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"North Ossetian State Medical Academy"
Ministry of Health of the Russian Federation

DEPARTMENT OF GENERAL HYGIENE
AND PHYSICAL CULTURE

Assessment of physical condition

Methodological recommendations
on the organization of independent work and study of the disciplines "Physical culture and sports" and "Elective course in physical culture and sports" of the main professional educational program of higher education – specialty program in the specialty 31.05.03 Dentistry (partially implemented in English)

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Assessment of physical condition makes it possible to determine the level of physical development and physical fitness of students in order to further use these data for an adequate choice of the type of physical activity, increase the level of physical performance, preserve and strengthen the health of students in physical culture lessons, i.e. carry out a differentiated approach to the process of physical education. A comprehensive assessment of physical condition allows you to record changes in the body under the influence of physical exercises and timely adjust the educational process of physical education.

This publication is recommended for students studying in the specialty "General Medicine", "Dentistry", "Pediatrics", "Medical and preventive work", "Pharmacy". The guidelines have been prepared in accordance with the Federal State Educational Standard for Higher Education.

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PURPOSE OF THE LESSON: research and assessment of physical development

A STUDENT SHOULD KNOW:

- physical development research methods: somatoscopy and anthropometry;
- methods for assessing physical development: index method and method anthropometric standards.

A STUDENT SHOULD BE ABLE TO:

- conduct an external examination of the patient (somatoscopy), determine the posture (normal, different forms of posture disorders), the shape of the chest, legs, feet;
- perform anthropometric research;
- assess physical development using standards and indices.

QUESTIONS TO BE SURRENDED:

- indicators of physical development;
- basic research methods for physical development:
  - ✓ anamnesis;
  - ✓ external examination (somatoscopy);
  - ✓ measurement of morphological and functional indicators (anthropometry);
- methods for anthropometric standards, correlation and indices.

RECOMMENDED LITERATURE:

1. Epifanov V.A. Healing Fitness. Tutorial. M.: "GEOTAR– Media". 2009.
2. Epifanov V.A. Sports medicine. Tutorial. M.: "GEOTAR–Media ". 2006.
3. Epifanov V.A.Healing Fitness. Directory. M.: "GEOTAR– Media". 2004.
4. N. D. Graevskaya, T.I. Dolmatova. Sports medicine. A course of lectures and practical exercises. 2004.

INDICATORS OF PHYSICAL DEVELOPMENT

Under ***physical development***means a complex of morphological and functional indicators that determine the level of age– related biological development of an individual at the time of examination. Physical development reflects the processes of growth and development of an organism at certain stages of its life. The size of the body depends on its length and mass, the circumference of the chest. The proportions of the body are determined by the ratio of the sizes of the trunk, limbs and their segments.

Under ***physique*** understand the size, shape, proportions and features of the relative position of body parts, as well as the development of bone, adipose and muscle tissues. Features of the physical development and physique of a person largely depend on his constitution.

The constitution is a set of morphological characteristics of an organism, formed on the basis of hereditary and acquired properties. Of the environmental factors, under the influence of which constitutional characteristics are formed (socio– economic conditions, nutrition, past illnesses, physical culture and sports), physical culture and sports are of significant importance, especially in childhood.

The constitution as a generalized morphofunctional characteristic of an individual reflects the characteristics not only of physique, but also of mental activity, metabolism and functioning of autonomic systems, adaptive, compensatory and pathological reactions of a person.

In medical practice, a constitutional type scheme is used M.V. Chernorutsky. In this case, the following three types are distinguished:

- ✓ *normosthenic type*characterized by proportional body size and harmonious development of the musculoskeletal system;
- ✓ *asthenic type,* which is distinguished by a slender body, weak development of the muscular system, the predominance (compared with normosthenic) longitudinal body size and chest size cells above the size of the abdomen; limb length – over length torso;
- ✓ *hypersthenic type*different from normosthenic excess fatness, the relative predominance of transverse the size of the chest over the longitudinal.

The indicators of physical development in adults depend on the mode of physical activity, the nature of the diet, and age. Men, as a rule, have higher indicators of physical development than women, differ from them in the features of the physique.

