

# Changes in the level of coordination preparedness of gymnasts 10–12 years as a result of the use of special exercises on the simulator "Bosu Balance Trainer"

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**Purpose:** to substantiate the effectiveness of using the developed exercise complexes on the simulator "Bosu Balance Trainer" ("BOSU") for the development of the coordination preparedness of female athletes of 10–12 years in rhythmic gymnastics.

**Material & Methods:** the study involved female athletes 10–12 years old engaged in rhythmic gymnastics. The control and experimental groups consisted of 12 gymnasts. To solve the problems, the following research methods were used: theoretical analysis and generalization of literary sources; pedagogical observations; testing; pedagogical experiment; methods of mathematical statistics.

**Results:** based on the results of the study, a positive effect of the developed exercise complexes on the BOSU simulator on the development of the coordination preparedness of female athletes aged 10–12 in rhythmic gymnastics was revealed.

**Conclusion:** the use of the developed exercise complexes on the BOSU simulator in the rhythmic gymnastics training process positively influenced the development of the level of coordination preparedness of female athletes of 10–12 years.

**Keywords:** rhythmic gymnastics, gymnasts 10–12 years, testing, simulator "Bosu Balance Trainer" ("BOSU"), exercise complexes.

## Introduction

Rhythmic gymnastics by the nature of motor activity belongs to difficult-coordination sports and requires athletes to display a wide range of motor skills, skills and qualities, especially at the stage of basic training, when a gymnast must master a large number of difficult coordination exercises and form stable and reliable technical skills and successfully show them in competitive activities. Therefore, in modern conditions of training young athletes there is a need to develop effective methods aimed at developing physical qualities, namely coordination abilities, the level of which, according to experts, significantly affects the performance of competitive activities [1; 2; 3]. The rapid complication of the technique of the sport leads to increased requirements for the development of coordinating readiness of gymnasts, which are especially important in connection with the complexity of the structure of motor activity and the need to memorize the large volume of relatively independent movements [4; 5]. With the introduction in 2017 of the new rules of competitions FIG [6] in rhythmic gymnastics the priority direction was the development of complex technical bases of competitive programs. This is possible only under the condition of modernization and improvement of the efficiency of the training process, which is directly dependent on the means used in the classes with athletes [2; 4; 5]. Experts [7–10] that the introduction of the training process of various technical tools and training devices is an effective way to increase the development of coordination abilities of female athletes. Recently, various types of training on an unstable surface with the use of additional equipment (balance training) have become very popular. One of such simulators is the universal balancing platform – Bosu Balance

Trainer ("BOSU"). BOSU resembles a large ball, cut in half, mounted on a rigid plastic base and tightly inflated with air. The name of the simulator "BOSU" – "Balance-trainer" is fully consistent with one of his appointments – training the vestibular apparatus and body coordination [11; 12]. The balancing platform "BOSU" is used not only in fitness programs: aerobics, power loads, pilates, stretching, but also actively used in professional sports: basketball, mountain skiing, snowboarding, gymnastics, tennis and martial arts. Athletes use these "balls" to improve muscle strength, coordination capabilities and balance development [11]. In this regard, the use of auxiliary means to increase the level of development co-ordination preparedness is a priority area in the training process of gymnasts.

**Purpose of the study:** to substantiate the effectiveness of using the developed exercise complexes on the simulator "Bosu Balance Trainer" ("BOSU") for the development of the coordination preparedness of female athletes of 10–12 years in rhythmic gymnastics.

## Material and Methods of the research

The study involved 24 athletes aged 10–12 years. The study used the following methods: theoretical analysis and synthesis of literary sources; pedagogical observations; pedagogical testing – "Juggling with tennis balls" (number of times), test "Arabesque on the knee" (s), test "Passe with closed eyes" (s), test "Yule" (s), "Three rolls-passe" (s), "Combination of movements with arms, torso and legs" (points), "Static equilibrium by the method of Yarotsky" (s) pedagogical experiment and methods of mathematical statistics.

Testing of the level of coordination abilities of young gymnasts was held twice – at the beginning and end of the training year. According to the results of the initial testing, the group of gymnasts was divided into control (n=12) and experimental (n=12), taking into account the absence of reliable differences in the indicators of coordination tests. Both groups of young gymnasts trained in accordance with the curriculum for rhythmic gymnastics [13]. However, in the training sessions of the athletes of the experimental group included specially developed exercise complexes on the simulator "BOSU" (Figure 1), aimed at developing coordination abilities.



