nutrition for the first 6 months and high bioavailability of nutrients.Infants are less likely to experience gastrointestinal infections, as there is no need for access to clean water, which can be a problem in developing countries in

particular (may also be due to protective factors).Prevention of other infectious diseases, especially respiratory, ear and urinary tract infections (greatest impact is for infants exclusively breastfed for first 6 months).Breastfed babies are less likely to be obese in later childhood.

7.2. School-aged children and adolescents. Children need a balanced diet to meet requirements for growth and development. Health-related behavior and attitudes towards food are formed in childhood. The processes for some adult diseases may start early in life.

*Healthy foods***:** Fruit; Vegetables: sticks of carrot, celery, cucumber; cherry tomatoes; Toast, teacakes, scone; Fruit or malt loaf; Oat cakes; Crackers; Rice cakes; Bread sticks; Bagels; Mixed nuts and raisins; Popcorn (unsweetened); Plain biscuits; Glass of milk; Cubes or slices of cheeseYogurt/from age fraise (lower sugar varieties); Low sugar cereal and milk.

Nutritional problems of children and adolescents. Adverse effects on the child's body of excessive consumption of carbohydrates development obesity, weakening of the body's resistance to infections, tendency to frequent diseases.

1. Obesity/overweight

In childhood obesity worldwide as widespread transition to energy dense diet and d in physical activity. This is also the case in the UK, where an estimated sixth (16%) of boys and girls aged 2–15 y are obese and almost a third (30%) are either overweight or obese.Prevalence of obesity increases with age.

Classification of childhood obesity: Assigningcut-offpointsforchildhoodobesityismorecomplexthanfor adults.BMIpercentilechartshouldbeusedtoidentifyobesityandthe UK1990chartisrecommendedforroutineclinicaldiagnosis.Overweight isclassifiedas≥91stcentile;andobesity≥98thcentileoftheUK1990 data.Forepidemiologicalstudies,aninternationallyacceptabledefinition^{2}toclassifyprevalenceofchildoverweight(≥85thcentile)andobesity (≥95thcentile)ofthe1990dataisrecommended.

*Immediateeffectsonhealth*Inextremecasesofchildhoodobesity, childrencandevelopcardiomyopathy,pancreatitis,orthopedicdisorders,upperairwayobstruction,orchest wallrestriction.

Effects on well-being. Besidesphysicalaspects,childrenalsosufferfromdself-esteem,dsocial

interaction,andpooreracademicachievement.Earlierpubertymayalso lemotionalproblemsasamismatchbetweenphysicalandemotional developmentcanlhigherexpectationsfromadults.However,obesity limited to childhood has little impact on social, psychological, economic, andeducationaloutcomesinadultlife.Persistentchildtoadultobesityis associatedwithpooreremploymentandrelationshipoutcomesin femalesonly.

Long-term effect on health. Theprevalenceofobesityandoverweightcombinedwithadietlowin fruitandvegetables,highinsaturatedfat,andlowincalciumandlow physicalactivitymeansthatitislikelythattherewillalsobeanriskof type II diabetes, CVD, suboptimal peak bone mass, osteoporosis, gall- stones,anddiet-relatedcancersinlaterlife,especiallyiftheincreasein obesityissustainedinadultlife.Olderobesechildrenareatahigherrisk of becoming obese adults, but not all obese children become obese adults.

Not achieving peak bone mass. Adolescence is a critical period with 725–40% of peak bone mass laid down at this time in 5, whilst 790–95% of peak bone mass is attained by 30 years of age. Adequate calcium and phosphate intake is necessary combined with weight-bearing physical activity to maximize peak bone mass

Iron deficiency anemia: iron is the most prevalent nutrient deficiency in UK girls: 45–50% of 11–18 y olds do not meet the lower recommended intake (LRNI).27% of 15–18 y old girls have low iron stores and 9% are anemic.Low intakes in UK girls are often due to lower meat consumption and restricted energy intakes as iron requirement with onset of menstruation.Low iron intakes are associated with d physical activity l d peak bone mass. Adolescent girls living in the UK who are non-Caucasians orvegetarian have poorer iron status than Caucasians or meat eaters.

*Constipation*duetolowfiberintakeandsometimeslowfluidintakeis relatively common in UK children. Encouraging fresh and dried fruit and vegetablesforpectin's,breadandbreakfastcerealsforcerealfiber,will relievesymptomsalongwithplentyoffluid,preferablyaswater.Children's accesstofluidmayberestrictedduringtheschoolday;ifso,theyshould beencouragedtocarrybottledwater/sugar-freefluidswiththem.They mayintentionallyrestricttheirfluidintaketoreducefrequencyofmicturition.

Unnecessarydieting. AroundafifthofUKfemaleadolescentsaredietingtoloseweightatany timewithlittleevidenceofastructuredweight-reducingplan.Inappropriate approaches are common, such as crash diets, binge eating, chaotic eatingplans,missingmeals,eatingslimmingproducts(alongsideenergy

densefoods),replacingmealswithhighsugarandfatsnacks.Thiscanlead tolowintakesofseveralnutrients,especiallyiron,calcium,vitamin$B_{6,}$and riboflavin,aswellasriskofdevelopingeatingdisorders.

Underweight. Undernutritioninchildhoodandadolescencecanresultinstunting,i.e. inabilitytoachieveinheritedpotential.Undernutritionmayalsoimpact on schoolachievement.

Acne. Youngpeopleoftenlinkacnewithadiethighinfatandsugar,butthere isnoevidencethatdietisafactorincausingacne.Reassurethemtheir eatingpatternisnotresponsiblefortheiracne;genesareanimportant determinantandthisisonethingtheycanblameontheirparents!

Dental health. Today dentalhealthinyoungpeopleisimproving,duetotheintroductionoffluoridetoothpasteinthe1970s.However,it ’sstillapublic healthconcern,particularlyinsociallydeprivedgroups,possiblybecause lesspreventivedentistryispracticed;frequentconsumptionofsugary foodsanddregularbrushingfluorideintake.

6.3.Nutrition for pregnant women

It is necessary that a woman is well nourished before pregnancy so thatby the time she conceives, the body has sufficient capacity to meet bothher and the baby’s needs. A malnourished woman may fail to deliverbaby alive or if she does, the baby is likely to be underweight (the normalrange is 2.5–4.5 kg at birth). One of the leading causes of maternal deathat childbirth is insufficient blood.During pregnancy women have high nutrient needs because they haveto build foetus tissue, build reserves for breast milk and also cater fortheir own nutritional needs. On average women should gain 8–12 kg inthe course of pregnancy. Pregnant women need to eat more food ratherthan decrease the intake.

• Pregnant women need to consume balanced diet following theguidelines for selecting energy-giving foods, body-building foodsand protective foods. Pregnant women especially need foods rich iniron and vitamin A in addition to the balanced diet. Iron needs arehighly increased partly due to the need to build reserves for childup to six months after birth before initiating complementary foodintake.

• Pregnant women need to take foods rich in calcium, e.g., milk andmukene (silver fish) partly to take care of the increased requirementfor building the foetus skeletal structure.

• Pregnant women have higher needs for nutrients generally andshould take snacks in between meals. In addition, pregnant women should be educated to strictly observe thefollowing: take the required amounts of iron and folic acid supplements toprevent anemia. Sleep under an insecticide-treated mosquito net. Visit the nearest health facility at least four (4) times for antenatalcare. This will enable them access a number of services that preparethem to deliver a healthy baby. Deliver in a healthy facility with the help of a skilled health worker. Get deworming pills, IPT and tetanus vaccine from a health facility. Avoid excessive workloads therefore community and family supportmechanisms should be encouraged.Pregnant women should limit intake of alcohol, cigarettes. Thesecause negative effects on the foetus.Should strictly take drugs on advice of the health personnel as someof them are potentially harmful to the unborn child. Avoid negative cultural practices that reduce the intake of nutritiousfoods or impact negatively on their health such as: not consuming chicken and eggs. Pregnant women not defecating in toilets/pit latrines.

Nutrition for breastfeeding mothers. Nutritional requirements during breastfeeding are higher than duringpregnancy because the mother has to produce enough milk to sustain a baby (bigger than the foetus) for the first six months and beyond. Breastfeeding women need to eat a wide variety of foods.Nutrition guidelines for pregnant women as well apply here but alactating mother needs to eat much more; that is to say one extra meal(five meals in total).Breastfeeding mothers should also take a lot of fluids to cater for thehigh amounts of water used to make breast milk. They should avoidself-medication, smoking and alcohol to prevent intoxicating the baby.Breastfeeding mothers should avoid stress and have enough rest.

6.4. Nutrition of people of intellectual work

When mental work in connection with an unloaded the musculoskeletal system (physical inactivity) power should be moderate. Composing diet must be strictly taken into account the body's need for energy in order to avoid the increase of body weight and obesity. Nutrition the people of intellectual labor must be complete. This means that they consume foods must contain all biologically valuable substances necessary for the body in a certain amount and the optimal ratio.

When mental work increased need for *protein*. Therefore, in the diet should be protein 13% of daily caloric food. Of particular importance are food components having anti-sclerotic and lipotropic properties, in particular methionine amino acid containing sulfur. The sources of methionine and other sulfur-containing amino acids are curd, cheese, chicken meat, type of fish - cod salmon and herring.According to the number of sulfur-containing proteins are distinguished beans and fish. Lipotropic andanti-sclerotic action have tocopherols, cyanocobalamin, folic acid, choline and inositol.Absence of food products rich in sulfur-containing amino acids with lipotropic properties in their diet cases disorders of lipid metabolism in the liver.

In connection with the great neuro-psychic and emotional stress, in which the body heavily uses vitamins, mental workers can develop vitamin deficiency. Therefore, in the diet should include foods that contain enough vitamins, including stimulating redox reactions. This property is possessed by almost all vitamins, but especially riboflavin, pyridoxine, ascorbic acid, nicotinic acid, etc. Prevention of vitamin deficiency is essential in maintaining the working capacity of people of mental work.

Fats also contain biologically valuable components needed for the human body engaged in intellectual work. Thus, phospholipids, ß-cytosterol, polyunsaturated fatty acids, tocopherols, vegetable oilsand improve the exchange of cholesterol fats (this is anti-sclerotic fatty components) inhibit peroxidation of cell membranes. Butter contains fat-soluble vitamins. However, the caloric fat part of the diet should not exceed 33% total caloric food. This means that the energy consumption 10 467 kJ daily intake of fat should be 80-90 g

The diet of people of intellectual work is necessary to limit *carbohydrates*, especially simple. Increased consumption of sugar (more than 50 grams per day) for a sedentary lifestyle inevitably leads to weight gain and obesity.Important in ensuring the biological full value of the diet of people of mental work is the inclusion in it of a large number of vegetables and fruits - rich sources of vitamins, mineral salts, sit sterols. An obligatory component of nutrition of this category of the population are fermented milk products: curdled milk, kefir, buttermilk, whey, and cream 10% fat. The 100 energy of a cream of the specified fat content is only 519 kJ, but they contain 5-6 times more retinol (vitamin A) than in milk. It is advisable to eat one egg a day, as in the egg yolk a lot of lecithin, and in the protein there are essential amino acids in the optimal ratio.

Bakery productspreferable use of whole meal flour.Instead of sugar, use fructose useful. Since fructose is more than 1,5 times sweeter than sucrose, is to meet the needs of her sweet little need. Thus, to maintain normal metabolism and optimal performance during mental work in the body should do the energy, the plastic and the catalyst substance (fructose, amino acids, vitamins, fats, fatty acids, lecithin, etc.). In this connection, it should be possible to vary the power of people engaged in intellectual work.

Diseases associated with the consumption of high-calorie foods in conditions of inactivity and lack of muscle tension arecirrhosis of the liver,atherosclerosis, obesity. Negatively affecting the health and working capacity of persons of intellectual (mental) worker is hypokinesia, insufficiency of motor-visceral reflexes,overweight.

Hypokinesia (Greek "from below" + "movement"), also referred to as bradykinesia, is a state of the body in which insufficient motor activity is observed(sedentary activity), which leads to a limitation of the pace and range of movements.

Motor activity worsensagainst the background of early mental and neurological disorders ,atherosclerosis,kidney stone disease, Parkinson's disease and other extrapyramidal syndromes. It is reported by approximately 98%of patients.Hypokinesia and hypodynamia are often considered synonymous words, but there are differences between them. So, hypodynamia is a consequence of prolonged hypokinesia and manifests itself in the form of a decrease in muscle strength. By itself, it arises due to a forced decrease in motor activity, for example, during the period of adherence to bed rest, with a sedentary lifestyle, or due to professional characteristics.

The effect of hypokinesia on the body:adaptive and compensatory reactions decrease;the functional and structural basis of movement changes (discoordination, joint stiffness);there is a pathological decrease in motor activity with impaired statokinetic reflexes (maintaining balance); energy and basal metabolism decrease, oxygen deficiency increases.

6.5.Dietary recommendations for sportsmen (sports nutrition).

Sports nutrition is the foundation of athletic success. It is a well-designed nutrition plan that allows active adults and athletes to perform at their best.The goal of sports nutrition - active adults and competitive athletes turn to sports nutrition to help them achieve their goals. Examples of individual goals could include gaining lean mass, improving body composition, or enhancing

athletic performance.These sport-specific scenarios require different nutritional programs. Research findings indicate the right food type, caloric intake, nutrient timing, fluids, and supplementation are essential and specific to each individual. The following are different states of training and competitive sport benefiting from sports nutrition.

It supplies the right food type, energy, nutrients, and fluids to keep the body well hydrated and functioning at peak levels. A sports nutrition diet may vary day to day, depending on specific energy demands.Sports nutrition is unique to each person and is planned according to individual goals.

Sports nutrition basics. The energy required for living and physical activity comes from the food we eat and fluid intake. Macronutrients in the following food groups supply the energy essential to optimal body function.