With aging, the morphological and functional indicators of physical development change significantly: muscle tissue atrophy occurs, the deposition of subcutaneous fat increases, the strength of certain muscle groups decreases, etc.
Features of a person's physical development depend on the mode of physical activity. Some indicators of physical development of athletes and athletes are significantly higher than those of people who are not involved in physical culture and sports.

PHYSICAL DEVELOPMENT RESEARCH METHODS

The main methods for studying physical development are collection:

- ✓ anamnesis;
- ✓ external examination (somatoscopy);
- ✓ measurement of morphological and functional indicators (anthropometry).

At the same time, a number of studies are used: photography, radiography, measurement with devices (kyphoscoliosometers) of physiological bends of the spinal column, measurement of the amplitudes of movements in the joints using a protractor (goniometry) and others.

1. ANAMNESIS

Anamnesis consists of 3 parts: general information, life history, sports history. General information includes passport data about a person: full name, date of birth, education, social and professional status. Separately, information about possible occupational hazards that affect the lifestyle and physical activity of a person is specified (in sports, these are excessive loads and irrational recovery).

It is necessary to find out what are the conditions of nutrition, study or work at the present time, the presence of bad habits. Along with this, it is important to clarify the hereditary pathology in the family.

The diseases and injuries suffered are specified. The emphasis is on viral hepatitis, childhood infectious diseases (scarlet fever, chickenpox, etc.). It is found out whether there have been operations and injuries (what, when): if the year is current or previous, the month is specified; if month is current or previous - date.

All of the above information helps to judge the health of the individual, is important in determining the level of motor load and its orientation.

Physical activity:

Professional, household (low, moderate, high).

How long does one walk per day (km).

Do you practice morning hygienic exercises (MHG) regularly or not regularly?

The sports history is collected in the most detailed way. Which medical group did he belong to at school, academy? Has he been engaged in physical education recently, the number of workouts per week, the use of additional means of recovery (sauna, massage, vitamins), hardening. The conclusion on the anamnesis is made based on the analysis of all its constituent parts, and gives certain ideas about the general level of health and fitness of a person.

This scheme for collecting anamnesis is used for all types of sports and medical testing of various groups of athletes and athletes.

2. SOMATOSCOPY

Somatoscopy reveals physique features, posture and condition of the musculoskeletal system.

An external examination is necessary to determine if there are any abnormalities in posture. Inspection is carried out in three positions: front, side and back:

- ✓ when viewed from the front, attention is paid to possible asymmetries of the face, neck, the shape of the chest, arms, legs, position of the pelvis;
- ✓ side examination allows you to check the posture in the sagittal plane (flat, round, stooped, flat-concave, round-concave back, etc.);
- ✓ when viewed from the back, possible curvature of the spine in the frontal plane (scoliosis) is revealed.

LEATHER

When examining the skin, pay attention to dryness, moisture, color, elasticity, the presence of a rash, calluses, unusual pigmentation, vascular pattern.

FAT DEPOSITION

Distinguish between normal, reduced and increased fatness. Fat folds are measured at the lower angle of the scapula (normal for men: 0.5–1 cm, for women - 1.0–1.5 cm) and on the abdomen, at the level of the navel on the right and left. Fingers are taken in a fold of a skin area with subcutaneous tissue in 5 cm. With low fatness, the researcher's thumb and forefinger easily feel each other, bone and muscle reliefs are clearly visible. With normal fatness, the skin fold is taken freely, but the ends of the fingers are not clearly felt, the bone and muscle reliefs are slightly smoothed. With increased fatness, the skin fold is taken with difficulty, bone and muscle reliefs are smoothed. For measurements, you can use a special tool - a caliper. It is necessary to indicate the uniformity of the development of subcutaneous fat.

MUSCULATION

To determine the shape of the hands in a standing position, the examinee should stretch his arms forward, palms up and connect them so that the little fingers of the hands touch. If the arms are straight, then they do not touch at the elbows, with an X-shaped shape, they touch.

Muscular development is good, satisfactory, weak, even, or not. The musculature is assessed by examination and palpation: by the volume of muscles, their relief, uniformity of development, symmetry, by muscle tone, the presence of seals, muscle pain.

RIB CAGE

It can be normally cylindrical and conical.

