Optimization of the training method for the turns of young gymnasts, taking into account the level of development of the ability to maintain balance

Alfiia Deineko
Olha Riabchenko

Kharkiv State Academy of Physical Culture, Kharkiv, Ukraine

Purpose: substantiate the effectiveness of using the methodology for developing the ability to maintain balance, which affects the technique of turns 13–15 years old athletes in rhythmic gymnastics.

Material & Methods: study involved 13–15 years old athletes, engaged in rhythmic gymnastics. The control group consisted of 10 gymnasts and the experimental group of 10 gymnasts. To solve the tasks, the following research methods were used: theoretical analysis and generalization of literary sources; pedagogical observations; pedagogical testing of the level of development of the ability to maintain balance; expert assessment method; pedagogical experiment; methods of mathematical statistics.

Results: the author's method of developing the ability to maintain balance by young gymnasts was developed. The positive influence of using means of developing the ability to maintain balance on the technique of turns by athletes 13–15 years old in rhythmic gymnastics was revealed.

Conclusion: an analysis of the results of the study shows that increasing the level of development of the ability to maintain balance by athletes 13–15 years old directly affects the improvement of the technique for turns competitive programs in rhythmic gymnastics.

Keywords: rhythmic gymnastics, gymnasts 13–15 years old, ability to maintain balance, technique of turns.

Introduction

The intensification of sports competition of national teams makes it necessary to pay special attention to coaches and scientists to increase the effectiveness of long-term training of athletes, to search for various training tools that contribute to more effective mastery of competitive exercises [1]. Modern fierce competition in rhythmic gymnastics leads to constant changes in the competitive programs of gymnasts. With the introduction of the FIG (2017) competition rules in rhythmic gymnastics [2], the development of complex competition programs that are complex in terms of technical base became a priority. This is possible only if modernization and increase the effectiveness of the training process, which is directly dependent on the means used in the classroom with athletes [3–5]. One of the most important categories of movements that are widely used in rhythmic gymnastics is turns, that is, movements with rotation of the athlete's body along its longitudinal axis [6]. In recent years, the arsenal of turns in gymnasts has been significantly enriched with new forms. Complex turns in the squat are officially recognized and included in the table [2], with the gradual bending and straightening of the supporting leg, turns with tilts forward and backward, turns on the knees and the like. Therefore, in modern conditions of training young gymnasts, mastering the practical skills of performing complex turns is relevant, it makes it possible to receive allowances for difficulty in connecting with other structural groups, in risks and in mastery of the subject.

Purpose of the study: substantiate the effectiveness of using the methodology for developing the ability to maintain balance, which affects the technique of turns 13–15 years old athletes in rhythmic gymnastics.

Material and Methods of the research

The study was conducted on the basis of the Children and Youth Sports School No. 16 in rhythmic gymnastics in Kharkov. The experiment involved 20 athletes 13–15 years old. In the course of the study, the following methods were used: theoretical analysis and generalization of literary sources; pedagogical observations; pedagogical testing of the level of development of the ability to maintain balance; expert assessment method; pedagogical experiment; methods of mathematical statistics.

Testing the level of development of the ability to maintain balance and an expert assessment of the technique of turning competitive programs by young gymnasts was carried out at the beginning and at the end of the summer training cycle. According to the results of initial testing of the level of development of the ability to maintain equilibrium and expert evaluation of turning techniques, gymnasts of the study group were divided into two equivalent groups - control (CG) and experimental (EG) of 10 athletes. Training sessions of the control group of gymnasts were conducted according to the generally accepted Rhythmic Gymnastics Curriculum [7]. In the training process of the gymnasts of the experimental group, the author's technique was specifically developed to develop the ability to maintain balance. The author's technique was used in the main part of the training session (15–20 minutes), where the technical element BD (equilibria, turns, jumps) was performed. During the study, in the training process in rhythmic gymnastics, specially developed sets of exercises were used in equilibrium in place (various racks on socks, on heels, on one leg, movements of the arms, legs, body with reduced support) in motion – varieties of walking, jogging and dance

