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Original Article

The influence of a special technique for developing coordination abilities on the level of technical preparedness and development of psycho-physiological functions of young volleyball players 14-16 years of age

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Abstract:
Purpose: development and experimental verification of the technique of using the coordination (high-speed) ladder to improve the technical skills and psychophysiological functions of young volleyball players.
*Material and methods.*Participants: 24 volleyball players from the Municipal Institution "Complex Children's and Youth Sports School No. 8 (14-16 years); 12 athletes entered the control group, 12 in the experimental group. The experiment was conducted during 3 month in the preparatory period at the stage of basic training of the third year of training. The experimental group trained with a coordinating ladder. At the beginning and at the end of the experiment, psychophysiological testing was conducted. The following tests were used: the parameters of a simple and complex reaction in various modes of signal feeding, indicators of efficiency and the nervous system were determined. Intergroup and intra-group differences in the tests were determined.
*Results.*The construction of a training and training process in volleyball with the use of a coordination ladder with a rapid change in the type of activity had a positive effect on the psychophysiological state of volleyball players. At the representatives of the experimental group in the test "The response of choice, the number of errors" the result significantly improved ($p<0.001$). After the experiment, the control and experimental groups began to differ reliably among themselves. Similar data were obtained in the tests "Response time of choice in the feedback mode" and "Mental stability according to the Schulte test". The obtained data testify to the advisability of using a coordination ladder with the subsequent performance of another kind of activity as an attacking blow and receiving the ball from the bottom in the training of young volleyball players to optimize the psychophysiological state.
*Conclusions.*The method of application of the coordination (high-speed) ladder is developed. The technique is an effective, accessible and reliable means of improving the psychophysiological state, increasing the physical and technical preparedness of young volleyball players.
Keywords: volleyball; coordination staircase; coordination abilities; psycho-physiological functions

Introduction

Volleyball is an acyclic team game, where muscular work is of a speed-power, accuracy-coordinating character. The execution of all the technical and tactical elements of the game requires accuracy and purposeful movements (Claver, Jimenez, Garcia-Gonzalez, Fernandez-Echeverria, & Moreno, 2016, Collet, do Nascimento, Folle, & Ibanez, 2017; Coutinho, Mesquita, Fonseca, & Cote, 2015). Therefore, as noted by Aoki, Arruda, Freitas, Miloski, Marcelino, Drago, et.al. (2017), the development of the coordination abilities of players

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acquires particular urgency. At present, in the context of studies of the coordination abilities of athletes in various sports, the authors touch upon the questions of the dosage of physical exertion (Kozina, Iermakov, Crełu, Kadutskaya, & Sobyanin, 2017), the psychophysiological state (Aksoy, & Agaoglu, 2017; Galli, Cimolin, Rigoldi, Moro, Loi, & Pau, 2017; Korobeynikov, Korobeynikova, Iermakov , & Nosko, 2016; Korobeynikov, Mazmanian, Korobeynikova, & Jagiełło, 2011; Korobeynikov, Myshko, Pastukhova, & Smoliar, 2017; Kozina, Iermakov, Crełu, Kadutskaya, & Sobyanin, 2017; Kozina, Prusik, Görner, Sobko, Repko, Bazilyuk, et al., 2017), the control of the training effect (Davila, Davidson, Dahl, Bazilyuk, et al., 2017; Fleddermann, Heppe, Eils, & Zentgraf, 2016; Kozina, Prokopenko, Cretu, Chaika, Ryepko, Osiptsov, Razumenko, Kudryavtsev, & Polianskyi, 2018; Davila-Romero, Hernandez-Mocholi, & Garcia-Hermoso, 2015; Gjinovci, Idrizovic, Uljevic, & Sekulic, 2017; Kozina, Kalinicenko, Cretu, Osiptsov, Kudryavtsev, Polishchuk, Ilnickaya, & Minenok, 2018; Palao, & Valades, 2016).

Shalayev (2007) notes that acrobatic exercises are one of the effective means of special training of athletes in volleyball. With their help, it is possible to improve the process of development of speed, agility, determination and ability to coordinate teamwork, orientation in space. Thus, coordination abilities are necessary for players in volleyball for rapid mastering of the technique and tactics of the game. Similar provisions were shown in the works of Opanowska, Wilk, Kusmierczyk, & Opanowski, 2016; Pajares, Fernandez-Echeverria, Gonzalez-Silva, Suarez, & Arroyo, 2017).

