

## Enhancing physical and functional fitness through the integration of health fitness elements in young gymnasts

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### Abstract:

The search for innovative technologies to enhance the organization and execution of training sessions in rhythmic gymnastics is a pressing challenge. Currently, the intricacy and virtuosity of sports performance programs, choreography, technique, and tactics continue to increase. Athletes must possess a heightened physical and functional potential to excel in this demanding sport. The objective of this study was to elevate the efficacy of physical and functional training for 10–11-year-old female athletes specializing in rhythmic gymnastics during the stage of sports perfection. To address this, we developed and implemented innovative exercises from health fitness, integrating sports equipment into the annual training macrocycle. Materials and methods. The pedagogical experiment involved 20 female athletes aged 10-11 years, actively involved in rhythmic gymnastics during the third year of sports specialization at a sports school in the Siberian Federal District (Russia). Randomly divided into control (CG, n = 10) and experimental (EG, n = 10) groups. The gymnasts underwent training using a supplementary sports program aligned with the federal standard for sports training in artistic gymnastics. In the preparatory phase, we introduced innovative physical exercises utilizing sports equipment commonly associated with health and fitness. This involved performing exercise complexes on a stepping platform, a Bosu hemisphere, and fitness sliders. The specific physical training in both groups remained consistent, encompassing exercises using traditional equipment for rhythmic gymnastics. Throughout the experiment, both CG and EG gymnasts underwent limit tests evaluating functional indicators, basic motor qualities, static and dynamic balance, and control exercises from specialized physical training in rhythmic gymnastics. Results. After the annual pedagogical experiment, it was evident that gymnasts in the EG group significantly outperformed the CG group, which adhered to a traditional training program. The superiority of the EG group extended to basic motor qualities, cardio-respiratory functional indicators, static and dynamic balance, as well as control exercises in specialized physical training. Consequently, the EG group exhibited heightened levels of physical fitness compared to the CG group. Conclusions. The proposed methodology, integrating health and sports equipment to enhance the physical and functional fitness of young female athletes specializing in rhythmic gymnastics, demonstrated remarkable efficacy.

**Key Words:** rhythmic gymnastics, health and fitness, sports equipment, physical and functional fitness

### Introduction

Rhythmic gymnastics refers to sports in which it is necessary to have a wide range of motor qualities, coordination abilities, stable static and dynamic balance, vestibular stability and large reserve capabilities of functional systems. One of the important directions of the educational and training process in sports, including rhythmic gymnastics, is to increase athletes' physical and functional fitness level (Kokarev et al., 2023). A prerequisite for conducting training sessions is the general and special physical training of an athlete. It is considered that such training allows an athlete to achieve the best results due to the fact that it is the basis for improving an athlete's technical, tactical and psychological readiness (Cunanan et al., 2018; Shepelenko et al., 2018).

General physical training is aimed at developing and improving an athlete's basic motor qualities. Scientific research by Nugroho et al. (2021) has shown that basic motor qualities allow developing technical, tactical abilities, strategy and psychology of an athlete. This is especially important for young athletes, because

general physical fitness pushes back the process of developing the body fatigue, increases general and special endurance and forms motivation to do sports (Hakman et al., 2018; Fachrezzy et al. 2021). Therefore, athletes need to constantly pay attention to the maintenance and development of motor qualities (Iedynak, 2017; Sermaxhaj et al., 2017; Jariono et al., 2020).

Currently, experts in the field of sports express the opinion that physical exercises used in physical training should be adapted to the chosen sport. It increases the effectiveness of the athlete's training and the effectiveness of his performance as well (Kokarev et al., 2023). Therefore, in order to optimize the training process of girls specializing in rhythmic gymnastics, elements of wellness fitness were used in the annual macrocycle.

