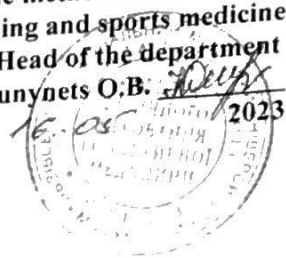


**LVIV NATIONAL MEDICAL UNIVERSITY N.A. DANYLO HALYTSKY**  
**Department of Physical Training and Sports Medicine**

Approved at the methodical meeting of  
the department of Physical training and sports medicine  
Head of the department  
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Protocol № 18 from 16.05.2023



**GUIDELINES**  
in the discipline  
**PHYSICAL REHABILITATION AND SPORTS MEDICINE**  
for 4th year students

training of specialists of the second (master's) level higher education in the field of  
knowledge 22 "Health" specialty 222 "Medicine" for independent work in  
preparation for practical classes

**Topic 5** *"Facilities of renewal and stimulation at the health and sporting training."*

LVIV-2023

Methodical guidelines are made in accordance with the requirements of the curriculum in the discipline "Physical Rehabilitation and Sports Medicine", compiled to train specialists of the second (master's) level of higher education in the field of knowledge 22 "Health" specialty 222 "Medicine".

According to the curriculum, the study of physical rehabilitation and sports medicine at the medical faculty is carried out in the 4th year of study. The program is designed for 75 hours, of which 30 classroom hours (practical classes), 8 hours - lectures and 37 hours of independent work of students (IWS).

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According to the general wording of the head of the Department of Physical Education and Sports Medicine, Candidate of Biological Sciences, Associate Professor O.B. Kunynets.

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Methodical recommendations were discussed and approved at the methodical meeting of the Department of Physical Education and Sports Medicine

Protocol № 18 from 16 of May 2023

## **1. Relevance of the topic:**

Modern high-achievement sport is marked by a growing interest in post-workout recovery tools and values.

The problem of recovery is of interest no less for sports medicine, but is gaining universal significance. Systematic use of physical activity associated with work, health training, active recreation require measures to combat fatigue, prevent chronic fatigue and reduce efficiency.

Physiological and biochemical studies have shown that the processes of recovery in regular physical education and sports depend on their direction (orientation) and may have different effects on performance. In this case, the body can develop two opposite states: increased fitness or fatigue.

If the recovery provides replenishment of energy resources, the preconditions for improving efficiency are formed. If there is no recovery of energy resources, it contributes to the development of fatigue.

Although under certain conditions, physical activity in conditions of incomplete recovery stimulates the growth of functional capabilities of the body and increase efficiency.

A complex set of rehabilitation programs includes a variety of tools: nutrition, autogenic training, pharmacological drugs, mason, physiotherapy procedures.

## **2. Duration of the lesson (or topic): 2 (h).**

## **3. Learning objective.**

### *To know:*

- ❖ Know the physiological mechanisms of recovery processes.
- ❖ Know the classification of recovery tools.
- ❖ Know the mechanism of action of methodological and biological means of recovery and stimulation of physical performance.
- ❖ Know the mechanisms of action of biologically active substances to maintain physical performance.
- ❖ Know the prohibited classes of substances and prohibited methods of stimulating performance (doping).

### *Be able:*

- ❖ Be able to explain the meaning of the recovery process during training.
- ❖ Be able to explain the essence of nutrition as a factor in recovery.
- ❖ Be able to characterize the main pharmacological means of prevention of fatigue and recovery of sports performance.

Be able to explain the essence of hardening as a factor in disease prevention.

- ❖ To master drawing up of schemes of pharmacological maintenance of improving training.
- ❖ Master the schemes of nutrition during health training.

## **4. Basic knowledge, skills, abilities necessary for studying the topic.**

Name of previous disciplines:

Normal physiology

Biological chemistry

Pharmacology

General hygiene

Pathological physiology

Acquired skills: Have an understanding of the mechanisms recovery processes in muscle work. Describe diets for achieving full recovery of the body during physical loads. Classify drugs used to stimulate recovery, explain their pharmacodynamics. Identify pharmacological drugs that belong to the group of doping. Be able to interpret the hardening process, as the body's adaptation to adverse factors.

