

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

k.b.s., associate prof. **Kunynets O.B.**
Protocol №1 from 30 of August 2021



GUIDELINES

in the discipline

PHYSICAL REHABILITATION AND SPORTS MEDICINE

for 3th year students

training of specialists of the second (master's) level higher education in the field of
knowledge 22 "Health" specialty 221 "Dentistry" for independent work in preparation
for practical classes

Topic 1 *"A comprehensive medical examination during exercises. Research and
evaluation of human physical development. Research and evaluation of the functional
state of the organism. Medical conclusion."*

LVIV-2021

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 221 "Dentistry".

According to the curriculum, the study of physical rehabilitation and sports medicine at the medical faculty is carried out in the 3d year of study.

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

Protocol № 1 from 30 of August 2021

1. **Relevance of the topic:** The dosage of physical activity during health, sports training or physical rehabilitation, according to many researchers, is no less important and responsible task than, for example, the dosage of drugs. For the most effective health-improving use of means of physical culture and sports the special complex unified medical examination of those who is engaged, or starts to be engaged in various kinds of physical exercises is necessary. *The purpose* of this survey is to individualize the recommendations for specific means and methods of rehabilitation, as well as to determine the optimal dose of exercise.
2. **Class duration: 2 hours.**
3. **Learning goal (specific objectives):**

To know:

- purpose, tasks and main sections of a comprehensive medical examination of persons engaged in physical culture or sports;
- features of history taking (general and sports) and medical examination of organs and systems when deciding on admission to exercise;
- methods of assessing physical development;
- medical documentation: medical control card of an athlete and athlete (form 061-y).

To be able:

- to collect the general and sports anamnesis and medical inspection of bodies and systems;
- perform somatoscopy and anthropometric measurements of indicators that determine the physical development of person;
- conduct an assessment of physical development with the provision of qualified recommendations and appointments for its improvement.

Learn practical skills:

- independently conduct stomatoscopic and anthropometric examination of the patient;
- keep medical records clearly.

4. Basic knowledge, skills, abilities necessary for studying the topic (interdisciplinary integration).

Anatomy: Know the anatomical structure of the human body, features of the musculoskeletal system and musculoskeletal system. Be able to determine the condition of the skin, subcutaneous fat, the degree of muscle development and fat deposits.

Physiology: Know the features of the physiological state of the organism after exposure to physical activity normal and pathology. Determine the change in heart rate, blood pressure.

Propaedeutics of internal diseases: To collect the general anamnesis, medical examination of bodies and systems. Perform somatoscopy and anthropometry. Evaluate the results obtained.

Propaedeutics children's diseases: Know the features of physique and physical development in children of different ages.

5. Student advice.

5.1. The list of the basic terms, parameters, characteristics which the student should master at preparation for the class.

Physical development - a set of morphological and some functional properties of the organism that are inherited (genotype), as well as acquired in the process of individual development (phenotype), and reflect the degree of conformity of biological and calendar age of man, determine the reserve of physical strength, endurance and capacity.

Somatoscopy - external examination of the human body and its proportions: skin and mucous membranes, thickness and uniformity of subcutaneous fat distribution, degree of muscle development, shape of the chest and back to identify the presence and severity of posture, leg shape, type physique.

Anthropometry - measurement of certain dimensions of the human body: height (standing and sitting), body weight, circumference (neck, chest, waist, abdomen, shoulder, forearms, thighs and legs), VL, muscle strength of the hand, posture strength, the degree of fat deposition (thickness of subcutaneous fat fiber), etc.

Constitution - a set of all morphological and functional features of the organism, formed on the basis of hereditary and acquired properties that determine the diversity of reactions of the organism on the effects of the external environment.

5.2. Theoretical questions for the lesson:

1. Methods of complex medical examination of persons engaged in physical exercises, its purpose and types depending on the tasks.
2. The main sections of a comprehensive medical examination in sports medicine.
3. Features of passport data collection and anamnesis (general and sports).
4. Features of the general medical examination of organs and systems. Physiological criteria of fitness.
5. Methods of external examination of the human body (somatoscopy).
6. Normal and pathological posture, the reasons for its violation; physiological and pathological curvatures of the spine, their significance for human health.
7. Methods of measuring the main indicators that characterize physical development (anthropometry).
8. General assessment of physical development, recommendations for harmonization or correction of physical development depending on its features and shortcomings.

5.3. Practical works (tasks) used in class:

1. Collect passport data, general and sports history.
2. Conduct a general medical examination of organs and systems.
3. To determine physical development according to somatoscopy and anthropometry.
4. Assess physical development using methods: standards, anthropometric profile and indices.
5. Make a conclusion on the general assessment of physical development and provide recommendations for harmonization or correction of physical development.

5.4. Topic content:

Sport medicine (SM) is a clinical discipline, that studies positive and negative influence of physical activities of different intensity on the organism of healthy or sick man with the aim of

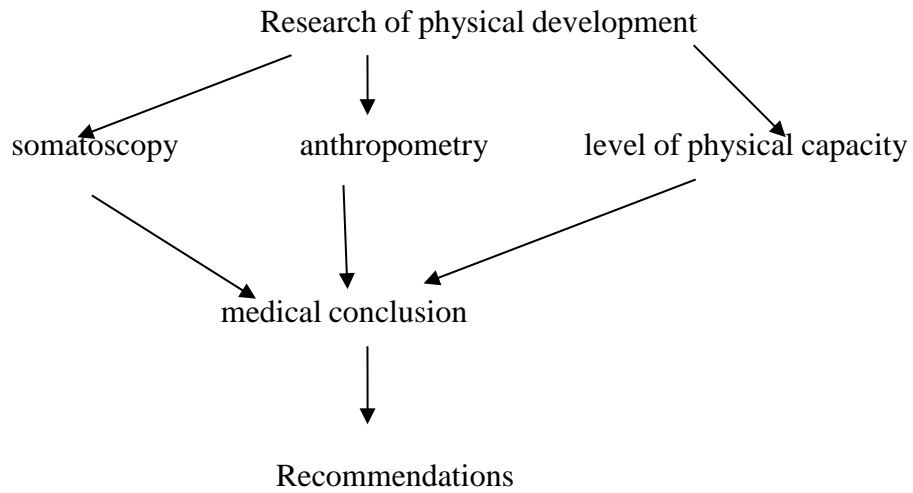
optimization of moviety activity for maintenance and strengthening of health, increase level of the functional state, height of sporting achievements. A basic division SM is medical control that studies the state of health, physical development and functional state of persons in practice of sporting-health activity, amateur mass sport and sport of higher achievements. The main task of SM is determination of accordance of physical activities to functional possibilities of organism on the different stages of the health or sporting training; a grant of timely skilled medicare is in case of exposure of rejections in the state of health; what related to the inefficient going in for sport or physical culture; participating is in training process control; sanitary- hygienical and medical providing educational-training process and sporting mass measures; realization of restoration treatment of persons that engage in a physical culture and sport after diseases and traumas.

Service of SM and curative physical education concordantly to the article of a 39 law of Ukraine “about a physical culture and sport” is the system of the medical providing of all contingents of population that engages in physical education and sport.

Main tasks of service:

- ✓ Determination of the state of health, physical development and functional state of organism of athletes and sportsmen, realization of prophylaxis, diagnostics and treatment of diseases and damages related to engaging in physical education and sport;
- ✓ Grant of timely highly skilled help to the person that go in for sport in case of exposure of rejections in the state of health;
- ✓ Participating is in training process control;
- ✓ Medical providing of sport- mass measures and educational- training collections.

Physical rehabilitation is independent area of medical knowledge studies theoretical and methodological bases of rational application of facilities of physical factors for successful renewal of health and capacity of man after the carried disease. On the modern stage in the system of PR of patients a considerable place belongs to one of major facilities of PR- to the curative physical culture. Curative physical education is a method of active, functional, nosotropic and training therapy and represents principles of active restoration treatment that is in complete accordance with rehabilitation direction in modern clinical medicine. The underestimation of this method quite brings to the increase of terms treatment over and to the origin of different functional violations, and sometimes and to the loss of capacity. Modern practice of health protection foresees application of physical rehabilitation on all stages of medical rehabilitation (permanent establishment, policlinic separation, sanatorium-resort treatment). A PR is conducted taking into account the succession of the stage by rehabilitation and combinations with the physical therapy methods of treatment and by other methods of treatment in the separation of pick up thread treatment, centers of professional rehabilitation and in the combined (medical and professional) rehabilitation centers.



