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EFFECTIVENESS OF DEVELOPING RHYTHMIC ABILITIES IN YOUNG TRACK-AND FIELD ATHLETES

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Annotation. The study's purpose is to test by experiment a methodology of developing rhythmic abilities in 9-10 year old track-and-field athletes, as well as to examine a degree of "trainability" of different signs of rhythmic abilities. This article presents results of studies demonstrating data on the level of rhythmic abilities' development in young track-and-field athletes. Different components of rhythmic abilities of 9-10 year old track-and-field athletes were examined. We also gave characteristics of the methodology of developing rhythmic abilities using a combination of means for improving tempo-rhythmic features of movement in local and global movements, an ability to preserve the maximum rhythm of movement and preservation of set tempo-rhythmic indicators when performing movements. The results of an experimental test of the effectiveness of the methodology of developing rhythmic abilities in young track-and-field athletes were presented. The developed approach allows increasing significantly the level of rhythmic abilities of young sprinters due to the use of special methodological approaches and dosing used means. Significantly higher results of used indicators were registered in the experimental group, where an amount of rhythmic exercises was increased by 13-15% by means of decreasing the same amount of strength exercises.

Introduction. According to the Federal Standard of track-and-field training, sports training starts at 9 years (Order of the Ministry of Sports of Russia from 20.08.2019 N 673 "On approving the federal standard of sports training in track-and-field"). The main task of the initial stage of training in track-and-field is learning basic elements of different disciplines' techniques (jumping, throwing and different distance running) [1, 2]. While solving this task, the predisposition of an athlete to a certain type is defined and the choice of a certain track-and-field discipline is made.

Many researchers note that the age of 9-10 years is the most favorable for developing coordination abilities [1, 3, 4]. Authors also notice a significance of coordination training in different disciplines of track-and-field [2]. Among all coordination abilities, a rhythmic ability is one of the leading ones for achieving the

maximum athletic result in running disciplines. Different components of tempo-rhythmic characteristics of movement are substantial for jumping types of track-and-field and throwing [5-7]. It is known that this type of coordination abilities is mainly determined by the inherited level of potential. However, if we apply a directed development of rhythmic abilities in the most favorable age periods, it is possible to achieve an increase [4, 8, 9, 10]. Broadening data on features of rhythmic abilities and a degree of their "trainability" is relevant for progressive development of sports practice, since new theoretical and practical aspects of developing rhythmic abilities can be a foundation for defining special means of training and can be used at stages of selection and choosing the specialty in track-and-field.

The aim of the study is to test by experiment a methodology of developing rhythmic abilities in 9-10 year old track-and-field athletes, as well as to examine a degree of "trainability" of different signs of rhythmic abilities.

Methods and organization. Following methods were used: analysis and generalization of scientific and methodological literature, pedagogical testing, psychomotor testing using the digital kinematic sensor, mathematical statistics methods. 30 young track-and-field athletes (16 boys and 14 girls) from the group of initial training participated in the study.

Results and discussion. Two tasks were being solved: analysis of the effectiveness of the training process aimed at developing rhythmic abilities of young track-and-field athletes; the experimental testing of the effectiveness of the developed approach using the combination of means and methods of improving different components of rhythmic abilities (holding maximum or set tempo of movement, repeating the set rhythm, precision of repeating tempo-rhythmic characteristics of movement according to spatial and time parameters).

When analyzing results of the preliminary study, we revealed a decreased level in a number of indicators of rhythmic coordination abilities in 9-10 year old sprinters (mean group values of test results are presented in table 1), which can lead to shower learning of the running technique and a decrease of athletic performance. In young track-and-field athletes, mean group values according to indicators of rhythmic abilities in most tests remain normal for this age in comparison with standards suggested by A.S. Belyakova [2]. However, the analysis of individual values show that more than a third of athletes have insufficiently high results of testing, which indicated a necessity to use the differentiated approach when developing rhythmic abilities.