Energy requirements:in order for athletes to meet their energy needs, they must consume sufficient calories. If energy needs are not met, fat and lean body tissue will be used as fuel by the body. This will cause a loss of strength and endurance. Furthermore, immune, endocrine, and musculoskeletal function will be compromised. Over time, low calorie intake may result in a slower resting metabolic rate, and inadequate consumption of essential vitamins and minerals.

Athletes who participate in weight class sports such as boxing, kickboxing, and mixed martial arts are at risk for the adverse effects of poor energy intake if they undergo extreme measures to rapidly lose weight prior to a competition. Such energy restrictions may cause loss of muscle and may interfere with athletic performance.

Daily training diet requirements. The basic training diet should be sufficient to:

- provide enough energy and nutrients to meet the demands of training and exercise
- enhance adaptation and recovery between training sessions
- include a wide variety of foods like wholegrain breads and cereals, vegetables (particularly leafy green varieties), fruit, lean meat and low-fat dairy products to enhance long term nutrition habits and behaviors
- enable the athlete to achieve optimal body weight and body fat levels for performance
- provide adequate fluids to ensure maximum hydration before, during and after exercise
- promote the short and long-term health of athletes.

*The athlete's diet.*An athlete's diet should be similar to that recommended for the general public,

with energy intake divided into:an ideal diet comprises 45% to 65% carbohydrates, 10% to 30% protein and 25% to 35% fat. Fluids are very important for maintaining hydration and should be consumed before, during and after athletic events to prevent dehydration.

Athletes who exercise strenuously for more than 60 to 90 minutes every day may need to increase the amount of energy they get from carbohydrates to between 65 and 70 %. More recent advice also provides guidelines for carbohydrate and protein based on grams per kilogram (g/kg) of body weight. The current recommendations for fat intake are for most athletes to follow similar recommendations to those given for the general community, with the preference for fats coming from olive oils, nuts, avocado, nuts and seeds. Athletes should also aim to minimize intake of high-fat foods such as biscuits, cakes, pastries, chips and fried foods.

*Carbohydrates.*Carbohydrates are either simple or complex, and the most important energy source for the human body. Simple carbs include sugars naturally occurring in foods like fruits, vegetables, and milk.Whole grain bread, potatoes, most vegetables, and oats are examples of healthy complex carbs. Your digestive system breaks down carbohydrates into glucose or blood sugar which feeds energy to your cells, tissues, and organs.

Athletes are advised to adjust the amount of carbohydrate they consume for fueling and recovery to suit their exercise level. For example:

- Light intensity exercise (30 mins/day): 3–5 g/kg/day
- Moderate intensity exercise (60 mins/day): 5–7 g/kg/day
- Endurance exercise (1–3 hrs/day):6–10 g/kg/day
- Extreme endurance exercise (more than 4 hrs/day):8–12 g/kg/day

Proteins. Protein is an important part of a training diet and plays a key role in post-exercise recovery and repair. Protein needs are generally met by following a high-carbohydrate diet, because many foods, especially cereal-based foods, are a combination of carbohydrate and protein.Proteins are made up of a chain of amino acids and are essential to every cell of the human body. Protein plays an important role in muscle recovery and growth. Also significance of a high level of protein in the diet during the rest period after intense sports activities: promotes increased muscle protein synthesis, promotes muscle strength.

The amount of protein recommended for sporting people is only slightly higher than that recommended for the general public. not less than 2 grams (per 1 kg of body weight in

grams).During the period of moderate and moderate intensity exercise, due to high losses of nitrogen, the protein content in the daily ration of athletes recommended up to 2.5 gram (per 1 kg of weight in grams).

Fats. Fats can be saturated or unsaturated, and they play a vital role in the human body. Unsaturated fats are considered healthy and come from plant sources like olive oil and nuts. Saturated fats are found in animal products like red meats and high-fat dairy, which are indicated to increase the risk of disease.Healthy fats provide energy, help with body development, protect our organs, and maintain cell membranes. The high fat content in the daily diet of athletes during submaximal intensity training canincreases the content of ketone bodies in the urine and blood.

Vitamin and mineral requirements. Micronutrients function in a variety of roles that optimize health. They are involved in energy production, blood synthesis, maintenance of bone health, immune function, and the prevention of oxidative damage. They also aid in the process of muscle and tissue repair during recovery from exercise or injury. Generally, athletes consuming a healthy diet do not require any additional supplementation of micronutrients.

Maintaining adequate levels of vitamins and minerals is important for bodily function, and therefore, athletic performance. As the activity level of an athlete increases, the need for different vitamins and minerals may increase as well.B vitamins, including thiamin, riboflavin and niacin, are essential for producing energy from the fuel sources in the diet. The very importance in the nutrition of athletesof vitamin B_6 for basal metabolism,it is has possesses lipotropic properties, greates an opportunity for rapid resynthesis of adenosine triphosphoric acid during high physical exertion. Carbohydrate and protein foods are excellent sources of these vitamins. Some female athletes may lack riboflavin, so it is important to ensure adequate consumption of riboflavin-rich foods, like milk. Milk products not only increase the riboflavin level but also provide protein and calcium. Milk and dairy products, fruits and vegetables are foods products rich in alkaline components, which should be included in the diet of athletes during intense muscular activity to prevent acidotic shifts.

Vitamin D has many functions in the body, and is crucial for calcium absorption. Athletes who train indoors for prolonged periods should insure that they consuming adequate amounts of vitamin D through diet.Exercise increases the oxidative stress on the body, increasing the need for vitamins C and E. Vitamin C in the nutrition of athletes has the most pronounced property to have

a stimulating effect on the processes of oxidation and reduction and quickly eliminate signs of fatigue.Vitamin Ehave an antioxidant intracellular effect, a normalizing effect on muscle activity, stimulant during sports tension.

6.6. Dietary recommendations for early and older people

Eating right and staying active are important no matter what your age.Physiological processes in the body also change with age.The predominance of assimilation processes over dissimilationregistration in aged up to 25 years and vice versa, ispredominance of dissimilation processes over assimilationstarting from 60 years old.Causes of aging are hypokinesia,changes in the digestive system.Changes characteristic of the aging process:decreased intensity of protoplasm renewal,degeneration of colloids, gonadsatrophy, changes in the digestive system,intestinal autointoxication, changes in the activity of the central nervous system (dementia).

Requirements for the nutrition of the elderly and older people: matching the amount of food consumed to needs, nutrition must have a high biological value, enrichment of food with natural anti-sclerotic substances.Olderpeoplewhoare‘frail’areathigherriskofmalnutrition,sothe aspects of healthy eating guidelines related to reducing consumption of energydensefoods(fromfatandsugar)areinappropriate.Inpractical termsthismeansthatfull-fatmilkandmargarineswillbepreferable,and sugarinthedietmayprovideusefulcaloriesandmayhelpwheretaste sensitivityisd.However,sweetfoodsneedtobepartofanutrient-rich dietandideallyeatenwithmeals.

*What older people are eating?*Older people are not a homogeneous group and the majority are adequatelynourishedandmeettheRNIformostvitaminsandminerals.However,thoselivingininstitutionsandinlo wersocio-economicgroups tendtohavelowerintakesofenergy,protein (the optimal norm of protein (corresponding to body weight) in the elderly and older people is 1 g per 1 kg of body weight),fiber,somevitaminsand minerals.It should be noted thatan unfavorable consequence of excessive animal protein,fats and easily digestible carbohydrates content in the diet of the elderly and older people cases to the development of atherosclerosis. Vitamins of lipotropic action, which has an inhibitory effect on the development of the process of atherosclerosis in the elderly and older people are choline,inositol,pyridoxine.In some older people (>85 year), B vitamin status is poor, particularly for folic

acid. Milk and dairy products, vegetables, fruits and berries are used to provide an alkaline orientation of nutrition to maintain acid-base balance in the body of the elderly and older people.

The importance of a high content of foods rich in magnesium in the daily diet of the elderly and older people for increase bile secretion, stimulate intestinal peristalsis.Function of food rich magnesium are antispastic and vasodilatory effect, stimulate intestinal motility.

Calcium and vitamin D. Housebound and 'institutionalized' older people have poorer vitamin D status, which is needed for the absorption of calcium and for bone health. Adults older than 70 need more calcium and vitamin D to help maintain bone health than they did in their younger years. To meet these needs, select calcium-rich foods and beverages and aim for three servings of low fat or fat-free dairy products each day. Other sources of calcium include fortified cereals and fruit juices, dark green leafy vegetables, canned fish with soft bones, and fortified plant-based beverages. Sources of vitamin D include fatty fish, such as salmon, eggs and fortified foods and beverages. If you take a calcium supplement or multivitamin, choose one that contains vitamin D.

Vitamin B_{12}. Some adults older than 50 may not be able to absorb enough vitamin B_{12}. Fortified cereal, lean meat, fish, and seafood are sources of vitamin B_{12}.

Dietary fiber. Eat fiber-rich foods to stay regular. The importance of dietary fiber in the diet of the elderly and older people: for promotes the excretion of cholesterol from the body, improves the activity of beneficial intestinal microflora, has a stimulating effect on intestinal peristalsis. Dietary fiber also may help lower your risk for heart disease and reduce your risk for type 2 diabetes. Eat whole-grain breads and cereals, and more beans peas and lentils— along with whole fruits and vegetables, which provide dietary fiber.

*Potassium.*The importance of including potassium-rich foods in the daily diet of the elderly and older people: increase the ability to remove fluid from the body, reduce the osmotic pressure in the body, and strengthen the contraction of the heart muscle.Consuming adequate potassium, along with limiting sodium (salt) intake, may lower your risk of high blood pressure. Fruits, vegetables, beans and low fat or fat-free dairy products are all sources of potassium. Also, select and prepare foods with little or no added salt. Add flavor to food with herbs and spices.

Fats. Most of the fats you eat should be polyunsaturated and monounsaturated fats, which are primarily found in nuts, seeds, avocados, vegetable oils and fish. Choose foods that are low in saturated fat to help reduce your risk of heart disease.

Undernutrition in older people.Therearecategoriesofolderpeoplewhoare'atrisk'ofmalnutrition.

-*Peoplewithdifficultyeating*,e.g.poordentitionorsoremouth, masticatingorswallowingdisorders, sensory loss, disorders of the upper limb, difficulty manipulating cutlery (could be fromarthritis).

-*Peoplewhodependonothers*,e.g.livingininstitutions(hospitals, nursing,orresidentialcarehomes);dependingonotherstoshopfor food(aroundhalfofolderpeoplerelyonsomeoneelsetodosome of their foodshopping).

- *Older age groups* (> 75 y).

-*Lowersocio-economicgroups*:thereisevidencethatintakesofa rangeofnutrientsarelessinolderlowersocio-economicgroups, especiallymagnesiumandpotassiuminwomen.Accesstoshops may beworse.

-*Peoplewithillness-relatedmalnutrition*,e.g.malignancy,Parkinson's disease,pressuresores(requirements).

-*Peopleinavulnerablepsychosocialsituation*,e.g.loneliness, depression,dementia,bereavementappetite.

-*Peoplewithphysicaldifficultyinpreparingfood*,e.g.painful/frail handsfromarthritisorreducedmusclestrength,couldldintakeof fresh fruit andvegetables.

-*Peopleoncertainmedication*affectingappetite,taste,GItract. However,inmostcases,thecausesofundernutritionaremultifactorial butanawarenessofsomespecificcontributoryfactorsisavaluablefirst stepinprevention.

Nutritionscreeningformalnutritionriskfactorsin olderpeople. Classifying undernutrition in older people is concerned with establishing risk.Theconsequencesoffailingtoidentifyandtreatundernutritionare potentially serious and therefore caution should be used wheninterpretingresults.Vulnerableolderpeoplelivinginthecommunityneedregular nutritionalassessmentsbyamemberofthePHCTusingaroutinenutritionalscreeningtool.Olderpeopleinresidentialhomesshouldbeassessedonentry (dietaryintakeandweight)andthenweighedmonthly.

Consequences of malnutrition in older people. The effects of undernutrition vary from subclinical, with no apparent clinicalimpairmenttodeath,andaredependentonthetype,length,and degreeofnutritionalinadequacyandthenutritionalandhealthstatusof theindividual.Inadditiontoasignificantincreasedriskofmortality,undernutritionis associated with greatermorbidity: weightloss(predominantlyfatandmuscle),e.g.poorer mobility,riskoffalls,riskofchestinfection; reducedimmunefunction,e.g.iratesofinfection; impairedsynthesisofnewprotein,e.g.poorwoundhealing;

prolongedrecoveryfromillnessandhospitalstays; psychological, e.g. depression, anorexia.

*Treatment of malnutrition.*The main indicator organization of catering for the elderly and older people is weakening the capacity of the digestive system. Thereisgoodevidencethatnutritionalsupportinolderpeoplecanenergyandproteinintake,weightloss,functionaloutcomes(muscle strength,walkingdistances,activitylevels,mentalhealth)andclinical outcomes(mortality,complications)inhospitalandcommunitysettings.Treatment options could include: i*mprovingfoodaccess*,e.g.arrangingsupportthroughappropriate careers,e.g.shopping,cooking,companywhilsteating; s*upplementationoffoodand/ordrinkusingordinaryfooditems*,e.g. increasingenergy/proteindensityofmealsbyfortifying,e.g.adding butterandgratedcheesetomashpotato; s*upplementationusingproprietaryproducts*;someareavailableon prescriptionoroverthecounter,e.g.milkorjuice-baseddrinks, soups,desserts.

*Other nutritional problems in older people. Constipation*isrelativelycommoninolderpeople.Fiberandfluidintake needtobeassessedandincreasedconsumptionencouraged.