1. The cylindrical chest has the shape of a cylinder, the ribs are horizontal, the rib angle is 90 °.

2. The conical rib cage has the shape of a truncated cone, the ribs are also horizontal, but the costal angle is obtuse (more than 90 °). As a result of diseases, the chest can acquire a pathological form: rickets (asymmetric or chicken), emphysematous (barrel-shaped), funnel-shaped, etc.

Athletes often have a cylindrical shape. For those who do not go in for sports, the conical shape of the chest is characteristic. In adults who lead a sedentary lifestyle, there is a flattened chest. In individuals with a flattened chest, respiratory function may be reduced.

Violation of the shape of the chest: pterygoid scapula, asymmetric position of the shoulder girdle. The abdomen is normally somewhat retracted.

POSTURE

This is the usual posture of a person, a manner of standing and sitting. Posture is usually assessed in a standing position, while the subject is kept completely at ease, without any tension. With correct posture, the head and trunk are on the same vertical, the shoulders are at the same level, deployed, slightly lowered, the shoulder blades are adjacent to the chest, the physiological curvatures of the spinal column are normally expressed, the chest is slightly convex, the abdomen is pulled in, the legs are extended at the knee and hip joints. Posture is examined and described from head to toe.

There are 5 types of posture: straight; bent; stooped; inclined; curved. *A straight type of posture is considered normal.* The rest are more or less anomalies.

The correct position of body parts in normal posture is as follows:

- ✓ feet a foot– width apart, parallel;
- ✓ knees are straight;
- ✓ the stomach is tucked up;
- ✓ the trunk is vertical, the angle of inclination of the pelvis is 45 °;
- ✓ the shoulders are laid back and lowered, the shoulder blades are close to the spine;
- ✓ arms are freely lowered along the midline of the body;
- ✓ the head is straight, the forehead and chin are in one vertical line.

Normally, there should be no lateral curvature of the spine – scoliosis. Scoliosis are thoracic, lumbar, total, and in the direction – left – or right – sided and S– shaped.

Posture disorders occur with muscle weakness at any age. More often than others, stoop develops. A round back is often referred to as juvenile kyphosis. A round and curved back reduces the function of breathing and blood circulation, a flat back reduces the spring function of the spine. It is important to timely identify

if there is a lateral curvature of the spine – scoliosis. With scoliosis of any localization on the convex side of the curvature, the space between the body and the lowered arms (triangle) is less pronounced. With the I degree of scoliosis, it is already possible to reveal the torsion of the vertebrae around the vertical axis in the position of the trunk tilt up to 90 °.

FEET

Distinguish between normal and hollow feet, longitudinal and transverse flat feet, as well as their combinations with varus or hallux valgus.

The shape of the foot can be determined by examining the arch of the feet. The subject (he must be without shoes) is offered to put his feet in parallel. If the inside of the feet does not touch the floor, this indicates the presence of an arch of the feet. Then the subject is asked to kneel on a chair and examine the plantar surface of the foot. Normally, the pigmented part of the foot should be no more than 1/3 of its width. When the foot is flattened, this part is more than 1/3 of its width; with flat feet, it can extend to the entire width of the foot. A more precise definition of the shape of the foot is given by plantography - a footprint on paper (with the help of easily washed off paint), which is used for measurement and evaluation (Fig. 1). Hollow foot - pigmented (supporting) part of the foot is less than 1/3 of its width. In addition to the longitudinal flat feet, violations of the shape of the foot include transverse flat feet, characterized by flattening of the transverse arch, and often combined with it, the deviation of the 1st toe outwards is halux valgus.

If necessary, radiography or functional strain podometry should be recommended, which allows to judge not only the supporting ability of the foot, but also its spring, balancing, motor functions, and consultation of an orthopedist.