## **5. Student tips:**

### **5.1. Theoretical questions for the lesson:**

1. The role of recovery processes in improving the efficiency of the organism.
2. The main mechanisms of recovery processes after exercise.
3. The concept of active recovery (active recreation).
4. How the diet of athletes is formed.
5. The role of carbohydrates in regular exercise.
6. The importance of fats in the diet of athletes.
7. The role of medical and biological agents in the restoration of efficiency.
8. Minerals - full components of recovery.
9. Groups of pharmacological agents used to restore the body after exercise.
10. Drugs of plastic action that stimulate the process of restoring the body's efficiency.
11. The use of nootropics for recovery in health and sports training.
12. Hardening - adaptation of an organism to adverse physical factors.
13. Side effects of doping in sports.

### **5.2. Practical tasks used in class.**

1. To make an approximate set of active recreation exercises for athletes of different specializations (gymnastics, basketball, weightlifting, wrestling, cycling).
2. Compare the diets of athletes, representatives of different sports.
3. Draw a scheme of pharmacological correction of fatigue for athletes after training.

### **5.3. Topic content:**

**Physiological mechanisms of recovery processes.**

*Recovery* - is a set of changes in the body that occur after the cessation of exercise. In the functional systems that provided the performance of this type of work, there are reverse changes. During the recovery period, the products of metabolism are removed and the energy balance, plastic substances, enzymes that were spent on muscle work are restored, ie homeostasis is restored. In addition, during the recovery period there are processes that ensure further growth of the body's functional reserves, its efficiency. Restoration of various functions after muscular work proceeds heterochronously.

During exercise, the body's oxygen supply, phosphogens (ATF and KrF), carbohydrates (muscle and liver glycogen, blood glucose) and fats are consumed. After work, they are restored, except for fats, which may not recover.

Restoration of oxygen, which is contained in the muscles in the form of a chemical compound with myoglobin, after physical activity occurs quite deeply and depends only on its delivery to the muscles.

Recovery of phosphogens, especially ATF, occurs within tens of seconds - a few minutes, mainly by the energy of aerobic metabolism.

The rate of glycogen recovery and its accumulation in the muscles and liver will depend on the amount of glycogen expenditure during exercise and diet during the recovery period.

Only an increase in the proportion of carbohydrates in the athlete's diet can provide a full recovery of carbohydrates in the body.

Utilization of lactic acid from muscle, blood and cell fluid is faster the less it is formed during operation.

Complete removal of lactic acid after maximum exercise at rest occurs within 60-90 minutes (passive recovery). If light work (active recovery) is performed after exercise, lactic acid is removed much faster. In untrained individuals, the optimal intensity of the load that restores is 30-45% of the IPC, and in trained athletes - 50-60% of the IPC, lasting up to 20 minutes.

*Utilization of lactic acid is as follows:*

1. Oxidation to CO<sub>2</sub> and H<sub>2</sub>O - about 70% of accumulated lactic acid;
2. Conversion to glycogen (in muscles and liver) and to glucose (in liver) -20%;
3. Conversion into proteins - 10%;
4. Excretion with urine and sweat - 1-2%;

The largest proportion of lactic acid is oxidized in skeletal muscle, especially in their slow fibers. This explains why light work (it involves mostly slow muscle fibers) promotes rapid removal of lactate after strenuous exercise.

**Nutrition as a factor in recovery.**

The main value of nutrition is to ensure the delivery of energy and plastic materials to replenish energy expenditure and build tissues and organs.

Food is a mixture of plant and animal products that contain proteins, fats, carbohydrates, vitamins, minerals and water.

The caloric content of the daily diet and the athlete depends on the volume, intensity of training and its nature.

### 1. *Vitamins*

Vitamins are organic substances that are absolutely necessary to ensure biochemical and physiological processes in the body. The role of vitamins is determined by participation in the regulation of biochemical processes. Vitamins are needed by the body in relatively small quantities, but, at the same time, they are essential components of food, because the body does not form or is formed in insufficient quantities.