Table 1

Mean group values of rhythmic abilities in 9-10 year old track-and-field athletes

Indicators	Mean group values	
	Boys	Girls
Finger tapping test (max frequency of movement for 10 c, number of taps)	58±3,1	54±3,6
Finger tapping test (difference between min and max frequency of movements for 10 s, number of taps)	12,5±3,6	14,0±3,8
Max tempo of running on the spot for 10 s (number of attempts)	50,6±9,9	49,3±8,3
Precision of repeating the rhythm of 48 beats per minute with an angle of 20º (error in °)	2,8±0,7	2,0±1,2
Precision of repeating the rhythm of 48 beats per minute with an angle of 50º (error in °)	2,3±0,7	1,08±0,7
Precision of repeating the rhythm of 48 beats per minute with an angle of 70º (error in °)	3,6±1,2	4,3±2,0
Rhythmicity of performing tasks for repeating the rhythm of 48 beats (range in time indicators, ms)	350±49,9	280±35,5
Precision of repeating the rhythm of 58 beats per minute with an angle of 20º (error in °)	1,03±0,04	1,06±0,03
Precision of repeating the rhythm of 68 beats per minute with an angle of 20º (error in °)	0,86±0,05	0,84±0,03
Evaluation of spatial precision of repeating 20 ° (error in °)	3,9±1,6	2,7±2,0
Evaluation of spatial precision of repeating 50° (error in °)	2,8±1,3	2,0±0,9
Evaluation of spatial precision of repeating 70° (error in °)	3,4±1,8	2,8±1,9
Rhythmicity of performing tasks for repeating the rhythm of 68 beats (range in time indicators, ms)	450±45,0	380±45,-5

A decreased level of precision in performing time characteristics of rhythmic movements when testing with the kinematic sensor was revealed. Thus, in case of a relatively small derivation of spatial parameters of movements, the range in time indicators in 10 movements when testing different spatial values with different tempo exceeds normal values for this age. That means that movements are performed precisely, but without rhythm.

Regarding tempo-rhythmic indicators when performing tasks of repeating different rhythm (48, 58, 68 beats per minute), the level of results decreases both in boys and girls in case of increasing rhythm frequency. It is shown in both spatial and time features of the rhythmicity. Derivation from the set rhythm also increases in higher amplitude local movements, also both in boys and girls. It is important to note that in separate tests results of girls are higher than those of boys.

The data obtained indicate that 9-10 year old male track-and-field athletes possess a higher level of spatial repeat of movements in angles of 20°, 50°, 70° than female track-and-field athletes of the same age. It is shown through the lower number of errors in repeating spatial parameters of movement without visual control. Such variability in indicators is possibly related to the fact that the level of leading

sensory systems that contribute to the precise evaluation and repeating parameters of movements is different in 9-10 year old track-and-field athletes. Moreover, in accordance with an individual physical development, each sensory system can become the leading one. For example, exclusion of visual analyzer as a main source of information leads to worse spatial and time sensations.

In the process of the study, we developed a methodology for improving rhythmic abilities in 9-10 year old track-and-field athletes. The course of using this methodology is calculated for 4 months during the preparatory period of the annual training cycle. The purpose of using the developed methodology is to improve rhythmic abilities and examine a possibility to train these abilities.

Main tasks of the developed methodology are:

1. Developing rhythmic abilities in local and global movements;

2. Systematic learning of new motor actions;

3. Improving motor actions in different conditions in order to comprehensive development of rhythmic abilities and tempo-rhythmic characteristics of movement;

4. Developing and improving abilities to preserve the set rhythm (including maximum tempo).

As means, the methodology uses exercises with a background sound (metronome, counting, music), exercises with tasks for orienting (markings on the floor, speed ladder, using game pieces), exercises with hurdles (placed at the same or different distance), exercises with varying tempo of performing, amplitude of movement, exercises with balls (dribbling on the spot with different tempo, amplitude, in limited space), exercises related to the precision of performing the set rhythm according to spatial and time tempo-rhythmic characteristics of movements, as well as exercises for holding the maximum tempo of movement (including hindering factors). We developed sets of exercises for the preparatory and main part of a training session.

Implementation of the developed methodology implied its inclusion into sections of physical and technical training. On practice it carried out separately (time was taken exclusively for coordination training of rhythmic abilities) or with performing different training exercises mainly related to the running technique (special running exercises (running with changing directions, from one game piece to another, with different speed, step length and frequency).

Implementation into the training process was carried out not on each session, but 2 times a week in the preparatory and main part of the session. Main tasks of the session remained unchanged. Inclusion of the methodology did not contradict solving tasks of the training process and was an auxiliary component in the structure of track-and-field physical training. The training session took 90 minutes; developing rhythmic abilities took a third of the whole session. We increased the

difficulty of physical exercises in this methodology with changing spatial, time parameters and using special methodological actions, e.g. varying signals, orienting points, movement tempo, limiting space and time and so on.

Testing the methodology demonstrated its effectiveness, which is indicated by higher growth rates of examined indicators in the experimental group. For example, tables 2,3 show results of testing athletes of the EG (experimental group) and CG (control group) after the experiment.