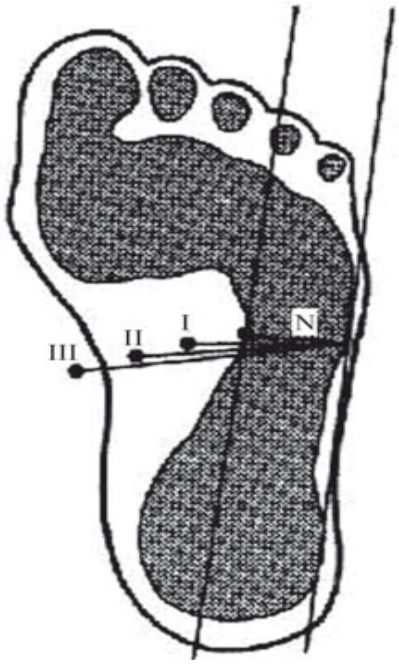
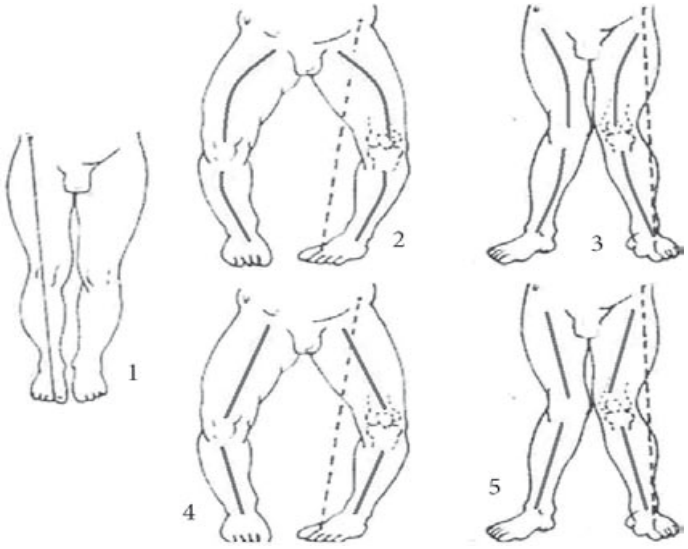


Fig. 1. Plantogram.
N – normal stop;
I – longitudinal flat feet of the 1st degree;
II – longitudinal flat feet of the 2nd degree;
III – longitudinal flat feet of the 3rd degree

The degree of curvature (X– and O– shape) is determined using a special triangle, which is placed between the inner ankles or knees. Similar to the above– described deviations of the lower leg relative to the thigh, there may be pathological deviations of the foot in relation to the lower leg: pes varus, pes valgus.

LEGS

They are considered straight if the hips, knees and heels are closed in the stand "to attention" (but without much muscle tension) and there is a small gap only below the knees or above the inner ankles. If with closed heels the knees do not converge, the legs are O– shaped, when the knees converge, but the heels do not, the shape of the legs is X– shaped.



(Fig. 2).

Figure: 2. Shape of legs:

1 – normal (the axis of the lower limb is normal);
2 – O– shaped deformation;
3 – X– shaped;
4 – genu varum (the axes of the thigh and tibia are straight, but the angle between them is open inside);
5 – genuvalgum (the axes of the thigh and tibia are straight, but the angle between them is open outwards)

The degree of curvature (X– and O– shape) is determined using a special triangle, which is located between the inner ankles or knees. Similar to the above deviations the lower leg relative to the thigh can be pathological deviations of the foot in relation to the lower leg: pes varus, pes valgus.

3. ANTHROPOMETRY

Anthropometric studies supplement and clarify the data of somatoscopy, make it possible to more accurately determine the level of physical development of the subject. Repeated anthropometric measurements allow you to monitor the dynamics of physical development in the process of systematic physical culture and sports.

With anthropometry, the following indicators are usually determined: body length standing and sitting (height); body weight (mass); circumference (girth) of the chest (pause, inhale, exhale), vital capacity of the lungs (VC), the strength of the muscles of the hand and back (back strength). Pay attention to correct measuring technique. When conducting anthropometry, it is necessary to comply with generally accepted methodological requirements for the comparability of results.

Determination of body weight

Body mass includes – body fat, skeletal weight, skeletal muscle and water. Allocate relatively energetically active body mass (cellular water, all proteins and all minerals in cells and extracellular fluid) and relatively inactive (body fat, bone mineral, extracellular water).

By determining the active mass index (IAM), you can determine the degree of muscle development:

$$IAM = M: R \times 10$$

M– active body weight (kg), R– body height (m)

The higher the training level, the higher the IAM. For example, among adolescents who are not involved in sports, the IAM is 0.77 – 0.86, and among athletes – 0.98 – 1.04.

