



The correlation of physical development and results of the training process of young gymnasts

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Abstract

Objective of the study was to evaluate the influence of compensatory exercises on the harmony of physical development and the efficiency of the body parts of young gymnasts as a single kinematic system.

Methods and structure of the study. 24 young gymnasts aged 13.5 ± 0.5 years with anthropometric indicators: height – 155.6 ± 7.5 kg; weight – 48.4 ± 7.5 cm; chest girth – 81.7 ± 5.9 cm. A method was used based on the distribution of all variants of the studied indicator into ranges from minimum to maximum values. To train and assess the ability to muscle balance and joint flexibility, the following were used: Romberg test; Kraus-Weber test, leg abduction in the supine position; leaning forward while sitting; twisting of the torso; tilts to the side.

Results and conclusions. The sporting achievements of young gymnasts at the age of 13 are largely determined by rational technique corresponding to morphological data, as well as biological development, the primary prerequisites of which are anthropometric characteristics. Compensatory exercises, used with a specialized focus on the development of the main muscle groups included in the kinetic links of performing gymnastic combinations, are one of the training options and can reduce the negative impact of unidirectional load on young gymnasts.

Keywords: young gymnasts, anthropometric indicators, harmony of physical development.

Introduction. Various sports have developed model characteristics that are used to predict the potential performance of athletes. The analyzed data includes anthropometric and morphological indicators of young athletes, which to a certain extent determine the processes of development of strength and speed qualities, endurance, flexibility, and adaptation to training loads. Factors of biological development also influence the increase in performance, the course of recovery processes and the performance results of athletes [2, 4, 6, 7].

Control of the dynamics of anthropometric and morphological indicators induces systemic monitoring of physical development. This allows not only to recommend this or that sport to beginner athletes, but also to make corrections in the training process [1, 9].

High unidirectional loads in artistic gymnastics cause overstrain of the musculoskeletal system in

young athletes, especially the muscles of the trunk, shoulder girdle, and lumbar spine, which can affect a decrease in athletic performance. Muscle imbalance occurs due to a decrease in the elasticity and active tone of the postural muscles, which counteract the reaction force of the projectiles and maintain the position of the gymnast's body in space [3, 5].

To train the main muscle groups included in the kinetic stages of performing gymnastic combinations, including on apparatus, it is advisable to use compensatory exercises that affect not only the passive part of the musculoskeletal system, but also the active segment of the system, consisting of the corresponding muscle groups [8].

Objective of the study was to evaluate the influence of compensatory exercises on the harmony of physical development and the efficiency of the body parts of young gymnasts as a single kinematic system.



Methods and structure of the study. 24 young gymnasts aged 13.5 ± 0.5 years with the following anthropometric indicators took part in the scientific experiment: height – 155.6 ± 7.5 kg; weight – 48.4 ± 7.5 cm; chest circumference – 81.7 ± 5.9 cm; hip circumference – 83.2 ± 4.3 cm; hanging at an angle on the bar on the right hand – 20.6 ± 4.6 s; hanging at an angle on the bar on the left hand – 12.8 ± 2.3 s.

To assess the harmonious physical development of young gymnasts, a method was used based on the distribution of all variants of the studied indicator across ranges from minimum to maximum values using a mathematical procedure dividing the scale into 100 equal parts. This method was used to identify an increase in anthropometric indicators of body weight, height, chest and hip girths, as well as a gymnastics-specific exercise in hanging on the crossbar, which were used to assess the harmonious morphological development of the body of young gymnasts.

The percentile table made it possible to distribute young athletes according to the studied indicators into the appropriate groups. The scale used provided range limits expressed in percentiles: 0 – 25 – 50 – 75 – 100%. Physical development was monitored using a unidimensional percentile scale.

The proportionality of physical development was determined by the maximum difference between the values of the percentile scales for height, body weight, chest girth and hip girth and was assessed as: 0 – 50 harmonious development; 75 – heterogeneous development; 100 – accelerated heterogeneous development.