Iron deficiency anemia. Around10%ofolderpeoplewerefoundtobeanemicinapopulation survey.Maybeduetopoorintakeordabsorptionfrom GIdisorders, GIbloodloss.Encourageiron-richfoodsandvitaminCconsumption.

Osteoporosis and the subsequent fractures (hip, wrist, spine) arean importantcauseofmorbidityandmortalityinolderpeople.Calciumand vitaminDintake,alongwithsunlightexposure,areimportantmeansof maintainingbonehealthinolderpeople.TheDHrecommendsregular sunlight exposure during May to September and vitamin D supplements duringwintermonthsifhousebound.Beingunderandoverweightcan influenceriskofosteoporosis.

*Dehydration.*Theriskofdehydrationismorecommoninolderpeople,especiallythose dependentonothersorwherethereismentalimpairment.Adailyintake of1500–2000mlisrecommended,around6–8mugs(1mug=250ml).

Arthritis. Dementia.

Appendix 1

Vitamins and Minerals for People Over Age 51

Vitamin/Mineral	Men Age 51+	Women Age 51+	Food Sources
Vitamin D	If you are age 51–70, you need at least 15 mcg (600 IU) each day, but not more than 100 mcg (4,000 IU). If you are over age 70, you need at least 20 mcg (800 IU), but not more than 100 mcg (4,000 IU).	If you are age 51–70, you need at least 15 mcg (600 IU) each day, but not more than 100 mcg (4,000 IU). If you are over age 70, you need at least 20 mcg (800 IU), but not more than 100 mcg (4,000 IU).	You can get vitamin D from fatty fish, fish liver oils, fortified milk and milk products, and fortified cereals.
Vitamin B12	2.4 mcg every day.	2.4 mcg every day.	You can get this vitamin from meat, fish, poultry, milk, and fortified breakfast cereals. Some people over age 50 have trouble absorbing the vitamin B12 found naturally in foods. They may need to take vitamin B12 supplements and eat foods fortified with this vitamin.
Calcium	Men age 51-70 need 1,000 mg each day. Men age 71 need 1,200 mg each day. Don't consume more than 2,000 mg each day.	1,200 mg each day. Don't consume more than 2,000 mg each day.	Calcium is a mineral that is important for strong bones and teeth, so there are special recommendations for older people who are at risk for bone loss. You can get calcium from milk and other dairy, some forms of tofu, dark-green leafy vegetables, soybeans, canned sardines and salmon with bones, and calcium-fortified foods.
Magnesium	420 mg each day.	320 mg each day.	This mineral, generally, is found in foods containing dietary fiber, such as green leafy vegetables, whole grains, legumes, and nuts

Vitamin/Mineral	Men Age 51+	Women Age 51+	Food Sources
			and seeds. Breakfast cereals and other fortified foods often have added magnesium. Magnesium is also present in tap, mineral, or bottled drinking water.
Potassium	Men need 3,400 mg each day.	Most women age 51 and older need 2,600 mg each day	Many different fruits, vegetables, meats, and dairy foods contain potassium. Foods high in potassium include dried apricots, lentils, and potatoes. Adults get a lot of their potassium from milk, coffee, tea, and other nonalcoholic beverages.
Sodium	Men 51 and older should reduce their sodium intake to 2,300 mg each day. That is about 1 teaspoon of salt and includes sodium added during manufacturing or cooking as well as at the table when eating. If you have high blood pressure or prehypertension, limiting sodium intake to 1,500 mg per day, about 2/3 teaspoon of salt, may be helpful.	Women 51 and older should reduce their sodium intake to 2,300 mg each day. That is about 1 teaspoon of salt and includes sodium added during manufacturing or cooking as well as at the table when eating. If you have high blood pressure or prehypertension, limiting sodium intake to 1,500 mg per day, about 2/3 teaspoon of salt, may be helpful.	Preparing your own meals at home without using a lot of processed foods or salt will allow you to control how much sodium you get.
Vitamin B6	Most men 51 and older should aim for 1.7 mg each day.	Most women 51 and older should aim for 1.5 mg each day.	Vitamin B6 is found in a wide variety of foods. The richest sources of vitamin B6 include fish, beef liver, potatoes and other starchy vegetables, and fruit (other than citrus).

Vitamin/Mineral	Men Age 51+	Women Age 51+	Food Sources
Vitamin A	Most men 51 and older should aim for 900 mcg RAE.	Most women 51 and older should aim for 700 mcg RAE each day.	Vitamin A can be found in products such as eggs and milk. It can also be found in vegetables and fruits, like carrots and mangoes.
Vitamin C	Most men 51 and older should aim for 75 mg each day.	Most women 51 and older should aim for 90 mg each day.	Fruits and vegetables are some of the best sources of vitamin C. Citrus fruits, tomatoes, and potatoes can be a large source of vitamin C.
Vitamin E	Most men age 51 and older should aim for 15 mg each day.	Most women age 51 and older should aim for 15 mg each day.	Vitamin E can be found in nuts like peanuts and almonds and can be found in vegetable oils, too. It can also be found in green vegetables, like broccoli and spinach.
Vitamin B1 (Thiamin)	Most men 51 and older should aim for 1.2 mg each day.	Most women 51 and older should aim for 1.1 mg each day.	You can find vitamin B1 in meat – especially pork – and fish. It's also in whole grains and some fortified breads, cereals, and pastas.
Vitamin B2 (Riboflavin)	Most men 51 and older should aim for 1.3 mg each day.	Most women 51 and older should aim for 1.1 mg each day.	You can find vitamin B2 in eggs and organ meat, such as liver and kidneys, and lean meat. You can also find it in green vegetables, like asparagus and broccoli.
Vitamin B3 (Niacin)	Most men 51 and older should aim for 16 mg each day.	Most women 51 and older should aim for 14 mg each day.	Vitamin B3 can be found in some types of nuts, legumes, and grains. It can also be found in poultry, beef, and fish.
Vitamin K	Most men 51 and older should aim for 120 mg each day.	Most women should aim for 90 mg each day.	Vitamin K can be found in many foods including green leafy vegetables, like

Vitamin/Mineral	Men Age 51+	Women Age 51+	Food Sources
			spinach and kale and in some fruits, such as blueberries and figs. It can also be found in cheese, eggs, and different meats.
Folate	Most men age 51 and older should aim for 400 mcg DFE each day.	Most women age 51 and older should aim for 400 mcg DFE each day.	Folate can be found in vegetables and fruit, such as broccoli, brussel sprouts, spinach, and oranges. It can also be found in nuts, beans, and peas.

PRACTICAL COURSE

Subject 1-2. Hygienic requirements for the rational nutrition. Modern norms of the needs of various groups of the population in nutrients and energy

Nutrition is one of the most active and important factors the external environment, which provides a variety of effects on an organism of the body, provides his growth, development, health preservation, capacity for work and optimum life expectancy. The physiological basis of nutrition - metabolism processes - dissimilation and assimilation, power inputs and their satisfaction, processes of growth and organism development. Nutrition physiology deals with how

the body extracts the nutrients from the food, how we obtain the needed energy, how we utilize nutrients and how all this is related to health and disease.The aim of nutrition concern development of physiological-hygienic bases of ration nutrition for population

Nutrition is the science of food, the materials or nutrients in food, what they do and how they interact - all in relation to health. Proper nutrition is an important factor in health, and malnutrition is an important factor in the etiology of several of the major causes of death and disability in our contemporary society.

Nutrition - is the main biological need of the human.Concept about nutrition is a physiological human need, the processes of the physiological effect of foods, biochemical transformation and assimilability Biological action of food on an organism is specific, pharmacological, nonspecific, protective. Wrong nutrition influences on development of an organism, lowers its protective forces, can cause many illnesses.The importance of rational nutrition- preventive cases of the alimentary diseases, connected with deficiency or over nutrition. Atherosclerotic vascular disease, hypertension, obesity, tooth decay, osteoporosis, diabetes, and cancer are common diseases in which nutrition is closely involved.

Our bodies require constant supply of energy and raw materials to maintain vital functions and to rebuild cellular structures and tissues worn out in the day-today processes of living. In addition to calories, we need specific nutrients in our diet, such as proteins, vitamins, and minerals. It is possible to have excess food and still suffer from malnourishment, a nutritional imbalance caused by a lack of specific dietary components or an inability to absorb or utilize essential nutrients.

Rational nutrition is a nutrition which ensures of organism homeostasis and maintains vital functions. In other words, it is nutrition both valuable in quality and adequate in quantity respects. Rational nutrition - a food almost healthy man, built on scientific foundations and promotes: improve the level of health; increase the body's resistance; the preservation of (possibly longer) high of working capacity, cheerfulness and life expectancy; physical and mental development of the younger generation. Biological effect-non-specific. Basic principles of a rational diet - increased intake of small amounts of food,complete exception of large meals, the exclusion of long intervals between meals.

Points to consider while planning a meal: family incomes and lifestyles; individual habits and preferences; nutritional/health status of target consumers; daily routines of family members such as work and school; availability of storage and cooking facilities; the occasion for which meals are required; food availability and season; nutritional needs of targeted consumers; time available for cooking; balance and variety in making food choices; type of fuel available for food preparation; meals are attractive and enjoyable; meals satisfy the appetite; meals are available when needed.

The first requirement of rational nutrition is an adequacy of daily ration caloric value to daily energy expenditures. The rational nutrition is nutrition should cause a feeling of satiety, should not adversely affect health, fully meet the energy needs of the body, and have a dietary habit.

*Main rules of rational (healthy) nutrition:*eating fruits, vegetables, and grain products that contain fiber may help prevent heart disease; limiting the amount of saturated fat and cholesterol in your diet may reduce your risk of heart disease; limiting the amount of total fat you eat may help reduce your risk for cancer; eating fiber-containing grain products, fruits, and vegetables may help prevent cancer; eating fruits and vegetables that are "low in fat" and "good sources" of dietary fiber, vitamin A, or vitamin C may help prevent cancer.

Nutrients - those components for which, in fact, consumed foods. Nutrients provide biological needs of the organism in the materials and energy, and the taste is not having usually a biological effect, provide certain organoleptic properties of food (its appearance, consistency, color, odor, taste, etc.). Hygienic requirements for the balance of nutrients in the organization of rational nutrition apply to food ration.

Food products are complex set of chemical substances, comprising:

1) nutrients: proteins, fats, carbohydrates, vitamins, mineral salts; flavoring: organic acids, esters, ketones, dyes, tannins, aromatic compounds and others;

2) anti-nutrients: anti amino-acids; anti-minerals; anti-vitamins;

3) the additional substances (impurities) - residues of pesticides, radioactive substances, salts of heavy metals, nitrosamines, impurities of plant and other origin and others.

Rational nutrition has three links:

1. Physiological norm.
2. The rules of product consumption.

3. Regime of nutrition.

Physiological norm - it is science-based nutrition standards, completely cover the body's energy expenditure and ensure it all substances in appropriate quantities and in the most favorable (optimal) parities.The nature of a person's nutrition is determined by a number of features of his lifestyle and working conditions. Healthy-efficient nutrition ensures the stability of the internal environment of the organism (homeostasis); ensures the vital manifestations of the organism (height, body shape, level of development, activity of various members and systems, etc.) in various conditions of work and everyday life.) is a high level of maintenance-free nutrition. In the organization of Nutrition, a person's age, gender, nature of his labor, body weight, height, geographical and climatic conditions, housing and living conditions, national traditions, physiological states of the body, etc. are determined. features must be taken into account.

The number of scientifically substantiated hygienic requirements are put forward for the organization of effective nutrition, regardless of the state of health of the body.

Hygienic requirements for the food ration in the organization of rational nutrition:

- energy value-calories,
- the composition of the nutrient,
- balance of nutrients,
- fast digestion and absorption of nutrients,
- the diversity ,
- organoleptic characteristics of dishes and products,
- attractive formulation of dishes,
- goal-oriented division of the intake times (depending on calorie, volume, alertness, etc.).,
- the sanitary and epidemiological impeccability of dishes.

The nutrition regime:

- food intake hours and intake time,
- purposeful division of dishes and products at the time of reception,
- the distribution of the diet for meals during the day,
- dishes temperature,
- the sequence of consumption of dishes,

- the meals frequency.

Hygienic requirements for the nutrition condition:

- dining room interior,
- the microclimate conditions of the room,
- formation of the table-serving,
- cultural service,
- supply of hygienic equipment and accessories.

In physiological nutritional standards differentiate two aspects: 1) *quantitative*, i.e. calorie of ration; 2) *qualitative* - which decrypted caloric structure, i.e. by which nutrients provided by calorie.

The quantitative aspect of physiological norms should provide covering energy expenditure of the organism, developing in normal conditions of uncontrolled spending - basal metabolic rate (1400-1700 kcal) and *specific dynamic effect of food* (SDE), constituting 10% of the basal metabolism, i.e.140-170 kcal and regulated expenses – consumption of energy in the workplace activities, household and domestic work, sports, etc. (200-260 kcal / h). As a result of a long study of the body's need for calories and nutrients were found to be the determining factor for children, adolescents and older people is their age, and to the working population - the age and character of work.

It becomes easy to determine the correspondence between the energy provided by food and the energy expended by a person. This is because both the energy expended by the body and the energy supply value of the daily diet are measured in calories. In inadequate nutrition, the caloric content of the daily diet does not cover the energy consumption during the day as a result of the implementation and leads to the formation of a negative energy balance. It is important to mobilize all the resources of the body for maximum energy efficiency in order to make up for the resulting energy deficit. In this case, all nutrients, including protein, are used as an energy source. When the negative energy balance is long-term, tissue protein also begins to be wasted for energy purposes. Thus, the negative energetic balance forms a single complex of its own energy-protein deficiency (alimentary dystrophy, marasmus, kwashiorkor). When the energy value of the food ration continues to exceed the energy consumption carried out, there is a serious problem in the positive energy balance (overweight, obesity, hypertension, cancer, diabetes).

