

An influence of sensorimotor coordination at the technical preparedness of young athletes in rhythmic gymnastics

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Purpose: to reveal the influence of the level of development of sensorimotor coordination of gymnasts 8–9 years on technical preparedness in exercise with clubs.

Material & Methods: tested ten gymnasts for 8–9 years on eleven test exercises with clubs, revealed the level of differentiation of muscular effort and reproduction of the time interval, statistical and correlation analysis of the data was carried out.

Results: close correlation relations of the marks for the performance of the competitive exercise with clubs are revealed with accuracy of reproduction of the time interval ($r=0,7$); heteronymic circles: in front – a large facial, behind the head – medium ($r=0,7$); with catching the clubs in two hands on the jump “touching” after throwing the left ($r=0,7$).

Conclusion: to perform basic exercises with clubs gymnasts affect the ability to analyze spatial-temporal characteristics of motions, differentiation own muscular effort proprioceptive sensitivity and anticipation.

Keywords: sensorimotor coordination, gymnasts, technical preparedness, exercise with clubs.

Introduction

A distinctive feature of rhythmic gymnastics are exercises with objects. Experts point to the ever-growing complexity of elements with objects performed by athletes in rhythmic gymnastics [2]. Rapid complication of the technique of the sport determines the increased requirements to the level of development of the coordination abilities of the gymnasts. In accordance with the research of N. A. Bernshtein [4] – the coordination of movements is built on the restriction of excessive degrees of freedom of our body, that is, their ordering and transformation into a controlled system of simple or complex movements based on sensory corrections. The specificity of rhythmic gymnastics requires from athletes a high level of sensorimotor coordination, response coordinated at the level of sensations of motor reactions to the perceived moving object with a clear idea of the positions of the links of its own body.

Analysis of the special literature on rhythmic gymnastics indicates that at present the number of studies devoted to the development of increases of gymnasts coordination abilities [1; 3; 8]. The problem of the technology of development of sensory systems in combination with the indicators of other types of training athletes is quite complex and requires in-depth study [5; 6; 7]. Stage of preliminary basic training in rhythmic gymnastics falls on the sensitive age of girls for the development of sensorimotor coordination. Gymnasts 8–9 years old are distinguished by high plasticity of the organism, increased ability to learn [2].

The relationship of research with scientific programs, plans, themes

The research was carried out in accordance with the initiative

theme of the department of dance sports, fitness and gymnastics: “Model characteristics of special physical fitness of athletes in sports kinds of gymnastics»

The purpose of the research

To reveal the influence of the level of development of sensorimotor coordination of gymnasts 8–9 years on technical preparedness in exercise with clubs.

Objectives of the study:

1. Determine the primary manifestation of coordination abilities in performing basic exercises with clubs for athletes 8–9 years.
2. Identify the effect of sensorimotor coordination at the technical preparedness of young gymnasts.

Material and Methods of the research

Composed of eleven test exercises with clubs, three sensory test are selected, conducted tests of ten gymnasts 8–9 years. Statistical and correlation analysis of the data obtained.

Results of the research and their discussion

A testing program was developed to determine the level of coordination abilities that girls need to perform basic exercises with clubs, as provided by this stage of training in the Sports School. The testing program included typical exercises performed by athletes with clubs, namely the variety of circles, “mills”, various throws, juggling, also the skills required for simultaneous work with two objects. Based on the results of

the motor tests, the gymnasts determined the level of development of abilities to analyze the space-time characteristics of movements, to differentiate their own muscular effort, proprioceptive sensitivity and anticipation.

Athletes have coped well with the basic element – the performance of various circles with clubs (6 points). Lower results were shown by young gymnasts in the context of complicating the basic elements by maintaining balance and performing different work with the right and left hands (5,5 points). In performing asymmetric movements with two hands in different planes and with different amplitude, the gymnast performed much better when working with the right hand than the left one (5,4 and 4,6 points respectively). Athletes showed good results in performing an elementary throw and catching the clubs in two hands (6,3 points). In the performance of successive symmetrical hands movements, circular mills athletes admitted inaccuracies (5,9 points). Gymnasts did a good job in combining the work of the body and the object, in catching the clubs in the jump “touching” (6 points; $V = 15\%$). However, there were significant shortcomings in this exercise with prevailing left-handed – 4,9 points. There were also shortcomings in juggling clubs with left hands (5,4 and 4,6 points respectively). There were significant differences between the individual results of gymnasts, the total average values for eleven tests: from 4,0 points to 7,1 points. The shortcomings are indicated by the minimum estimates in the group: from 1 point to 5 points (table 1).

It is well known that the better the ability of gymnasts to manage movements in time and in terms of the degree of muscular effort, the more effectively the process of their special preparation. With the athletes testing of the accuracy of reproduction of the time interval (ARTI) was carried out, the ability of subjective time counting was determined (Fig. 1).