Moving actions of volleyball players include instant starts and accelerations, jumps, a large number of explosive percussion movements with a long and almost continuous response to a situation that is constantly changing (Radu, LE, Fagaras, SP, & Graur, C. (2015; Trajkovic, N., Kristicevic, T., & Sporis, G. (2017; Trajkovic, Sporis, & Kristicevic, 2016; Tudor, & Tudor, 2015; Wesselly, & Rachita, 2016a; Wesselly, & Rachita, 2016b). Physical fitness of volleyball players coordination abilities among other physical qualities of volleyball players occupy a special place. Firstly, a high level of development of coordination abilities is a decisive prerequisite for qualitative mastery and improvement of the technique of the game, and secondly, the "coordinated" athlete at the competitions quickly adapts to the constantly changing uses the most effective ways of playing the game. The present time is the use of the "coordination ladder" simulator (Kristicevic, Krakan, & Baic, 2016; Nesen, Pomeshchikova, Druz, Pasko, & Chervona, 2018).

Recently, increasing popularity in the training process, athletes acquire exercises using the coordination of the stairs. So, in the work of Srinivasan and Saikumar (2012) revealed the effect of a significant improvement in the maneuverability of motion in badminton players when completing the classical training program with lessons using the coordination ladder.

The high-speed (coordination) ladder is one of the most common and effective simulators for health-improving activities and training of athletes in many sports. The ladder is an outfit aimed at active sports exercises. The use of the coordination ladder facilitates the development of both large muscles and muscles, which form the skeleton of the musculoskeletal system. Skeletal muscles are hardest to train, because they are deep, and only a limited number of exercises can use them (Grabara, 2015; Kozina, Iermakov, Bartík, Yermakova, & Michal, 2018). The design of the coordination ladder is aimed at improving body ownership and increasing the speed of leg movements by increasing the speed of the foot movements and the speed capabilities of the calf muscles. The application of the coordination ladder provides for a constant increase in various motor abilities (Kristicevic, Krakan, & Baic, 2016; Nesen, Pomeshchikova, Druz, Pasko, & Chervona, 2018).

Exercises on the ladder cause the human nervous system to send additional information to the muscles at a tremendous speed, including more and more motor cells. It helps a person to be faster, faster and more efficient. The current time it is used in many sports. However, the scientific justification of the effectiveness of this tool in gaming sports is not yet enough. The effectiveness of the coordination ladder in handball is shown (Nesen, Pomeshchikova, Druz, Pasko, & Chervona, 2018). It is logical to assume that the application of the coordination ladder in volleyball will also have a positive impact on the level of technical preparedness of the players. Since the main role in the management of movements belongs to the central nervous system, the study of the influence of the application of the coordination ladder not only on the physical qualities, technical fitness of the athletes, but also on the psychophysiological functions of the players assumes special importance.

In connection with these provisions, the following **purpose** of the work was put forward: development and experimental verification of the technique of using the coordination (high-speed) ladder to improve the technical skills and psychophysiological functions of young volleyball players.

Materials and methods.

Participants.

Have been examined 24 volleyball players aged 14-16 from the Municipal Institution "Integrated Children and Youth Sports School No. 8; 12 athletes entered the control group, 12 in the experimental group. The division of athletes into groups was conducted randomly. The groups created were identical in terms of physical fitness ($p>0,05$).

The study was carried out in accordance with the principles of the Helsinki Declaration and approved by the Ethics Committee of the University.

Methods and organization of research.

The experiment was conducted from September 25, 2017 to December 22, 2017 in the preparatory period at the stage of basic training.

To determine the psychophysiological state of athletes during the first and last week of the experiment, psychophysiological indicators were recorded using the computer program "Psychodiagnostics" (Kozina, Iermakov, Crełu, Kadutskaya, & Sobyanin, 2017; Kozina, Prusik, Görner, Sobko, Repko, Bazilyuk, et al. , 2017; Kozina, Prokopenko, Cretu, Chaika, Ryepko, Osiptsov, Razumenko, Kudryavtsev, & Polianskyi, 2018; Kozina, Kalinicenko, Cretu, Osiptsov, Kudryavtsev, Polishchuk, Ilnickaya, & Minenok, 2018). The following parameters were fixed:

• a set of indicators for the rate of a simple visual-motor reaction (mean of 30 attempts (ms), standard deviation (ms), number of errors); duration of exposure (signal) - 900 ms; Complex indicators of a complex visual-motor reaction of selecting 1 element from three and selecting two of the three elements (average of 30 attempts (ms), standard deviation (ms), number of errors); duration of exposure (signal) - 900 ms;

