

## EXERCISE PROGRAMS WHICH ARE DEVOTED TO PREPARING BY TECHNICAL TRAININGS FOR GYMNASTICS, THEIR ATTITUDES TO MOTOR SKILLS AND RHYTHM-TEMPO-STRUCTURE

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### ABSTRACT

Conducted research materials have been brightened that the improvement of the special-motional readiness of gymnasts should take into account the specific requirements for control over the quality of fulfillment of elements, ligaments and combinations in general, arising from the rhythm-tempo structure of a sportsman's special-motional actions.

**Keywords:** Rhythm-tempo structure, correlational analysis, motor skill, motor qualities, control tests, physical fitness, technical readiness, program gymnastic exercises.

### IMPORTANCE

According to L.Ya. Arkaeva, N.G. Suchilina (1), Yu.K. Gaverdovskiy (2,4), M.N. Umarova, A.K. Eshtaeva (5), the problem of the relationship of motor qualities and coordination abilities with the success of complete competitive motor actions has long attracted the attention of theorists and practitioners of sports. The overwhelming majority of studies have been carried out in the field of cyclic sports (3), and there are practically no such works in artistic gymnastics. At the same time, the requirements for the motor qualities and coordination abilities of a gymnast are extremely high (7). Without reaching the required level of development of these qualities, it is impossible to achieve high sports results (1,3,4,5,7). This was the basis for research in this direction.

**The purpose of the research:** Raising the physical fitness of gymnasts, taking into account the specific requirements to control over the quality of elements and combinations fulfillment in general, arising from the rhythm-tempo characteristics of motor actions.

**The results of the research:** We have determined the level of physical fitness of athletes, as well as some of the most general rhythm-tempo indicators, taking into account the duration of the performance of individual elements on gymnastic apparatus. Physical fitness was determined: in the static mode of work, the level of development of the maximum muscle strength (in relative units) was measured, in the dynamic mode - the average strength, maximum speed of movements and the power of the developed efforts (method of complex dynamography). Further, the total indicator of 5 muscle groups was calculated (flexors of the hand, flexors and extensors of the forearm, extensors of the legs and adductor muscles of the arms). Dynamic indicators were measured at 5 various levels of external resistances, which determine the strength and speed modes of muscle work.

Special tests for determining the rhythm-tempo structure of a motor skill in conditions close to the fulfillment of gymnastic exercises have not yet been developed. This forced us at the first stage to evaluate the general rhythm-tempo structure of the movement, taking into account the partial observance of the requirements for the tempo of the movement in gymnastics. The

model for determining the gymnast's abilities to the general rhythmic organization of movements was a motor stereo type, which is formed in response to light signals of a certain frequency (with an interval of 2 s). This test consisted of three series. In the first, the sports shift was assigned the task of squeezing the right hand in response to light signals. In the second, the subject had to bend the foot at the moment the signal appeared. In the third series of studies, the task became more complicated: the athlete had to alternately squeeze the hand and bend the foot. During processing, the number of motor responses was counted, coinciding with the signal, ahead of it and arising after the light flash. Analysis of all three types of reactions made it possible to judge the rate of formation of a general motor rhythmic stereotype. In relation to the ratio of the number of exact answers (coinciding with the signal) to the total number of reactions in each series of studies, the gymnasts' ability to rhythmically organize relatively simple and more complex forms of movements was determined. The experiment was carried out with the participation of 20 gymnasts of the highest ranks during the period of direct preparation for important competitions.

These data and sports results in competitions served as the source material for the statistical analysis of the relationship between the level of motor and general rhythm-tempo fitness of athletes and the sports and technical results shown by them in these competitions (the method of rank correlation - tab. 1).

In such types of exercises as freestyle and vault, a high degree of correlation with sports results was found in the strength indices of the leg extensor muscles (the correlation coefficients are 0.72 and 0.73, respectively). In exercises on a horse, the sports result depends on the strength indicators of the muscles of the hand and the extensors of the forearm - 0.55 and 0.70.