Classification of physique: normotonic, asthenic, hypertonic

In research of physical development and musculoskeletal system we used:

Skin: smooth, clean, dry, moist, elastic.

Thickness of fatty cellulose: weak, moderate and considerable.

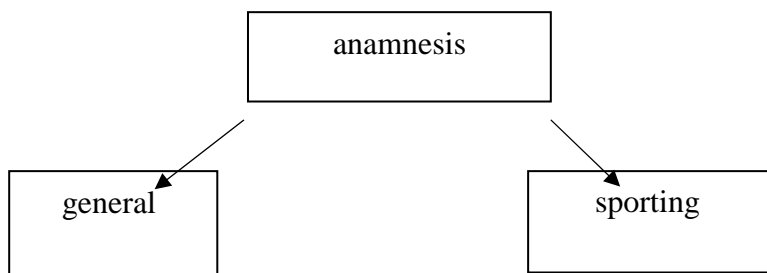
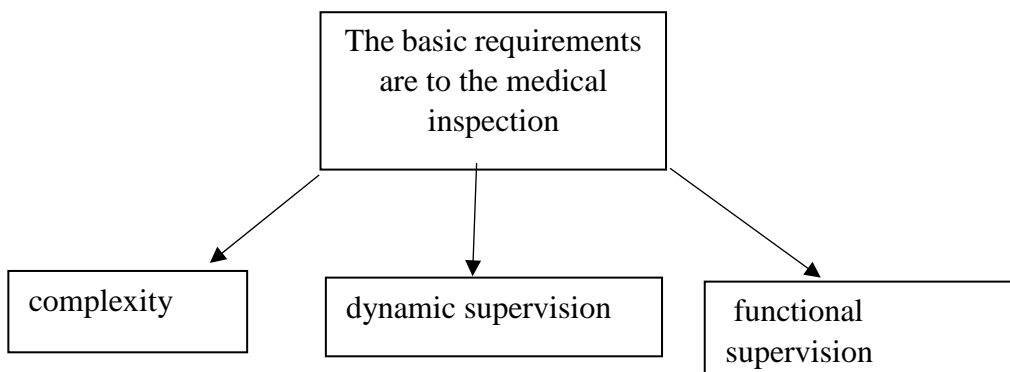
Development of muscles is estimated as: weak, middle and considerable.

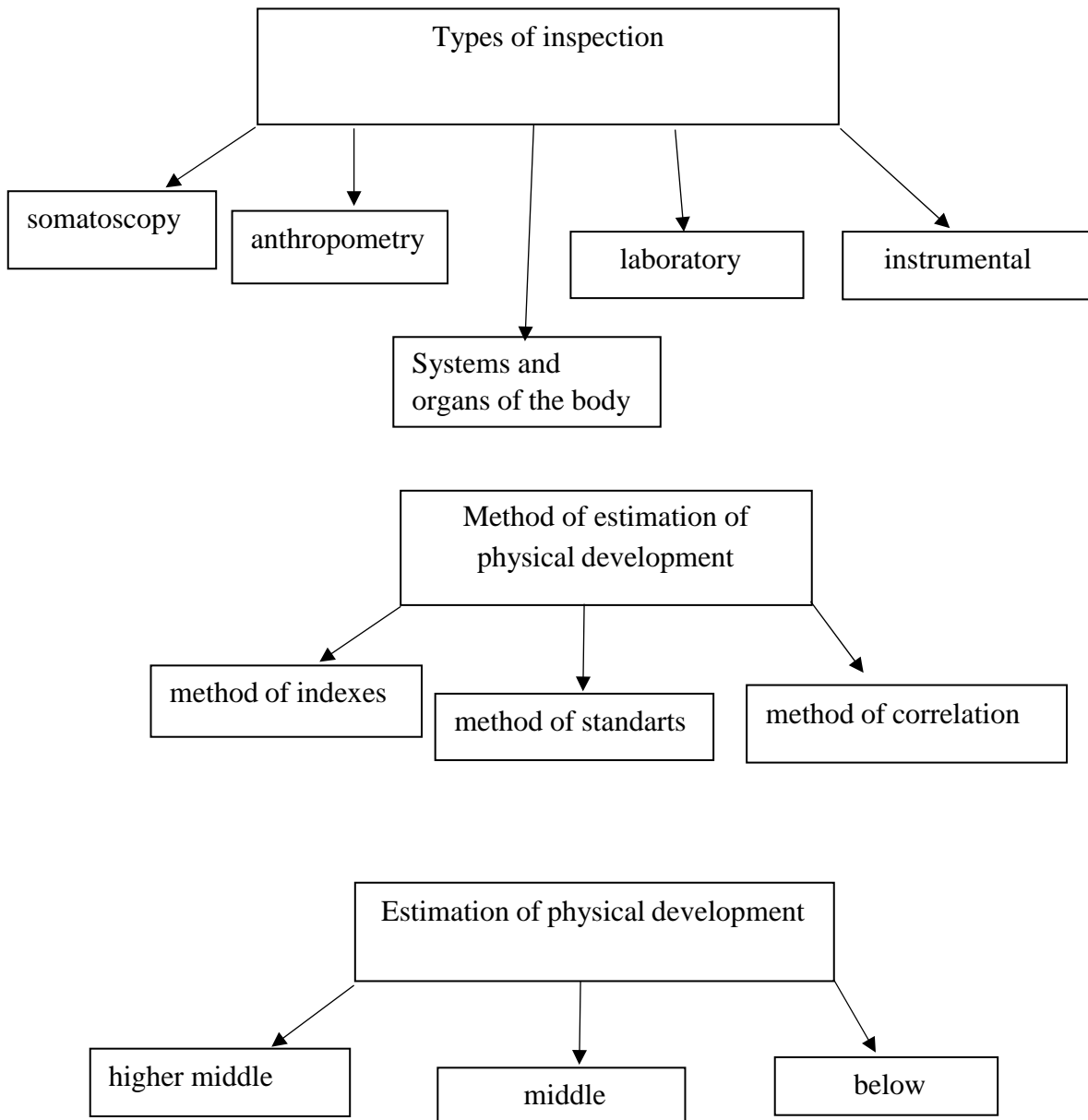
Form of thorax: cylindrical, conical and flat.

Form of back: normal, round, flat, roundly- hollow.

Form of feet: lines (straight), X-similar, O-similar.

Methods of inspection of sportsmen and athletes





A primary inspection is conducted before the beginning of every sports season. At a primary inspection a doctor decides about admitting to employments of physical education and sport. At an inspection determine the state of health, physical development and adjusted of organism to the doses physical activities.

At repeated determine influence of the regular going in for sports on the state of health. Conduct on the basic stages preparations with the aim of correction of training process 1 time on 3 months.

The additional will get organized at the decision of questions about possibility to begin training after the carried trauma or disease, after the protracted interruptions in employments, at the phenomena of overstrain.

Complex methodology provides for:

-taking the history (general and sporting)

-general medical review, functional inspection

-somatoscopy and anthropometry

-x-ray of organs of thorax

-blood and urine test

-functional tests for cardiovascular system, respiratory, nervous system, neuro-muscular vehicle, analyzers.

Medical control include: data of anamnesis, somatoscopy and anthropometry, research of the system of organism, functional tests, tests with the dosed physical activity, conclusion of doctor.

The general anamnesis is collected according to the generally accepted scheme. First of all, it is important to obtain information about the facts of the subject's life, which may be relevant to the occurrence of diseases - living conditions, budget per family member, hereditary and other diseases of close relatives, nature and frequency of nutrition, profession and nature of work, education, lifestyle, bad habits (smoking, alcohol, drugs), etc. Particular attention should be paid to diseases that could cause complications from the heart, liver, kidneys or other vital organs, which during normal household activities did not show anything, but with increased physical activity, especially during professional sports, can adversely affect adaptation of an organism to physical activities or more serious negative consequences.

Sports anamnesis allows the doctor to get an idea of the physical fitness of the subject. At the same time, information on physical exercises during the entire previous period of life (which sport classes, health-improving physical culture or exercise therapy; their volume, intensity; or according to medical indications (according to which) they were exempted from classes) is clarified, what was the effectiveness of these classes (sports category, victories in competitions, etc.), as well as whether previous classes did not harm health. It is important to know how the subject tolerates these loads, whether he feels tired (after that, its duration), whether it is accompanied by unpleasant sensations, pain (in the muscles, heart, etc.). A separate issue concerns current exercise or sports. Find out the nature of these classes, their regularity, frequency.