• a complex of parameters of a complex visual-motor reaction of selecting two of the three elements in the feedback mode, that is, as the reaction time changes, the time of signal delivery changes; "Short version" is carried out in the feedback mode, when the exposure time varies automatically depending on the corresponding reactions of the subject: after the correct answer, the duration of the next signal is reduced by 20 ms, and after the wrong one - increases by the same amount. The range of the signal exposure change during the test subject's operation is within 20-900 ms with a pause between exposures of 200 ms. The right answer is to press the left (right mouse button while displaying a certain exposure (image), or during a pause after the current exposure. In this test, the time for exiting the minimum exposure of the signal and the time of the minimum exposure of the signal reflect the functional mobility of the nervous processes, the number of errors reflects the strength (the lower these parameters, the higher the mobility and strength of the nervous system).The duration of the initial exposure is 900 ms, the magnitude of the change in the duration of the signals with correct and therefore erroneous responses - 20 ms, a pause between the presentation of signals - 200 ms, the number of signals - 50. The indicators are recorded: the average value of the latent period (M), ms, rms deviation (σ), ms, number of errors, run-time test, s, minimum exposure time, ms, time of exposure to minimum exposure, sec.

• a complex of parameters of a complex visual-motor reaction of selecting two of the three elements in the feedback mode, that is, as the reaction time changes, the time of signal delivery changes; The "long-term variant" is carried out in the feedback mode, when the duration of exposure changes automatically depending on the corresponding reactions of the subject: after the correct answer, the duration of the next signal is reduced by 20 ms, and after the wrong one - increases by the same amount. The range of the signal exposure change during the test subject's operation is within 20-900 ms with a pause between exposures of 200 ms. The right answer is to press the left (right mouse button while displaying a certain exposure (image), or during a pause after the current exposure.In this test, the time for exiting the minimum exposure of the signal and the time of the minimum exposure of the signal reflect the functional mobility of the nervous processes, the number of errors reflects the strength nerve processes (the lower these parameters, the higher the mobility and strength of the nervous system) .In addition, the total time of the test reflects a combination of strength and mobility of the nervous system The duration of the initial exposure is 900 ms, the magnitude of the change in the duration of the signals with correct or erroneous responses is 20 ms, the pause between the presentation of signals is 200 ms, the number of signals is 120. The indicators are fixed: the average value of the latent period (M), ms, rms deviation (σ), ms, number of errors, test run time, s; minimum exposure time, ms, minimum exposure time, s.

Indicators of mental performance according to the Shulte test were also determined (Kalinicenko, Kozina, Ahmad, Polishchuk, Chuprina, Seryy, Kolman, Ivanova, & Kudryavtsev, 2018). In this test, the subject needs 5x5 tables with 25 digits (from 1 to 25) arranged in random order, in turn to mark the numbers from 1 to 25. After passing the first table, immediately appears the second with a different order of numbers, etc. All tested passes 5 tables. Fixed the time of work on each table of five (min.), Efficiency of work as the arithmetic average of the time of operation on five tables (mines).

The speed of the response of choice was also determined according to the special program "The time of the reaction of the point in space" "Button selection" (Iermakov, Kozina, Ceslicka, Musketa, Krzeminski, & Stankevich, 2016).

To determine the level of development of physical qualities and the level of technical preparedness of athletes, the following tests were used: Coordinate running test provides a comparison of running speed in normal and complicated conditions. The test consists of two parts. First, the testing participant runs 30 meters from the high start. Then, also from a high start runs the same distance, but in the form of a shuttle race 3x10m (running around balls that are in a semicircle).

Determination of the coefficient of the difference in running speed in the complicated (the speed of the shuttle race is 3x10 m) and the usual (running speed at 30 m) conditions. The smaller the difference, the higher the level of development of coordination abilities.

Flexion and extension of hands in the support lying on the maximum number of times. The testing participant assumes the position support lying, hands straight at the width of the shoulders with the hands forward, the trunk and legs form a straight line, the toes rest on the floor. At the command "Can" the participant starts rhythmically with full amplitude to bend and unbend his hands. The result of testing is the number of error-free bending and extension of hands for one attempt. When bending your hands, you should touch the chest of the floor or the support. It is forbidden to touch the floor or the support with the hips, change the direct position of the body and legs, stay in the starting position and with bent hands for more than 3 seconds, rest, lie down on the floor, unbend hands alternately, unbend and bend the hands not with full amplitude.

Attack strike in the zone. The striker strikes the zone in 1, 6, 5 alternately. The athlete must alternately perform attacking strikes in the zones, preserving the following sequence of zones: 1, 6, 5. There are 5 attempts to perform the test. If the athlete does not hit the right area, the attempt is not counted.

Reception of striker strike in pairs. Testing is performed in pairs at a distance of 8-10 meters. The first number - takes, and the second - performs an attacking blow from his own throwing the ball into different zones. Five attempts are given. The ball is received only from below with both hands.