steps. Of particular value in the framework of the developed methodology were exercises in pairs, as well as performing the original, non-traditional for rhythmic gymnastics, exercises – disagreements on the gymnastic bench (on the bottom of the lava). It should be noted that the author's methodology, aimed at developing the ability to maintain the balance of gymnasts of 13–15 years old, provided for the following complications when mastering basic exercises: use of various positions of the arms, the tilts of the head and asymmetric positions of the arms when performing a basic exercise, excluding support on the floor of the exercise on toes, without visual control; an increase in the number of repetitions and retention time of the static position of the body, as well as the use of rhythmic gymnastics (rope, hoop, ball, maces, ribbon) – that is, a combination of the proposed basic exercises with the dynamic work of the subject. Thus, at the end of the experiment, the gymnasts of the experimental group had to perform the proposed exercises according to the following scheme:

BASIC EXERCISE + PROPOSED COMPLICATIONS + + DYNAMIC WORK WITH THE SUBJECT

Due to the fact that the results of expert evaluations are points, then for their analysis it is necessary to use rank (nonparametric) methods. Three experts participated in the study and to determine the consistency of their opinions, the method of calculating the concordance coefficient, as proposed by Kendal [8], was used. The concordance coefficient varies in the range $0<W<1$; in this case, if $0–0,1$ – the opinion of experts is inconsistent; $0,1–0,3$ – low consistency; $0,3–0,7$ – average consistency; $0,7–1,0$ – high consistency.

Results of the research

To test the effectiveness of using the author's technique, at the end of the experiment, a second test was carried out to test the level of development of the ability to maintain the balance of gymnasts in the control and experimental groups (Table 1).

As can be seen from the research materials, in the test "statodynamic balance "yule", the athletes of the control group showed an average group result of 9,3±0,59 s, and the athletes of the experimental group 12,6±0,94 s. The difference between these indicators is statistically significant. insofar as $t_p=2,96>t_{gr}=2,10$. This means that in the experimental group, in relation to the control, the results of performing this test objectively improved. When performing the exercise "Pase balance without visual control" gymnasts of the CG showed an average result on the right – 28,7±2,58 s; on the left – 27,7±2,92 s, while gymnasts of the EG on the right – 37,2±3,10 s and on the left – 30,2±2,83 s. Comparison of the results obtained on the right foot according to Student's criterion shows that the difference between the average group values is statistically significant $(p<0,05)$ as opposed to the result on the left, where the difference between the average result of the experimental group relative to the control is statistically unreliable $(p>0,05)$ (Table 1). Similar changes in the test results of athletes in the control and experimental groups were also observed with the exercise "Pase balance at half fingers", namely: athletes from the CG showed an average result on the right – 54,9±3,11 s; on the left – 55,9±3,36 s, and EG on the right – 65,6±3,29 s on the left – 63,2±3,47 s. Comparison of the results obtained on the right foot according to the student criterion shows that the difference between the average group values is statistically significant, since $t_p>t_{gr}$, in contrast to comparing the results to the left, where the difference between the average results in the experimental group and the control is statistically unreliable, since $t_p<t_{gr}$. The results of introducing the developed author's technique for developing the ability to maintain balance indicate that when performing the test exercise "Tilt to the right", the gymnasts of the CG showed an average group result of 103,3±3,74 s, and the gymnasts of the EG – 123,1±5,78 s. Thus, the results of the study indicate a significant $(p>0,05)$ improvement in the result. To assess the development of the ability to maintain balance of gymnasts 13–15 years old, the test "Tilt to the left" was also used. The results of the study showed that the control group performed this exercise with an average group result of 88,5±4,31 s, and the experimental group – 105,6±3,8 s. It should be noted that according to Student's criterion, the difference between these average group values is statistically significant, since $t_p>t_{gr}$. Over the period of the experiment, the results of the test exercise "Tilt back, the number of times in 15 s" underwent significant changes. So, CG girls showed an average result 16,2±0,87 s, and EG – 19,8±0,98 s. According to Student criterion, the difference between the group average in this test is statistically significant $(p<0,05)$.