The issue of organizing the actual nutrition of the population in accordance with physiological and hygienic requirements and effectively is considered one of the important issues facing all doctors regardless of their qualifications (especially in the field of nutritional hygiene, working in children's institutions, hospitals, sanatoriums and rest homes, military units).

In balanced nutrition, nutrients are well absorbed by the body.*The second main requirement* - the daily diet should ensure the inclusion of nutrients in the required amount-essential nutrients (protein, fat, carbohydrates) and biologically active substances (vitamins, mineral elements). Thus, it is important not only the quantitative side, but also the optimal proportions of nutrients, their qualitative interaction or, in other words, their spacing.

The optimal ratio of the main nutrients, their qualitative relationship is called - ***first order balance*** (protein, fat, carbohydrate, etc.). Balanced nutrition also provides a physiologically pleasant ratio of the essential components of most nutrients (***second order balance***) – implies the interaction of proteins with amino acids, fats with fatty acids, carbohydrates with starch and sugar, individual vitamins among themselves and with other components of food.

Below are a number of important approaches (principles and norms) of balanced nutrition:

1.in the caloric content of daily ration: the ratio of the calorie content of protein: fat: carbohydrate should be as follows ***(P: F:C) - 11-13%: 27-33% : 54-56%.***For example:you want to determine how much fat is if the calorie content of the daily diet is 2000 kcal. Since the norm is 33 percent, you should divide 2000 by 33, get 660. That is, the calorie content of the diet only due to fat was 660 kcal.

2. proportions between protein, fat and carbohydrate (P:F:C) , it is recommended:

as 1: 1,2: 4,6.

3. the proportions of the main mineral elements Ca:Mg:P = 1:0,5: (1,5-2,0).

4.*55%* of the total amount of protein should be ***protein of animal origin***.

5. Of the irreplaceable amino acids tryptophan : methionine : lysine the optimal proportions are 1: 3: 3

6.plants fats should make up 30% of the total fat. (50% of animal fats, 20% of margarine and culinary oils) PUFA accounts for 10%, saturated fatty acids – 30%, monounsaturated fatty acids (oleic) – 60%.Norm of fats depend of geographical factors and the climate condition, for example: recommended increase in energy demand due to fat among the population of the

Northern to *5-7%;* the reduction in energy demand due to fat among the population of the Southern to *5%*.

7. the total amount of **carbohydrates** in the daily ration should be 75% starch, 20% sugar, 3% pectin, 2% cellulose.

8. variety of foods.

9. 6 groups of products should be included in the medium-cut harvesting:

I - Milk and dairy products; II – meat, poultry and offal; III – bakery products, cereals and macaroni products; IV – fats; V – potatoes and vegetables; VI-fruits and berries.

What is digestion? Digestion is the complex process of turning the food you eat into nutrients, which the body uses for energy, growth and cell repair needed to survive. The factors affecting on process of digestion: the chemical composition of food, the origin of food, cooking food processing, organoleptic properties of food. The digestion process also involves creating waste to be eliminated

Absorption of food – is the degree of utilization by the body of the nutrients contained in it. The absorption of nutrients depends on the characteristics of their absorption from the gastrointestinal tract. The amount of absorption (absorption coefficient) is an indicator of the total amount of nutrients in the product or ration in percentages. For example, 20 mg of iron enters the body daily with food, but 2 mg of iron is absorbed from the intestine into the blood; the absorption rate of iron is 10%. The coefficient of absorption of nutrients depends on the nature of the products included in the ration, the methods of their culinary processing, and the state of the digestive organs.

Food digestion – characterized by the degree of tension of secretory and motor functions of the digestive organs during the digestion of food. The use of nutrients by the body depends on food digestion. Also, the rate of digestion of food dependent on: secretory and motor function of the digestive organs. Quantitative absorption capacity, expressed as a percentage of the total content of the nutrient in the product, is called the ***coefficient digestibility***. To low-digestibility food, include legumes, mushrooms, and meat rich in connective tissue, fruits, heavily fried and very fatty products, fresh hot bread. The indicators of quick digestion and meaningfulness of food sometimes do not correspond to each other. Cooked hard eggs are difficult to digest and strain the function of the digestive organs, but the nutrients in the eggs are well absorbed.

In order to ensure the quantitative and qualitative completeness and balance of nutrition of each population group, it is necessary to correctly draw up the menu tables of dishes in the daily diet, correctly divide the types of products included in the composition of dishes and food into separate intake times during the day.In organized nutrition institutions, food rations are prepared according to the menu schedule, which is drawn up in advance.

Menu-apportion (see subject 4) to be prepared during the day, separate food products included in each of them and ready meals, as well as separately served products (bread, sugar, cheese, sausage, etc.) is a distribution table that shows their name, type, variety and quantity in grams per person. These indicators are recorded separately for each time of food intake (breakfast, lunch and dinner, supper). The menu-apportion table of the daily food ration can be compiled according to the appropriate form.

3. Regime of nutrition (table 1.1.). One of the important elements of efficient nutrition is the correctness of the nutritional regime, where it is understood the complete division of food intake during the day and its distribution in quantity according to food intake. In modern conditions, more physiologically, four-time food intake during the day is justified. One of the main approaches to an efficient feeding regime is the frequent, small intake of food, the correct regulation of the break between food intakes.

On the other hand, food products – bread, meat, butter, sugar, etc. determine the amount of weight and divide them into separate reception times; then cereals, vegetables and other products necessary to prepare each dish specified in the menu were selected, the weight of each should be noted in the menu table.

If the dish is prepared at home, then the hostess who prepares the dish should study and clarify information about the gross or ***netto- weight***, type and variety of the product she takes for each portion of the dish she will prepare.

The "gross" weight of the product (weighing the scales) means the total weight of the product in combination with the inedible part of it and the hopper during mechanical processing. By "netto" weight of the product is understood its net weight or the weight of the product purified from the waste part.

When drawing up such a ration, the following conditions should be taken into account:

1.The caloricity of the ration should be justified by taking into account the age, sex, nature of the work, form of rest of the person, ensuring its compliance with the energy expended.

2. It is important to correctly divide the calorie content of the daily ration by the intake Times of food .

Table 1.1.

Day of regime

Daily regime (energy)	**Breakfast 1 (%)**	**Lunch(%)**	**Dinner 1 (%)**	**Dinner 2 (%)**	**Supper(%)**
I - 3 meals per day	30	-	45	-	25
II - 4 meals per day	25	15	35	-	25
III - 6 meals per day	15-15	10	35	20	Snack before bedtime 5

Thus, it is recommended to consume at least 60% of the total daily amount of food in the 1st half of the day (before 15.30), at breakfasts and dinner.

•The intervals between meals should not exceed 4 or 5 hours. It contributes to consumption of moderate amounts of food at each intake and forms a healthy habit not to overeat.

•Dinner should be taken 2.5-3 hours before bedtime (according to modern approaches, 30-40 minutes before bedtime.The last meal should be no later than an hour before bedtime. The diet should include only low-caloric food (milk, fermented milk drinks, fruit, and fruit juices). Fried dishes and food rich in fat, crude fiber, spicy and salty food are prohibited.

•It is necessary to eliminate snacks in between meals.

•Intakes should be at strictly set hours.

•The time factor plays a big role in the formation of conditioned reflex reactions (secreting saliva, gastric juice, bile, and so on). The human organism behaves as if it is preparing to ingest and digest food.

•Do not rush while having meals. Chew the food carefully and slowly.

•The duration of the meal at lunch time should be at least 30 minutes.

• The epidemiological safety of the food to be ingested must also be constantly kept in the spotlight.

•Hygienic requirements for nutritional conditions:microclimatic conditions,dining room interior (it is necessary to keep the dining room clean and cozy), table decoration (serving). The quiet, cozy atmosphere in the dining room while eating makes for a proper digestion and health maintenance.

Distractions from having meals which must be eliminated are conversations, radio, television, reading, etc. It should be remembered that ignoring the principles of the balanced diet is one of the main causes of diseases of the digestive organs (ulcer disease, chronic gastritis, colitis, and others).

Energy balance-calorie-energy required to increase the temperature of one gram of water one degree centigrade; dietary Calorie = 1 kilocalorie; energy balance = number of calories taken in is equal to the number of calories used; ***1 calorie equal = 4.184 J.*** Positive energy balances more calories taken in than used-excess energy is stored; negative energy balance more calories used than are taken in (figure 1.1).

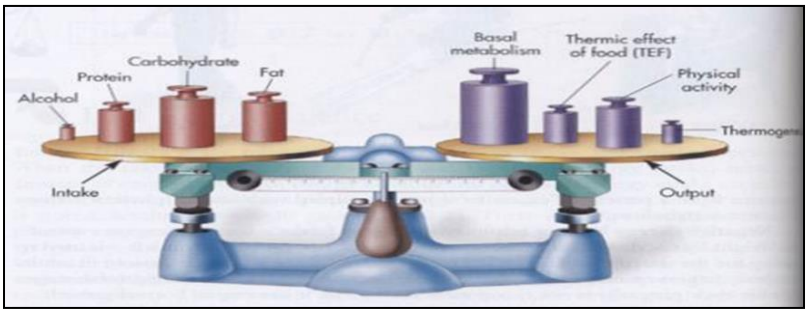


Figure 1.1. Uses of energy by the body

Positive and negative energy balance. Positive energy balance (the healthy way). If the caloric content of the diet systematically prevails over the daily energy consumption. Diseases observed with a positive energy balance is hypertension, atherosclerosis, obesity, diabetes and others. When your body is in a positive energy balance or neutral energy balance it has been proven to work much more efficiently in losing or gaining weight, whatever your goal maybe. Positive energy balance has got a lot to do with what goes into your cells – the right nutrients and calories. Your body will function correctly using up the energy it needs and the additional

exercise you do with burn the remainder. You then consume more calories again and the cycle continues. When you see this functionality working correctly you will see your hormone levels balance out too (burn more fat + build more muscle = better mood) So in all your body will be running a lot smoother, which will ensure you become a stronger more sustainable version of yourself!

Negative energy balance *(the unhealthy way).* If the daily energy consumption is not systematically compensated by the caloric content of the diet. When your body is in a negative energy balance, admittedly you will see quick weight loss, but there is an unhealthy way and a healthy way to this. The unhealthy way is to lose weight by dropping 500 calories from your guided RMR and not exercising – but be warned you are basically robbing your body of what it really needs. This is why you will see a lot of people on crazy diets, getting ill more often and feeling fatigued all the time – there immune system doesn't have the energy it needs to function. From actioning this harsh lack of calorie (the high school diet I call it) your body metabolism will decline, and your body will get used to burning less calories naturally. A number of functions will start slowing down, such as; the release of fat burning hormones, estrogen and testosterone levels as well as non-survival functions.

Subject 3. Expenditure of energy as a base for determination of nutrition energetic adequacy

The daily energy expenditures (DEE) is formed of:

•**energy of basal metabolism** or energy expenditures on functioning of internal organs for maintenance basic vital functions of the body, such as blood circulation, and respiration.

•**energy expenditures on food digestion** (energy of specific and dynamic action of food).

•**energy expenditures on muscular work** (intellectual work, physical activity, active forms of rest, sport).

The not controllable energy expenditure is energy expenditure on the basal metabolism, on the food digestion (specific- dynamic action of food). Controllable energy expenditure is energy expenditure on the intellectual and physical activity.

- *energy of basal metabolism* or energy expenditures on functioning of internal organs for maintenance basic vital functions of the body, such as blood circulation, respiration, the functions of the endocrine system, heart and kidneys work. Basal metabolism - this is the

minimum energy expended in a fasting state, awake, at rest in a warm, quiet environment. Basal metabolism determine in a state of complete rest, 14-16 hours after eating, on an empty stomach. Basal metabolic rate: 0.9 kcal/kg/hour in women, 1.0 kcal/kg/hour in men. Factors that influence BMR: greater the lean body mass the higher the BMR; greater the body surface area/volume ratio the higher the BMR; gender; thyroid hormones; nervous system function; age; nutritional status; pregnancy; caffeine and tobacco.The main exchange indicator is influenced by the functional state of the central nervous system, the functions of the endocrine system, body weight,height, gender, age. For example, the hyper function of the thyroid gland increases the main exchange, while the hyper function of the pituitary gland and gonads reduces the intensity of the main exchange.

Age: in accordance with the applicable physiological rules and work intensity whole population is divided into several groups. Among them, nine groups of children based on age, including three group of infants, six groups of preschool and school age. In the last two groups, in addition to age used gender feature - boys and girls in the group of 11-13 years and boys and girls in the group of 14-17 years.

children up to 17 years (11 groups: 1-3 month's; 4-6 months; 7-12 months; 1-3 years; 4-6 years; school age: 7-10 years. From 11 years, old begin the division of children by gender: 11-13 years (2 subgroups, boys and girls), 14-17 (also 2 subgroups);

The adults up to 59 years divided three groups:

adults up to 59 years divided three groups (18-29 years, 30-39 years, 40-59 years);

Based on age and allocated a group of persons of pension age 60-74 years (elderly) and older than 75 age (old age) years with the differentiation by gender.

after 60 years, pension age, 2 groups (60-74 years and after 75 years, and 2 groups men's and 2 groups women's).

Therefore, it varies within wide limits – from 1000 to 2000 Kcal, to average ***1700 Kcal (average body weight of 70 kg) for men***; and ***1400 (average body weight of 60 kg) for women.*** Knowing the basal metabolism, it is possible to determine the energy expenditures on food digestion.

Gender: the basal metabolic rate in women is 5-10% less than in men, in children 10-15% higher than in adults, in old and old age 10-15% lower than in young people.