In practice, to obtain operational information, as a rule, they are limited to determining the weight values of total fat, muscle mass, skeletal mass and subcutaneous fat.

Weighing is carried out on a medical scale, which must be verified and adjusted before use. The platform of the balance must be exactly horizontal (this is checked by the plumb line or the water "eye" installed on the balance). The balance should be sensitive to a weight of 100 g. The subject should stand motionless in the middle of the balance platform.

Body length measurement

Height (body length) – an important indicator of physical development. In girls, the body length increases to 17– 19 years, in boys – to 19– 22 years. Growth is influenced by many factors – nutrition, diseases (especially endocrine glands, such as pituitary, thyroid, adrenal glands), geographic environment and climatic

conditions, physical activity. But first of all, heredity affects growth. According to experts, the growth of children can be predicted by the growth of parents using the following formulas:

- ***final body length of boys = (father's height + mother's height) x 0.54 – 4.5;***
- ***final body length of girls = (father's height + mother's height) x 0.51 – 7.5.***

Taking into account the proper indicators of growth, it is possible to assess the growth rates (Table 1).

Table 1

Height of boys and girls (in%) of the final the height of an adult (according to A.F. Sinyakov)

Age, years	***Percentage of final adult height***	
	Boys	*Girls*
ten	78.75	84.15
eleven	80.68	86.59
12	83.24	92.07
13	86.65	94.51
14	90.06	96.95
15	94.60	97.26
16	98.29	98.78
17	99.32	99.70
eighteen	99.77	one hundred
19	99.89	one hundred
twenty	one hundred	one hundred

Example. The height of the father is 171 cm, the mother is 160 cm. It turns out that the proper height of their son is 174.24 cm, and at the age of 10 he is 133 cm. This is 76% of the due. According to the table, the height of a 10– year– old boy should be 78.75%. So in the given example, the boy's growth is still lagging behind.

The body length is measured with a stadiometer. Measurement of body length while standing with the help of a stadiometer is carried out as follows: the subject stands on the stadiometer platform with his back to the rack with a scale and touches it with three points – heels, buttocks and interscapular space. The head should not touch the stadiometer, but should be slightly tilted forward so that the upper edge of the external auditory canal and the outer corner of the orbit are on the same horizontal line.

The measuring person stands to the side of the subject and lowers the tablet on his head, sliding on a centimeter scale. The report is carried out along the lower edge of the tablet. It is necessary to ensure that the subject stands without tension; for women with high hairstyles, the hair should be loose when measured.

Measurement of body length in a sitting position is carried out with the same stadiometer, which has a folding bench, fixed at a distance of 40 cm from the floor. The measurement is carried out as follows: the subject sits deeper on the bench with his back to the stadiometer stand, touching it with the sacrum and interscapular space, the hips should be horizontal. If the legs are short, wooden supports of the appropriate height are placed under them. The head position is the same as when measuring standing height.

Measurement of chest circumference

The measurement is carried out with a measuring tape in three positions: at rest (pause), with maximum inhalation and full exhalation. The difference between the size on inhalation and exhalation is a chest excursion; it is an important indicator of respiratory function.

Technique for the study of chest girth

The investigator is offered to spread his arms to the sides. A centimeter tape is applied so that from behind it passes directly under the lower corners of the shoulder blades, and in front in men – along the lower segment of the nipple, in women – above the mammary gland, at the place of attachment of the IV rib to the sternum; after applying the tape, the subject drops his hands. For convenience, it is recommended to conduct research in front of a mirror, to which the subject is turned his back, in order to see in the mirror whether the tape is lying correctly behind.

The average rate of chest excursion for women is 6–8 cm, for men – 8–10 cm. As a result of regular exercise, especially sports, this figure can significantly increase and reach 12–15 cm.

Spirometry

Spirometry is a method by which the vital capacity of the lungs (VC) is determined. The measurement is carried out with a spirometer.

VC is the amount of air that an individual is able to exhale after taking the deepest possible breath.

Lung vital capacity measured with a spirometer. The examinee takes a deep breath and exhale 2– 3 times, and then, taking a maximum breath, tightly takes the mouthpiece of the spirometer into his mouth and, holding his nose with his free hand, evenly exhales air to failure. The measurement is carried out three times, the largest indicator is taken into account. VC depends on gender, age, body size, state of fitness and is determined using a spirometer.