To solve this goal, the next component of the study was re-evaluation by experts of the technique of turning competitive programs by gymnasts of the control and experimental groups (Table 2).

An expert assessment of the gymnasts 'technique of performing the "Ring"with the help of the arm on the right foot

Table 1

Changes in the level of development of the ability to maintain balance of gymnasts 13–15 years old at the end of a pedagogical experiment ($t_{gr.}=2,10$ at $p<0,05$)

No.	Name of test		CG (n=10)	EG (n=10)	$t_{p.}$	p
			$\overline{X}±m$			
1.	Statodynamic balance of "yule", s		9,3±0,59	12,6±0,94	2,96	<0,05
2.	Pase balance without visual control, with	right	28,7±2,58	37,2±3,10	2,11	<0,05
		left	27,7±2,92	30,2±2,83	0,61	>0,05
3.	Pase balance at half fingers, s	right	54,9±3,11	65,6±3,29	2,36	<0,05
		left	55,9±3,36	63,2±3,47	1,51	>0,05
4.	Tilt to the right, s		103,3±3,74	123,1±5,78	2,88	<0,05
5.	Tilt to the left, s		88,5±4,31	105,6±3,87	2,95	<0,05
6.	Tilt back, number of times in 15 s		16,2±0,87	19,8±0,98	2,75	<0,05

Table 2

Results of evaluations by experts of the technique for performing turns of gymnasts 13–15 years after the introduction of the author's technique ($t_{gr.}$=2,10 at p<0,05), points

No.	Turn name		CG(n=10)	EG (n=10)	$t_{p.}$	P
1.	Turn ""Ring" with the hand"	right	6,2±0,30	7,1±0,34	1,96	>0,05
		left	4,5±0,24	5,3 ±0,33	1,94	>0,05
2.	Turn "Front twine with the hand"	right	5,9±0,32	7,1±0,25	2,95	<0,05
		left	4,5±0,27	5,4±0,39	1,88	>0,05
3.	Turn "Penche" leg into twine	right	6,4±0,29	7,7±0,37	2,74	<0,05
		left	4,8±0,31	5,9±0,40	2,18	<0,05
4.	Turn "Penche" with a bent leg	right	5,7±0,33	7,3±0,45	2,82	<0,05
		left	4,2±0,30	4,8±0,20	1,98	>0,05

at the end of the pedagogical experiment is as follows: in the control group – 6,2±0,30 points, in the experimental group – 7,1±0,34 points. The difference in the results of this exercise is statistically unreliable, since t_p=1,96<t_{gr}=2,10 (Table 2). Similar changes in the results were observed when the gymnasts on the left leg performed this turn, so the gymnasts of the CG received an average group score of 4,5±0,24, and the gymnasts of the EG received 5,3±0,33 points. According to student criterion, the difference between these average values is statistically unreliable (p>0,05). The gymnasts performed the control group of the "Front twine with the hand" turn on the right foot, experts rated it 5,9±0,32 points, and the experimental 7,1±0,25 points. The difference between these indicators is statistically significant, since t_p=2,95>t_{gr}=2,10. This means that at the end of the study, the assessment of the technique of performing the "Front twine with the hand" twist by the EG gymnasts objectively improved with respect to the CG. When performing this turn on the left leg, the gymnasts showed the following results: in the control group – 4,5±0,27 points, in the experimental group – 5,4±0,39 points. The difference between these indicators, according to student criterion, is statistically unreliable, since t_p<$t_{gr.}$ (Table 2).