The level of basal metabolism is usually calculated using the special tables (considering the body weight, height, age and sex). The energy that the body expended on the basal metabolism can also be calculated and determined using the numbers A and B in (see table…. and …….) by *Harris and Benedict.* To do this, they determine the age, height and weight of the examined person. In the A-digits in table 3.1, they find and record the number sought by body weight and gender, and in the B-digits in table 3.2., they find and record the corresponding number by height, age and gender. The sum of both numbers indicates the amount of energy that that person expended on the basal metabolism in kilo calories or Joule calories. For example, let's say that a 20-year-old (boy) weighing 60 kg and a height of 160 cm needs to determine the energy expended on the basal metabolism.

Table 3.1.

Harris and Benedict I part of the table-***A-figures***

(amount of Basal metabolism according to body weight, kcal)

Weight (kg)	men	female	Weight (kg)	men	female	Weight (kg)	men	female
3	107	683	29	465	932	55	823	1181
4	121	693	30	479	942	56	837	1191
5	135	702	31	493	952	57	850	1200
6	148	712	32	507	961	58	864	1210
7	162	721	33	520	971	59	878	1219
8	176	731	34	534	980	60	892	1229
9	190	741	35	549	990	61	905	1238
10	203	751	36	562	999	62	919	1248
11	217	760	37	575	1009	63	933	1258
12	231	770	38	589	1019	64	947	1267
13	245	779	39	603	1028	65	960	1277
14	258	789	40	617	1038	66	974	1286
15	272	789	41	630	1047	67	988	1296
16	286	808	42	644	1057	68	1002	1305
17	300	818	43	658	1066	69	1015	1315
18	318	827	44	672	1076	70	1029	1325
19	327	837	45	685	1085	71	1034	1334
20	341	846	46	699	1095	72	1057	1344
21	355	856	47	713	1105	73	1070	1353
22	368	865	48	727	1114	74	1084	1363

23	382	875	49	740	1124	75	1098	1327
24	396	885	50	754	1133	80	1167	1420
25	410	894	51	768	1143	85	1235	1468
26	424	904	52	782	1152	90	1304	1516
27	433	913	53	795	1162	95	1373	1564
28	452	923	54	809	1172	-	-	-

Table 3.2.

Harris and Benedict II – part of the table - ***figures B***

(size of height and amount of basal metabolism by age, kcal)

Height sm.	men									female							
	age																
	15	20	25	30	35	40	45	50	55	15	20	25	30	35	40	45	50	55
		-	-	-	-	-	-	-	-	-	-							
		-	-	-	-	-	-	-	-	-	-							
		-	-	-	-	-	-	-	-	-	-							
		-	-	-	-	-	-	-	-	-	-							
		-	-	-	-	-	-	-	-	-	-							
90	80	-	-	-	-	-	-	-	-	35	-							
100	180	-	-	-	-	-	-	-	-	5	-							
105	230	-	-	-	-	-	-	-	-	25	-							
110	280	-	-	-	-	-	-	-	-	45	-							
115	330	-	-	-	-	-	-	-	-	65	-							
120	380	-	-	-	-	-	-	-	-	85	-							
125	430	-	-	-	-	-	-	-	-	105	-							
130	480	-	-	-	-	-	-	-	-	125	-							
135	530	-	-	-	-	-	-	-	-	145	-							
140	580	-	-	-	-	-	-	-	-	165	150							
145	630	581	-	-	-	-	-	-	-	185	165							

150	680	618	582	548	514	480	447	413	379	204	180	161	138	113	90	68	44	2
155	730	651	607	573	539	505	472	438	404	228	195	170	147	122	100	77	53	3
160	780	684	632	598	564	530	497	463	429	242	209	179	155	132	109	86	62	39
165	815	714	657	623	589	555	522	488	454	260	222	189	164	142	119	95	71	48
170	850	744	682	648	614	580	547	613	479	278	234	198	175	151	128	104	81	58
175	875	774	707	673	639	6o5	572	538	504	296	247	207	184	160	137	114	90	67
180	900	804	732	698	664	630	597	563	529	313	259	216	193	169	146	124	99	76
185	950	834	757	723	689	655	622	588	554	341	280	225	203	178	155	134	108	86

In Table 3.1, they search for the number corresponding to 60 kg in the column "men" and find the number 892, in Table 3.2, the number corresponding to 160 cm height and 20 years in the column "men" again and find the number 684. The sum of these two numbers indicates the amount of energy of the person's body in that example expended on basal metabolism (892 + 684 = 1576 kcal, or 6594 kJ).

- energy *expenditures on food digestion* (energy of specific and dynamic action of food). Knowing the basal metabolism, it is possible to determine the energy expenditures on food digestion. When food is eaten, the activity of the digestive organs and skeletal muscles, cells increases, which leads to an elevation of the basal metabolism.

Energy released as a result of oxidation of 1 gram of protein is :4 kcal, fats: 9 kcal, carbohydrate:4 kcal.

The degree of elevation of exchange depends on the composition of the food ingested. Metabolism rises more (30-40%) when you take in protein, (4-14%) when you take in fat and (4-7% when you take in carbohydrates.It has been established that the energy expended on the specific-dynamic action of food is as much as 10% of the energy expended on the basal

metabolism, when mixed food is ingested and the proportions of proteins, fats and carbohydrates in the composition of food are normal.

For example, if the energy expended by the body on the basal metabolism is 1600 kcal or 6684.4 kJ, then the energy expended on the specific-dynamic action of food (SDA) of food will be 160 kcal or 668.4 kJ. Then to calculate DEE you should sum up 1700 Kcal + 170 Kcal + energy expenditures on muscular work.

Example:In a 20-year-old boy under examination, energy expenditure for basal metabolism according to the tables of Harris-Benedict is 2000 kcal. Determine the change in basal metabolism in this young man, if he mainly takes carbohydrate food.

Calculation :2000 : 100 x 4 ((4-14%) carbohydrate) =80.

In the same way, you can calculatechange in basal metabolism if you people takes proteins, fats, mixed foods.

- *energy expenditures on muscular work* (intellectual work, physical activity, active forms of rest, sport).

Depending on the will of a person and circumstances, the regulated energy consumption can increase or decrease significantly. The main indicator that determines the energy expenditure in physical activity is characterized by the load and nature of the muscle work expended to perform the production process – physical work. The more manual work that requires physical force in the production process, the greater the energy consumption will be. At present, due to the increasing mechanization and automation of labor processes, the energy consumption of people in labor activity has sharply decreased.

*Type of physical activity.*Therefore, in the new norms, the physiological needs of 18-60-year-olds for *nutrients and energy*, ad also *intensity of work* are defined in 5 groups depending on energy consumption. Since women are not to work in professions with heavy labor intensity, there is no norm for women in-group V (allowed women defined 4 groups).

Also recommending determine Coefficient of physical activity (CPhA). According to WHO, the gradation of the population by groups is based on the physiological and biochemical characteristics of the body and is carried out according to the value of the basal metabolic rate (BMR), taking into account the coefficient of physical activity (CPhA) (see table 3.3.). The

coefficient of physical activity is the ratio of daily energy expenditure (DEE) to the value of the basal metabolism (BM):

CPhA = DEE / BM

It should be noted, that population groups with energy consumption at the coefficient physical activity (CPhA) below 1.4. and above 2.5. from the basal metabolism are considered as risk groups.

The maine indicator of nutritional requirements depending on the groups of work intensity is energy expenditure of the body

I. Intellectual work (CPhA 1.4.) – workers in light physical work - engineering and technical workers, whose work is associated with some physical effort, workers employed in automated processes, workers of electronic industry, sewing industry, agronomists and livestock specialists, veterinary workers, nurses and orderlies, sellers, service workers, workers of telegraph communication,workers of culture , teachers,heads of enterprises and organizations , instructors of physical education and sport coaches.

II. Easy physical work (CPhA 1.6.) - workers mostly mental work - heads of enterprises and organizations,agronomists, livestock specialists, sellers in industrial goods stores, engineers and technical workers, whose work does not require significant physical activity,nurses, doctors (except for surgical doctors); science workers; writers, cultural and educational workers; of physical education and sports teachers, staff of planning and accounting, secretaries, managers and employees of the control panels.

III. **Middle physical work** (CPhA 1.9.) – the employees on average severity of labor, machine operators, mechanics, fitters and customizers, surgeons, chemists, textile workers and shoemakers, vehicle drivers, employees of the food industry, workers of public utilities and public catering, sellers of food products, foremen of transport and field team, workers of railway and water transport, machinists of hoisting mechanisms, polygraphists.

IV. Hard physical work (CPhA 2.2.) - workers in heavy physical labor, construction workers, the bulk of agricultural laborers and mechanics, miners at surface work, workers of the oil and gas industry, metallurgists and workers of foundry, workers the pulp and paper and wood industry, slingers and riggers, carpenters, workers of building materials industry.

V. Very hard physical work (CPhA 2.5.)- workers employed particularly heavy physical labor,of loaders,miners working underground, lumberjacks, steelworkers, workers in the building materials industry, wood fellers, masons and reinforced concrete, the diggers, loaders.

3. Sex: BW (body weight) of women is 10% less, than men.

4. Social aspect: social behavior and tradition.

5. Geographical factors and the climate.

6. Body weight.

7. Physiological condition (as pregnancy, breastfeeding: mothers with child 1-6 months of age and 7-12 months of age).

Table 3.3.

Coefficient of physical activity (CPhA) different work intensity

Labor intensity	Occupation	CPhA
Category 1 Very light (male and female)	Mostly brain workers: researchers, students, teachers, officials, computer operators, inspectors, dispatchers, control panel operators, librarians, architects, engineers, dealers, brokers, museum workers, designers, tax service employees.	1.4
Category 2 Light (male and female)	Workers engaged in light physical labor: assembly line workers, consumers service employees, medical personnel, sewers, packers, salespeople, telecommunications workers, police, customs inspectors, guides, photographers.	1.6
Category 3 Moderate (male and female)	Workers engaged in moderate physical labor: transportation drivers, railway workers, emergency doctors and surgeons, machine-tool operators, mechanics, set-up people, adjusters, drillers, bulldozer and excavator drivers, gardeners, plant-breeders, greenhouse facility workers.	1.9
Category 4 Hard	Workers engaged in hard physical labor: building and agricultural workers, metallurgists,	2,2
(male and female)	shaftmen, foundrymen, foresters and game keepers, woodworkers.	
Category 5 Very hard (male)	Workers engaged in especially hard, nonmechanized physical labor: loaders, tree fellers, miners, concrete workers, diggers, rescuers, divers, masons, high professional sportsmen at the training period, deer-breeders.	2.5

Measurement of the body weight is a simple method to check and control the daily energetic adequacy of nutrition of any person. For this purpose the ***Body Mass Index (BMI)*** and ***Brok index*** (IB) is usually used.

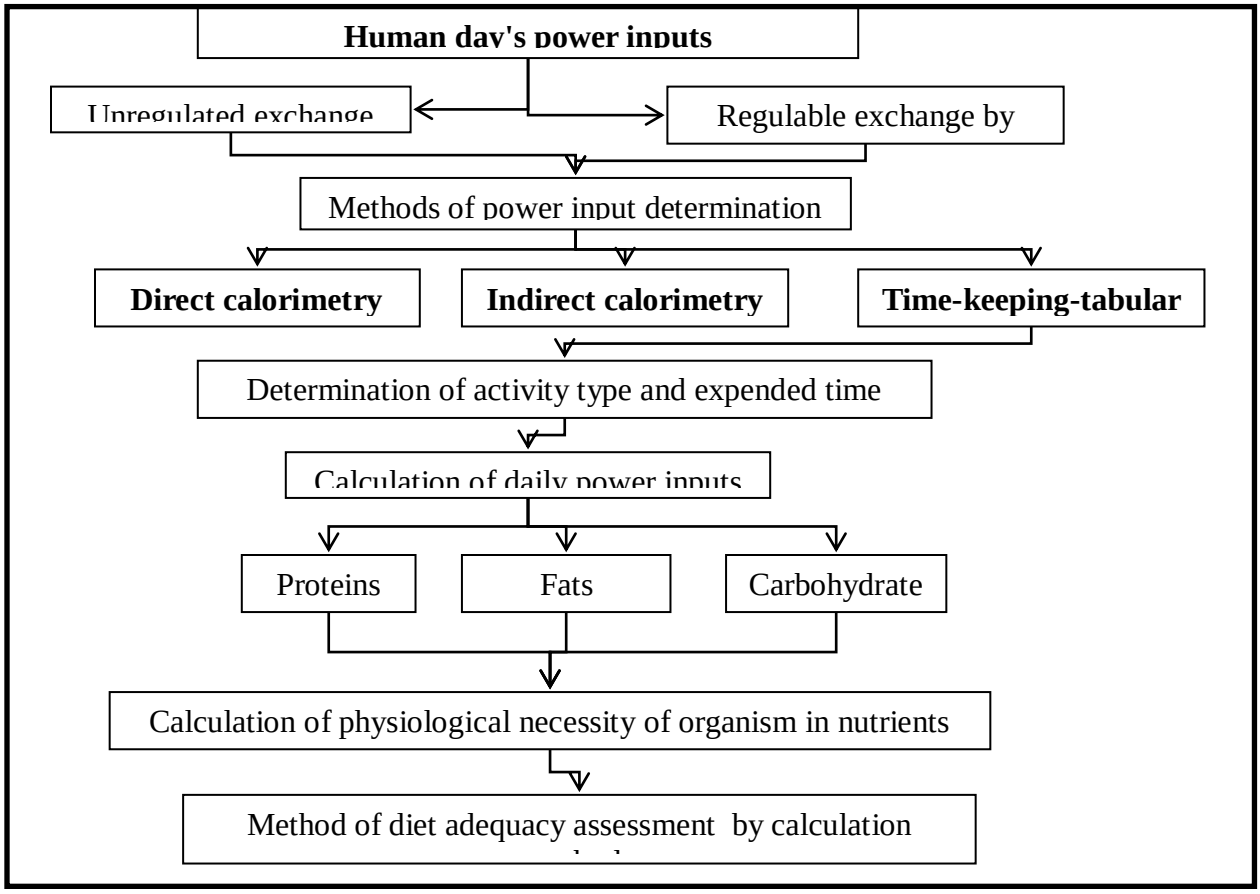
Brok index (IB):

IB = weight (kg)/ height -100

The normal BI is in the interval: 0,9-1,1 -normal, <0.9- weak(skinny), >1.1 -strong (thick).