A mandatory component of athletes' training process in many sports is coordination training, which increases the effectiveness of sports training and prevents possible sports injuries (Chagas et al., 2018; Anthonius et al., 2018). Currently, various training devices are widely used in training sessions. An important role is assigned to simulators, which are based on the principle of an unstable surface (Kryzhevsky et al., 2022). Performing exercises on the «Bosu» hemisphere develops speed-strength qualities, static and dynamic balance well (Mischenko et al., 2020), step platform and sliders increase the strength qualities of the muscles of the lower, upper limbs and trunk. When using such simulators, experts note an increase in speed qualities, static and dynamic balance, vestibular stability and coordination of movements with a slight increase in muscle mass. It is especially important for gymnasts who strictly monitor their body weight (Moeskops et al., 2018; Charm iS a lot et al., 2020).

Another direction of general physical fitness is to increase the level of the human body's functional capabilities. It is known that it is impossible to achieve a significant sports result without increasing the reserve capabilities of functional indicators (Franchini et al., 2019; Muhamad Syamsul Taufik et al., 2021). In functional training, it is especially important to increase the reserve of the body cardiorespiratory system, which ensures the economical functioning of all body systems (Dupuy & Dugué, 2018). This makes it possible to increase an athlete's motor performance, which is an important task of the training process (Guzii et al., 2021). Ignoring the functional training use in training leads to a low athletic result (Lisenchuk et al., 2019).

There is information about the use of exercises from wellness fitness in athletes' training in the scientific literature. In particular, elements of wellness fitness are used in the training (Kokarev et al., 2023). However, we have not found information in the scientific literature about the use of wellness fitness elements with sports equipment for athletes aged 10-11 engaged in rhythmic gymnastics to increase the level of physical and functional fitness. We believe that studying this issue will make it possible to make adjustments to the educational and training process of young gymnasts, which will increase not only the functional reserves of their body, but also the indicators of basic motor qualities, static and dynamic balance and control exercises from special physical training.

**Research aim.** To increase the effectiveness of physical and functional training of female athletes aged 10-11, specializing in rhythmic gymnastics at the stage of sports improvement, to offer and test innovative exercises from wellness fitness with sports equipment in the annual training macrocycle.

## Material & methods

The pedagogical experiment involved 20 female athletes aged 10-11 years (mean age = 10.3±1.8 years), who were engaged in rhythmic gymnastics in the third year of the stage of sports specialisation on the basis of a sports school of the Siberian Federal District (Russia).

Parental consent was obtained for the participation of the children in the experiment. The study adhered to the ethical norms and regulations of scientific experiments outlined in the Helsinki Declaration of 2008.

The girls were randomly assigned to either the control group (CG, n=10) or the experimental group (EG, n=10). The gymnasts underwent supplementary athletic coaching in adherence to the Federal standard for rhythmic gymnastics sports training. This standard was registered with the Ministry of Justice of Russia on 20th December 2022.

The gymnasts attended training sessions 4 times a week, each lasting 3 hours. The annual training load was 624 hours. The training program included theoretical training, practical exercises, rehabilitation activities and testing. The ratio of different types of sports training and other activities at the stage of sports specialization of gymnasts in CG and EG is presented in Table 1.

**Table 1. Ratio of types of training activities of CG and EG gymnasts in the third year of the sports specialization stage, %.**

No	Direction of education and training process	Percentage, %
1	General physical education	6-10
2	Specific physical training	18-26
3	Participation in sports competitions	3-7
4	Technical training	50-60
5	Tactical, theoretical, psychological training	2-4
6	Recreational activities, tests	6-8