**Figure 1. "BosuBalanceTrainer" ("BOSU") – universal balancing platform**

The proposed method (sets of exercises on the "BOSU" simulator) provided for complications of the exercises on the "BOSU" simulator due to: different positions of the hands and head; asymmetric hand positions and head tilts; exercise only with the support of the simulator "BOSU"; performing exercises on socks and without visual control; use of various jumps increase in the number of repetitions; increase in the time of retention of a static body position increase in the amplitude of movements. As part of the developed methodology for developing the coordination abilities of gymnasts 10–12 years old, the main pedagogical principle "from simple to complex" were used. That is, if at the first stages of learning the exercise proved difficult to perform – it was simplified and, conversely, with careful study and mastering – complicated. In addition to performing the developed exercise complexes on the BOSU simulator, this device was used in training sessions and for the elaboration of competitive elements, namely, equilibrium. Also, this simulator was used in exercises (part of the lesson at the machine) in classical choreography and in some exercises of folk choreography.

## Results of the research

To test the effectiveness of using the developed exercise complexes on the BOSU simulator, a re-testing of the gymnasts of the control and experimental groups was carried out at the end of the experiment. A comparative analysis of changes in the level of coordination preparedness of young gymnasts during the study is presented in Table 1.

As can be seen from the results of the study, in the test "Juggling with tennis balls" on the right hand, athletes of the CG showed the average group result  $7,33 \pm 0,71$  times, and athletes of the EG –  $9,17 \pm 0,58$  times. The difference between these indicators, according to Student's criterion, is not statistically significant, since  $t_p < t_{gr}$  (Table 1). When performing this test on the left hand, the average group result of the CG gymnasts was  $4,83 \pm 0,26$  times, and the EG gymnasts –  $5,75 \pm 0,44$  times. Comparison of these results by the Student's criterion shows that the difference between these group average values is also statistically insignificant ( $>0,05$ ). Thus, the obtained indicators characterizing the spatial-temporal parameters of movements indicate an improvement in the results in the experimental group in relation to the control by 21% for the right and 16% for the left hand. The results of the study indicate that when performing the "Arabesque on the knee" test on the right, young athletes from the control group showed a result of  $80,42 \pm 2,28$  s, whereas with the experimental one –  $92,33 \pm 4,63$  s. The difference between these indicators is statistically significant because  $t_p = 2,31 > t_{gr} = 2,07$ . When performing this test on the left gymnast of 10–12 years showed the following results: CG –  $50,08 \pm 2,92$  s and EG –  $64,58 \pm 4,58$  s. In the process of comparative analysis of the indicators of development of resistance to the preservation of the posture – equilibrium ("Arabesque on the knee"), there was a significant improvement in the results ( $p < 0,05$ ) in the experimental group in relation to the control (improvement of the result in the experimental group – 13% on the right and 21% on the left leg). The following indicators of the development of resistance to posture (balance) preservation also underwent significant shifts over the study period. When performing the "Passe with closed eyes" exercise on the right leg of the girl, the control group showed an average result of  $42,08 \pm 1,89$  s, and the experimental one –  $51,08 \pm 3,45$  s. Similar results were observed when performing this test task on the left: the female athletes of the CG –  $23,75 \pm 1,98$  s, and the female athletes of the EG –  $33,25 \pm 1,58$  s. The result of

**Table 1**  
**Changes in the level of coordination preparedness of gymnasts 10–12 years old at the end of the study**  
( $t_{gr} = 2,07$  since  $p < 0,05$ )

No. i/o	Test name	$\bar{X} \pm m$		$t_p$	p
		Result CG (n=12)	Result EG (n=12)		
1.	Juggling tennis balls on the right, number of times	$7,33 \pm 0,71$	$9,17 \pm 0,58$	1,98	$>0,05$
2.	Juggling tennis balls on the left, the number of times	$4,83 \pm 0,26$	$5,75 \pm 0,44$	1,79	$>0,05$
3.	Test "Arabesque on the knee" on the right, s	$80,42 \pm 2,28$	$92,33 \pm 4,63$	2,31	$<0,05$
4.	Test "Arabesque on the knee" on the left, s	$50,08 \pm 2,92$	$64,58 \pm 4,58$	2,67	$<0,05$
5.	Test "Passe with closed eyes" on the right, s	$42,08 \pm 1,89$	$51,08 \pm 3,45$	2,29	$<0,05$
6.	Test "Passe with closed eyes" on the left, s	$23,75 \pm 1,98$	$33,25 \pm 1,58$	3,74	$<0,05$
7.	Test "Yula", s	$5,83 \pm 0,39$	$7,50 \pm 0,56$	2,43	$<0,05$
8.	"Three rolls – passe" on the right, s	$45,25 \pm 3,13$	$59,83 \pm 5,10$	2,44	$<0,05$
9.	"Three rolls – pass" on the left, s	$30,42 \pm 1,56$	$38,17 \pm 3,25$	2,10	$<0,05$
10.	Combination of movements with arms, torso and legs, points	$6,67 \pm 0,25$	$8,08 \pm 0,42$	2,91	$<0,05$
11.	Static equilibrium by the method of Yarotsky, s	$30,17 \pm 0,89$	$37,25 \pm 2,93$	2,31	$<0,05$