It is within the following limits: for men – 3.5– 5.0 liters; for women – 2.5– 4.0 liters. For athletes, this value can reach: for men, 7.0 liters or more, for women – 5.0 liters or more. In some cases, in people of very high growth, VC can reach 9.0 liters.

Research methodology

The examinee stands facing the spirometer, takes the mouthpiece in his hands. Then, having made a preliminary 1– 2 inhalation and exhalation, the nose picks up the maximum amount of air and smoothly blows it into the mouthpiece to failure. It is necessary to ensure that the air does not escape past the tube or through the nose, for which the subject is pinching his nose with the fingers of his free hand. The study is carried out three times in a row; take into account the best result. Moreover, each subject must use an individual mouthpiece. After examination, the mouthpieces are sterilized.

Spirometry is the simplest and most affordable method for determining the function of the respiratory system. The vital capacity of the lungs changes with age.

Dynamometry

Dynamometry is a method by which the muscle strength of the hands and the strength of the back extensor muscles are determined. The handheld dynamometer is an ellipsoidal steel plate, the compression of which indicates the strength of the muscles, expressed in kilograms.

Hand muscle strength

To measure the flexion force of the hand, the method of hand dynamometry is used. The dynamometer is taken in the hand with the dial inward. The arm is pulled to the side at shoulder level and the dynamometer is squeezed as much as possible. Two measurements are taken on each hand, the best result is recorded. The average strength of the right hand (if the person is right– handed) in men is 35 – 50 kg, in women – 25 – 33 kg, the average strength of the left hand is usually 5 – 10 kg less.

Any measure of strength is usually closely related to the volume of muscle mass, i.e. with body weight. Therefore, when evaluating the results of dynamometry, it is important to take into account both the basic absolute force and the relative, i.e. related to body weight. They are expressed as a percentage. To do this, the indicator of the strength of the right hand is multiplied by 100 and divided by the indicator of body weight. Average indicators of relative strength in men are 60– 70% of body weight, in women – 45– 50%.

Stan Power

Back extensor muscle strength measured by a back dynamometer. Its leg is fixed on the floor (or they become feet on it), the handle is installed at knee level. The examinee should evenly, without jerking, pull the handle with maximum force, keeping his arms and legs straight.

Body strength cannot be measured for lower back pain, abdominal and back muscle injury, and in women during menstruation and pregnancy. The body strength of adult men is on average 130 – 150 kg, women – 80 – 90 kg.

The indicator of relative strength is determined as in the case of hand dynamometry and averages 180 – 240%.

A relative strength of less than 170% is considered low, 170– 200% is below average, 200– 230% is average, 230– 250% is above average, above 260 is high.

Contraindications for measuring back strength:

- ✓ high myopia;
- ✓ pathology of the spin;
- ✓ hernia (inguinal, umbilical);
- ✓ menstruation, pregnancy;
- ✓ hypertonic disease.

METHODS FOR ASSESSING PHYSICAL DEVELOPMENT

Physical development can be assessed by anthropometric standards, correlation and index methods.

Anthropometric standards method

Anthropometric standards physical development is determined by calculating the average values of anthropometric data obtained during the examination of various groups of people, the same in gender, age, social composition, profession, etc.

Average values (standards) of anthropometric characteristics are determined by the method of mathematical statistics. For each feature, the arithmetic mean (M– mediana) and the standard deviation (s– sigma) are calculated, which determines the boundaries of the homogeneous group (norm) for each feature and characterizes the magnitude of its fluctuations (variations). So, for example, if we take the average height of students 173 cm (M) ± 6 (s), then most of the surveyed (68– 75%) have a height in the range from 167 cm (173– 6.0) to 179 cm (173 + 6.0), the rest may be either less than 167 cm, or more than 179 cm.

When determining a score by standards, it is first determined how much your performance is greater or less than similar indicators by the standards.

For example, your height is 181.5 cm, and the average by standards (M) is 173 cm (with s = 6), then your height is 8.5 cm more than the average (181.5– 173 = 8.5). The resulting difference is then divided by s. The assessment of this anthropometric characteristic is determined depending on the value of the received quotient: less than – 2.0 – very low; from – 1.0 to – 2.0 – low; from – 0.6 to – 1.0 – below average; from – 0.5 to +0.5 – average; from +0.6 to +1.0 – above average; from +1.0 to +2.0 – high; more than +2.0 – very high.