Insufficient supply of vitamins to the body develops specific conditions - hypo - and avitaminosis, accompanied by metabolic disorders and disorders of all body functions.

In sports practice, vitamin preparations are used to prevent hypovitaminosis (ie vitamin deficiency) for almost a year. The need for increased intake of vitamins arises when changing climatic conditions and geographical zones, with a lack of vitamin-rich foods in the diet and during periods of high-intensity exercise.

For prophylactic purposes, it is recommended to prescribe not individual drugs, but vitamin complexes, preferably in the form of ready-made multivitamins (Complivit, Glutamevit, Aerovit, Selnevit, Centrum, Vitrum, Supradin, etc.).

Another indication for the use of vitamin preparations is the need to act on the course of anabolic, restorative processes, in the event of disorders of one or another type of metabolism, as well as in states of overstrain. In such cases, in addition to multivitamins, one or more vitamin preparations are prescribed, the choice of which is based on the predominant effect of individual vitamins on one or another link of metabolism.

### 2. *Multivitamin complexes.*

For rational pharmacological maintenance of training process it is possible to use practically any multivitamin complexes available in a drugstore, such as Kvadevit, Aerovit, Dekamevit, Undevit, etc.

### 3. *Coenzymes, derivatives of vitamins.*

In addition to vitamin preparations in sports medicine, some of their derivatives (coenzymes) are also used.

It has been established for some time that biocatalytic activity, as a rule, does not belong to the vitamins themselves, but to the products of their biotransformation - coenzymes. Coenzymes, in turn, combining with specific proteins, form enzymes - catalysts of biochemical reactions that underlie the physiological functions of the body. For some time, the structure of many coenzymes is known, a number of them were obtained by chemical synthesis. In addition, open coenzymes that do not have vitamin precursors (carnitine, phosphaden, lipoic acid).

Coenzyme preparations of vitamin nature include cocarboxylase (coenzyme form of thiamine - vitamin B1), natural oxalophosphate (vitamin B6), cobamamide (vitamin B12). The group of drugs based on vitamins is represented by pyriditol (a derivative of pyridoxine) - has a mild stimulating effect on brain tissue; pantogam (homologue of pantothenic acid containing gamma-butyric acid; oxycobalamin (metabolite of vitamin B12).

### 4. *Minerals*

#### *Potassium. Sodium. Chlorides.*

Soluble salts (potassium and sodium chlorides) are part of all fluids in our body and are involved in the full range of biochemical reactions.

These elements are lost in athletes with sweat in the elevated so there may be a need to fill these elements with specialist drugs.

Ordinary table salt, which is added to most foods when cooking, provides the body, but it is important not to consume too much salt (sodium chloride), because it creates an unnecessary burden on the kidneys. Chlorides are also found in yeast, bacon and smoked fish.

Potassium is present in yeast, fruits and vegetables. The content of these trace elements in foods is slightly reduced during cooking.

Deficiency is unlikely, as these elements are abundant in most products. Additional amounts may be needed only after intense exercise, when these substances are lost with sweat.

#### *Magnesium*

Needed for the transmission of nerve impulses, so it is sometimes called the "anti-stress element". Magnesium can help a person suppress depression and maintains a healthy circulatory system, helps prevent heart disease.

Deposited in bones and soft tissues. Magnesium works together with potassium, so these two elements must be in balance. The best sources of magnesium: soybeans, nuts, meat, fish and seafood, dates.

#### *Calcium*

The best source of calcium: all dairy products, especially raw, yogurt and cheese, as well as green leafy crops, cauliflower, canned fish bones (salmon and sardines), peanuts and sunflower seeds. Skimmed milk contains slightly more calcium than breast milk. Only 20-30% of what is received with food of calcium is assimilated.

#### *Phosphorus*

The best sources: all dairy products, vegetables, fish, meat, nuts, whole grains. Phosphorus deficiency is rare because phosphorus enters the body with a variety of foods and is commonly used in many supplements.

Phosphorus preparations are not necessary for a healthy person with a normal level of load, but an athlete needs a diet high in phosphorus and specific drugs ("Phosphagens") when performing high-speed work.