The control and experimental groups were trained on the same programs 6 times a week for 2-2.5 hours. Each training began with 5 minutes run, followed by a warm-up on the spot to warm up all muscle groups, at the end of the warm-up - exercises for flexibility and special feeding exercises and exercises at the net. The preparatory part of the training took about 30 minutes. The main part took most of the time: about 1 hour. 20-30 minutes, the main part began with the leading exercises with balls; then the ball was transmitted in pairs: only from above, only from below, alternation of gears from above and from below, intermediate transfers above itself and with impacts. After that, they switched to an attacking blow with a pass from zone "3" to zones "2" and "4"; from zone "2" to zone "3" and "4". Then the filing was carried out and a two-way game was played from two games. The training wos ended with power exercises for the arms, legs, back and abdomen.

The experimental group trained with a coordination ladder. Exercises were conducted in the main part of the lesson and included exercises to develop strength and speed and to improve technical preparedness in complicated conditions (Fig. 1-4). The action of the coordination ladder was the execution of an attacking blow or the reception of the ball from below immediately after performing the exercises on the coordination ladder. Each exercise was performed twice. The duration of the exercises using the coordination ladder was 20-25 minutes.

Examples of exercises using the coordination ladder.

I. To receive the ball in the falling.

Standing at the "ladder". 1- jump on the first cell two legs, 2 - jump on the next cell the right foot, 3 - jump on the first cell two legs, 4 - jump on the next cell the left foot, etc. with the subsequent exit to receive the ball in falling with two hands from below (Fig. 1).

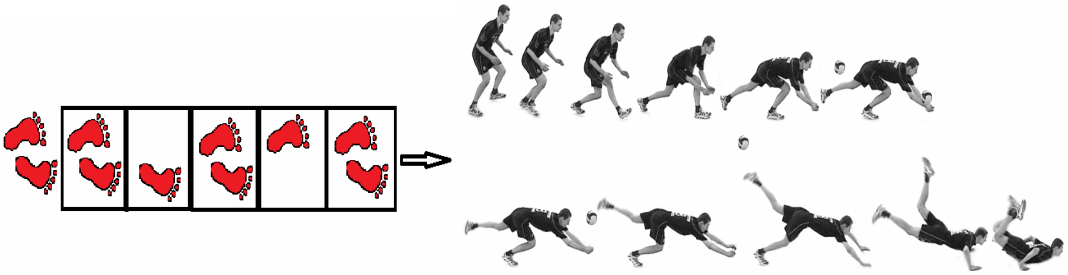

Fig. 1. Illustration of exercise 1 (source: drawing by authors)

2. Standing at the "ladder". Jumping: legs together-apart from moving forward on the ladder with the subsequent exit to the ball in falling with two hands from below (Fig. 2).

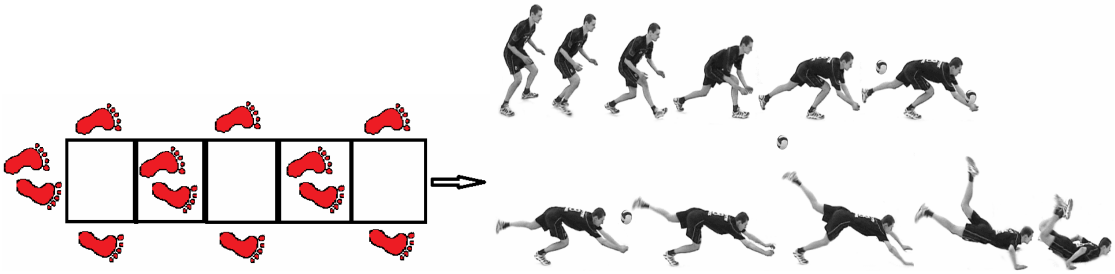

Fig. 2. Illustration of exercise 2 (source: drawing by authors)

II. To perform the attacker hit.

3. Hands on the second square, legs in front of the "ladder". Alternately change the position of the hands in the square of the "ladder", the legs move to the position "apart" at the "ladder". Next - get up, to perform acceleration and to perform the attacker hit (Fig. 6).