Energy (caloric) requirement of people depends on: age, type of physical activity (5 professional groups of adults), sex, social aspect, geographical factors, and the climate, body weight, physiological condition, economical status.

For energy expenditures determination the methods of direct and indirect calorimetry are used. Also time-keeping tabular method is applied (scheme 1). The method of studying the energy expenditure of the body based on the control of body weight and the study of the energy value of food is called alimentary ergometry.



Scheme.1. Methods of energy expenditures determination

The first method (**direct calorimetry**) is rare applied because of complicacy of equipment (biocalorimetric camera) and because many kinds of physical activities are not be accomplished in that cameras.This method most accurate and objective.These bio - calorimetric cameras (Etwater-Benedict, Shaternikov camera) have double walls (fig.3.1.).

Between walls the water circulates by ducting. The man is placed within the camera and he carries out any kind of activity.

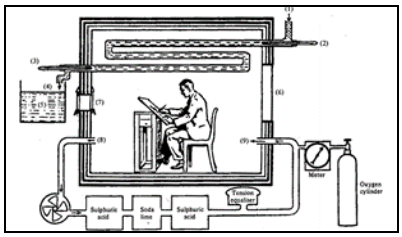


Figure 3.1. The calorimetric cameras of Etwater-Benedict

The energy, which is out as warmth should be determined by recognizing of water volume and temperature changes (heating of water). In other words, energy expenditures are determined by exactregistration of body heat in any kinds of body activity.

The second method – **indirect calorimetry** is determination of energy expenditures by respiratory metabolism. It is more simple. It is based on determination of chemical composition of inspired and expired air (the ratio of carbon dioxide and oxygen). Then the respiratory coefficient (RC) is defined. For this method the different apparatus (Douglas-Holden bag, Etwater) (fig. 3.2.) are applied. If you know energetic equivalent of 1 L of inspired oxygen and mean of lungs ventilation, you can determine the energy expenditure for any kind of man activity.

Figure 3.1.Douglas-Holden bag

Timekeeping-tabular method. Daily energy expenditures (DEE) can also be calculated by tables. This method is a very simple and available for determination of approximate level of DEE of a big group of population (for example to find out of DEE of students, or any professional group) for all activities performed during the day.

Using this method the first step is to make the timekeeping of all kinds of man activity:in other words, you should determine the time (minutes), spent on every kind of activity during 24 hours, including thefood intake, rest, sleep and other. Then obtaineddata you have to multiply byenergetic values of any activity. The energetic values of every activity you should find in special tables in kcal/kg/min and include the basal metabolism. (Energetic value of every kind of activity was determined on the base of indirect calorimetry method). Summing energetic expenditures on different activities for certain duration of it (min.) you can calculate the total energy expenditures for 24 hours and on 1 kg of weight. Then you should multiply received level of energy by weight of examined person.

For example if the total energy expenditures for all activities during the 24 hours is 40,2 kcal and the weight of man is 69 kg, so the DEE of this person is: 40,2 kcal x 69 kg = 2774 kcal.

If the any kind of activity is not indicated in table you can use the other onesimilar to it by nature. For example, clerical work or the work of draftsman are very close (on energy expenditures) to typing

The data, obtained by this method is approximate, butgive an estimate of DEE and requiredenergetic valueofration (table 3.4.).

Table 3.4. The scheme for DEE calculation of medical university student

nn	**Type of activity**	**Duration (minutes)**	**Energy expenditures (including BM)**	
			kcal/kg/min	kcal/kg/min x duration
1	**Study hours:** Practical lessons a) laboratory		0.0360	
	b) seminars		0.0250	
	c) on clinical department of therapeutic type		0.0260	
	d) on clinical department of surgical type		0.2660	
2	Lectures		0.0243	
3	Breaks		0.0258	
	Off-hours:			

4	Homework (preparing for lessons)		0.0250	
5	Trip to the university: a) walking along asphaltic road (4-5 km/h b) by transport		 0.0597 0.0267	
6.	Domestic work: a) tidying up of the room, household device, furniture b) shopping c) child care d) linen washing e) dish washing		 0.0402 0.0450 0.0360 0.0511 0.0313	
7	Self-service: a) to make the bed b) eating (at the table) c) washing (waist-deep) d) shower e) trousers cleaning f) clothes and shoes cleaning g) dressing and undressing		 0.0329 0.0236 0.0504 0.0570 0.0317 0.0493 0.0264	
8	Free time, rest a) standing b) sitting c) to lie (without dream)		 0.0264 0.0229 0.0183	
9.	Entertainments a) reading b) dancing (waltz) c) singing d) to play chess		 0.0230 0.0596 0.0290 0.0242	
10	Sport a)morning physical exercises b) race with speed 8 km/h c) race with speed 180 m/min d) race with speed 320 m/min e) gym f) swimming		 0.0648 0.1357 0.1780 0.3200 0.1280 1.1190	

11	Work a) simple physical work b) middle physical work c) hard physical work		 0.0405 0.0690 0.1072	
12	Sleeping		0.0155	

Expenditures on muscular work should be determined by using tables of energetic value of different kinds of activities (Kcal/hour). For example, intellectual work is 7-8 kcal per hour or dish washing is 59 kcal per hour. So, knowing duration of any activity you can also calculate the muscular work energy expenditures. Therefore, depending on character and intensity of muscular work DEE can vary from 2450- 3750 kcal (for men) and from 2000- 2850 (for women).

Alimentary ergometry methods is based on studying the energy expenditure of the body based on the control of body weight and the study of the energy value of food.

This method is considered one of the modern methods of determining the energy consumed by the body in scientific and practical activities. The essence of the method is based on accurate registration of the energy value of food intake and control over body weight for 15-16 days. The person involved in the examination is weighed every morning on an empty stomach with an accuracy of 50 g on a medical scale (even the underwear he is wearing must be the same), in parallel, an accurate record of the meals and products taken by the person during the day is made (if there is an uneaten part of the food ration and products, it is deducted from the total amount). . Body weight does not change when the energy of the food intake corresponds to the energy lost by the body. When this ratio is disturbed, the body weight either increases or decreases. The increase in body weight is mainly explained by the accumulation of fat in the body. Adipose tissue has an average water retention capacity of 25%. Therefore, 1 kg growth of a healthy person's body is equivalent to 6750 kcal (28242 kC) of energy. During the examination, the energy exchange of the examined person can be estimated with high accuracy by subtracting the energy value of the fat accumulated in the body from the absorbed energy of the food ration. The practical feasibility of the method was substantiated by P.E. Kalmykov and I.M. Buznik. The method is quite simple at first glance and can be easily applied by doctors working in the field of nutrition. However, it is quite difficult to accurately assess the energy value of daily food, and it is necessary to involve competent experts in the research.

Theme 4. Hygienic estimation of nutrition valuable. The method of ration energy cost determination

In catering system it is important to calculate the right *menu-apportion* with receipts of all dishes. Menu-apportion is a list of dishes for the day with weight of food stuffs, taken for every dish cooking. Menu-apportion shows what amounts of different food stuffs are needed to be taken to deliver recommended daily norms of protein, fats, carbohydrates, vitamins and minerals. Thus, the norms of energy requirements of daily ration become as real quantity of foodstuffs, which should be consumed by man. Menus are usually composed for every day and are the main document planning quantity and quality composition of rations in conditions of collective nutrition. In menu-apportion the amounts of all foodstuffs are indicated. Studying the daily menu-apportion for the period of 1-2 weeks it is needed to calculate different nutrients (proteins, fats and othrs), contained in food stuffs to learn the caloric value of ration. Calculation of rations caloric value is made by using special tables, named as "Tables of foodstuffs chemical composition" (Extracts from tables find on the appendix 4.1). In that tables amount of all nutrients in different foodstuffs are indicated in g, mg or mkg per 100 g of any foodstuff.

Calculation procedure: Calculation of proteins, fats, carbohydrates content and ration's caloric value are made by multiplication of food weight by amount of nutrients in foodstuff (from tables) and then received result should be divided by 100 (appendix 4.2).

*Example.*You need to determine content of proteins and fats in 180 g of beef, contained in cooked dish. Using the tables you can find, that 100 g of beef contents 12 g of proteins and 7.8 g fats. Then you can calculate how many proteins and fats are in 180 g of meat:**180 g. x 12 : 100= 21.6 g.** of proteins and **180 g .x 7.8 : 100= 14.04 g.**of fats. To calculate the energetic value of ration you should quantity of proteins and fats multiply by caloric equivalent of protein (4.1 kcal) and fat (9.3 kcal):**21.6 g. of proteins x 4.1= 88.6 kcal; 14.04 g. of fats x 9.3= 130,6 kcal; Total kcal = 219.2 kcal**

Then calculated quantity of proteins, fats, carbohydrates and calories in every foodstuff, taken for dish cooking should be summed up by every dish, every meals. After that you get required caloric value of breakfast, lunch, dinner and full daily ration as a whole. Then the daily ration caloric value compare with daily energy expenditures which you determined last lesson. Based on this comparison you can judge about energetic adequacy of nutrition (table 4.1).The next regime (energy) is recommended by nutritionists:

Table 4.1.Composition form of menu-apportion

Menu	Products	We-ight, g	Proteins		Fats		Carbohydra-tes, g	Calorie content, kkal	Ca, mg	P, mg	Mg, mg	Vitamins			
			ani-mal	vege-table	ani-mal	vege-table						A	caro-tin	B_1+ B_2	C
Breakfast															
altogether															
Dinner															
altogether															
Supper															
altogether															
Total															

Table 4.2. Example of daily menu-apportion

Food product or dish	Quantity of dishes (portion) and food stuffs, g	Food stuffs as a part of dishes, g	Quantity of food stuffs, g.	nutrients, g			Ca, loric cost
				Proteins	Fats	Carbo-hydrates	
1	2	3	4	5	6	7	8
Breakfast Tea with sugar	200	tea sugar (4 p.)	0.2 24				

Wheat bread with butter cheese fried eggs	70 30 79	wh. bread butter cheese eggs (2) butter	50 20 30 82 10				
Total for I breakfast							
Lunch Cocoa with milk	 250	cocoa milk sugar	2 230 18				
Wheat bread Sausages	50 98	wh. bread sausages (2)	50 98				
Total for II breakfast							
Dinner 1. Vinaigrette	150	Potato Beetroot Carrot Sauerkraut Vegetable oil onion	30 23 15 44 15 23				
2.Borsh (Meat Bouillon)	450	Potato Cabbage Beetroot Carrot Tomato onion Vegetable oil	36 36 72 18 13 18 5				
3.Stuffed cabbage (2 pieces)	260	Beef Rice Onion Cabbage	79 10 10 132				
4.Apple 5. Wheat bread	88 150	Fennel, coriander Apple Wheat bread	8 88 150				
Total for dinner							

Supper: Fried fish with potato:	125/100	Fish flour vegetable oil potato vegetable oil	149 7 8 145 10				
Tea wheat bread Curd with sugar	200 100 124	tea wheat bread curd sugar	0.2 100 100 24				
Total for supper							
Total for day							

Appendix 4.1. Extracts from the "Tables of foodstuffs chemical composition"(Chemical composition and caloric value per 100 g of food stuffs edible part)

Food stuffs	**Proteins, g**	**Fats, g**	**Carbohyd-rates, g**	**Calories, kcal**
1	2	3	4	5
Rice	7.0	0.6	77.3	323
Wheat bread (from wheat flour of prime sort)	7.6	0.9	49.7	226
Sugar	0	0	99.8	374
Cocoa	24.2	17.5	27.9	373
Milk	2.8	3.2	4.7	58
Curd (18% richness)	1			
Cheese	23.4	30.0	-	371
Butter	0.6	82.5	0.9	748
Eggs	12.7	11.5	0.7	157
Vegetable oil	0	99.9	0	899
Cabbage	1.8	-	5.4	28
Sauerkraut	0.8	-	1.8	14

Potato	2.0	0.1	19.7	83
Onion (bulb)	1.7	-	9.5	43
Carrot	1.3	0.1	7.0	33
Fennel,coriander	3.7	-	8.1	45
Tomato	0.6	-	4.2	19
Beetroot	1.7	-	10.8	48
Fish (pike perch)	19.0	0.8	-	83
Sausages	12.3	25.3	-	277
Beef	18.9	12.4	-	187
Chicken	18.2	18.4	0.7	241
Apples	0.4	-	11.3	46
Lemon	0.9	-	3.6	31
Pasta	10.4	0.9	75.2	332

Appendix 4.2.Chart of day's nutrition ration assessment

1. Diet adequacy assessment:

- Calorie content of ration is compared with day's power inputs determined on previous lesson. A deficit or surplus of ration calorie value is determined with percent of divergence calculation.
- Content of proteins, fats, carbohydrates is compared to the values calculated on previous lesson and coverage of physiological necessity with determination of lack or surplus of albumens, fats, carbohydrates is assessed.
- Content of mineral salts and vitamins is compared with the nutrition norms, preliminary determining the labor intensity group by day's power inputs.