#### *5. Microelements.*

Microelements are vital components of body tissues. Being in small concentrations in the structure of a number of important enzymes, hormones, vitamins and other biochemical assets of the body, trace elements are able to stimulate or suppress many biochemical processes. The presence of micronutrients is especially important in athletes during heavy training loads and competitions, when metabolism is sharply accelerated.

#### *6. Enzymes*

All biochemical processes that determine the state of the organism are carried out with the participation of enzymes that play the role of biological catalysts. As catalysts, enzymes reduce the activation energy barriers of biochemical processes. Their specificity extends both to the reacting molecules and to the chemical reaction itself.

Enzymes used in medical practice, by their origin are divided into proteases of plant (papain) and animal nature (trypsin, chymotrypsin, pancreatin, amylase, lipase). Each substance is used in its direct action: amylase - breaks down carbohydrate compounds, lipase - is involved in lipid metabolism, protease - is involved in protein metabolism.

There are various pharmacological drugs - pancreatin, festal, digital, panzinorm, in which a combination of enzymes and their dosage achieve that the drug acts as a substitute for insufficiency of the pancreas, stomach, intestines, liver, gallbladder; help digest food in excess (for example, when training over muscle volume). Trypsin, chymotrypsin is widely used in injuries in the postoperative period, providing faster recovery.

The use of enzymes can withstand training loads of high volume and intensity, increases the reserves of adaptations and the development of stress, and also contributes to a more recovery period, which is confirmed by biochemical and psychofunctional tests.

Improves cerebral circulation.

There is an increase in psychophysical performance. The increase in efficiency is accompanied by an increase in psychological tone, improvement of indicators of central activity, persistence and energy. There is a significant decrease in mental tension.

The use of enzymes in cases of endurance sports, during intense training, allows you to maintain hemoglobin levels, avoid the loss of potassium and calcium ions, increase energy efficiency, normalize the tone of arterioles and venules (signs of venous outflow disappear). The concentration of lactate during exercise decreases on average.

At sports injuries application of enzyme therapy is possible, considering a complex of pharmacological effects: anti-inflammatory, analgesic, thrombolytic, immunomodulatory; as well as pathomorphological changes in the injured muscle, joint, bone for the treatment and recovery of damaged tissues.

#### 7. *Adaptogens.*

The general effect for all adaptogens is a nonspecific increase in functionality, increase of adaptability (adaptation) of an organism under complicated conditions of existence. Adaptogens practically do not change normal functions of an organism, but considerably increase physical and mental working capacity, endurance of loadings, resistance to various adverse factors (heat, cold, thirst, hunger, infectious stresses, etc.) and reduce terms of adaptation to them.

Adaptogens are drugs, usually of natural origin, obtained from natural raw materials (parts of medicinal plants or animal organs), which have a long history of use (some of them have been used in oriental medicine for millennia).

Capsules of ginseng (produced in various combinations with honey, bee's milk), ginsan (100 mg. Active substance).

Saparal tablets containing the amount of glycosides obtained from the roots of Manchurian aralia.

Synthetic adaptogen with a broad spectrum of action is the drug safinor, which also has an anabolic effect, sodium oxybutyrate, calcium oxybutyrate.

For athletes, it is preferable to take adaptogens in the form of tablets and capsules than in alcoholic solutions.

#### 8. *Antioxidants and free radicals (oxidants).*

Free radicals are unstable, chemically active compounds formed during the combustion of oxygen "fuel" in cells.

In sports, as a result of excessive loads and the action of "external" oxidants, free radical processes are initiated, which contributes to the formation of toxic products that disrupt the function of cell membranes and bioenergetic mechanisms.

Taking antioxidants gives the body a means to stop these destructive reactions.

In the practice of sports such antioxidants are used as:

- vitamin A, C, E, B, beta-carotene;
- selenium, enzymes, neurobutal (calcium oxybutyrate, sodium oxybutyrate, olifen);
- adaptogens;
- coenzyme Q-10, ubiquinone, OPC;
- honey. pollen;
- cerebrum compositum (homeopath).