Physical development- complex morphologically-functional properties of organism that studies capability of organism. Physical development includes different morphological indexes: height, weight, circumference of breast, specific gravity of body.

The basic methods of research of physical development are an external review (somatoscopy) and anthropometry.

Somatoscopy is performed on the background of an anthropometric grid, under conditions of well-lit body of the subject (in direct or bilateral lateral illumination), while the researcher is at a distance of 2-2.5 m.

Skin is defined as normal color (pale; hyperemic; yellowish), moderately moist (excessively moist; dry), elastic, supple (flabby), clean (with rashes), and so on.

The degree of fat deposits and the uniformity of their distribution is essential for determining the physique (especially in women). The thickness of subcutaneous fat in different parts of the body depends on age, gender and constitutional characteristics, the nature of nutrition, professional activities, the intensity of metabolic processes. In the visual determination of the degree of fat

deposition, the following formulations are used: fat deposition is expressed weakly, moderately or excessively. However, this is not always objective.

The degree of muscle development is assessed as good, medium and weak. With a good degree, there is a large volume and elasticity of the muscles, the muscular relief is clearly defined even at rest. In the middle degree, the average volume and elasticity of the muscles is noted, their relief at rest is weakly expressed, but becomes pronounced when the muscles are tense. With poor development, muscle volume and elasticity are reduced, and muscle relief is not determined even when they are tense.

The shape of the chest is considered correct if it is symmetrical and has no visible deviations from the norm. Normal forms of the chest include cylindrical (mostly in women), conical (mostly in men) and flattened (mostly in asthenics) forms. There are also a number of transitional forms: cylindrical-flattened, cylindrical-conical, and others. The main features that characterize the shape of the chest are the location of the ribs and the size of the epigastric angle. The latter is formed by the lower ribs on both sides.

Pathological forms of the chest are most often associated with diseases or injuries. These include the following:

- flat: the chest is flattened in front, elongated and narrowed, the epigastric angle is acute; the main reason for the formation of this form is muscle weakness;
- chicken: often has a keel-shaped shape and is characterized by a significant bulge forward of the sternum, an increase in anterior-posterior size, flattening of the lateral roundings of the ribs; most common in kyphoscoliotic curvatures of the spine;
- funnel-shaped (inflammation): more common in men and characterized by sagging of the sternum and xiphoid process; at the same time the depression can be considerably expressed and testify to a considerable anomaly of development;
- emphysematous: characterized by the fact that the anterior-posterior size of the chest is increased, the ribs are slightly raised and often take a horizontal position, supra- and subclavian fossae are smoothed

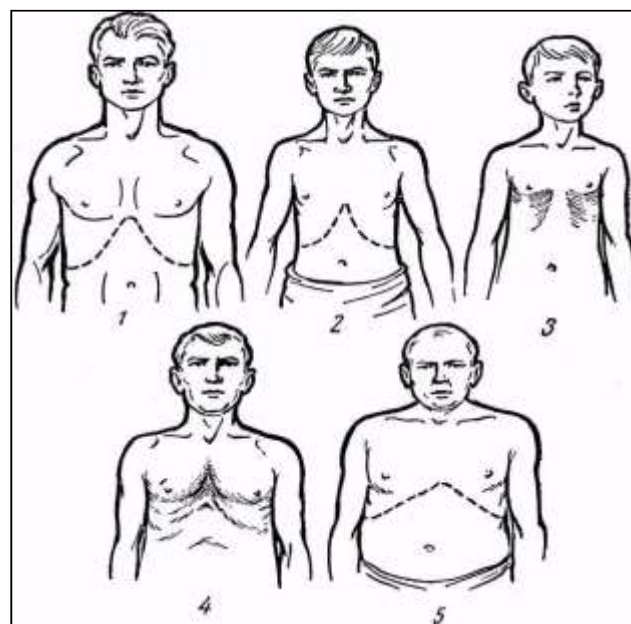


Fig. 1. Normal and pathological forms of the chest

(1 - normal; 2 - flat, 3 - chicken, 4 - funnel-shaped, 5 – emphysematous)

The shape of the back largely depends on the condition of the spine and its normal or pathological curvatures. There are normal and pathological forms of the back. Normal back is a back with the presence of 4 physiological curves of the spine in the sagittal plane: cervical and lumbar lordosis (bending inverted convexity forward), and thoracic and sacrococcygeal kyphosis (bending inverted convexity backwards). The depth of these curves is normally 3-4 cm.

Pathological forms of the back include: round, round and flat forms

- round back - is characterized by a significant increase in sagittal curvature of the spine in the thoracic region in the dorsal direction, ie thoracic kyphosis.
- round inflammation of the back - characterized by an increase in thoracic kyphosis and lumbar lordosis;
- flat back - is determined in cases where all physiological curvatures of the spine are smoothed.

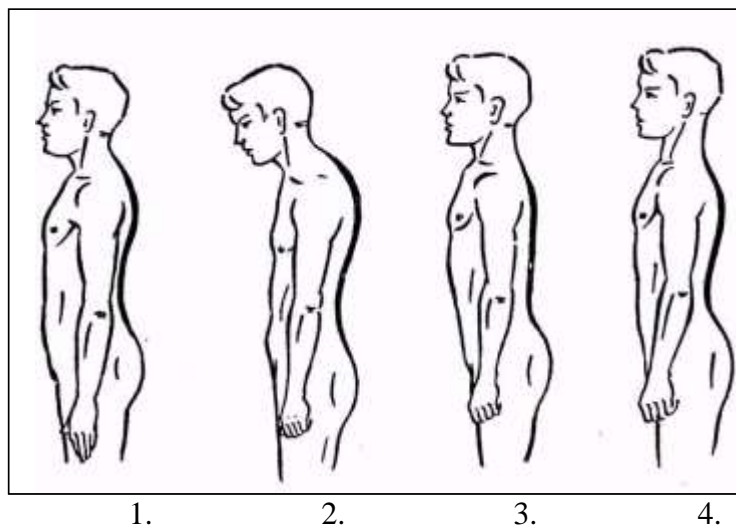


Fig. 2 Shapes of the back (1- normal; 2 - round; 3 - flat; 4 - round inflammation)

Posture is the usual posture of a person in a standing and sitting position. Normal posture is characterized by: symmetrical position of the upper arms, shoulders and shoulders; the vertical location of the spine.

One of the most common causes of spinal deformities is a hypotonic state of the muscles and ligaments in childhood. The development of curvatures of the spine is also facilitated by negative external factors: improper sitting at a desk and table, the mismatch of furniture for the growth of children, the usual carrying of weights in one hand.

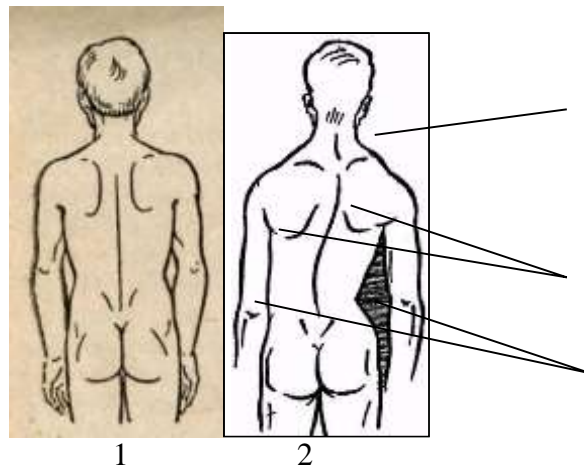


Fig.3 Normal (1) and pathological posture (with scoliosis) (2)

Asymmetry of the upper arms and shoulders (a), the angles of the shoulders (b) and different sizes of the waist triangles (c).

Scoliotic curvatures are divided into 3 stages:

the first degree - is characterized by a small curvature, which is manifested mainly by the asymmetry of the upper arms and shoulders and passes with the active straightening of the back by volitional effort; usually such a distortion is anatomically and physiologically associated with a slight dysfunction of the musculoskeletal system.

second degree ("scoliosis") - is characterized by more pronounced changes that do not disappear with active straightening of the back; in these cases, as a rule, there is anti-curvature and development of the costal hump and the muscular roller; curvature can be removed only (though not always) by stretching the spine with the weight of your own body.

the third degree - is characterized by persistent anatomical changes: the presence of a pronounced costal hump, significant deformation of the chest and spine; at this stage, the changes already extend to the bone tissue, in the area of curvature immobility is formed. In such cases, special treatment is required, even in a hospital, often with surgery.