The program of general physical training of CG and EG athletes included exercises aimed at developing basic motor qualities and functional fitness of the body. For this purpose, generally accepted sets of physical exercises were used for CG athletes, which were performed in the conditioning part of the training. In the conditioning part of the training, the EG athletes used innovative physical exercises with sports equipment designed for wellness fitness. To do this, the athletes performed the complexes of physical exercises developed by us on a step platform, a «Bosu» hemisphere and fitness sliders. The duration of the conditioning part of the training in both groups was 25-30 minutes. To improve the functional fitness of the cardiorespiratory system, increase endurance, coordination of movements and muscle strength of the lower extremities and trunk of EG athletes, a step platform of the StarFit model with a step height of 15 cm was used, the training time on the apparatus was 10-12 minutes. BRADEX's «Bosu» hemisphere was used to develop the static balance of the body and the coordination abilities of gymnasts. The exercise time was 8-10 minutes. Sliders (a set of 6D™ SLIDING) were used to improve coordination, balance, increase strength abilities, endurance and flexibility. The training time on the sliders was 8-10 minutes. A necessary condition for the training session was compliance with safety regulations. Special physical training in both groups did not differ from each other and included complexes of exercises with a skipping rope focused on the young athletes' speed and strength qualities development and complexes of exercises with a hoop, ball, clubs and ribbon for coordination abilities development. In the process of special physical training, the development and improvement of the gymnasts' leading physical qualities continued, technical skills and virtuosity of performance were honed, correct posture was brought up, motor memory and musicality were developed. During the experiment, the CG and EG gymnasts underwent high-stakes testing of the body functional parameters, basic motor qualities, static and dynamic balance and control exercises from special physical training with rhythmic gymnastics hand apparatuses

**Table 2. Types of tests for gymnasts**

<i>General Physical Fitness</i>	<i>Static and dynamic balance</i>	<i>Functional fitness</i>	<i>Control exercises for specific physical fitness</i>
<i>Tests and assays</i>			
1. Shuttle race 3x10 m, s 2. 60 m run, s 3. forward bending from sitting position, cm 4. Bending and stretching arms in a handrest from a prone position, number of repetitions 5. Long jump from standing position, cm	1. Romberg's test - 2, s; 2. Walking on the gymnastic rope test, s	1. 20 knee bends for 30 s; 2. Ruffier index, conditional units 3. Stange test, s; 4. Henchy's test, s	1. "Bridge"; 2. "Sprawl Press"; 3. back bends; 4. twine right (left); 5. cross twine; 6. balance "in the ring" right/left; 7. jump on two legs over a skipping rope with a double turn forward for 10 s. 8; 8. Rolling the ball on arms and chest; 9. Rolling the ball on arms and back; 10. Throwing a hoop; 11. "Turning" with one arm; 12. "Sunshine" with clubs; 13. Throwing two clubs with one hand; 14. "Spiral" with ribbon; 15. "Snake with ribbon

Evaluation of the control gymnastic exercises performance was carried out at competitions according to the program of the first sports grade in the types of all-around rhythmic gymnastics. They gave an assessment in the points of exercises without a subject and with subjects: with a rope, a hoop, a ball, clubs and a ribbon. After that, the average score was calculated. The score of 5.0-4.5 corresponded to a «high» level of special physical training; 4.4-4.0 – «above average»; 3.9-3.5 – «average» level; 3.4-3.0 – «below average»; 2.9 and less – «low» level. The received material was processed using the licensed version of the STATISTICA 10.0 and MS Excel 2010 programs.

## Results

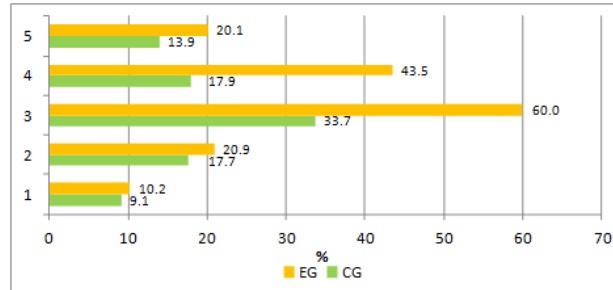
The results of testing the main motor qualities of the CG and EG gymnasts at the beginning and at the end of the pedagogical experiment are shown in Table 3.