#### 9. *Antihypoxants.*

The problem of hypoxia in high-achievement sports is quite acute. Clinical data and theoretical studies convincingly show that the most promising in the fight against hypoxia is the use of pharmacological agents that improve the utilization of oxygen circulating in the body. These drugs are called antihypoxants.

Conditionally antihypoxants can be divided into two groups:

- 1) acting on the transport function of blood;
- 2) correcting cell metabolism



The first group includes compounds that increase the oxygen capacity of the blood, the affinity of hemoglobin for oxygen, as well as vasoactive substances of endogenous and exogenous nature. The second group includes compounds with membrane-protective action.

Aktovegin - a drug that is based on an extract from the serum of calves and contains only physiological components with high biological activity,

- organic low molecular weight compounds: amino acids, nucleosides and glycolipids, electrolytes and a number of important trace elements.

Olifen (Hypoxene) is an antihypoxant that improves the tolerance of hypoxia by increasing the rate of oxygen consumption by mitochondria and increasing the binding of oxidative phosphorus.

#### *10. Anabolic drugs*

This group of drugs includes pharmacological agents of different structure and origin, which by acting on various mechanisms enhance protein biosynthesis in the body and thus accelerate muscle growth.

A key position in the group of pharmacological drugs that are not doping and can be recommended for building muscle mass and increasing strength, are steroid drugs of plant origin.

Ecdysten has a tonic and anabolic effect.

Methyluracil is a pyrimidine derivative similar in structure and action to potassium orotate. The drug promotes protein synthesis and stimulates hematopoiesis. They are used to increase endurance and performance during high-volume training loads, as well as during "overvoltage" therapy.

L - carotene - a natural substance related to B vitamins, found in heart and skeletal muscle. Participates in metabolic processes as a carrier of fatty acids across membranes in the mitochondria - the area of beta-oxidation, where they burn with the formation of large amounts of energy; stimulates fat metabolism, stabilizes the immune system.

In sports with the predominant manifestation of endurance helps to accelerate the recovery process. In speed - power sports has a stimulating effect on muscle growth reception of 2 g. on 70 kg. body weight (2 teaspoons of 20% solution) 2 times a day in the morning and afternoon for 30 minutes. Before eating, diluting with liquid. Available as a solution of "El Car".

#### *11. Psychoenergetics (nootropics).*

During intense training loads or competition activities, the body is in such tension that there may be a violation of the blood supply to the brain, ie a violation of its nutrition, oxygen supply and normal functioning.

Nootropic drugs increase the energy metabolism of brain cells, develop potential neurophysical capabilities and, as a consequence, lead to knowledge of fatigue, increased memory, assimilation of information, memory, concentration, but do not have a calming effect, nor excitatory effect; very low toxicosis.

In sports pharmacology, drugs such as aminalone (gammalon - GABA - gamma-aminobutyric acid), piracetam (nootropil), pyriditol, encephabol (pyritinol), neurobutal (calcium oxybutyrate), sodium oxybutyrate, sodium oxybutyrate are used.

Gliatilin (choline alfoscerate) - improves concentration, memory and reproduction of information. Improves mood, helps to eliminate emotional instability, irritability and apathy. Activates mental activity. Possible applications in the process of mastering new elements of "technical" techniques in complex coordination types. It can be used in traumatic sports (boxing, hockey, football - head game, etc.) in the acute period of traumatic brain injury.

### *12. Macroergs (phosphagens).*

The universal source of energy (including muscle) is the free energy of the macroergic phosphate bond of adenosine triphosphate (AFT), which is released during the hydrolysis (decomposition) of AFT to adenosine - and adenosine monophosphate (ADP and AMP) and inorganic phosphate.

ATP (synonyms: atrifos (Hungary), myotrifos (Poland), phosphobion (Romania) is a drug derived from animal muscle tissue.

Neoton is a phosphocreatine drug (Italy).

Phosphaden (synonym: AMP, adenyl, adenosine monophosphate) - regulates redox processes. Has a vasodilating effect, participates in the biosynthesis of porphyrins.