2.Ration balance assessment:

- ratio of albumens, fats, carbohydrates, mineral substance Ca:P and Ca:Mg are calculated;
- Calorie quota of proteins, fats, carbohydrates taking into account day's calorie content of ration is determined.

$$\text{Calorie quota of proteins} = \frac{\text{Amount of proteins} \times 4 \times 100\%;}{\text{Calorie content of ration}}$$

Calorie quota of fats = $\frac{\text{Amount of fats} \times 9 \times 100\%;}{\text{Calorie content of ration}}$

Calorie quota of carbohydrates = $\frac{\text{Amount of carbohydrates} \times 4 \times 100\%;}{\text{Calorie content of ration}}$

- it is determined the specific weight of albumens, fats of animal and vegetable origin.

1. Diet assessment: food intake multiplicity; interval between food intake; distributing of ration calorie content of by food intake; duration of food intake.

Conclusion of adequacy of individual diet assessment: recommendations on optimization of nutrition ration with indication of some food stuffs including or removal with a purpose increases or diminishments of maintenance of certain nutritive in a ration; correction of diet by a way: changes of food intake multiplicity; redistributions of calorie content of ration on food intake; changes of duration of food intake and intervals between the food intake.

Theme 5. Hygienic examination of food products

The main purpose of food hygiene is to prevent the contamination of food at all stages of production, i.e. harvest, processing, manufacturing, transportation, storage and sale and to protect consumers' health. The indicators defining quality of foodstuff: physical-organoleptic, chemical, bacteriological, helminthological, biological.

Types of inspections: current and emergency.

Current inspection (scheduled):

1. Routine work of food inspectors to control the sanitary condition of the: a) food markets, b) food production enterprises and c) public catering establishment as canteen in the schools, kinder-gardens, hospitals, and restaurants.

2. Control the quality of new produced foods.

3. Control the quality of food stuffs contaminated by antibiotics, pesticides, heavy metals and other harmful elements.

Emergency inspection (unscheduled):

If there is any epidemiological indications, as incidents of food poisoning, or to resolve any unsettled problem concerning any suspected food.

Food product after food examination:

1. Safe (good quality) - harmless for the health of the consumers.

2. Unsafe - dangerous for the health of the consumers.

3. Conditional – used after special treatments (frosting, boiling, salting and othr.), for example conditional meat (helminth)

4. Adulterated (with low nutritious value).

The food quality is usually defined by next indexes:

• Physical- organoleptic: temperature, odor, color, humidity (%), specific gravity, pH, acidity. If the suspected food product has bad odor, and changes of its color, or any visible changes it means that this food is unsafe. For any other analysis, food sample should be sent to sanitary laboratory for examination check.

• Chemical: nutritive value of food and the correct proportion of proteins, carbohydrates, fats, vitamins and minerals.

• Chemical pollution (by fertilizers, pesticides and other.).

• Bacteriological pollution (by pathogenic bacteria and viruses).

• Helminthological (helminthes).

• Radiological pollution (radio spectrometry).

• Biological test: (if suspected food contents any toxins).

The food sample size for analysis is usually taken according to official normative documents, if there is no instruction, we can take 5-10% of any suspected food for analysis.

Stages of inspections:

- Checking of food certificates or any cover documents to find out information about food product: expiry date, manufacturing country, factory and chemical contents.
- Organoleptic parameter of food product –consistency, the form, color, odor, test.
- Laboratory analyses results.

After that you can write conclusion about food product quality.

Classification of food products according to storage stability:

1. Particularly perishable products: fish and fish products, milk and dairy products, pates, aspic dishes, jellies, brawns, boiled sausages.Particularly perishable products may be stored only under refrigeration conditions and only for strictly limited periods.

2. Perishable goods: meat and meat products, milk and dairy products, fish and fish products.

3. Non-perishable: dry food with less than 14-15% humidity content.Non-perishable products are cereals, pasta, sugar, honey, jams.

Theme 6. Food poisoning. Investigation of the food poisoning cases

Food poisoning- acute or chronic poisoning are as result of digestion food, contaminated by pathogenic microorganisms, toxins or chemical harmful agents. The severity of clinical feature depends on: type and quantity of the causal agents; age of the individual and his body weight; physiological condition of the body.

Food poisoning classification: bacterial, non-bacterial and unstated etiology are distinguishing.

To write conclusion on food poisoning cause and type the sanitary inspector should to :

1) Sample the suspected food (200-300 g.).
2) Collect the samples from fecal, urine, and vomiting (100-200 ml.).
3) Send these sterile packed samples to the sanitary bacteriological laboratory.
4) Check the sanitary condition of food market and food premises in that area.
5) Check the health condition of food staff in that area.
6) Sample the suspected food from markets and food premises.

7)Conduct the questioning of the food poisoning patient: name and family, age, work place, where and when he ate in the last two days, date and time of first symptoms (vomiting, temperature, headache, gastrointestinal problems).

8) What kind of suspected food was taken before illness.

9) Place and time when suspected food was taken (figure 6.1).

The scheme of investigation of food poisoning cases include*:*

- urgent care for intoxicated persons;
- report about the case of food poisoning (should be sent to sanitary inspector during 24 hour after occurring the case);
- order for laboratory tests: vomiting masses, feces, incriminated food products;
- group of sanitary inspection: sanitary inspector, physician, administrator, and cook;
- plan of inspection interviewing of patients, personnel of catering organization;
- sanitary inspection of kitchen, medical examination of personnel, report preparing;
- conclusion about the results of inspection;

- preventive and sanitary measures.

Functions of sanitary inspector: forbid of suspected food sale in markets; prevention of food staffs' acute and chronic diseases; control of the sanitary condition and methods of disinfection in food premises and markets.

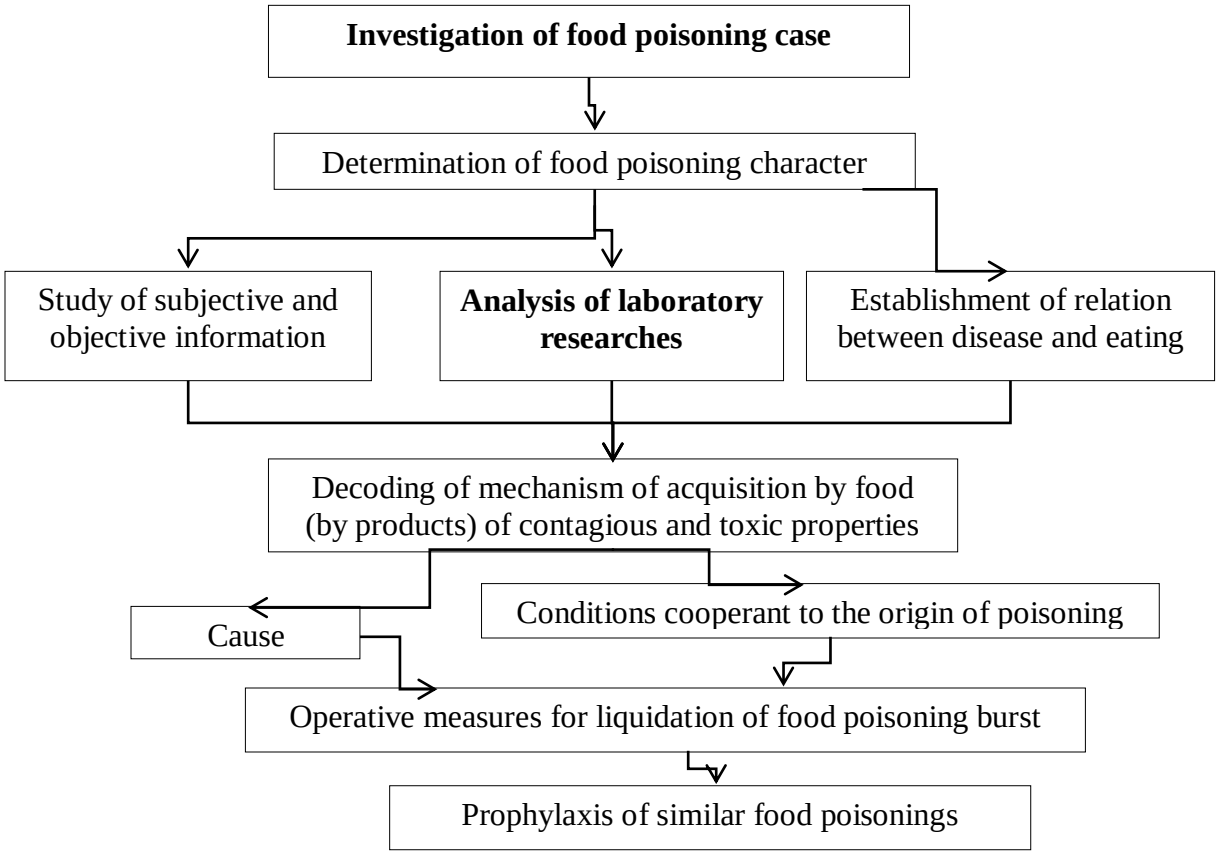


Figure 6.1. Algorithm on the investigation of the food poisonings

Theme 7. Methods of studying the dietary assessment of the population

Studying the **dietary** nutrition of the population has great socio-economic and hygienic importance. As the well-being of the population improves, the type and quality of the food products it uses changes. People with scientific knowledge in the field of nutrition, with a high nutritional culture, increase the amount of quality and high biological value products in their diet, on the contrary, those with high financial means, who do not have knowledge in this field, are mainly formed over many years, accustomed to prefer the quantity of food and in the food rations

of people who make up the majority of the population, the place of "empty calorie" products with high nutritional value is increasing, and the amount of products with high biological value is mainly decreasing. This creates the basis for the increase of non-infectious-alimentary pathologies among the population.

The goal of studying the fdietarynutrition of the population is to optimize their nutrition at a level corresponding to optimal physiological norms.

When studying population nutrition, it is important to clarify the following issues:

1. Typical characteristics of used food products and variety of foods.
2. Chemical composition and biological value of food.
3. Regime of nutrition.
4. Anticipation of national traditions in the selection of food products and food preparation.

*The complex indices:*subjective (questionnaire, interrogation) and objective are used for nutritional status assessment of the individual or collective with similar labor conditions and nutrition.

The questionnaire and interrogation data have to include the following information:

- passport data, sex, age, occupation;
- harmful habits (smoking, alcohol, drug usage);
- labor conditions (labor activity types, hard physical activity, occupation hazard characteristics and intensity – physical, chemical, biological, certain organs and systems overstrain);
- life conditions, municipal services level and quality, physical training and sport activity (type, regularity), the family or organized collective economical capabilities;
- characteristic of nutrition in last 1-3 days: food intake quality, hours and places of food intake, meals, products and their weight list, culinary handling quality and others.

There are two groups of methods used for dietary assessment:

1)*socio-economic methods*, used in the analysis and planning of food policy at the republic, regional, municipal levels;

2)*socio-sanitary methods*, used to assess nutrition at the individual and group levels.

Socio-economic methods:

•*The balance method* allows the calculation of per capita consumption of food products by the population. This methods based on the principle of using information available in state statisticsinstitutions.

•*The budget method* includes the study of consumption patterns in households different on the socio-economic and territorial bases.

The following issues concern the medical study of the dietary assessment of population:

1. The dietary nutrition of the population. In the weighing method, the net (without waste) weight of all food products used to prepare food in the family, each portion of ready and eaten food, as well as the weight of leftover food is determined, comparing the information obtained as a result of study with physiological norms.

2. Assessment of health status in relation to the characteristics of dietarynutrition.

3. Development and implementation of measures to improve the dietary nutrition of the population.

The dietary nutrition of the population is medically studied in two directions:

1 – study of family and individual nutrition;

2 – study of collective nutrition.

1. The following methods are used to study family and individual nutrition:

a) At least 50-60 families should be selected in the district or city where the survey is carried out when the survey studies nutrition by weight method. In these families, the nutrition of families should be studied 3-4 times a year and for 7-14 days each time for different seasons.

In the households selected for inspection, accurate information about the daily consumption of food products should be obtained by asking the person engaged in household work (marketer, cook) and determining the weight of the products used.

c) In the questionnaire method, special questionnaires are distributed to the persons (or family members) whose nutrition is being studied, which characterizes the state of nutrition, as well as questions about the state of health related to nutrition. This is a convenient and widely used method. The accuracy of the method depends very much on the correct conduct of relevant explanatory work with those involved in the survey and the honest attitude of the person filling out the questionnaire.

Examination by the questionnaire method allows to determine the typical and individual characteristics of nutrition of different groups of the population.

The basic rules of statistics must be strictly observed in examinations conducted by the questionnaire method:

1. People whose nutrition is examined should be selected correctly according to age, profession and work experience.
2. The number of selected persons should not be less than 100 according to their profession and work experience, age and gender.
3. The questions in the questionnaire should directly characterize the quantity and quality of nutrition and should be clearly expressed.
4. Before distributing the questionnaires, the purpose of the examination, filling out the questionnaire, the meaning of individual questions and the procedure for writing answers to them should be explained in detail to the persons involved in the examination.

When studying individual or family nutrition through a questionnaire, the amount and types of food consumed by those people, whether they eat often or occasionally in public catering establishments, the names of the dishes they eat, the diet of the whole family and its individual members, and a number of other characteristics can be determined.

Each family's or individual's nutrition should be examined by this method for 7-10 days. The examination carried out during this period allows to learn about the variety of foods, the repetition of individual food products included in the ration during the week and the types of dishes prepared from them.

The advantage of the questionnaire method compared to other proposed methods for studying nutrition is that when conducting an examination with this method, it is possible to obtain accurate information about the nutritional characteristics of various population groups and a large number of people with little effort and money. It can be considered appropriate to study the actual nutrition of the population through the questionnaire method and learn the experience of examination by the example of medical university students. The results of examinations conducted through a special questionnaire designed for this purpose can comprehensively characterize the actual nutrition of students, its quantitative and qualitative indicators.