The shape of the legs is distinguished as follows: normal (straight), X-shaped and O-shaped. The legs are considered straight if the longitudinal axes of the thigh and lower leg coincide, and the inner surfaces of the legs touch at least 3 points: in the upper thighs, in the knees and ankles. If the legs touch only the upper thighs and the knee area, and there is some distance between the ankle joints of the closed legs, then such legs are called X-shaped. If, on the contrary, when the ankle joints are closed, the knees diverge, such legs are considered O-shaped.

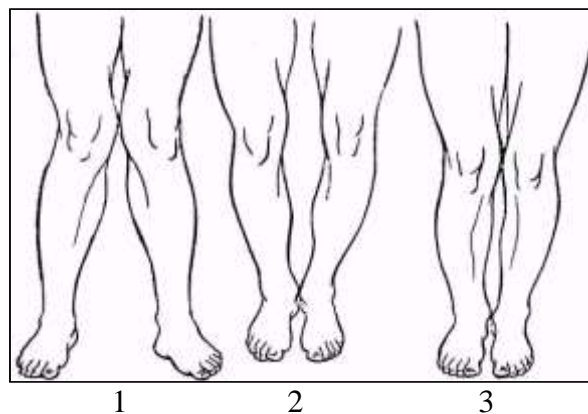


Fig. 4 Leg shapes (1 - X-shaped, 2 - O-shaped, 3 - normal)

Depending on the condition of the arch, *the foot* can be normal or correct; hollow, flattened and flat. To obtain an objective quantitative assessment of the condition of the arch of the foot, there are more accurate methods - various methods of teleradiography, podography. To observe the dynamics also use the analysis of footprints by the method of Chizhin: the subject is on a cloth soaked in a 10% solution of ferric chloride, and then - on a sheet of paper lubricated with a 10% solution of tannin in alcohol, a dark imprint of the soles, the plantogram, appears on the paper.

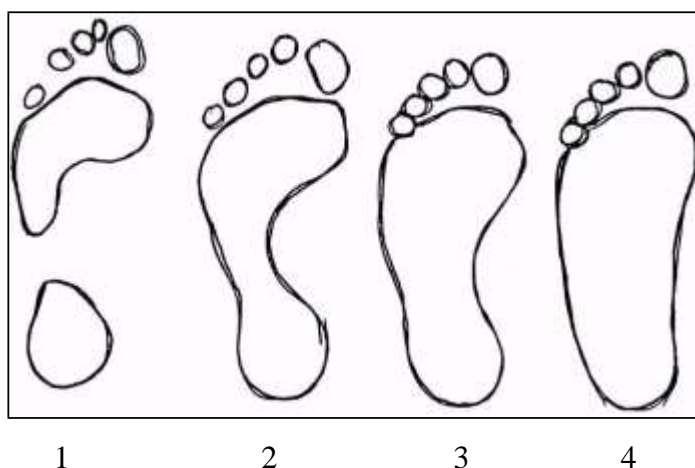


Fig.5 Foot shapes (according to plantogram)

(1 - hollow; 2 - normal; 3 - flattened; 4 - flat)

According to the classification there are: normosthenic, asthenic and hypertensive body types. Normosthenic body type is characterized by the proportionality of body shapes and the relationship between longitudinal and transverse body dimensions. Asthenic body type is determined if there is a predominance of longitudinal body dimensions over transverse - long and thin limbs, long and thin neck, narrow shoulders, wing-like shoulders. Hypertensive body type is characterized by the predominance of transverse dimensions over longitudinal - short limbs, wide hands with short fingers, short and thick neck, wide and straight shoulders.

There are: normosthenic, asthenic and hypersthenic body types.

- *normosthenic* body type is characterized by the proportionality of body shapes and the relationship between longitudinal and transverse body dimensions; it is most often characterized by a conical or cylindrical shape of the chest.
- *asthenic* body type is determined if there is a predominance of longitudinal body dimensions over transverse - long and thin limbs, long and thin neck, narrow shoulders, wing-like shoulders, narrow and flat chest.
- *hypertensive* body type is characterized by the predominance of transverse dimensions over longitudinal - short limbs, wide hands with short fingers, short and thick neck, wide and straight shoulders, wide and short chest.

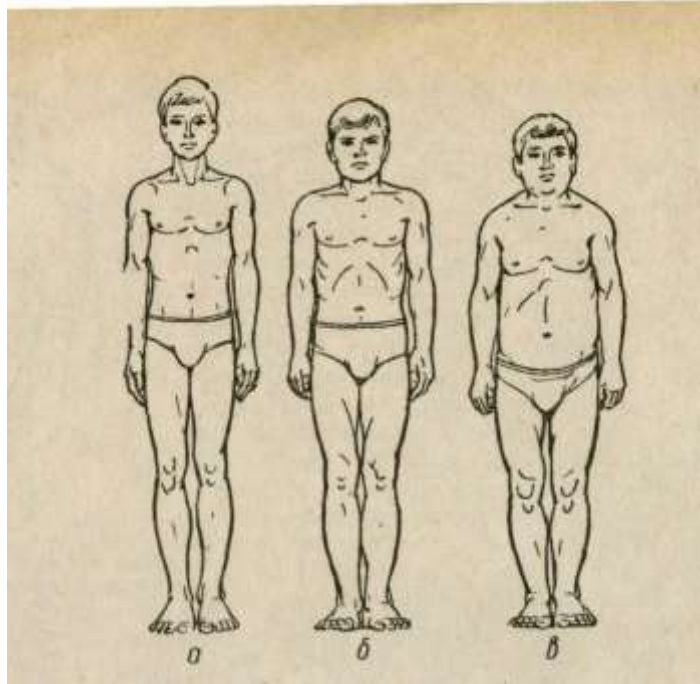


Fig.6 a - asthenic; b - normosthenic; c - hypertensive

Anthropometry- need is for determination of physical development of man (height, mass of body, volume of thorax, spirometry, dynamometry a class and spray). Basic index are: height, weight, volume of thorax.

Body length (standing and sitting) - measured with a height meter. When measuring the length of the body while standing, the subject stands on the site of the height meter with his back to the rack with the scale and touches it with three points - heels, buttocks and interscapular area. When measuring *the length of the body while sitting*, the subject sits on a folding seat and touches the rack with two points - the buttocks and the interscapular area.

Body weight is measured on conventional tithe medical scales, with a sensitivity of up to 50 g, which must be calibrated and adjusted before use.

The circumference of the chest and its excursion is measured with a centimeter tape in the vertical position of the subject. A centimeter tape is applied behind, regardless of gender, at the lower corners of the shoulder blades, in front of men under the lower segment of the nipple circles; in women - above the breast, at the level of attachment of the IV rib to the sternum. The circumference of the chest is measured (without tearing the tape from the subject) in three positions: during a pause, during maximum inhalation and full exhalation.

VL is determined using the method of spirometry. Measurements are performed with special devices - spirometer (water, air) or spiograph. Initially, the subject takes 1-2 deep breaths and exhales. The average VL for adult men is 3500-4000 ml, for women - 2500-3000 ml.

The strength of the hand muscles is determined by a manual (hand) dynamometer. The subject in a standing position takes a dynamometer in a hand, then without tension in a shoulder joint pulls out a hand aside and compresses the dynamometer with the maximum force. The average

strength of the right (working) hand for adult men is 40-45 kg, for women - 30-35 kg, the average left hand is usually 5-10 kg less. The study is performed 2-3 times for each hand, recording the best result.

Positional strength or strength of the back muscles (extensors) is measured with a standing dynamometer. When measuring the positional force, the dynamometer handle must be located at the level of the knees, which is achieved by adjusting with a special stick dynamometer.

The estimation of physical development uses 4 different methods: method of anthropometric standards with a draft of their basis of anthropometric profile, method of correlation, method of anthropometric indexes and method of percentile.

The method of anthropometric standard- permit every measured index with the averages of these indexes of physical development, got during an inspection. Calculate such indexes: arithmetic average, median and standard deviation of all indexes registered in a group from this size.

Method of correlation- gives an opportunity to estimate certain parties of biological organization of man in objective quantitative indexes.