All these drugs, increasing the number of energy-saturated compounds in the body, are most effective when working in the anaerobic lactate power zone, and their use to correct physical performance during competitions and at those stages of the training process, which aims to develop speed endurance and there is a significant share of work in anaerobic mode.

### *13. Immunomodulators.*

During the period of intense training loads before the competition, during the period of competition stress, there is a drop in the activity of the body's immune system, which can lead to an increased risk of colds (so-called ARI) and other infectious diseases. In order to prevent the development of possible complications, modern sports pharmacology offers preventive treatment of the following groups of drugs:

1. Multivitamin complexes with a mandatory content of B vitamins, folic and ascorbic acids. The presence of mineral salts is desirable. Examples: glutamevit, complivit, supradin, oligovit, biovital, centrum, and others.

2. Bee products: apilak, apilactose, pergo honey, honey of long-term exposure.

3. Preparations from pollen: granular pollen, polytabs, cernilton.

4. Nonspecific biogenic stimulants such as bioglobin.

5. Enzymotherapy.

6. Drugs that stimulate immunity: amixin, viferon, decaris, dibazole, immunofan, interleukin-2, interferon, levamisole, lycopene, polyoxidonium, poludan, ribomunide, liquidostin, roncoleukin, thymalin, thymogen, cycloferon, etc.

### *14. Regulators of neuropsychological status.*

This group includes:

- means of correction of sleep disorders (barbiturates, noxiron, nitrozepam, eunoctin, radedorm);

- antihistamines (pipolfen, diphenhydramine, suprastin, tavegil, etc.);

- means of correction of excessive neuropsychiatric reactions:

➤ psychosedatives (bromine salts, valocordin, St. John's wort, white willow bark, valerian, motherwort, passionflower, etc.);

➤ tranquilizer (elenium, seduxen, eunoctin, trioxazine, oxylidine, meprobamate, etc.);

➤ drugs that inhibit the involvement in the emotions of the autonomic centers (pyroxane, sodium oxybutyrate, neurobutal).

In most cases, these drugs effectively normalize sleep and psycho-emotional disorders, but reduce the next day faster and the accuracy of motor reactions (except valerian).

### *15. Hepatoprotectors.*

The main function of hepatoprotectors is to prevent liver cells from being damaged by the increased amount of breakdown products formed during intense physical activity of higher achievement sports.

The most common hepatoprotectors: heptral, methionine, carsil, essentielle.

It is important to know that drugs can cause direct liver damage or change the metabolism so that it becomes pathogenic to the liver. Most often, athletes use the following drugs that cause these lesions: aspirin, paracetamol, sulfonamides, oxacillin, corticosteroids. Alcohol and salts of heavy metals have a similar effect.

In order to protect against hepatitis B, the athlete as a representative of the risk group must be vaccinated.

#### *16. Actoprotectors.*

Actoprotectors - a new, still small class of stimulants of physical performance, affecting many organs and systems of the body and preventing the development of fatigue, ie a class of drugs with a multifunctional mechanism of action.

Actoprotectors prevent the development of the negative effects of hypoxia, which increases with intense exercise, as well as with insufficient oxygen content in the air.

Actovegin - helps to improve energy processes at the cellular level, regardless of the state of the body, by increasing the supply and accumulation of glucose and oxygen.

Tanakan is a standardized extract from the leaves of the relict ginkgo biloba tree.

#### *17. Stimulators of hematopoiesis and blood circulation.*

Muscle strength depends on the area of its cross section. But the more muscle itself, the more nutrients it consumes, therefore, requires more blood flow. Capillarization, ie an increase in the number of small blood vessels, is a prerequisite for the growth and development of muscle tissue. Development of a muscular capillary network, increase in a blood-groove through capillaries is considerably stimulated at loadings of a large volume of aerobes. In athletic work, when there is an increase in muscle mass and an increase in the cross section of the muscles, the capillary support of their work lags behind the supply of muscle tissue with nutrients, oxygen and excretion of breakdown products. Thus, insufficient supply of tissue with blood delays the recovery process and prevents the full functioning of aerobes.