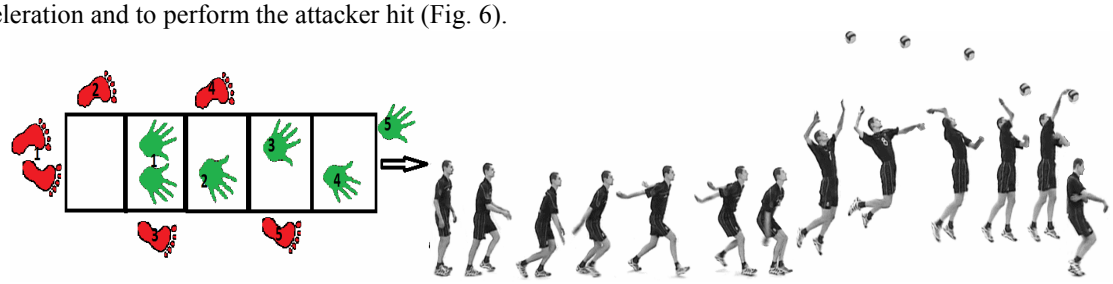

Fig. 3. Illustration of exercise 1 (source: drawing by authors)

4. Hands on the second square, legs in front of the "ladder". Touch with hands in the stairs to the right and left, the legs move to the position apart at the "ladder". Next - get up, and to perform the attacker hit (Fig. 4).

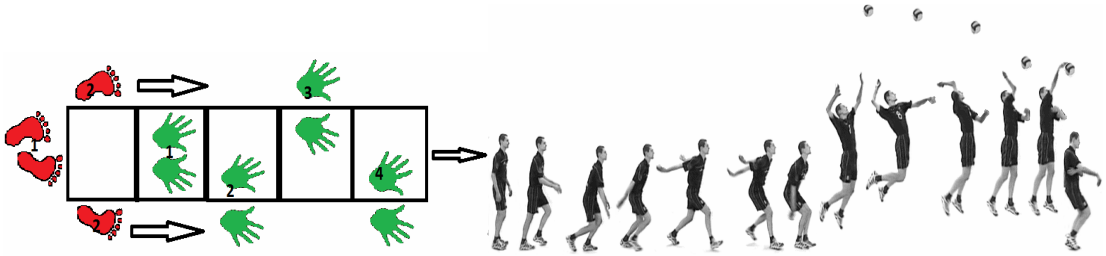

Fig. 4. Illustration of exercise 4 (source: drawing by authors)

Statistical analysis.

The digital material obtained during the research was processed using traditional methods of mathematical statistics. For each indicator were determined the arithmetic mean X, the standard deviation S (standard deviation), the standard error m, an estimate of the reliability of the differences between the parameters of the initial and final results, as well as between the control and experimental groups by the t-test of the Student with the corresponding significance level ($p<0,05$). Mathematical processing of data was carried out using programs for processing the results of scientific research Microsoft Exel "Data Analysis", SPSS. Differences were considered significant at a significance level of ($p<0.05$).

Results

The construction of the training process in volleyball with the use of the coordination ladder in the training sessions has had a positive effect both on the level of special physical and technical readiness of the players, and on their psycho-physiological state.

Analysis of changes in the registered indicators by t-criterion Student shows a significant increase in the indicators of strength endurance and coordination training of young athletes (Fig. 11-16, Tables 1, 2). In players of the control group, this change is less pronounced. The control and experimental groups did not differ from each other according to the test data before the experiment. After conducting the expedition, the control and experimental groups on the tests "running at 30 m from the high start", "shuttle running 3x10m", "bending and extension of the arms in the emphasis of the lying (maximum number of times)", "holding the angle in the focus on the bars (s)", "Attacking punch in the zone" and "reception of attacking impact in pairs" began to differ significantly between each other (Fig. 11-16 of Table 1, 2) ($p<0.01$, $p<0.001$).

Regarding the psycho-physiological state, it should be noted that the representatives of the experimental group in the test on "The reaction of choosing a point of space for 15 s," reducing the number of errors (Fig. 17-18, Table 1, 2) indicates an increase in such qualities, as stability, endurance of the nervous system, which are also indicators of the strength of the nervous system. Based on the data obtained, we can conclude that the athletes of the experimental group as a result of the use of the coordination ladder in the classes increased the stability of the nervous system and its strength. And in the control group, the number of errors and the speed of the test did not change much. We associate this with the fact that at the beginning of the training season in the body only adaptation changes began, and therefore, without the use of special means aimed at increasing the speed of neurodynamic processes, athletes are experiencing a temporary decline or delay in increasing trenirovannosti. This is manifested in the level of physical, technical preparedness and psychophysiological state.

Similar data were obtained in the tests "Response time of choice in feedback mode" (Fig. 19, Table 1, 2)

and "Mental resistance of the Schulte test" (Fig. 20, Table 1, 2). Athletes of the experimental group showed significant improvement ($p < 0.001$), and athletes in the control group - a significant deterioration ($p < 0.01$) of the test results. Experimental and control groups did not differ from each other until the experiment was performed ($p > 0.05$). After the experiment, the experimental and control groups began to differ significantly from each other ($p < 0.001$, $p < 0.05$) according to the results of these tests.