**Table 3: Results of testing the main motor qualities of CG and EG gymnasts at the end of the pedagogical experiment, M±m**

<i>Test number</i>	<i>Test name</i>	<i>CG (n=10)</i>		<i>EG (n=10)</i>	
		<i>Before Experiment</i>	<i>After Experiment</i>	<i>Before Experiment</i>	<i>After Experiment</i>
1	Shuttle run 3x10 m, s	9.9±0.21	9.0±0.17*	9.8±0.34	8.8±0.48*
2	Running 60 m from a low start, s	12.3±0.15	10.1±0.12*	12.4±0.16	9.8±0.11*
3	Bending forward from a sitting position, cm	9.2±1.4	12.3±1.9	9.5±1.8	15.2±2.2*
4	Supine arm flexion/extension, number of repetitions	10.4±1.14	12.7±1.22	10.8±1.35	15.5±2.42*
5	Long jump from one point, cm	132.3±6.40	150.7±7.18*	131.2±7.32	157.5±8.32*

Note: \* The difference between the values is reliable ( $p < 0.05$ ).

At the beginning of the pedagogical experiment, there were no significant differences in the values of motor test indicators between the girls in CG and EG,  $p \geq 0.05$ . At the end of the pedagogical experiment, an increase in the motor tests of physical fitness indicators values was registered in gymnasts of both observation groups. A significant increase in the values of the indicators in CG girls was noted in three of the five tests ( $p \leq 0.05$ ) and in gymnasts EG in all control tests,  $p \leq 0.05$ . It was found that the value of the increase in all motor tests was greater in the gymnasts of the experimental group, compared with the athletes of the control one, as illustrated in Figure 1.



Note 1, 2, 3, 4, 5 - number of tests

**Fig. 1: Percentage increase in test scores at the end of the observation period**

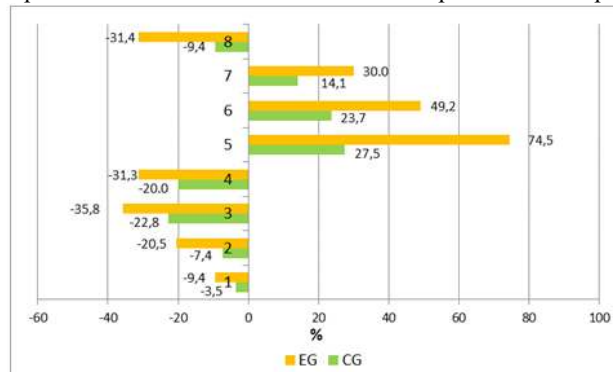
There was a significant increase in the values of the EG gymnasts in movement test no. 3 (forward bending) and test no. 4 (flexion and extension of the arms in a supine position on the floor). The rhythmic gymnastics training sessions allowed to improve the values of functional indices, static and dynamic stability of the gymnasts CG and EGG at the end of the pedagogical experiment, Table 4.

**Table 4: Results of stage control of functional indices, static and dynamic balance in female athletes (M±m)**

Number of tests	Type of control test	CG (n=10)		EG (n=10)	
		Before Experiment	After Experiment	Before Experiment	After Experiment
<i>Cardiovascular functional indices</i>					
Test 20 squats for 30 s					
1.	Resting heart rate, beats/min	82.2±3.42	79.3±3.07	83.4±3.56	75.6±3.01*
2.	Post-exercise heart rate, beats/min	126.7±7.45	117.3±6.34	132.7±8.64	105.5±5.68*
3.	Heart rate recovery time, seconds, c	122.4±6.26	94.4±5.03*	125.2±6.78	80.3±4.57*
4.	Ruffier index Индекс Рурье	6.5±0.22	5.2±0.19*	6.7±0.20	4.6±0.15*
<i>Respiratory function indices</i>					
5.	Stange test, s	34.2±2.34	43.6±3.38*	32.5±2.26	56.7±4.12*
6.	Henchy test, s	19.8±1.23	24.5±1.78*	19.3±1.12	28.8±2.45*
<i>Static equilibrium</i>					
7.	Romberg 2 test, s	15.6±0.12	17.8±0.34*	15.0±0.10	19.5±0.38*
<i>Dynamic equilibrium</i>					
8.	Walking on a gymnastics bench test, s	3.2±0.14	2.9±0.12*	3.5±0.22	2.4±0.10*

Note. \* Difference is reliable ( $p < 0.05$ )

Significantly greater enhancement of functional indices was observed in the experimental group, which incorporated health fitness components, in contrast to the gymnasts in the control group. The functional test results of both observation groups at the conclusion of the educational experiment are depicted in Figure 2.