To train the ability to muscle balance and flexibility in joints, the following means were used: Romberg test; Kraus-Weber test, which includes six items; abduction of the leg in a lying position; leaning forward while sitting; twisting of the torso; tilts to the side.

The gymnasts performed compensatory exercises to strengthen the trunk muscles and improve flexibility and mobility in the joints for 30 minutes twice a week.

The effectiveness of the training program was assessed by indicators of discrimination of the main parameters of movement: time, amplitude and speed of performing elements on gymnastic apparatus.

Results of the study and discussion. As the variance of the distributed random variable (percentile) changed, percentage performance was expressed as a median ranging from 3% to 97%. This indicates the location of the gymnasts within the reference group. The studied indicators, related to the average morphological profile, can be considered an indicator of a high degree of physical development.

The physical development of gymnasts turned out to be predominantly heterogeneous or simultaneously accelerated and heterogeneous in chest and hip girths. The numerical difference between the percentile intervals between the values of the 25-50% and 50-75% ranges showed the harmonious development of the gymnasts' height and body weight indicators.

Studying the development features of the musculoskeletal system of young gymnasts based on assessing the ability to muscle balance, the level of development of flexibility and mobility in the joints, is a means of increasing the effectiveness of training activities. Binary assessment of compliance with model indicators of age development of young gymnasts (“complies” – “does not correspond”) indicates the successful completion of motor tasks by athletes.

The table shows statistically significant changes that occurred as a result of the use of corrective exercises.

Statistically significant changes were recorded in the sitting forward bend. According to research, the results of tests characterizing the general flexibility of gymnasts can be classified as above average. However, changes in the amplitude of lateral trunk bending caused by corrective exercises were not statistically significant.

Compared with the results of hip mobility tests presented in previous studies, the test data obtained for young gymnasts were classified as average. Upon completion of the corrective program, a statistically

Table 1. Dynamics of anthropometric indicators of young gymnasts

Indicator		Before	After	t
Leg abduction in a lying position, degrees	right	$95,6 \pm 9,8$	$102,9 \pm 13,5$	1,8
	left	$95,8 \pm 8,7$	$100,5 \pm 10,2$	0,6
Bend forward while sitting, + cm		$18,7 \pm 3,6$	$21,4 \pm 8,9$	2,3
Torso turns left-right, n/min		$79,5 \pm 5,3$	$87,3 \pm 6,2$	1,7
Tilt of the body to the side, degrees	to the right	$37,6 \pm 3,4$	$38,7 \pm 1,4$	1,9
	to the left	$37,2 \pm 6,9$	$37,9 \pm 7,8$	4,6



significant improvement in mobility in the hip joints was observed ($p < 0.05$).

Despite the initial discrepancy in the indicators in the duration of holding an angle hang on one arm, in tests for the magnitude of the inclination towards the side, no statistically significant differences were established between inclinations to the right and left. This is due, as a rule, to the symmetrical power work of the hands on apparatus, in contrast to representatives of team sports, who have functional asymmetry in the work of the limbs, established by numerous studies.

The study of the results of instrumental measurements of the ability to distinguish between amplitude, time and muscle effort when performing exercises on gymnastic apparatus revealed statistically significant changes in the skills of coordinating control of the own movements of young gymnasts.

Conclusions. The sporting achievements of young gymnasts at the age of 13 are largely determined by rational technique corresponding to morphological data, as well as biological development, the primary prerequisites of which are anthropometric characteristics.

Assessment of the functional state of the musculoskeletal system of young gymnasts is the basis for the development of training tools, including moving, stabilizing and strengthening forms of exercises.

Compensatory exercises, used with a specialized focus on the development of the main muscle groups included in the kinetic links of performing gymnastic combinations, are one of the training options and can reduce the negative impact of unidirectional load on young gymnasts. The method of compensatory tests can be used to monitor the growth of individual parameters of physical development depending on the somatic characteristics of young gymnasts.

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