Therefore, during intense training loads, it is possible to recommend taking drugs, helping to strengthen muscle capillarization, prevent capillary blood flow disorders, improve microcirculation. These are drugs such as actovegin, solcoseryl, ginkor fort, trental (agapurin).

Hematopoietic stimulants include vitamin B12, cobamamide, folic acid, and iron supplements.

#### *18. Amino acids.*

Currently, certain amino acids are attracting attention due to their therapeutic effect, and this has become a new and impressive field of medicine that uses therapeutic nutrition.

Arginine - stimulates the formation of growth hormone, promotes tissue regeneration, enhances spermatogenesis, is part of bone and tendon cells.

Valine is necessary for the normalization of muscle metabolism, tissue repair and maintenance of nitrogen balance in the body. It is also used to treat depression because it acts as a weak stimulant compound.

Isoleucine is necessary for the normal formation of hemoglobin and skin growth. Accelerates the process of energy production, increases endurance and helps to restore muscle tissue.

Leucine - lowers blood sugar and promotes rapid healing of wounds and bones. Amino acids such as aspartate, arginine, ornithine, glycine, proline, serine, tyrosine, citrulline, taurine, cysteine, valine, isoleucine, leucine, lysine, tryptophan, have anabolic activity.

Hardening - a set of methods aimed at increasing the body's functional reserves and its resistance to adverse physical environmental factors (cold, heat, lowering atmospheric pressure, etc.) by systematic dosed training under the influence of this factor.

Hardening is an important component of disease prevention and health promotion measures.

Hardening is an adaptation achieved by the systematic repeated influence of one or another physical factor on the body, which forms a restructuring of metabolism and certain physiological functions aimed at ensuring homeostasis; improves neuro ... and metabolic processes in organs and systems; increases nonspecific immunity, the ability to quickly mobilize protective resources under the influence of adverse factors.

Hardening to the cold is of the greatest practical importance, as hypothermia is perhaps the most common cause of acute respiratory diseases. Hardening provides training of processes of both physical and chemical thermoregulation, improvement and adjusts their clearer and more energy-intensive work.

Doping is called biologically active substances, methods and techniques of artificially improving athletic performance, which have side effects on the body and for which there are special methods of detection.

Doping is contrary to both medical ethics and medical science. The concept of doping is as follows:

- Use of substances belonging to prohibited classes of pharmacological drugs, and / or;
- Use of various prohibited methods.
  1. Prohibited classes of substances:
    - A) Stimulants;
    - C) Drugs;
    - C) Anabolic substances;
    - D) Diuretics;
    - E) Peptide and glycoprotein
  2. Prohibited methods:
    - A) Blood doping;
    - C) Pharmacological, chemical and physical manipulations.
  3. Classes of drugs used with certain restrictions: A) Alcohol;
    - C) Marijuana;
    - C) Local anesthetics;
    - D) Corticosteroids;
    - E) Beta-blockers.

#### **Anabolic steroids**

Anabolic steroids are pharmacological drugs that mimic the action of male sex hormones - testosterone and dihydrotestosterone. Anabolic steroids accelerate protein synthesis within cells, which leads to severe hypertrophy of muscle tissue (in general, this process is called anabolism), as a result of which they are widely used in bodybuilding. They are used to build muscle mass and improve results in various sports. Such their appointment is absolutely unacceptable both for medical reasons and from an ethical point of view, contrary to the requirements of the Olympic Committees.

Prolonged administration of anabolic steroids causes serious complications resulting from their androgenic action, namely: retention of Na<sup>+</sup> and water in the body, increased blood clotting, mental disorders, the formation of bile and kidney stones, sexual dysfunction.

#### **5.4. Materials for self-control:**

##### **1) Questions for self-control:**

1. What is the role of recovery during exercise?
2. What is the stimulator of the process of recovery?
3. How are recovery tools shared?
4. How to explain the positive effect of active recreation on the recovery of the body after exercise?
5. What are the main differences in the diet of athletes?