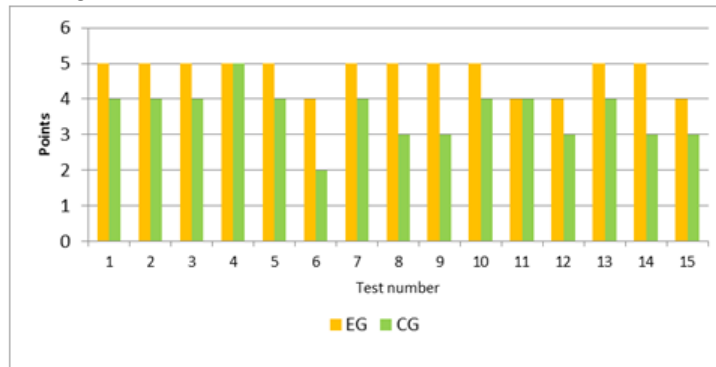
Note 1, 2, 3, 4, 5, 6, 7, 8 - Test numbers

**Fig. 2: Increase in functional test indicators, static and dynamic balance at the end of the educational experiment**

It was found that in all control tests, the increase in the functional test indicators values in EG gymnasts turned out to be significantly greater than in CG athletes. A significant increase was found in EG girls in tests # 3 (pulse recovery time after «20 squats in 30 seconds» exercise), # 5 (Stange's test) and # 6 (Genchi's test). These data indicate a more effective adaptation to physical exertion of the cardiorespiratory system of the EG gymnasts, compared with the CG ones. The EG athletes have dynamic balance more than 3 times higher, and static one - 2 times higher.

The results of testing special physical fitness for 15 control exercises allowed establishing that at the beginning of the pedagogical experiment, the point value of the indicators did not differ between the CG and EG gymnasts fluctuated in various exercises from 2.8 to 3.3 points. This fact corresponded to the rating of «low» and «below average».

The results of performing control exercises of special physical fitness at the end of the pedagogical experiment are shown in Figure 3.



Notes. Test numbers: 1. "Bridge"; 2. "Sprawl Press"; 3. back bends; 4. twist right (left); 5. cross twist; 6. balance "in the ring" right/left; 7. jump on two legs over the rope with a double turn forward for 10 s; 8. Roll ball on arms and chest; 9. Roll ball on arms and back; 10. Throw hoop; 11. "Twirl" hoop; 12. "Sunshine" with clubs; 13. throw two clubs with one hand; 14. "Spiral" with ribbon; 15. "Snake with ribbon"

**Fig. 3. Results of the evaluation of the performance of the control exercises of the special physical training of the gymnasts CG and EG at the end of the pedagogical experiment.**

It was found that the EG gymnasts had higher values of indicators in all control exercises than the CG gymnasts. The average value of the 15 control exercises performance from special physical fitness in EG athletes was  $4.66 \pm 0.26$  points («high» level) and was 22.7% higher than in CG athletes, where this indicator was  $3.60 \pm 0.18$  points («average» level),  $p \leq 0.05$ .

The results of wellness fitness elements use in the educational and training process among female athletes aged 10-11 specializing in rhythmic gymnastics showed a significantly high efficiency of increasing the values of functional, general and special physical fitness indicators, compared with the control group athletes who were engaged in a traditional training program.

## Discussion

In the training of athletes having various specializations, there is always a task to increase their level of physical and functional fitness (Fabio Scamardella et al., 2020; Kokarev et al., 2023). Based on this, the key task of coaches and scientists in the field of sports is the development and testing of new effective technologies, methods and techniques for organizing training sessions allowing achieving high sports results. The analysis of scientific literature shows that physical exercises used in general physical training should be adequate to the chosen sport, which increases an athlete's technical and tactical training effectiveness and also the effectiveness of his/her performance (Kokarev et al., 2023). This recommendation of scientists determined our choice of experimental methods of using elements of wellness fitness with sports equipment to improve the physical and functional fitness of girls engaged in rhythmic gymnastics in comparison with the traditional training program of training in this sport.