The number of errors when performing the test on the rate of reaction of choice indicates the quality, such as stability, endurance of the nervous system, which is also an indicator of the strength of the nervous system. Based on the data obtained, it can be concluded that athletes of the experimental group as a result of the use of the coordination ladder in the classes increased the results of tests on physical and technical coaching. In the control group, the decline in these indicators can be explained by the fact that the experiment was conducted in the beginning of the training season, and adaptation changes have just begun in the body. This causes inconsistency in the work of various systems of the body, including, and nervous, which explains the increase in errors in the athletes of the control group when passing the test on the rate of reaction of choice.

Table 1.Results of testing of athletes of the experimental (n = 12) group before and after the experiment

Name of metrics	Group	Statistical Indicators				
		$\bar{x}$	S	m	t	p
The reaction of choosing a point of space for 15 s (Iermakov's test), the number of errors	E_1	2,00	1,13	0,33	6,14	0,00
	E_2	0,00	0,00	0,00		
The reaction of the choice of point space for 15 s, the result, number	E_1	15,08	2,11	0,61	-4,63	0,00
	E_2	19,67	2,71	0,78		
Table Schulte, implementation time No. 1, s	E_1	56,25	18,01	5,20	3,53	0,00
	E_2	37,00	5,67	1,64		
Table Schulte, implementation time No. 2, s	E_1	53,58	17,23	4,97	1,36	0,19
	E_2	45,33	11,96	3,45		
Table Schulte, implementation time No. 3, s	E_1	65,58	17,66	5,10	3,09	0,01
	E_2	47,00	11,05	3,19		
Table Schulte, implementation time No. 4, s	E_1	56,08	13,45	3,88	1,82	0,08
	E_2	47,50	9,34	2,70		
Table Schulte, implementation time No. 5, s	E_1	55,00	11,62	3,35	4,22	0,00
	E_2	38,58	6,83	1,97		
Table Schulte, efficiency of work, c.u.	E_1	58,23	8,21	2,37	3,97	0,00
	E_2	46,93	5,45	1,57		
"Simple visual-motor reaction" is the time of the latent period., ms	E_1	284,75	69,91	20,18	0,72	0,48
	E_2	265,50	61,16	17,65		
"Simple visual-motor reaction" errors, number	E_1	4,67	2,71	0,78	5,97	0,00
	E_2	0,00	0,00	0,00		
"Reaction of choice 2-3" time of latent period, ms	E_1	487,25	120,17	34,69	0,16	0,88
	E_2	479,58	119,40	34,47		
"Reaction of choice 2-3", errors, number	E_1	21,92	5,98	1,73	12,70	0,00
	E_2	0,00	0,00	0,00		
The reaction time of the choice in the feedback mode, ms	E_1	430,67	89,64	25,88	2,05	0,05
	E_2	370,33	48,13	13,90		
Reaction selection in feedback mode, errors, number	E_1	69,67	18,97	5,48	5,60	0,00
	E_2	36,50	7,82	2,26		
Reaction selection in feedback mode minimum exposure time, ms	E_1	463,33	138,26	39,91	0,12	0,90
	E_2	456,33	136,97	39,54		
Reaction selection in feedback mode, total test run time, s	E_1	110,92	29,19	8,43	0,35	0,73
	E_2	106,67	29,91	8,63		
Reaction selection in feedback mode, exit time to minimum exposure, s	E_1	74,67	15,22	4,39	0,74	0,46
	E_2	69,92	16,04	4,63		
Runs at 30 meters from the high start, s	E_1	4,55	0,16	0,05	7,60	0,00
	E_2	4,13	0,11	0,03		
"Coordinating racing test" shuttle racing 3x10 meters with obstacles, s	E_1	7,52	0,16	0,05	2,25	0,04
	E_2	7,35	0,20	0,06		
Bending and bending of the hands in the emphasis on lying down, number	E_1	44,83	3,86	1,11	-5,14	0,00
	E_2	53,42	4,32	1,25		
Hold the corner in focus on the bars, s	E_1	28,33	4,19	1,21	-11,30	0,00
	E_2	50,92	5,52	1,59		
Attack strike in the zone, number	E_1	2,42	0,51	0,15	-17,38	0,00
	E_2	5,00	0,00	0,00		
Reception of striker strike in pairs, number	E_1	2,58	0,51	0,15	-16,26	0,00
	E_2	5,00	0,00	0,00		

E1 is experimental experiment; E2 is experimental after the experiment

Table 2. Results of testing of athletes of the control group (n = 12) before and after the experiment