Method of anthropometric indexes-

1. Index Kettle

General mass of body/height 350-400 g-woman, 325-375 man

2. Index Broka

Height upright cm-100=weight, kg

3. Vital index

Vital capacity of lungs, ml/general mass of body 65-70 man, 55-60 women

4. Index of proportion of development of thorax (index Erismana)

Circumference of thorax= height/2+5.8 man

3.3woman

5. Power index

Force of arm/mass of body-100=65-70 man, 48-50 woman

6. Index of durability of body built (index Pinie)

$J=P-(M+O)$

J-index, P-height, M-mass, O- Circumference of thorax.

Method of percentile –allow by means of percentile scale to distinguish persons with middle, by high and subzero indexes. As estimation is conducted by means of tables of centile row. Allow to estimate harmoniousness of development.

5.5. Tasks for students to perform practical work:

1. Master the technique of somatoscopy.
2. Master the technique of anthropometry

5.6. Materials for self-control:

1. Questions for self-control:
 - 1) What is the main purpose of a comprehensive medical examination of persons who begin to engage in or are engaged in exercise, its types, depending on the tasks?

- 2) Name the main sections of a comprehensive medical examination. What are the features of collecting general and sports history?
- 3) How is the method of external examination of the human body (somatoscopy). What signs are investigated and how are they characterized?
- 4) What is "posture" and how it is defined. What posture should be considered normal?
- 5) Specify ways to study the condition of the arch of the foot. Describe the normal and pathological forms of the foot, indicate their impact on health?
- 6) Name the types of human physique, give their characteristics, what is their importance for choosing the most optimal type of sports activity?
- 7) How is the technique of anthropometry. What are the rules for measuring basic anthropometric indicators?
- 8) What are the methods of assessing physical development and indicate their essence?

2) Situational (clinical) tasks for self-control:

- Typical, standard, classic, have an unambiguous answer, students know the algorithms for their solution - **II level**.

№ 1. During the study of physical development in a student M., 20 years old, the following indicators were established: height - 172 cm, weight - 90 kg, chest circumference at rest - 95 cm, VL - 3000 ml, Dynamometry of the right and left hands - 30 kg and 28 kg, respectively, the strength of the back muscles - 85 kg.

Task:

1. What method was used to study physical development;
2. What methods should be used to assess physical development;
3. Assess the level and harmony of physical development of the subject;
4. Give an opinion on the possibility of admitting the patient to physical activity and recommendations on the necessary type and level of physical activity that are necessary to correct abnormalities in physical development.

№ 2. During the study of physical development in a student L., 20 years old, the following indicators were established: height - 192 cm, weight - 70 kg, chest circumference at rest - 85 cm, VL - 3500 ml, Dynamometry of the right and left hands - 25 kg and 26 kg, respectively, the strength of the back muscles - 75 kg.

Task:

1. What method was used to study physical development;
2. What methods should be used to assess physical development;
3. Assess the level and harmony of physical development of the subject;
4. Give an opinion on the possibility of admitting the patient to physical activity and recommendations on the necessary type and level of physical activity that are necessary to correct abnormalities in physical development.

№ 3. During the study of physical development in student M., 20 years old, the following indicators were established: height - 163 cm, weight - 51 kg, chest circumference at rest - 85 cm, VL - 3800 ml, Dynamometry of the right and left hands - 20 kg and 18 kg, respectively, the strength of the back muscles - 75 kg.

Task:

1. What method was used to study physical development;
2. What methods should be used to assess physical development;
3. Assess the level and harmony of physical development of the subject;

4. Give an opinion on the possibility of admitting the patient to physical activity and recommendations on the necessary type and level of physical activity that are necessary to correct abnormalities in physical development.

№ 4. During the study of physical development in student K., 18 years old, the following indicators were found: height - 182 cm, weight - 50 kg, chest circumference at rest - 75 cm, VL - 2800 ml, Dynamometry of the right and left hands - 10 kg and 12 kg, respectively, back muscle strength - 55 kg.

Task:

1. What method was used to study physical development;
2. What methods should be used to assess physical development;
3. Assess the level and harmony of physical development of the subject;
4. Give an opinion on the possibility of admitting the patient to physical activity and recommendations on the necessary type and level of physical activity that are necessary to correct abnormalities in physical development.

№ 5. During the study of physical development in student L., 22 years old, the following data were obtained: the thickness of the skin fold at the level of the navel - 1.5 cm, the muscles under the skin are contoured, the chest is symmetrical, has the shape of a truncated cone, the back is characterized the presence of 4 curves of 3-4 cm, legs of the correct shape, examination of the foot revealed that the isthmus is equal to 1/3 of the width of the foot.

Task:

1. What method was used to study physical development;
2. What methods should be used to assess physical development;
3. Evaluate the data obtained during the survey;
4. Give an opinion on the possibility of admitting the patient to physical activity and recommendations on the necessary type and level of physical activity that are necessary to correct abnormalities in physical development.

- Atypical, non-standard, reflecting complicated professional situations - **III level.**

3) Tests for self-control:

1. The main tasks of a comprehensive medical examination of persons engaged in various types of exercise:

- A. Determination and assessment of the level of physical development, functional state, functional abilities of the organism and state of health;
- B. Determination and assessment of the level of general physical fitness;
- C. Research and evaluation of the functional state and functional capabilities of the organism;
- D. Determination and assessment of body type and posture;
- E. Conducting a general medical examination to determine the level of somatic health.

2. The main types of medical examinations do not include:

- A. Primary;
- B. Additional;
- C. Current;
- D. Fundamental;
- E. Stages.

3. At somatoscopy the degree of development of muscles is estimated as:

- A. Good, average, weak;
- B. Good, satisfactory, unsatisfactory;
- C. Normal, satisfactory, unsatisfactory;
- D. Hypertrophic, normal, hypotrophic;

- E. Hypertensive, normal, hypotonic.
- 4. At somatoscopy the degree of fat deposits is estimated as:
 - A. Weak, moderate, abundant;
 - B. Good, average, weak;
 - C. Good, satisfactory, unsatisfactory;
 - D. Normal, satisfactory, unsatisfactory;
 - E. Uniform, uneven.
- 5. Normal forms of the chest:
 - A. Cylindrical, conical, flattened, transitional shapes;
 - B. Cylindrical-conical, funnel-shaped;
 - C. Round, flat, round lit;
 - D. Cylindrical, conical, fuse, chicken;
 - E. Normosthenic, asthenic, hypersthenic.
- 6. There are the following forms of the back:
 - A. Normal, round, round-convex, flat;
 - B. Physiological, pathological;
 - C. Normal, scoliotic, kyphotic;
 - D. Normal, round, round-convex;
 - E. Normal, round, flat.
- 7. The main characteristics of the normal shape of the back:
 - A. The presence of cervical and lumbar lordosis, thoracic and sacrococcygeal kyphosis in the sagittal plane, no curvature in the frontal plane;
 - B. The presence of cervical and lumbar lordosis, thoracic and sacrococcygeal kyphosis in the frontal plane, no curvature in the sagittal plane;
 - C. The presence of cervical and lumbar kyphosis, thoracic and sacrococcygeal lordosis in the sagittal plane, no curvature in the frontal plane;
 - D. The presence of cervical and lumbar kyphosis, thoracic and sacrococcygeal lordosis in the frontal plane, no curvature in the sagittal plane;
 - E. The presence of 4 physiological curves of the spine.
- 8. The main characteristics of the round shape of the back
 - A. Increased sagittal curvature of the spine in the thoracic region in the dorsal direction, from the cervical to the lumbar vertebrae;
 - B. Increased sagittal curvature of the spine in the thoracic region in the dorsal direction, in the cervical and thoracic spine;
 - C. Increased thoracic kyphosis and lumbar lordosis;
 - D. The size of the thoracic kyphosis 3-4 cm;
 - E. Increase in all curves of the spine.
- 9. Scoliotic posture is called:
 - A. Curvature of the spine in the frontal plane;
 - B. Curvature of the spine in the sagittal plane;
 - C. Curvature of the spine in the frontal and sagittal planes;
 - D. The presence of radiologically confirmed lateral curvature of the spine;
 - E. Increased thoracic kyphosis and lumbar lordosis.
- 10. At dynamometry of arms the dynamometer is compressed:
 - A. In the straight side, three times;
 - B. In the raised hand, abruptly;
 - C. In the diverted side bent at the elbow, three times;
 - D. In the lowered hand, three times;
 - E. In the lowered hand, once.