The experimental method proposed by us includes the use of innovative physical exercises from wellness fitness with sports equipment in the annual training macrocycle of classes. Physical exercises with fitness equipment were performed in the conditioning part of all training sessions for 25-30 minutes.

The results of testing the basic motor qualities of the EG gymnasts at the end of the pedagogical observation indicate a significantly greater increase in the indicators values of all conditioned tests compared with the results of the CG, where classes were conducted according to the traditional program. A significant increase was established in the motor quality of flexibility (60.0%) and speed and strength training (43.5%). The EG gymnasts had a 2-fold increase in static balance and a 3.3-fold increase in dynamic one compared to the CG. We believe that this can be explained by the use of sports equipment for fitness, which is consistent with the opinion of other researchers who conducted similar observations (Boloban et al., 2016; Kryzhevsky et al., 2020).

A well-developed balance increases the level of technical readiness in various sports (Ștefan Alecu, Dragoș Ionescu - Bondoc, 2018; Montesano Pietro, Mazzeo Filomena, 2019). The development of statokinetic stability, speed and strength qualities is noted after 8 weeks of training using unstable support of sports equipment (Degtyareva, Turchina, 2015).

Along with the obtained results of improving overall physical fitness, we have established a significant increase in the EG gymnasts' functional potential. In this observation group, the reserve capabilities of the cardiovascular and respiratory systems, which ensure high physical performance of athletes, increased significantly more. All test loads on the cardiorespiratory system were significantly better in the EG athletes compared to the CG ones. According to our data, the EG gymnasts had a heart rate at rest and after exercise, the pulse recovery time after it, the Roufier index were significantly less than those of athletes engaged in the traditional curriculum. These studies are consistent with the conclusions of other authors who have observed the dynamics of changes in the cardiorespiratory system of highly qualified athletes engaged in aerobic gymnastics with elements of wellness fitness (Kokarev et al., 2023). In many sports, the development of speed and strength abilities in athletes is impossible without increasing the adaptive capabilities of the cardiovascular and respiratory systems (Franchini et al., 2019; Muhamad Syamsul Taufik et al., 2021). Therefore, the growth of sports results is impossible without an increase in the functional capabilities of the body cardiorespiratory system.

Despite the fact that the traditional means of physical training of the CG gymnasts also showed quite high efficiency, the results of control testing of exercises from the special physical training program were significantly higher for the EG athletes. The average score of the EG gymnasts' control exercises in special physical fitness was 22.7% higher than that of the CG ones'. We believe that the significant result of the pedagogical experiment is due to the use of innovative physical exercises with sports equipment, including unstable support, in the course of training sessions.

### Conclusions

To increase the level of physical fitness, static and dynamic balance, functional capabilities of the cardiorespiratory system in gymnasts aged 10-11 specializing in rhythmic gymnastics, a method of using innovative exercises from wellness fitness with sports equipment was proposed and tested. To do this, in the conditioning part of each workout, exercises on a step platform, a «Bosu» hemisphere and fitness sliders were used.

At the end of the pedagogical experiment, it was found that the EG gymnasts significantly increased the indicators values in all tests of general physical fitness, especially in terms of strength, speed and flexibility. According to the results of functional tests, they had a more effective adaptation to the physical exertion of the cardiorespiratory system, compared with the CG. The EG athletes had static balance indicators more than 2 times, and dynamic one — more than 3.3 times than the CG ones. The average value of the performance of 15 control exercises from special physical fitness in the EG athletes was  $4.66 \pm 0.26$  points and it was 22.7% higher than in the CG athletes, where this indicator was  $3.60 \pm 0.18$  points,  $p \leq 0.05$ .

We believe that the high efficiency of the proposed method of using innovative exercises from wellness fitness with sports equipment, including with unstable support, can be used in the training of young athletes specializing in rhythmic gymnastics.

**Conflicts of interest.** The authors declare no competing interests.

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