**Table 1:** The correlational degree between the relative static muscle strength and the sports and technical results of gymnasts \*

Types of gymnastic in each fields	Flexors		Extenders		Adductors of the arms	Total indicator
	brushes	forearms	forearms	feet		
Floor exercise						
Horse	+0,55	+0,93	+0,70	+0,72	+0,55	+0,62
Rings	+0,61	+0,63	+0,58	+0,73	+0,59	+0,78
Bounce	+0,65		+0,43	+0,60	+0,63	+0,63
Bars	+0,58				+0,75	+0,57
Crossbar	+0,58					+0,75
All-around	+0,62					+0,77
						+0,77

\* The table shows only those correlational coefficients that turned out to be significant at  $P = 0.05$ .

The exercises that are done on rings, the level of development of the strength of the flexors of the forearm, hand, extensors of the forearm and adductor muscles of the hands is of great importance - 0.93, 0.61, 0.58 and 0.55; in exercises on the uneven bars and crossbar - the relative static strength of the muscles of the hand and adductor muscles of the arms - 0.58 - 0.59. The total strength of the 5 examined muscle groups is interrelated with all types of gymnastic all-around (the correlation coefficient varied from 0.57 to 0.78). The sum of points in the all-around also has a high degree of interconnection with the value of the measured indicators of the indicated muscle groups.

We'll show the data that allow us to judge the relationship between the level of dynamic motor indicators before the competition and the sports and technical results of performances in certain types of gymnastic all-around (Table 2). Due to the difficulty of measuring dynamic indicators, we examined only two muscle groups important for gymnasts: the flexors of the forearm and the extensors of the leg. In floor exercises, the most important indicator was the maximum rate of contraction of the flexors of the forearm and extensors of the leg, both in the power mode of muscle work and in the speed mode during measurements. In exercises on a horse - all the main dynamic motor indicators of both muscle groups in the entire range of set resistances. In exercises on rings - the level of development of dynamic strength, speed and power of movements of the muscles flexing the forearm at all specified external resistances. The highest correlation coefficients of motor and sports-technical results were found here. In vault, reliable correlation coefficients were found for the power of the forearm flexors and leg extensors only in the high-speed mode of operation, which speaks of the great value of the speed-power indicators of the indicated muscle groups, especially extensors legs.

**Table 2:** The relationship between dynamic motor indicators, sports and technical results of gymnasts

Types of gymnastics multisport	Average force, kg		Maximum				Speed, cm / s				Power, kgm / s	
	Forearm flexors		Leg extensors		Forearm		Extenders leg		Forearm flexors		Leg extensions	
Floor exercises					+ 0,49	—	+0,50	+0,50	—		—	
Horse/swings	+0,70	+ 0,53	—	—	+0,92	+0,53	—	—	+0,87	+0,53	—	—
Rings	—	+0,73	—	—	+0,58	+0,70	—	—	+ 0,53	+0,73	—	—
Bars	—	+0,70	—	—	—	+0,62	—	—	—	+0,70	—	—
Crossbar	—	+ 0,63	—	—	+ 0,55	+0,47	—	—	+0,47	+0,63	—	—
Vault		+0,47				+0,52				+0,57		+ 0,62

The greatest correlation was found with the speed-strength indicators of the flexor muscles of the forearm (speed mode of muscle work, the correlation coefficient was 0.70) by the exercises on the uneven bars. A rational combination of strength and speed components of the motional actions of gymnasts has a great importance in exercises on the crossbar.

Analysing the investigations (Table 1, 2), characterizing the dependence of the maximum speed of contraction of the flexors and extensors of the muscles on the value of external resistance, makes it possible to determine the specifics of individual speed-strength qualities, that is, which of the components prevails in a given gymnast: strength or high-speed. And this makes it possible to purposefully select speed-strength exercises to improve special physical fitness, taking into account individual characteristics in turn.