1. Relevance of the topic: The most important and responsible task of medical control is the correct assessment of the functional state and functional abilities of a person. To assess the functional state of the body in medicine there is a special section - functional diagnosis. The essence of functional diagnostics is also in the analysis of mechanisms that cause changes in the functioning of organs and systems under the influence of various factors. Carrying out functional tests is crucial in admission to competitions, trainings after the transferred diseases, injuries, after long breaks in employment, for fatigue, on the recommendations of coaches or at the request of athletes. Therefore, determining the functional state of the cardiovascular, respiratory and autonomic nervous systems is relevant and necessary in the daily work of a sports doctor.

2. Duration of the lesson (or topic): 2 (hours).

3. Learning aim:

Specific goals:

To know:

- theoretical bases of carrying out functional tests and their value in functional diagnostics of cardiovascular, respiratory and autonomic nervous systems;
- classification of functional tests;
- functional indicators of fitness.

Be able:

- master the method of conducting functional tests: with breathing stop during inhalation (Stange) and exhalation (Genchi); with a change in body position in space (ortho- and clinistically); with physical activity (20 squats in 30 seconds and Letunov's test);
- analyze the data obtained during functional tests;
- mastering the skills of working with special medical documentation during functional tests (form № 061 / o or №162 / o).

Learn practical skills:

- independently perform functional tests: with respiratory arrest during inhalation (Stange) and exhalation (Genchi); with a change in body position in space (ortho- and clinistically); with physical activity (20 squats in 30 seconds and Letunov's test);
- to provide recommendations on the choice of the type of physical exercises and recreational and health or training motor modes depending on the functional abilities of the subject.

4. Basic knowledge, skills, abilities necessary for studying the topic (interdisciplinary integration).

Normal physiology- have basic registration skills physiological indicators.

Pathological physiology- to determine the mechanisms of development of pre-pathological and pathological changes in the body.

Propaedeutics of internal diseases- conduct functional tests with respiratory arrest, with a change in body position in space, with exercise. Interpret the received clinical data.

Physical Education- have the technique of health and sports training. Carry out self-control during physical training.

5. Student advice.

5.1. The list of the basic terms, parameters, characteristics which the student should master at preparation for the class.

Functional test- precisely dosed effect on the body of various factors, which allows you to study the response of physiological systems to a particular effect and allows you to get an idea of the state organism in terms of active life.

Functional condition- the level of adaptation of basic physiological systems to change the state of the internal and / or external environment.

Functional diagnostics- determination and assessment of the functional state of organs and systems of the body as a whole.

5.2. Theoretical questions for the lesson:

1. Organization and purpose of functional diagnostics.
2. General concepts of functional tests and their significance in clinical medicine. Determination of functional tests.
3. The main tasks to be solved during functional tests.
4. Classification of functional tests depending on the influencing factor.
5. Classification of functional tests with physical activity.
6. General requirements and scheme of functional tests.
7. Methods of conducting functional tests with respiratory arrest during inhalation (Stange) and exhalation (Genchi) and evaluation of the results.
8. Methods of conducting functional tests with changes in body position in space (ortho- and clinostatic) and evaluation of the results.
9. Methods of conducting a functional test with physical activity for recovery for low-trained individuals (20 squats in 30 seconds. (Martine-Kushelevsky).
10. Evaluation of the results of functional tests with physical activity for recovery.
11. Types of response of the cardiovascular system to exercise.
12. Characteristics of the normal type of response to exercise (normotonic).
13. Characteristics of pathological types of reaction to physical activity (hypotonic, hypertonic, hyperreactive, dystonic and stepped).

5.3. Practical work (tasks) performed in class:

1. Conducting and evaluating functional tests with respiratory arrest during inhalation (Stange) and exhalation (Genchi);
2. Conducting and evaluating functional tests with changes in body position in space (ortho- and clinostatic);
3. Conducting and evaluating tests with physical activity for recovery (20 squats in 30 seconds (Martine-Kushelevsky) or combined Letunov test);
4. Filling in special medical documentation during functional testing (form № 061 / o or №162 / o);

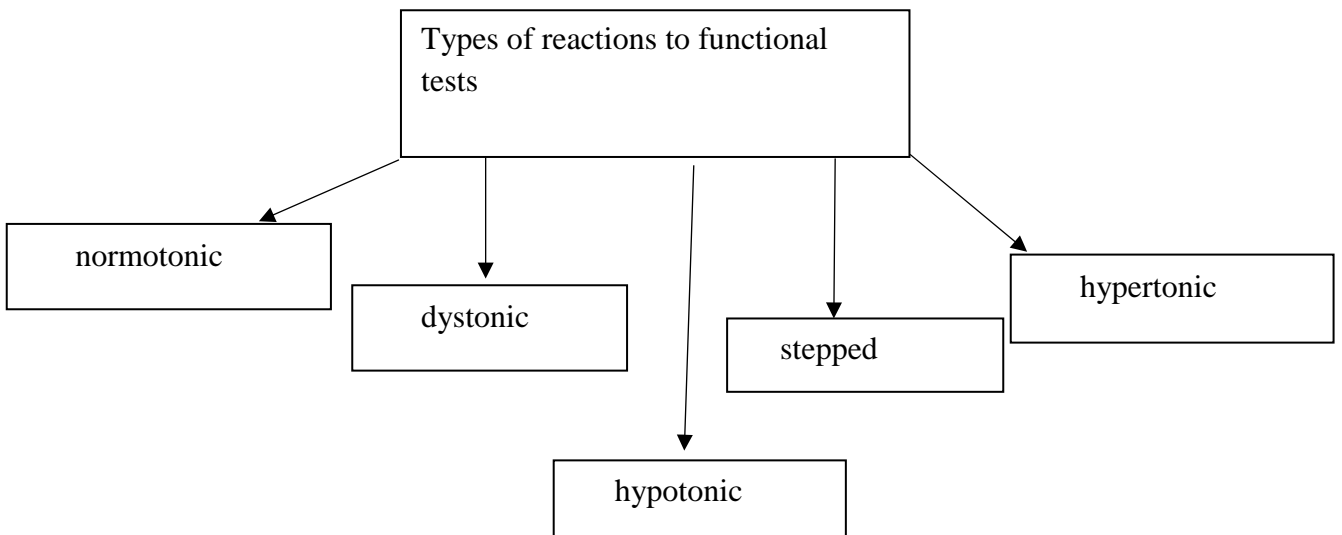
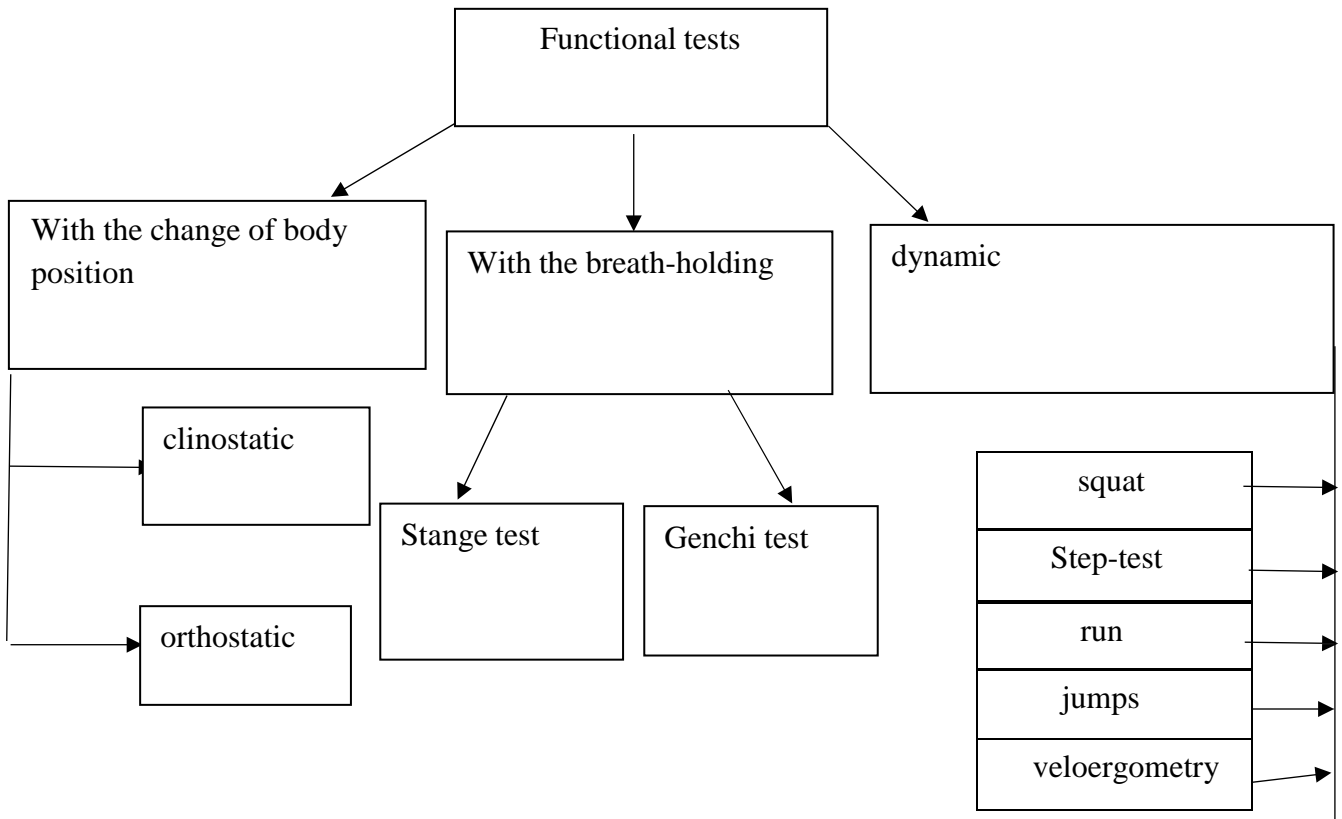
5.4. Topic content:

The main tasks of functional research:

1. Determining and assessing the degree and nature of the response of organs and systems to the influencing factor.
2. Identification of mechanisms of adaptation of the organism to changing conditions.
3. Detection of latent violations of the function, scope and extent of these violations.

Functional samples are used to assess mainly the response of a particular system in response to exposure. However, most of them characterize the activity of not one individual system, but the body as a whole.

Classification of functional tests:



General requirements are to the functional tests:

It should be noted that whatever the functional tests, they must meet certain requirements, namely - to be the same type, standard and dosed. Because only under such conditions it is possible to compare the data obtained from different individuals, or from one person in different periods of time, ie in the dynamics. In addition, functional tests should be completely safe and at the same time sufficiently informative, as well as simple and accessible, without requiring special skills to perform them. Exercise tests should ensure that as many muscles as possible are involved and that the intensity of the load can be measured and varied as necessary.

Functional tests apply:

- ✓ For determination of physiology reaction on physical activities
- ✓ For the correction of training process
- ✓ With the aim of drafting on the individual program of physical rehabilitation of patients, and her correction
- ✓ Determinations of level of physical capacity of healthy and sick
- ✓ For the estimation of efficiency of training process
- ✓ For research of influence on the organism of pharmacological preparations.

Features of registration of some indicators

It is also necessary to pay attention to features of registration of some indicators, mainly it concerns pulse rate, when carrying out functional tests. In order to study the reaction of this indicator, it is calculated not for one minute, but for shorter time intervals, usually 10, 15 or 30 seconds.

Methods of conducting and evaluation of functional tests

Breath holding tests

Breath holding test during inhalation (Stange test). The test is performed in a sitting position. The subject should take a deep (but not maximum) breath and hold his breath as long as possible (squeezing his nose with his fingers). The duration of the break in breathing is counted with a stopwatch. At the moment of exhalation the stopwatch is stopped. In healthy but untrained individuals, the time of respiratory break ranges from 40-60 seconds for men and 30-40 seconds for women. For athletes, this time increases to 60-120 seconds for men and up to 40-95 seconds for women.

Breath holding test during exhalation (Genchi test). After making normal (not excessive) exhalations, the subject holds his breath. The duration of the break in breathing is marked by a stopwatch. The stopwatch is stopped at the moment of inhalation. Respiratory delay time in healthy untrained individuals ranges from 25-40 seconds for men and 15-30 seconds for women. Athletes have significantly higher rates (up to 50-60 seconds for men and 30-50 seconds for women).

Samples with changes body position in space

Orthostatic test. After lying down for at least 3-5 minutes the subject counts the pulse rate for 15 seconds and the result is multiplied by 4. Thereby determine the initial heart rate for 1 min. Immediately after the transition to a vertical position, and then after 3 minutes. standing (ie when the heart rate stabilizes) his blood pressure is measured again and determine the heart rate (according to the pulse for 15 sec., multiplied by 4).

The normal response to the test is to increase the heart rate by 10-16 beats per 1 minute immediately after lifting. After stabilization of this indicator in 3 min. standing heart rate decreases slightly, but by 6-10 beats per 1 min. higher than in the horizontal position. A stronger reaction indicates increased reactivity of the sympathetic part of the autonomic nervous system, which is characteristic of insufficiently trained individuals. Weaker reaction is observed in the case of reduced reactivity of the sympathetic part and increased tone of the parasympathetic part of the autonomic nervous system.

Clinostatic test. This test is performed in reverse order: heart rate is determined after 3-5 minutes calm standing, then after a slow transition to a supine position, and finally after 3 minutes. being in a horizontal position. Pulse is also counted for 15 second time intervals, multiplying the result by 4.

For a normal reaction is characterized by a decrease in heart rate by 8-14 beats per 1 min. immediately after the transition to a horizontal position and some increase after 3 minutes stabilization, but the heart rate at the same time for 6-8 beats per 1 min. lower than in the vertical position. A greater decrease in heart rate indicates increased reactivity of the parasympathetic part of the autonomic nervous system, less - a reduced reactivity.

Exercise tests

Rufie test: conducting a test, in investigated, that are in position, lying on a back during 5 min, determine a pulse for 15 second (P1). Then during 45 seconds the investigated executes 30 squats for 45 second. After it he lie down and for him again count up a pulse for the first 15 seconds, and then for the last 15 seconds from the first minute of period of renewal.

$$\text{Rufie test} = \frac{4(P1+P2+P3)-200}{10}$$

Combined Letunov test. The test consists of 3 consecutive different loads, which alternate with rest intervals. The first load - 20 squats (used as a warm-up), the second - running on the spot for 15 seconds. with the maximum intensity (speed load) and the third - running on the spot for 3 minutes. at a pace of 180 steps in 1 minute. (endurance load). The duration of rest after the first load, during which heart rate and blood pressure are measured, is 2 minutes, after the second - 4 minutes. and after the third - 5 minutes. Thus, this functional test allows to estimate adaptation of an organism to physical activities of various character and various intensity.

There are 5 main types of reactions of the cardiovascular system: normotonic, hypotonic, hypertonic, dystonic and stepped

1. The normotonic type of reaction is characterized by:

- acceleration of pulse rate by 60-80% (on average by 6-7 beats per 10 sec.);
- moderate increase in systolic blood pressure to 15-30% (15-30 mm Hg);
- moderate decrease in diastolic blood pressure by 10-15% (5-10 mm Hg), due to a decrease in total peripheral resistance due to dilation of peripheral vascular vessels to provide working muscles with the required amount of blood;
- the normal period of the recovery process: for men it is up to 2.5 minutes, for women - up to 3 minutes.

This type of reaction is considered favorable, as it indicates an adequate mechanism of adaptation of the body to exercise.

2. Hypotonic (asthenic) type of reaction is characterized by:

- significant acceleration of the pulse - more than 120-150%;
- systolic blood pressure is slightly increased, or does not change, or even decreases;
- diastolic blood pressure often does not change, or even increases;
- significantly slowed down recovery period - more than 5-10 minutes.

This type of reaction is considered unfavorable because the mechanism of adaptation to the load is unsatisfactory.

3. The hypertensive type of reaction is characterized by:

- significant heart rate acceleration - more than 100%;
- significant increase in systolic blood pressure - up to 180-200 mm Hg. and above;
- a certain increase in diastolic blood pressure - up to 90 mm Hg., or a tendency to increase;
- the recovery period is significantly slowed down (more than 3 minutes).

The type of reaction is considered unfavorable due to the fact that the mechanism of adaptation to the load is unsatisfactory. This type occurs with a predisposition to hypertensive conditions (including latent forms of hypertension), vegetative-vascular dystonia of the hypertensive type.

4. The dystonic type of reaction is characterized by:

- significant heart rate acceleration - more than 100%;
- significant increase in systolic blood pressure (sometimes above 200 mm Hg);
- reduction of diastolic blood pressure to zero ("phenomenon of infinite tone"), which lasts for more than 2 minutes (the duration of this phenomenon up to 2 minutes is considered a variant of the physiological response);
- slowing down the recovery period.