6. What are the requirements for the protein component of the diet of athletes?
7. What is the role of carbohydrates in the diet of athletes?
8. What is the role of vitamins in the recovery process?
9. What groups of pharmacological drugs restore plastic processes in the body?
10. What drugs increase the body's resistance to adverse factors?
11. What physiological mechanisms are hardened?
12. How is the side effect of doping on the body of athletes explained?

**2) Situational tasks for self-control:**

1. Athlete uses rest breaks to improve performance. Indicate at what heart rate during training it is advisable to switch to the work of muscles that do not participate in training:

- 1) 110-120 beats / min.
- 2) 150-160 beats / min.
- 3) 170-180 beats / min.

2. During long mental work pauses of active rest are:

- 1) Exercises for training the vestibular apparatus.
- 2) General developmental exercises.
- 3) The maximum possible power loads.

3. In the diet of athletes, proteins of animal origin should make up the following share in the total protein content:

- 1) 10% -20%.
- 2) 50% -60%.
- 3) 80% -90%.

4. In the period of intensive training (competition) the energy value of food should be increased by:

- 1) 7-10%;
- 2) 30-40%;
- 3) 60 - 70%.

5. Glycogen stores in the liver are restored:

- 1) Vegetable fats.
- 2) Carbohydrates.
- 3) Milk protein

**4) Tests for self-control:**

1. What is the main task of the doctor during surgery?

- A. Determining the effectiveness of an individual approach to students.
- B. Determining the level of fitness.
- C. Determining the compliance of physical activity with the functional capabilities of athletes.

D. Determining the level of formation of basic physical qualities.

E. Determining the level of technique for performing basic exercises in athletics.

2. What kind of control determines the long-term effect, analyzes the degree of fatigue and recovery after exercise?

A. Current.

B. Operational control in the form of observation during training.

C. Operational control performed by using additional loads.

D. Staged.

E. Operational control in the form of comparison of functional indicators before and after training.

3. What information does the physiological curve of the lesson reflect?

- A. Proper distribution of loads and their compliance with the level of physical training.
  - B. Dynamics of physical activity and the correctness of their distribution.
  - C. The dynamics of changes in the cardiovascular system.
  - D. Correct distribution of loads during the lesson.
  - E. Correspondence of physical activity to the level of physical training.
4. Stimulators of regenerative processes include:
- A. The process of relaxation.
  - B. The process of overfatigue.
  - C. The process of fatigue.
  - D. The process of excitation.
  - E. Absolute calm.
5. The period of supercompensation is:
- A. Period of fatigue, when reduced efficiency.
  - B. The period of the recovery process, when physical performance is reduced.
  - C. A process not related to physical performance.
  - D. The period of the recovery process when the efficiency exceeds the initial level.
  - E. The maximum possible level of physical performance.
6. What sanitary indicators should be taken into account when training in athletics in the open air in order to prevent overheating of athletes?
- A. Air temperature.
  - B. Humidity.
  - C. Air velocity.
  - D. Temperature and humidity.
  - E. Temperature and speed of air movement.
7. What drinking regime does an athlete need when is training in the hot summer months in the form of cycling in terms of fluid intake per day?
- A. Up to 3.0 liters.
  - B. Up to 1.5 liters.
  - C. Up to 2.0 liters.
  - D. Up to 2.5 liters.
  - E. Up to 3.5 liters or more.
8. What is the daily requirement of potassium in the diet of the athlete?
- A. 1-2 g.
  - B. 15-20 mg.
  - C. 3-4 g.
  - D. 25-50 mg.
  - E. 15-20 g.
9. What is the daily requirement of sodium chloride in the athlete's diet?
- A. 25-30g.
  - B. 15-25g.
  - C. 30-45g.
  - D. 5-10g.
  - E. 10-15 g.
10. The ultimate goal of rehabilitative activities for athletes is:
- A. Injury prevention.
  - B. Achieving record results.
  - C. Stabilization or improvement of functional status.
  - D. Correction of the psycho-emotional state of the athlete.
  - E. Correction of training mode.

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### **Informational resources**

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<http://www.kmu.gov.ua/control/uk/cardnpd?docid=248719473>

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