Table 2

Value of an error in repeating movements in angles of 20°, 50°, 70° among 9-10 year old boys after the pedagogical experiment

Attempt №	Angle of 20°		Angle of 50°		Angle of 70°	
	CG	EG	CG	EG	CG	EG
	Error (°)		Error (°)		Error (°)	
1	2,8±2,9	2,0±2,3	1,7±0,5	1,5±1,3	5,7±2,3	4,0±1,9
2	1,8±1,9	1,9±1,7	2,5±0,8	2,0±1,2	4,8±1,7	3,9±1,4
3	2,3±1,0	1,5±1,2	2,2±1,5	1,7±1,2	4,0±2,0	3,5±1,0
4	1,5±1,0	1,3±0,9	1,7±1,2	1,3±0,4	3,8±2,1	3,3±0,8
5	1,3±0,5	1,2±1,0	1,0±0,9	0,8±0,9	3,3±2,7	3,0±0,9
X±σ (n=5)	2,8±0,7	1,7±0,4	2,3±0,7	1,5±0,4	3,6±1,3	3,5±0,5
min-max $\overline{X} \pm \sigma$	3,9±1,6	1,3±0,8*	2,8±1,3	2,3±1,0	3,4±1,8	2,8±1,5*
V(%)	25	23,5	29,4	26,6	35,7	14,2

Note: * – statistically significant differences between the CG and EG were registered, p≤0,05

Table 3

Value of an error in repeating movements in angles of 20°, 50°, 70° among 9-10 year old girls

Attempt №	Angle of 20°		Angle of 50°		Angle of 70°	
	CG	EG	CG	EG	CG	EG
	Error (°)		Error (°)		Error (°)	
1	4,6±1,7	2,4±1,4	3,1±1,2	2,2±1,2	5,4±2,1	4,0±2,0
2	3,6±1,1	2,7±1,0	2,8±1,0	2,1±1,0	4,3±1,4	4,2±1,9
3	3,1±0,4	2,9±1,0	2,5±1,4	1,9±1,1	3,4±0,9	3,0±1,0
4	1,5±0,9	1,7±0,8	1,9±1,1	1,6±0,9	3,0±1,1	2,9±0,9
5	1,3±0,9	1,0±0,7	1,4±1,1	1,3±1,1	2,0±1,2	1,9±0,8
X±σ (n=5)	2,0±1,2	1,9±1,0	1,8±0,7	1,8±0,4	4,3±2,0	3,2±1,3
min-max $\overline{X} \pm \sigma$	2,7±2,1	1,3±1,0*	2,0±0,9	1,8±1,1	2,8±,1	2,2±1,8
V(%)	60	52,6	38,8	22,2	46,5	40,6

Note: * – statistically significant differences between the CG and EG were registered, p≤0,05

We have proven by experiment an effectiveness of the methodology of developing rhythmic abilities in 9-10 year old sprinters. In the course of the experiment, data of the EG revealed significantly higher growth rates in indicators of rhythmic abilities in comparison with the data of the CG. In particular, it can be seen in values of an error from set tempo-rhythmic and spatial parameters of

movement according to the Zhukovskij's method, in indicators of an ability to preserve spatial characteristics of movements in the set rhythm, which is of significance in training and competitive activity of sprinters. The least changed ones are abilities to preserve maximum frequency of movements. It is possibly related to the fact that they were insufficiently trained. Therefore, the conducted pedagogical experiment contributed to an evidence of effectiveness of the developed approach and approved our suggestion that rhythmic abilities can be sufficiently trained at this age.

Conclusion. We revealed a decreased level in a number of indicators of rhythmic coordination abilities of 9-10 year old track-and-field athletes that can lead to slower learning of the running technique and decrease in athletic performance. The highest error of repeating the set value is noted at an angle of 70°. It indicates lower precision and stability among 09-10 year old track-and-field athletes when performing movements with higher amplitude. Boys possess a higher level of an ability to preserve the set tempo of movement; girls have higher indicators when tested for an evaluation of the sense of rhythm on the kinematic sensor. It is shown in a lesser error of repeating spatial parameters of rhythmic movement without visual control.

Practical effect from using the developed methodology for improving rhythmic abilities with a combination of means for developing tempo-rhythmic characteristics in local and global movements, an ability to preserve maximum rhythm of movement and preserving set tempo-rhythmic indicators when performing movement allows increasing significantly the level of rhythmic abilities of young sprinters using special methodological approaches and dosing used means. When diagnosing coordination rhythmic abilities, we revealed significantly higher results of used indicators in the EG, where an amount of rhythmic exercises was increased by 13-15% by means of decreasing the same amount of strength exercises.

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