Name of metrics	Group	Statistical Indicators $\bar{x}$	S	m	t	p
The reaction of choosing a point of space for 15 s (Iermakov's test), the number of errors	K_1	0,83	0,83	0,24	2,13	0,04
	K_2	0,25	0,45	0,13		0,05
The reaction of the choice of point space for 15 s, the result, number	K_1	14,17	2,48	0,72	-1,24	0,23
	K_2	15,42	2,47	0,71		
Table Schulte, implementation time No. 1, s	K_1	48,67	13,83	3,99	0,29	0,78
	K_2	47,42	6,23	1,80		
Table Schulte, implementation time No. 2, s	K_1	51,17	13,91	4,02	0,11	0,92
	K_2	50,58	13,22	3,82		
Table Schulte, implementation time No. 3, s	K_1	68,67	16,11	4,65	3,07	0,01
	K_2	51,50	10,77	3,11		
Table Schulte, implementation time No. 4, s	K_1	57,67	13,05	3,77	1,03	0,31
	K_2	52,92	9,19	2,65		0,32
Table Schulte, implementation time No. 5, s	K_1	62,50	11,81	3,41	4,81	0,00
	K_2	43,67	6,65	1,92		
Table Schulte, efficiency of work, c.u.	K_1	55,51	9,90	2,86	1,48	0,15
	K_2	50,54	6,02	1,74		
"Simple visual-motor reaction" is the time of the latent period., ms	K_1	294,50	72,54	20,94	0,85	0,41
	K_2	271,50	59,58	17,20		
"Simple visual-motor reaction" errors, number	K_1	7,58	3,53	1,02	5,97	0,00
	K_2	1,17	1,19	0,34		
"Reaction of choice 2-3" time of latent period, ms	K_1	487,50	126,33	36,47	-0,04	0,97
	K_2	489,42	120,05	34,66		
"Reaction of choice 2-3", errors, number	K_1	20,33	7,64	2,21	7,17	0,00
	K_2	3,58	2,64	0,76		
The reaction time of the choice in the feedback mode, ms	K_1	444,17	83,98	24,24	2,58	0,02
	K_2	372,00	48,48	14,00		
Reaction selection in feedback mode, errors, number	K_1	74,50	19,87	5,74	5,50	0,00
	K_2	40,00	8,80	2,54		
Reaction selection in feedback mode minimum exposure time, ms	K_1	498,17	136,25	39,33	0,61	0,55
	K_2	464,67	134,90	38,94		
Reaction selection in feedback mode, total test run time, s	K_1	115,00	30,92	8,93	0,48	0,64
	K_2	109,08	29,61	8,55		
Reaction selection in feedback mode, exit time to minimum exposure, s	K_1	78,00	14,43	4,17	0,88	0,39
	K_2	72,42	16,59	4,79		
Runs at 30 meters from the high start, s	K_1	4,64	0,26	0,08	2,88	0,01
	K_2	4,33	0,28	0,08		
"Coordinating racing test" shuttle racing 3x10 meters with obstacles, s	K_1	7,62	0,24	0,07	2,51	0,02
	K_2	7,41	0,15	0,04		
Bending and bending of the hands in the emphasis on lying down, number	K_1	46,83	3,86	1,11	-0,93	0,36
	K_2	48,33	4,01	1,16		
Hold the corner in focus on the bars, s	K_1	29,92	5,73	1,65	-1,10	0,28
	K_2	32,25	4,59	1,33		
Attack strike in the zone, number	K_1	2,83	0,83	0,24	-5,17	0,00
	K_2	4,25	0,45	0,13		
Reception of striker strike in pairs, number	K_1	2,83	0,83	0,24	-5,01	0,00
	K_2	4,17	0,39	0,11		

K1- control to the experiment; K2 is the control after the experiment

Discussion

The hypothesis of this study on the positive impact of the methodology of the use of the coordination (high-speed) ladder in the training of young volleyball players was confirmed in relation to the increase in the level of physical and technical preparedness, in particular, the development of coordination and speed-strength abilities, as well as - the mobility of the nervous system.