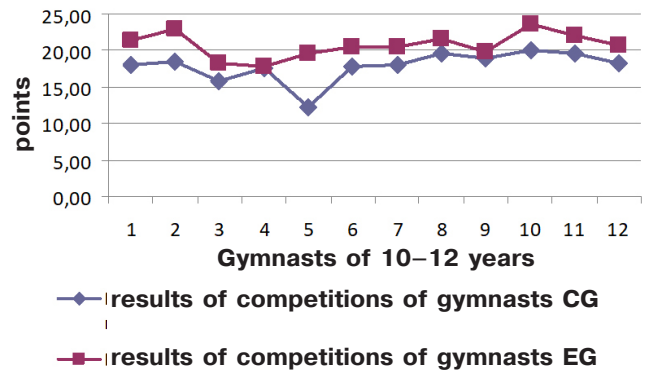
the comparison of these indicators indicates a statistically significant difference ( $p < 0,05$ ). Thus, the results shown by the EG gymnasts are 19% more on the right, and 29% more on the left leg than the results shown by the CG gymnasts (Table 1). It should be noted that the introduction of the experimental group of the developed exercise complexes on the BOSU simulator into the training process improved their result in the Yula test by 22% relative to the control group. So, the athletes of the CG showed the result of  $5,83 \pm 0,39$  s, whereas the athletes of the EG –  $7,50 \pm 0,56$  seconds. The difference between these indicators is statistically significant because  $p < 0,05$ . The obtained indicators, which also characterize the level of development of posture (balance) preservation – the test "Three rolls – passe" on the right and left legs, indicate an improvement in the results in the experimental group relative to the control by 24% and 20%, respectively. In accordance with the student's criterion, the differences between the average results shown by the gymnasts in these tests are statistically significant, since  $t_p > t_{gr}$  (Table 1). In the test "Combination of movements with arms, torso and legs" athletes from the control group at the end of the study showed an average result –  $6,67 \pm 0,25$  points, and from the experimental group –  $8,08 \pm 0,42$  points. The difference between these indicators is statistically significant ( $p < 0,05$ ). This means that the results in the experimental group in relation to the control objectively improved. Their increase was 17%. As the research materials show, in the test "Static equilibrium by the Yarotsky technique" young athletes from the control group showed a result of  $30,17 \pm 0,89$  s, whereas with the experimental one –  $37,25 \pm 2,93$  s. Thus, the results obtained by gymnasts show that the difference between their average values is statistically significant, since  $t_p = 2,31 > t_{gr} = 2,07$ . Thus, the results of this test allow us to state the improvement in the level of development of the coordination abilities of gymnasts 10–12 years of the experimental group by 19% relative to the control (Table 1).

However, at the end of the experiment, the results of the All-Ukrainian tournament on rhythmic gymnastics "Spring Swallows" were analyzed, where the gymnasts of the experimental and control groups participated (Table 2).

According to the data in the table, gymnast No. 1 CG performed the exercises with a hoop and a ball (subjects of choice) with a score of 18,05 and took 12th place out of 17 ri-

vals of her current; gymnast No. 1 of the EG performed the exercises with a rope and a hoop, with a score of 21,5 and took the 5th place out of 14 rivals of her current, etc. (Table 2).

So, according to the results of the All-Ukrainian tournament on rhythmic gymnastics "Spring Swallows" in individual all-round in performing two types of competitive combinations, it should be noted that the increase in the level of coordination training of gymnasts aged 10–12 years positively influenced their technical preparedness (Figure 2).