Correlation method

For related features (which are the indicators of physical development), parameters are used that allow the correlation method to be obtained. The correlation method is based on the fact that the physical development of different parts of the body is interconnected. This relationship (correlation) can be

positive, when, for example, increase in height, the body weight increases, and negative, in which one increase causes a decrease in the other. This relationship can be expressed mathematically in the form of a correlation coefficient (relationship), denoted by the letter R, the limit value of which is 1. The relationship between the features will be the closer the closer the value of R approaches one.

The correlation coefficient is used to calculate the regression coefficient (b), which shows how much one value will change if the other associated with it changes by one. To assess physical development by the correlation method, special tables are developed.

Index calculation method

Of the many methods for assessing physical development, the most convenient and simple method for calculating indices.

Index – the value of the ratio of several anthropometric signs (weight with height, with the vital capacity of the lungs, with strength, etc.). This method can also be used to control during independent exercise.

The most commonly used anthropometric indices:

Brock– Brooksch growth mass index calculated by the formula: height (cm) – 100 = weight (kg). The result shows the normal body weight (weight) for a person of a given height. This is the simplest indicator, but it must be remembered that the subtraction of the number 100 is applicable only to people of short stature (155– 165 cm), with a height of 166– 175 cm this figure is 105, with a height of 175 cm and above – 110.

When determining normal body weight, you can use the Quetelet mass– growth index: body weight in grams is divided by height in centimeters. The average is 370– 400g per 1 cm of height for men, 325– 375 for women.

Life indicator – the ratio between VC and body weight. This determines how many cubic centimeters of air fall on 1 kg of body weight at the highest inspiration. The vital sign is obtained by dividing VC (ml) by body weight (kg). The average value of the indicator for men is 65– 70 ml / kg, for women – 55– 60 ml / kg, for athletes – 75– 80 ml / kg, for athletes – 65– 70 ml / kg. Thus, the higher the vital indicator, the better developed the respiratory function of the chest.

Body proportionality indices

Difference index. Determined by subtracting:

Body length (sitting height) – leg length (standing height – sitting height).

The average value for men is 9– 11 cm, for women – 11– 12 cm or less – this is a proportional physique. If the values are greater, then the physique is not proportional. The smaller the index, the longer the legs and vice versa.

Strength indicator *(indicator of relative strength).* There is a known ratio between body weight and muscle strength. Generally, the greater the muscle mass, the greater the strength.

The strength indicator is determined by the formula and is expressed as a percentage:

hand strength (kg): body weight (kg) x 100;

The average indicators of the strength of the hand of the strongest hand in men are considered to be 65– 75% of body weight and 45– 55% in women, body strength in men – 180– 220%, in women – 135– 150%. For athletes, respectively – 75– 81% and 260– 300%; among athletes – 60– 70% and 150– 200%. The strength of the hand increases with age, reaches a maximum by the age of 30– 35 and decreases after 40– 50 years, especially in persons who are not engaged in physical labor and physical education.

Chest development proportional index equal to the difference between the size of the chest circumference in the pause (cm) and half the length of the body (cm). If the chest circumference prevails over half the height, this indicator is indicated by a + (plus) sign, but if the chest circumference is less than half the height, it is indicated by a minus sign. Average indicators for a well– physically developed person are + 5– 6 cm for men and + 3– 4 cm for women. If the difference is equal to or greater than these values, it indicates good development of the chest.

Physique strength index gives more accurate information about the ratio of a person's weight and the constitution of his body, therefore, when determining the index, the indicators of growth, body weight and chest circumference are taken into account.

The body strength index is calculated by the formula:

IR = height (cm) – (weight (kg) + expiratory chest circumference (cm))

The smaller the difference, the better the score (in the absence of obesity). In an adult, the difference characterizes less:

10 – strong constitution;
from 10– 20 – good;
from 21– 25 – average;
from 26– 35 – weak;
more than 36 – very weak.

Erisman index determines the body type:

Env. gr. cl. (cm) × one hundred . height (cm),

env. gr. cl. – chest circumference in a pause.