Figure 1 shows the results of testing athletes in the accuracy of muscular effort by 50% of the previous maximum effort by right and left hand. The error in the accuracy of the muscular effort was: right arm – from 0 kg to 4,5 kg, left arm – from 0,1 kg to 3,8 kg. It should be noted that the mean error in the differentiation of muscular effort with the right hand is greater than the left one (2,48 kg, 1,6 kg). As a result of testing the subjective time counting abilities, it was determined that, on average, deviations in the reproduction of a ten-second interval in gymnasts amounted to: from 1,6 s to 4,3 s. Athletes test

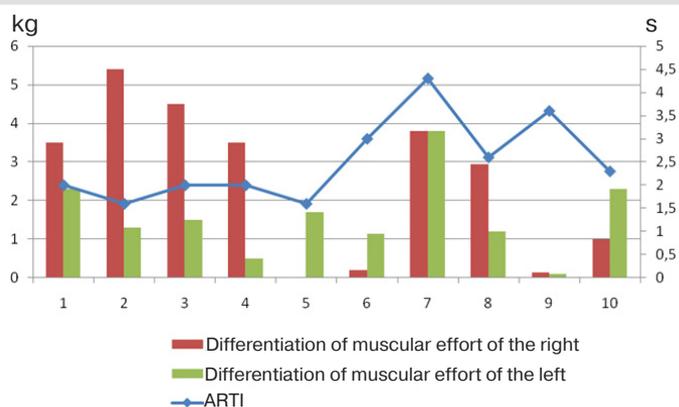


Fig. 1. Results of testing the accuracy of muscle effort and the accuracy of reproduction of the time interval

group had a greater tendency to shorten the time interval.

As a result of the correlation analysis of the studied indicators, it was revealed that the result obtained by the gymnasts at the school championship for the exercise with clubs, has close correlation with the estimates: dumping two clubs from the shoulders in the front balance ($r=0,7$); juggling clubs right ($r=0,7$) and left ($r=0,8$) hands. Significant correlations results of the school's championship were revealed with throws and catching of clubs in two hands ($r=0,6$); with catching in two hands in the jump “touching” after throwing the left ($r=0,6$); with accuracy of reproduction of the time interval ($r=0,6$); differentiation of muscular effort right ($r=0,6$).

Thus, young athletes showed the best results in small throws with clubs, in performing symmetrical circles with two clubs, in an elementary throw and catching two clubs. With the complication of typical work with an object with unstable balance, asymmetrical movements of hands, movements of various parts of one's own body, gymnasts had problems, and they made mistakes. Technical mistakes athletes are interlinked with the level of development of their coordination abilities, namely with the ability to analyze the space-time characteristics of movements, the differentiation of their own muscle effort, proprioceptive sensitivity and anticipation.

At the training in the children's and youth sports school gym-

Table 1

Results of testing the coordination abilities of athletes in exercises with clubs

Test	Result				
	Points*	Σ	V	min	max
1. Side circles (large, medium back, small forward)	6	1,56	26	3	8
2. Resetting two clubs from the shoulders in front balance	5,5	1,84	33	3	8
3. Varied circles: in front – Varied circles: in front – medium	5,5	1,65	30	3	8
4 Left small circles in the horizontal plane; Right – a large lateral circle forward	5,4	1,84	34	2	8
5. Right small circles in a horizontal plane; Left – a large lateral circle forward	4,6	1,58	34	1	7
6. Throw in the horizontal plane of two clubs. Catching in two hands.	6,3	1,25	19	4	8
7. “Circular mill” (hands up)	5,9	1,60	27	4	8
8. Catching in two hands in the jump “touching” after throwing the right	6	0,94	15	5	8
9. Catching in two hands on the jump «touching» after throwing the left	4,9	1,37	27	3	6
10. “Juggling”, starting with the right hand	6,8	1,75	25	4	9
11. “Juggling”, starting with the left hand	5,8	1,99	34	2	8

Note. * – maximum number of points – 10.

nasts are given one hour to warm up and prepare an individual program, the next two hours – to perform the first kind of all-around and workout the second type of all-around. At each training session, the gymnast, according to the instruction of the coach, was warming up at an intense, rapid pace, thereby reducing her. Thanks to this, 15 minutes were freed for additional work on the development of the coordination abilities required when performing elements with clubs. To develop coordination abilities, complexes of exercises without object and with object were made. In exercises without the object of the gymnast performed gradually increasing tasks for static stability, orientation in space, coordination of movements in different parts of the body, differentiation of muscle effort, sense of time, proprioceptive sensitivity and anticipation. Complexes began with general exercises, for example: the rotation of the head to the left; hands up, balance on two legs on the half-toes with closed eyes (10 accounts). Complexes of exercises without an object included elements of choreography, acrobatics, connections of body elements of various structural groups. Complexes of exercises with clubs included rolls, small throws, small throws of clubs, "semicircular mills", "street", throws of one mace, large throws, transfer in pairs, "mills" in various planes. Movements were performed from ten to twenty repetitions with increasing tempo. Complexes of exercises were applied at each training session for 1,5 months. As the exercises were assimilated and the coordination abilities of the young athletes improved, the tasks became more complicated. In the future, training combinations with clubs were composed, which included exercises from testing and elements, ligaments from the competition programs of gymnasts. The training combinations were also applied for 1,5 months on each training, the repetition of each combination – on average 2–3 times per training session.