**Figure 2. Results of the All-Ukrainian tournament on rhythmic gymnastics "Spring Swallows" gymnasts 10–12 years at the end of the study**

## Conclusions / Discussion

The results of the studies completed are supplemented by the theoretical positions formulated in the works of T. Yu. Krushevich [14], V. N. Platonov [8], R. I. Andreeva [15], that the coordination abilities of a person are very diverse and specific, but they can be differentiated on separate types on features of manifestation, criteria of estimation and factors which condition. The conducted research confirms the data of R. Andreeva [15], A. H. Deineko, I. V. Krasova [1] on the constant complication of the programs of performances of gymnasts of 10–12 years in connection with regular changes in the rules of competitions [6]. We also agree with the statement of experts [2; 4; 5; 15; 16] that in connection with early specialization, reduction of terms of training and the complication of sports equipment for young gymnasiums high requirements

**Table 2 Results of the "Spring Swallows competition" of gymnasts from the control and experimental groups at the end of the study**

Results of gymnasts CG			Results of gymnasts EG		
	$\Sigma$ (sum of points)	Place		$\Sigma$ (sum of points)	Place
№ 1	18,05	12 (17)	№ 1	21,5	5 (14)
№ 2	18,6	11 (17)	№ 2	22,9	4 (11)
№ 3	15,9	11 (11)	№ 3	18,35	6 (15)
№ 4	17,7	7 (17)	№ 4	17,93	5 (12)
№ 5	12,2	9 (9)	№ 5	19,75	4 (11)
№ 6	17,75	4 (12)	№ 6	20,55	4 (13)
№ 7	18,15	8 (11)	№ 7	20,55	6 (9)
№ 8	19,65	4 (10)	№ 8	21,7	6 (12)
№ 9	18,95	7 (12)	№ 9	19,85	5 (9)
№ 10	20,0	4 (6)	№ 10	23,7	5 (12)
№ 11	19,55	4 (7)	№ 11	22,15	4 (11)
№ 12	8,35	6 (8)	№ 12	20,7	3 (9)



in terms of manifestation of coordination abilities are presented. This necessitates the search for new ways and means by which it is possible to teach gymnasts better and faster to manage their movements.

The conclusions of R. I. Andreeva [15], A. Ya. Mullagildinoy [5], Zh. A. Belokopytov, V. A. Lavrent'eva, L. K. [16], V. V. Bayer [17] and other scientists were confirmed. that the improvement of coordination abilities in rhythmic gymnastics is one of the most promising areas of technical training for athletes.

The results of our research complement the data of scientific works on the use of various means and methods for improving coordination abilities in the training process of young gymnasts, which increase the development of coordination of movements in them, help to improve orientation in space and time and stability to maintain balance, improves their technical readiness [1; 5; 15; 16]. The data presented by us is confirmed by the results of the conducted research, namely, the average group estimation for the individual combined event in the performance of two types of competitive combination at the All-Ukrainian tournament on rhythmic gymnastics "Spring swallows" of athletes CG was 17,90 points, athletes EG – 20,80 points.

The results of the entire complex of studies carried out confirm the findings of many experts that the development and improvement of coordination qualities is important and inalienable in the complex training process in rhythmic gymnastics, but at the same time remains one of the least developed sections of the training of athletes [4; 5; 15; 16].

Specialists V. Ye. Vodlozerov and S. P. Evseev emphasize that the introduction of various technical means and training devices into the training process is the main direction of its im-

provement. Special various simulators will effectively develop various motor skills and abilities of athletes, improve technical skills, skills and physical qualities, create the necessary conditions for precise control and management of the most important parameters of the training load [9; 10]. But for the first time, we are considering the effectiveness of using the developed exercise complexes on the Bosu Balance Trainer (BOSU) simulator to develop the coordination abilities of female athletes 10–12 years old.

Thus, the results of this study showed the effectiveness of the use of the BOSU simulator for the development of coordination training for gymnasts of 10–12 years (the difference between the mean-group results shown by gymnasts of CG and EG in most test assignments is statistically significant). Also, their technical readiness improved significantly, which was confirmed by the results of the "Spring Swallows" competitions (the average group score in the individual all-round of athletes of the CG was 17,90 points, and athletes EG – 20,80 points). This is due both to the general developmental influence of the developed sets of exercises, and to the fact that the movements of the athletes received greater accuracy, which contributed to the implementation of competitive exercises at a higher technical level.

**Prospects for further research.** Due to the fact that the use of special exercises on the BOSU simulator had a positive result in the development of coordination skills of gymnasts 10–12 years old and contributed to the improvement of their technical preparedness, we plan to develop and implement exercises on this simulator in the training process of gymnasts 6–8 years at the initial preparation stage and examine their effectiveness.

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