If the index is 50 ... 55% – normostenic; if the index is less than <50 – asthenic (narrow chest); if more> 55 – hypersthenic (wide chest).

Based on the results of assessing physical development by methods of standards and indices, a generalized conclusion about physical development is made and appropriate recommendations for its improvement are given.

CONCLUSION ON PHYSICAL DEVELOPMENT

1. General assessment of physical development by most ratings anthropometric indicators.
2. Body type and posture assessment.
3. Indication of specific deficiencies identified by the methods somatoscopy, anthropometry.
4. Recommendations:
   a) to eliminate the identified deficiencies by means and methods the main sport and additional exercises;
   b) at the choice of means and methods of increasing physical development in relation to the chosen sport.

Growth Research

Subject _____
FULL
NAME _____
Gender _____ Years _____ Height _____ Body weight _____
Conditions _____
(training period and research goal)

I. SOMATOSCOPY DATA

1. Body type _____
2. Posture (overall assessment) _____, deficiencies _____
3. Shape of hands _____ Legs _____ Stop _____
4. Muscular development _____
5. Fat deposition _____

II. ANTHROPOMETRY DATA

III. CONCLUSION

1. General assessment of physical development _____
2. Body type _____ 3. Posture _____
4. Disadvantages identified by somatoscopy and anthropometry methods_____
5. Recommendations:
   a) to eliminate the identified deficiencies _____
   b) to improve physical development_____

ANTHROPOMETRIC PROFILE

Index	Designation, formula 1	Growth	Weight	VC	Circle										Diameter				Force	
						chest				shoulder										
					neck	inhale	exhalation	pause	excursion.	stress	relaxed	forearm	hips	shins	brachial	blameless	lane / rear	basin	brushes	dead
Measured																				
Standard																				
Difference +																				
Deviation in "σ"																				
Very tall																				
Tall																				
Above the average																				
Average																				
Below the average																				
Low																				
Very low																				

CONTROL AND TRAINING TESTS:

Choose one or more correct answers.

1. THE ASSESSMENT OF PHYSICAL DEVELOPMENT IS PRODUCED BY THE METHODS:

1) somatoscopy;
2) by the method of standards, indices, profiles;
3) anthropometry;
4) caliperometry;
5) correlations

2. THE KETLE INDEX IS:

1) difference indicator;
2) growth– mass index;
3) constitutional indicator;
4) mass– growth rate;
5) proportionality indicator

3. THE DYNAMOMETRY OF THE STRONGEST ARM IN AVERAGE IS FROM BODY MASSES IN WOMEN:

1) 40– 50%;
2) 50– 60%;
3) 60– 70%;
4) 70– 80%;
5) 80–95%

4. FOR PERSONS WITH A LARGE DIFFERENCE INDEX, MORE READING TO DO:

1) long jump;
2) figure skating;
3) running long distances;
4) skiing;
5) high jump

5. AT LONGITUDINAL FLAT OF THE 1ST DEGREE OF PRINTS– SUSPENDING ON THE PLANTOGRAM, THE PART OF THE FOOT IS:

1) no more than 1/4 of the foot width;
2) no more than 1/3 of the foot width;
3) more than 1/3 of the foot width;
4) the entire width of the foot

6. WITH NORMOSTENIC TYPE OF BODY CONSTRUCTION INDEX ERISMANA IS:

1) 40–45%;
2) 45– 50%;
3) 50–55%;
4) 55– 60%;
5) more than 60%

7. THE MOST FUNCTIONALLY SIGNIFICANT INDICATOR OF THE PHYSICAL WHOSE DEVELOPMENT:

1) difference index;
2) quetelet index;
3) dead power;
4) VC;
5) Erisman index

8. DYNAMOMETRY OF THE MUSCLES OF THE BACK (STAND FORCE) IN THE AVERAGE MAKES FROM BODY WEIGHT IN MEN:

1) 135– 150%;
2) 150– 185%;
3) 185– 200%;
4) 200– 220%;
5) 220– 250%

9. TO MORPHOLOGICAL SIGNS OF PHYSICAL DEVELOPMENT RELATE:

1) chest circumference;
2) sitting height;
3) body weight;
4) spirometry;
5) percentage of subcutaneous fat