According to the control estimation of competitive exercise with clubs was held end of the experiment. Judging was carried out in accordance with the rules of the competition. Table 2 shows the ratings of athletes according to the results of the competition in exercise with clubs at school championship rankings after control estimations, as well as the dynamics of the studied test results (table 2).

In figure 2, the number of athletes on the horizontal axis corresponds to the ratings obtained after the control training in the competition exercise with clubs. The two athletes who are the first in the ranking clearly see significant improvements in the indicators of sensory systems, namely, in improving the reproduction of the time interval by 1,7 s and 1 s, in differenti-

ating the muscular effort on 4,1 kg and 4,2 kg (Fig. 2).

A correlation analysis was made of the results of repeated

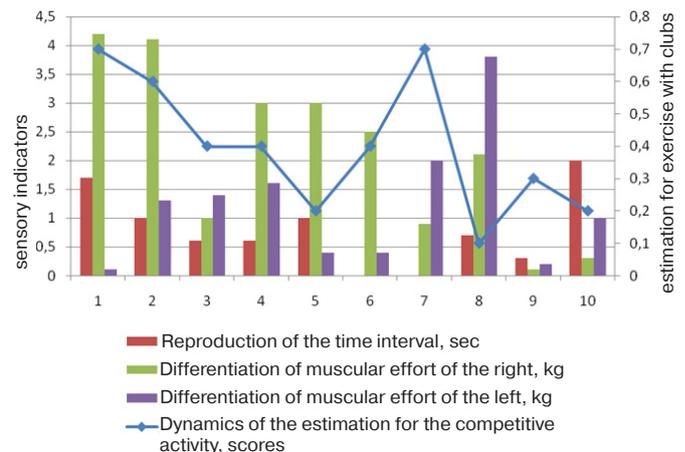


Fig. 2. Competitive ratings and changes in sensory parameters of gymnasts

testing with the marks received by gymnasts for a competitive exercise with clubs. The level of technical training of gymnasts, the evaluation of the performance of the competitive combination in the control training, has close correlation with the result for unlike circles: in front – a large front, behind the head – medium ($r=0,7$); with the result for catching the clubs in two hands on the jump "touching" after throwing the left ($r=0,7$) and with the accuracy of reproduction of the time interval ($r=0,7$). Significant correlations between the results of the school championship with the result for the dumping of two clubs from the shoulders in the front balance ($r=0,6$); with differentiation of muscular efforts of the left were revealed ($r=0,4$).

Thus, the analysis of the data obtained confirms that the level of technical preparedness of young gymnasts is interrelated with the level of development of their sensorimotor coordination, namely with the ability to analyze the space-time characteristics of the movements of the object and the links of one's own body, proprioceptive sensitivity and anticipation.

Conclusions

1. To perform basic exercises with clubs gymnasts need to have a high level of coordination abilities, namely the coord-

**Table 2
Dynamics of the test results**

Controlled indicators	Results, ratings									
	1	2	3	4	5	6	7	8	9	10
School championship, points	7,5	7,8	7,8	7,4	7,6	7	7,2	7,1	7	6,8
Ratings at the school championship	4	1	2	5	3	8	6	7	9	10
Control training, points	7,9	8,4	8,5	7,6	8	7,2	7,3	7,5	7,3	7,5
Ratings after control training	4	2	1	5	3	10	8	6	9	7
Dynamics of the marks for the competitive exercise, points	0,4	0,6	0,7	0,2	0,4	0,2	0,1	0,4	0,3	0,7
Dynamics of ratings in tests with clubs, points	1,55	1,64	1,45	1,82	1,91	1,55	1,91	2	1,64	1,64
Changes in the reproduction of the time interval, s	0,6	1	1,7	1	0,6	2	0,7	0	0,3	0
Changes in the differentiation of the muscular effort of the right, kg	3	4,1	4,2	3	1	0,3	2,1	2,5	0,1	0,9
Changes in the differentiation of the muscular effort of the left, kg	1,6	1,3	0,1	0,4	1,4	1	3,8	0,4	0,2	2

dination of symmetrical and asymmetric movements of both hands complicated by the movement of their own parts of the body and the movement of the object.

2. Close correlation links between the level of technical preparedness of gymnasts and the manifestation of their sensorimotor coordination have been revealed: the accuracy of reproduction of the time interval ($r=0,7$); Control asymmetrical movements of hands (unlike circles: in front - large facial,

behind the head – medium) ($r=0,7$); with the analysis of the space-time characteristics of the movements of one's own body and object (catching the clubs in two hands on the jump "touching" after throwing the left) ($r=0,7$).

Prospects for further research in this direction suggest an analysis of the manifestation of the predominant coordination abilities of gymnasts in working with other subjects of gymnastic all-around.

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