According to biomechanical analysis data, the maximum speed of muscle contraction increases from 7 to 11 times in relation to the value of the speed at high external resistance. In the general case, the slope of the velocity growth curve to the abscissa axis characterizes the specificity of muscle work. The greater the increase in speed, that is, the value of the angle  $\alpha$ , the higher the speed qualities of the indicated muscle groups, and, on the contrary, the lower the numerical value of  $\alpha$ , the more the power component of muscle work prevails. The dependence of the maximum speed of movements on the value of the external set resistances has a slightly different form. But this already applies to the entire series of resistances, and not to the two extreme ones. The main direction in the development of requirements for artistic gymnastics in the world testifies to the dominant tendency to the speed-strength character of exercises fulfillment. Technical mastery when performing more complex elements, connections and combinations is generally associated with lightness and ease, which is determined by the speed and strength qualities of the gymnast. Slowdowns, delays, unreasonable pauses reduce the effect and, as a result, lead to the loss of valuable points. Our researches convince that it is necessary to select the means for the improvement of special physical fitness on the basis of the individual combination of the basic motor qualities of gymnasts.

In addition to the motor fitness of gymnasts, we studied some indicators that characterize their ability to rhythm-tempo organization of movements. There is practically no connection between the accuracy of the engine responses to a light stimulus and the sports and technical results of gymnasts (Table 3). So, with a simple motor reaction (squeezing the hand).

**Table 3:** The value of the correlation coefficients between technical results and indicators in tests of rhythm-tempo structure

Tests	Floor exercise	Control Horse (swing)	Rings	Jump	Bars	Crossbar	Total points
Hand (separately)	-0,21	0,12	-0,17	0,17	0,12	0,11	0,17
Leg (separately)	0,15	0,47	0,13	0,38	0,50	0,30	0,41
Hand (alternately)	0,04	0,24	-0,24	0,29	0,15	0,14	0,18
Leg (alternately)	0,45	0,14	-0,18	0,22	0,17	0,12	0,22

The correlational coefficient varies from 0.11 to 0.21, which are clearly explained below the significance level. In the test that determines the motor response of the lower extremities (flexion of the foot), these coefficients are somewhat lower: with the results in the exercise on the horse  $r = 0.47$ . In the future, we consider it expedient to develop more specialized tests to assess the rhythm-tempo abilities of gymnasts.

The prosperity of gymnastic exercises fulfillment on apparatus at a sufficiently high level of coordination abilities largely depends on motor readiness. At the same time, it is necessary to note the specificity of the requirements for the differentiation of rhythmic parameters of movements. So, let us trace the nature of the relationship between the strength and rhythm-tempo indicators of gymnasts (Table 4).

There is an inverse relationship between the level of improvement of muscle power indicators and the results in rhythm-tempo tests. This is especially noticeable in the forearm extensor muscle group. Here, reliable correlation coefficients vary within the range from -0.62 to -0.72.

Apparently, the specificity of gymnastic exercises is associated with a subtle differentiation of motor efforts.

**Table 4:** The relationship of the relative strength of individual muscle groups with results in tests of rhythm-tempo structure

Relative power	Hand (separately)	Leg (separately)	Hand (alternately)	Leg (alternately)
Flexor hands	-0,18	0,55	-0,21	-0,45
Forearm extensors	-0,72	-0,17	-0,69	-0,62
Forearm -leg extensors	-0,31	-0,06	-0,05	-0,12
Adductor muscles of the hands	-0,05	-0,31	-0,33	-0,13

It can be considered that a development level of physical fitness of a gymnast often leads to excessive confidence, especially in a competitive situation, hence errors arise in the transition from one structure of movement to another. Consequently, the improvement of the physical qualities of gymnasts should be in close unity with high requirements for quality control of the performance of elements and combinations as a whole.

This is confirmed in the studies of L.Ya. Arkaev (1), Yu.K. Gaverdovsky (2), V.N. Platonov (3), M.N. Umarov, A.K. Eshtaev (5,6) on assessing the reliability of gymnasts' performances with a high functional redundancy of leading qualities.

However, some highly qualified gymnasts compensate for the insufficient level of special physical fitness by a high ability for rhythm-tempo differentiation of complex movements.

The analysis of the dependence of the maximum speed of muscle contraction on the value of external resistance made it possible to develop a method for assessing the speed and power components in the general structure of the physical qualities of gymnasts. Therefore, it becomes necessary to develop more specialized tests to assess the rhythm-tempo abilities of gymnasts. Improvement of physical fitness of gymnasts should take into account specific requirements for quality control of elements and combinations fulfillment in general, arising from the rhythm-tempo characteristics of motor actions.

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