Methods of statistical calculation of menu apportionand laboratory examination (analysis) of food rations are used to study collective nutrition.

In collective feeding places, all members of the collective either receive a full ration (orphanages, day-and-night kindergartens, orphanages, boarding schools, technical vocational schools, high schools, pioneer camps, hospitals, sanatoriums and rest houses), or a part of the ration- they are provided with breakfast or lunch (canteen, restaurant, children's institutions where one or two meals are applied, industrial and agricultural workers). Examinations should be carried out in different seasons of the year in order to create a complete picture of the state of nutrition in such feeding areas and to characterize it thoroughly.

•The statistical calculationmenu apportion. The method studies nutrition in *organized groups* (pre-school educational institutions, boarding schools, health facilities, etc.) and assesses the qualitative and quantitative characteristics of food allowances. Also using laboratory study of food rations.

•Survey-weight and weight, and questionnaire. The methods study unorganized, individual, family nutrition.

•The method of 24-hour food reproduction. Each investigated person keeps a food diary. During a week he writes down the names and amounts of the dishes after each meal. The data are processed for statistical presentation of the average daily food allowance.

•The laboratory method or laboratory examination of food rations. It is a method of chemical analysis of nutrients in the diet. The method gives the most accurate results, but due to its complexity and expensiveness is rarely used. Generally, it is used as a checking method.

Dietary assessment

Assessing food and fluid intake is an essential part of nutrition assessment. It provides information on dietary quantity and quality, changes in appetite, food allergies and intolerance, and reasons for inadequate food intake during or after illness. The results are compared with recommended intake such as recommended dietary allowance (RDA)7 to counsel clients on how to improve their diets to prevent malnutrition or treat conditions affected by food intake and

nutritional status (e.g., cardiovascular disease, cancer, obesity, diabetes, and hyperlipidemia). Several common ways to assess dietary intake are described next.

Food consumption measures

Weighing method. This method is usually applied at the household level but can also be used for individuals. Food items to be used are weighed before the preparation of each meal, while information on the food consumed outside the home is obtain by interviewing each member of the household. This method is very accurate but cannot be used for long periods because it is time-consuming and expensive. Therefore, it cannot measure food consumption over time.

Food record method. In this method an individual regularly records the type and quantity of all food consumed. This method is accurate but requires very careful training and supervision by the survey taker and the close co-operation and motivation of the respondents for the task to be carried out consistently.

24-hour recall. This method was designed to quantify the average dietary intake for a group of people, although it can be used to assess individual nutrition intake. During a recall, a client is asked to remember in detail every food and drink consumed during the previous 24 hours. The method can be repeated on several occasions to account for day-to-day variation in intake. Health care providers may prompt clients to remember what they ate or drank by time periods or activities (e.g., just after waking up, before going to bed) or to estimate portion sizes by looking at household measures, food models, household utensils, photographs, or actual food.

Theme 8. Organism nutritional status and method of its assessment

The nutritional care process, you would realize, begins with nutritional assessment. Nutrition assessment is the evaluation of an individual's nutritional status and nutrient requirements. It is a

systematic process of obtaining, verifying, and interpreting data in order to make decisions about the nature and cause of nutrition-related problems. It is an ongoing, dynamic process that involves not only initial data collection, but also continual reassessment and analysis of patients/clients/ group's needs. The purpose of nutrition assessment is to: obtain adequate information in order to identify nutrition-related problems, define accurately an individual's nutritional status, determine the level of nutritional support that individuals need, and monitor changes in the nutritional status and the effect of nutritional intervention.

Why is nutrition assessment important?

Optimal nutritional status—the state of the body with respect to each nutrient and overall body weight and condition—is a powerful factor in promoting health and preventing and treating diseases. Weight loss of 10 percent or more has been associated with adverse outcomes and prolonged hospitalization, and in lean, healthy people, weight loss of more than 35 percent has been associated with death.1 Nutritional status affects immune response and response to medical therapies. Health care providers assess clients' nutritional status for many reasons:

-To identify people at risk of malnutrition for early intervention or referral before they become malnourished.

-To identify malnourished clients for treatment—malnourished people who are not treated early have longer hospital stays, slower recovery from infection and complications, and higher, morbidity and mortality.

-To track child growth.

-To identify medical complications that affect the body's ability to digest food and utilize nutrients

-To detect practices that can increase the risk of malnutrition and infection

-To inform nutrition education and counseling

-To establish appropriate nutrition care plans

The results of a client's nutrition assessment and classification of nutritional status determine all the other elements of nutrition assessment, counseling, and support (NACS) for that individual—including counseling, treatment, and referral to food security and other support.

What is nutrition screening?

Full nutrition assessment can be preceded by rapid and simple identification of people who may be malnourished or at risk of malnutrition and need, more detailed nutrition assessment. Nutritionists and trained facility-based health care providers or community service providers can do nutrition screening in health care facilities, during growth monitoring or home-based care, and during support group meetings. Simple nutrition screening can include checking for bilateral pitting edema, measuring weight and mid-upper arm circumference (MUAC), and asking about recent illnesses and appetite.

Nutrition screening requires standardized training in line with national and local health policy. Special training materials may be needed for low-literacy or illiterate populations. Community service providers need government-approved recording and referral materials, and clear guidance on provider roles, whom to screen, how, and how often. They may also need incentives to do accurate and consistent community nutrition screening and make referrals.

Nutrition assessment includes taking anthropometric measurements and collecting information about a client's medical history, clinical and biochemical characteristics, dietary practices, current treatment, and food security situation. Nutritional assessment is the interpretation of anthropometric, biochemical (laboratory), clinical and dietary data to determine whether a person or groups of people are well nourished or malnourished (over-nourished or under-nourished). The word anthropometry comes from two words: *Anthropo* means 'human' and meter means 'measurement'. In your community you will be able to use anthropometric measurements to assess either growth or change in the body composition of the people you are responsible for. The different measurements taken to assess growth and body composition are presented below.

Anthropometry is the measurement of the size, weight, and proportions of the body. Common anthropometric measurements include weight, height, MUAC, head and chest circumference, and skinfold.

Height. This is measured with the child or adult in a standing position (usually children who are two years old or more). The head should be in the Frankfurt position (a position where the line passing from the external ear hole to the lower eye lid is parallel to the floor) during measurement, and the shoulders, buttocks and the heels should touch the vertical stand. Either a

stadiometer or a portable anthropometer can be used for measuring. Measurements are recorded to the nearest millimeter.

Weight. Weighing is usually the first step in anthropometric assessment and a prerequisite for finding weight-for-height z-score (WHZ) for children and BMI for adults. Weight is strongly correlated with health status. Unintentional weight loss can mean poor health and reduced ability to fight infection. Weighing requires a functional weighing scale that measures weight in kg to within the nearest 100 g. Accurate weight measurement is important because errors can lead to incorrect classification of nutritional status and the wrong care and treatment.

Ideal body weight according to the age

Height in cm	*Males*			*Height in cm*	*Females*		
	asthenic	normo-sthenic	hyper-sthenic		asthenic	normo-sthenic	hyper-sthenic
155.0	49.3	56.0	62.2	152.5	47.8	54.0	59.0
157.5	51.7	58.0	64.0	155.0	49.2	55.2	61.6
160.0	53.5	60.0	66.0	157.5	50.8	57.0	63.1
162.5	55.3	61.7	68.0	160.0	52.1	58.58	64.8
165.0	57.1	63.5	69.5	162.5	53.8	60.1	66.3
167.6	59.3	65.8	71.8	165.0	55.3	61.8	67.8
170.0	60.5	67.8	73.8	167.5	56.6	63.0	69.0
172.5	63.3	69.7	76.8	170.0	57.8	64.0	70.0
175.0	65.3	71.7	77.8	172.5	59.0	65.2	71.2
175.5	67.3	73.8	79.8	175.0	60.3	66.5	72.5
180.0	68.9	75.2	81.2	177.5	61.5	67.7	73.7
182.5	70.9	77.2	83.6	180.0	62.7	68.9	74.9
185.0	72.8	79.8	85.2				

Comment: the body weight increase by 2.5 kg for females and by 6 kg for males above thirty is allowed

BMI is an anthropometric indicator based on weight-to-height ratio. It is used to classify malnutrition in non-pregnant/non-postpartum adults. BMI is not an accurate indicator of nutritional status in pregnant women or adults with edema. Use MUAC for these groups.

Calculate BMI by dividing a person's weight in kg by the square of the person's height in meters. You will have to convert measurements in cm to m (100 cm = 1 m). A non-pregnant adult is considered to have a normal BMI when it falls between 18.5 and 25 kg/m^2.

BMI can also be found using look-up tables or a BMI wheel. MI values below or above the WHO range for normal nutritional status (shown in the table below) indicate a need for nutrition interventions to slow or reverse weight:

$$\text{BMI} = \frac{\text{Weight (in Kg)}}{\text{Height (in metres)}^2}$$

The normal range of BMI is between **18.5 and 25**.A BMI value less than 18.5 denotes under nutrition; BMI values of 25-30 is considered overweight. Those with a BMI greater than 30 are obese. Next degree of malnutrition distinguish:

The indicator of the height-weight index, estimated as I grade malnutrition: **18,5-17,5;**

the II degree of malnutrition:**17,5-16 ;**

the III degree of malnutrition:**16-15 ;**

IV grade malnutrition:below **15.**

If an adult person has a BMI of less than 16 kg/m^2 they will not be able to do much physical work because they will have very poor energy stores. In addition, they will be at increased risk of infection due to impaired immunity.

Risk of mortality and morbidity is related to the nutritional status as assessed by the BMI. If people are too fat or too thin, their health suffers. The risk of mortality and morbidity increases with a decrease in the BMI.

Head circumference. The head circumference (HC) is the measurement of the head along the supra orbital ridge (forehead) anteriorly and occipital prominence (the prominent area on the back part of the head) posteriorly. It is measured to the nearest millimeter using flexible, non-stretchable measuring tape around 0.6cm wide. HC is useful in assessing chronic nutritional problems in children under two years old as the brain grows faster during the first two years of

life. But after two years the growth of the brain is more sluggish and HC is not useful. Now you have looked at how to take different measurements you are going to learn how the measurements are converted into different indices.

Measuring fat-free mass (muscle mass). An accurate way to measure fat-free mass is to measure the Mid Upper Arm Circumference (MUAC). The MUAC is the circumference of the upper arm at the midway between the shoulder tip and the elbow tip on the left arm. The mid-arm point is determined by measuring the distance from the shoulder tip to the elbow and dividing it by two. A low reading indicates a loss of muscle mass.

MUAC is a good screening tool in determining the risk of mortality among children, and people living with HIV/AIDS. MUAC is the only anthropometric measure for assessing nutritional status among pregnant women. It is also very simple for use in screening a large number of people, especially during community level screening for community-based nutrition interventions or during emergency situations.

Measuring the MUAC of children. A special tape is used for measuring the MUAC of a child. The tape has three colors, with the red indicating severe acute malnutrition, the yellow indicating moderate acute malnutrition and the green indicating normal nutritional status.

Nutrition Diagnosis. Nutrition diagnosis is the identification and labeling that describes an actual occurrence, risk of, or potential for developing a nutrition problem that dietetics professionals are responsible for treating independently. At the end of the assessment step, data are clustered, analyzed and synthesized. This will reveal a nutrition diagnostic category from which to formulate a specific nutrition diagnostic statement. Analyzing the assessment data and naming the nutrition diagnosis provide a link to setting realistic and measurable expected outcome, selecting appropriate interventions, and.tracking progress in attaining those expected outcomes. It is important to remember that nutrition diagnosis changes as the patients/ clients / groups response changes. Once the nutritional care plan is formulated, it is easy to implement.

Biochemical assessment. Biochemical assessment means checking levels of nutrients in a person's blood, urine, or stools. Lab test results can give trained medical professionals useful information about medical problems that may affect appetite or nutritional status.

Clinical assessment.As a frontline health worker providing health services at community level, you will almost certainly encounter many people with nutritional deficiency problems. In

addition to the anthropometric assessments, you can also assess clinical signs and symptoms that might indicate potential specific nutrient deficiency.

Clinical methods of assessing nutritional status involve checking signs of deficiency at specific places on the body or asking the patient whether they have any symptoms that might suggest nutrient deficiency from the patient. Clinical signs of nutrient deficiency include: pallor (on the palm of the hand or the conjunctiva of the eye), Bitot's spots on the eyes, pitting edema, goitre and severe visible wasting (these signs are explained below).

Bilateral pitting edema. Bilateral pitting edema, also called nutritional edema, is swelling in both feet or legs (bilateral) caused by the accumulation of excess fluid under the skin in the spaces within tissues. Either too much fluid moves from the blood vessels into the tissues or not enough fluid moves from the tissues back into the blood vessels. This imbalance can cause swelling in one or more parts of the body. Bilateral pitting edema is characterized by pitting in the skin (i.e., a visible indentation that persists after the pressure is released from skin that has been pressed by a thumb). Edema is a sign of severe malnutrition only if it exists in both feet or both legs. Other causes of edema, especially in adults, that are not related to nutrition include congestive heart disease, lymphatic disorders, and kidney disease, among other conditions.

Bilateral pitting edema is a sign of severe malnutrition on its own, regardless of the results of anthropometric assessment. Anyone with severe bilateral pitting edema (Grade +++), even with appetite and no medical complications, should be admitted for inpatient management of severe acute malnutrition. A person with bilateral pitting edema Grades + or ++ with appetite and no medical complications should be treated for severe acute malnutrition on an outpatient basis.

Grades of edema. Depending on the presence of edema on the different levels of the body it is graded as follows. An increase in grades indicates an increase in the severity of edema.

0 = no edema

+ = Below the ankle (pitting pedal edema)

++ = Pitting edema below the knee

+++ = Generalized edema.