The type of reaction is considered unfavorable and indicates excessive lability of the circulatory system, due to a sharp violation of the nervous regulation of the peripheral (microcirculatory) vascular bed. Observed in disorders of the autonomic nervous system, neuroses.

5. For the step type of reaction is characterized by:

- a sharp increase in heart rate - more than 100%;
- stepwise increase in systolic blood pressure, ie systolic blood pressure measured immediately after exercise - in the first minute - lower than in 2 or 3 minutes of the recovery period;
- delayed recovery period

The type of reaction is considered unfavorable because the mechanism of adaptation to the load is unsatisfactory. It indicates a weakened circulatory system, unable to adequately and quickly provide the redistribution of blood flow needed to perform muscular work. It is often observed in the elderly, especially diseases of the cardiovascular system.

5.5. Materials for self-control:

1) Questions for self-control:

1. What are the features of the examination of an athlete or sportsman?
2. What is the essence of functional diagnostics?
3. What is a functional state?
4. What is the scheme of functional research?
5. What are the main tasks of functional research?
6. What "tool" is in the hands of a doctor to study the functional state?
7. What is the difference between the concepts of functional state and functionality?
8. What is the classification of functional tests?
9. What samples can be used to study the functional state of the cardiovascular system?

10. What samples can be used to study the functional state of the respiratory system?

2) Situational (clinical) tasks for self-control:

- Typical, standard, classic, have an unambiguous answer, students know the algorithms for their solution - **II level**;

- Atypical, non-standard, reflecting complicated professional situations - **III level**.

II level:

1. After the test with dosed exercise 20 squats for 30 seconds. in the subject L., 30 years increased heart rate from 14 beats. for 10 sec. up to 28 beats. for 10 sec., blood pressure changed from 130/80 to 180/90 mm Hg. The recovery period was 4 minutes

Task:

1. Determine the type of reaction of the cardiovascular system to the load;
2. Describe the recovery period;
3. Assess the quality of the response of the cardiovascular system to the load;
4. Assess the mechanism of adaptation of the cardiovascular system to the load;
5. Give an opinion on the possibility of admitting the patient to physical activity and recommendations on the necessary motor mode and level of physical activity.

2. After the test with dosed exercise 20 squats for 30 seconds. in the examined V., 33 years the pulse from 12 beats increased. for 10 sec. up to 26 beats for 10 sec., blood pressure changed from 120/80 to 145/0 mm Hg. Recovery time was 300 seconds.

Task:

1. Determine the type of reaction of the cardiovascular system to the load;
2. Describe the recovery period;
3. Assess the quality of the response of the cardiovascular system to the load;
4. Assess the mechanism of adaptation of the cardiovascular system to the load;
5. Give an opinion on the possibility of admitting the patient to physical activity and recommendations on the necessary motor mode and level of physical activity.

3. After the test with dosed exercise 20 squats for 30 seconds. the subject V., 13 years old, who had recently suffered from SARS, had an increased heart rate of 12 beats. for 10 sec. up to 26 beats for 10 sec., blood pressure changed from 120/80 to 145/0 mm Hg. Recovery time was 300 seconds.

Task:

1. Determine the type of reaction of the cardiovascular system to the load;
2. Describe the recovery period;
3. Assess the quality of the response of the cardiovascular system to the load;
4. Assess the mechanism of adaptation of the cardiovascular system to the load;

5. Give an opinion on the possibility of admitting the patient to physical activity and recommendations on the necessary motor mode and level of physical activity

III level

1. A girl A, 13 years old after the orthostatic test, the following results were obtained: an increase in heart rate immediately after getting up by 18 beats / min. and an increase in heart rate by 12 beats / min. after 3 minutes standing position relative to the initial heart rate.

Question:

1. Evaluate the results obtained?
2. What system do we test with an orthostatic test?
3. What diseases can these disorders lead to in the future?
4. Give advice to this girl regarding the level of physical activity and the necessary type of physical activity to prevent possible diseases.

3) Tests for self-control

1. During the combined functional test Letunov apply the following physical activities:
 - A. Running on the spot for 3 minutes. at a pace of 180 steps in 1 minute, 20 squats in 30 seconds, running on the spot for 15 seconds. with a high rise of the thighs
 - B. Running on the spot for 15 seconds. with a high rise of the thighs, 20 squats in 30 seconds, running on the spot for 3 minutes. at a pace of 180 steps in 1 minute.
 - C. 20 squats for 30 sec., Running on the spot at maximum speed with a high rise of the thighs for 15 sec., Running on the spot for 3 minutes. at a pace of 180 steps in 1 minute.
 - D. 20 squats in 30 seconds, 60 jumps in 30 seconds, running on the spot for 3 minutes. at a pace of 150 steps in 1 minute.
 - E. 60 jumps in 30 seconds, running on the spot for 3 minutes. at a pace of 120 steps in 1 minute.
2. Functional systolic murmur after exercise test:
 - A. Intensifies;
 - B. Does not change;
 - C. Increases or weakens;
 - D. Weakens or disappears;
 - E. Changes the timbre.
3. The main tasks to be solved during most functional tests:
 - A. Assessment of the nature of the response of organs and systems to a functional test;
 - B. Research of mechanisms of adaptation of an organism to the changed conditions;
 - C. Detection of latent dysfunction of organs and systems;
 - D. All answers are correct;
 - E. There are incorrect answers.
4. After trying 20 squats for 30 seconds. the subject's heart rate increased from 12 beats. for 10 sec. up to 20 beats. for 10 sec., blood pressure changed from 120/80 to 140/60 mm Hg. Determine the type of reaction of the cardiovascular system:
 - A. Normotonic;
 - B. Hypotonic;

- C. Hypertensive;
 - D. Dystonic;
 - E. Stepped.
5. The main manifestation of the economization of physiological functions at rest in trained individuals is:
- A. Acceleration and deepening of respiration;
 - B. Reduction of the diastole phase;
 - C. Sinus bradycardia;
 - D. Sinus tachycardia;
 - E. Increased cardiac output.
6. The main signs of long-term adaptation of the cardiovascular system to optimal physical activity (especially for the development of endurance) are:
- A. Sinus bradycardia, physiological hypotension, severe myocardial hypertrophy;
 - B. Sinus bradycardia, moderate hypertension, hypertrophy mainly of the left myocardium;
 - C. Sinus bradycardia, physiological hypotension, moderate myocardial hypertrophy with the corresponding development of coronary bleeding;
 - D. Sinus bradycardia, hypotension, hypertrophy mainly of the right myocardium;
 - E. Sinus tachycardia, physiological hypertension, moderate myocardial hypertrophy with the corresponding development of coronary bleeding.
7. Organic systolic murmur after exercise test:
- A. Weakens;
 - B. Intensifies;
 - C. Does not change;
 - D. Changes the timbre;
 - E. Disappears.
8. What parameters determine the type of reaction of the cardiovascular system to standard exercise:
- A. Changes in heart rate;
 - B. Changes in systolic and diastolic blood pressure;
 - C. Pulse excitability, the nature of changes in systolic, diastolic and pulse blood pressure;
 - D. Changes in heart rate and respiration;
 - E. Changes in heart rate and pulse blood pressure.
9. The normotonic type of reaction of the cardiovascular system to exercise is characterized by:
- A. Increase in heart rate to 60-80%, moderate increase in systolic blood pressure, some (up to 10%) decrease in diastolic blood pressure, increase in pulse blood pressure to 60-80%;
 - B. Increase in heart rate to 60-80%, moderate decrease in systolic, diastolic and pulse blood pressure;
 - C. Increase in heart rate to 60-80%, a significant increase in systolic, diastolic and pulse blood pressure;
 - D. Increase in heart rate over 100%, slight increase in systolic, diastolic, decrease in heart rate;
 - E. Increase in heart rate over 100%, significant increase in systolic blood pressure, significant decrease in diastolic blood pressure.
10. After trying 20 squats for 30 seconds. the subject's heart rate increased from 12 beats. for 10 sec. up to 25 beats for 10 sec., blood pressure changed from 120/80 to 180/95 mm Hg. Determine the type of reaction of the cardiovascular system:
- A. Normotonic;
 - B. Hypertensive;
 - C. Hypotonic;

- D. Dystonic;
- E. Stepped.

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