According to various researchers (Rudenko, & Rudenko, 2008; Shalayev 2007 $ Nesen et.al., 2018), the use of a high-speed ladder is intended for the development of high-speed skills when driving on short distances, coordination of motion and motor skills synchronization, for training speed of work legs with variable pace and directions, increased frequency of leg work, improvement of the quality of movements with a change of direction. Our study complemented the results of previous researchers with the results of the effectiveness of the coordination stairs in volleyball. In addition, our research for the first time proposes a methodology for using the coordination ladder in conjunction with the implementation of technical techniques of volleyball (attack strike and reception of the ball). The effectiveness of the implementation of the coordination ladder, which was found in our study, is explained by the fact that when exercising exercises on a simulator with subsequent change in the type of activity (attacking and blasting), there is not only the development of coordination and speed-strength capabilities, but also the refinement technical training in complicated conditions. In this case, you need to quickly switch to another type of activity. For example, in the exercises proposed in the nursing study, it is necessary to perform jumps through the ladder in each sector and quickly switch, accelerate and technically gravitate to take the ball. Therefore, as a result of the use of the simulator athletes in the game, it becomes easier to switch and react from the block on the primo of the ball, from the reception of the ball to the attacking blow, and so on. One of the most important elements for the development of general athletic skills is the ability of the nervous system to activate more motor cells and coordinate the work of motor cells among themselves (Korobeynikov, Mazmanian, Korobeynikova, & Jagiełło, 2011; Kozina, Iermakov, Bartík, Yermakova, & Michal, 2018) . This provides more productive work of the muscles. Thus, higher speed and strength is achieved, which helps to improve proprioreceptor (sensation of the relative position of body parts and their movements in a person, that is, the sense of one's body). The ladder makes the nervous system send additional information to the muscles at a higher rate, including the work of more and more motor cells. This helps the athlete to be faster, more agile and more mobile. Therefore, the effect of the use of the coordination ladder was sufficiently significant even within three months.

In other tests, there were no significant changes. Therefore, we can conclude that the use of the simulator primarily affects the speed and strength and coordination capabilities on the stability and strength of the nervous system. The developed method of application of the coordination (high-speed) ladder is an effective, accessible and reliable means of improving the psycho-physiological state, increasing the physical and technical training of young volleyball players. The use of the coordination stairs positively affects mental endurance, emotional state, speed of reaction to changing the type of activity, physical and technical training, coordination and speed-strength abilities, stability and strength of the nervous system. Many studies are devoted to the development of certain coordination skills of athletes through the use of author's approaches to address this issue. So avorussian technique Nesen, et. al. (2018) contributed to a significant improvement in the coordination capabilities of handball players. Zavorotnaya (2008) proposes to use blocks of non-specific and specific basketball players' exercises, aimed at the development of kinestetic ability, equilibrium stability, regulation of spatial and temporal and dynamic parameters of motion, coordination of movements, responsive ability and ability to navigate in space. According to Yakimenko, Galashko, Galashko, Poruchikov, Starodubtsev (2014), for the development of coordination abilities with the use of stairs in children, it is necessary to increase the complexity of physical exercises by changing spatial, temporal and dynamic parameters, as well as at the expense of external conditions, changing the order of the means , their weight, height; changing the area of the support, or increasing its mobility, combining walking with jumping, running and catching objects; performing exercises for a signal or for a limited time.

Rudenko, & Rudenko (2008) used a ladder to enhance the system's ability to balance the athletes. Exercises using the high-speed (coordination) ladder in the handball, which was located on the floor, consisted of jumps in the squares and beyond their limits, with rotation and equilibrium on one and two legs when landing, described in the papers Shalayev (2007), Nesen et.al (2018). Comparing the data obtained in our study with the results of the studies of these authors, we can conclude that after The use of specially selected exercises with the use of a high-speed (coordination) ladder in combination with exercises to improve the technical methods of volleyball was marked improvement in the indicators of coordination preparedness. Based on the results, it was concluded that in the volleyball the use of the coordination (high-speed) ladder was used for the first time, but was used in other sports such as: football, basketball, handball. Therefore, we can conclude that the positive effect of the application of this technique is provided in the training of young volleyball players, since all these sports - gaming, and physical training in the game modes of sports are similar. Our study showed a positive effect of the application of the coordination (high-speed) ladder to the physical and technical training, namely, coordination, speed-force capabilities, techniques of attack and protection. Therefore, our findings allow us to

quantify the effectiveness of the use of the coordination ladder for the development of coordination and strength among young volleyball players. These data were obtained for the first time in volleyball and are new in comparison with the data of other authors. The method of coordination (high-speed) ladder is an effective, accessible and reliable tool for improving the effectiveness of coordination, speed-strength abilities and technical training in the process of training young volleyball players.

Conclusions

The method of application of the coordination (high-speed) ladder for improvement of technical training of young volleyball players has been developed and its implementation in the practice of the training process is substantiated; The positive influence of the coordination stairs on the quality of the training process of young volleyball players has been determined. The proposed method of coordination staircase allows for a short period of time to effectively increase the level of psychophysiological functions, physical preparedness and technical skills of young volleyball players.

Conflict of interest. The authors state that there is no conflict of interest.

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