In the process of turning the "Penche" leg into twine on the right foot by athletes 13–15 years old, the components of the technique of this exercise were estimated by experts in gymnasts of the CG at 6,4±0,29 points, and gymnasts in the EG 7,7±0,37 ball (Table 2). Comparison of these results by the Student criterion shows that the difference between these average group values is statistically significant (p<0,05). When performing this rotation on the left foot, the following was observed: the average group score of the gymnasts of the CG is 4,8±0,31 points, and the gymnasts of the EG – 5,9±0,40 points. Because t_p=2,18>t_{gr}=2,10, it cannot be concluded that the difference between these indicators is statistically significant. This means that in the experimental group, the results objectively improved in relation to the control group.

According to experts, the gymnasts of the experimental group performed the "Penche with bent leg" turn on the right better than the gymnasts of the control group with a significant difference (p<0,05), in contrast to the difference in the results of expert evaluation of this turn on the left leg, which is statistically unreliable (t_p=1,98<t_{gr}=2,10). Thus, the analysis of the study showed that the developed methodology for developing the ability to maintain balance by gymnasts of 13–15 years old improves the technique of turning by young athletes (the majority of the average group expert estimates of the technique of turning by gymnasts of the control and experimental groups received significant differences (p<0,05)).

Let us analyze the consistency of expert assessments of the technique of performing basic turns by gymnasts 13–15 years after the experiment using the calculation of the Kendall concordance coefficient (Table 3–4).

Arithmetic average number of ranks Q_{av}=(4+4+4+6+14+16,5 +15,5+16)/8=10.

Sum of squared deviations from the mean S=259.

Value of the coefficient of concordance: $W = \dfrac{12S}{n^2(m^3 - m)}$,

where S – the sum of the squares of the deviations of all rank estimates of each examination object from the average n is the number of experts; m is the number of objects of expertise.

Thus, W=0,69, which indicates the average level of consistency of expert estimates.

Q_{av} =(15,5+3+5+4+13,5+18+4+16,5)/4=9,9.
S=294,2
W = 12x294,2/9x(512–8)=0,78, which indicates a high level of consistency of expert assessments.

Table 3

Calculation of the Kendall concordance coefficient of the results of expert evaluation of the turning technique by CG gymnasts

Turn name		Expert rating			Sum of ranks	Deviation from the mean	Deviation square
		1	2	3			
1. Turn ""Ring" with the hand", points	right	1	2	1	4	−6	36
	left	1	1	2	4	−6	36
2. Turn "Front twine with the hand", points	right	1	1	2	4	−6	36
	left	1	2	3	6	−4	16
3. Turn "Penche" leg into twine, points	right	6	3	5	14	4	16
	left	5,5	6	5	16,5	6,5	50
4. Turn "Penche" with a bent leg, points	right	5,5	5,5	4,5	15,5	5,5	33
	left	6	5,5	4,5	16	6	36

Table 4

Calculation of the Kendall concordance coefficient of the results of expert evaluation of the turning technique of the gymnasts

Turn name		Expert rating			Sum of ranks	Deviation from the mean	Deviation square
		1	2	3			
1. Turn ""Ring" with the hand", points	right	6	5	4,5	15,5	5,6	31,3
	left	1	1	1	3	−6,9	47,6
2. Turn "Front twine with the hand", points	right	1,5	2,5	1	5	−4,9	24,0
	left	1	2	1	4	−5,9	34,8
3. Turn "Penche" leg into twine, points	right	4,5	3	6	13,5	3,6	12,9
	left	6	6	6	18	8,1	65,6
4. Turn "Penche" with a bent leg, points	right	1	2	1	4	−5,9	34,8
	left	5	6	5,5	16,5	6,6	43,5

Thus, the obtained indicators of the Kendall concordance co-efficient provide a basis for the conclusion about the uniformity of the results of the technique of performing basic turns by gymnasts 13–15 years after the implementation of the developed technique. According to all criteria, an average and high level of consistency of expert estimates was recorded [8].

Conclusions / Discussion

The results of the study complement the theoretical provisions formulated in the works of A. Aftimichuk, A. Krajdan [9], G. Andreeva, [10], N. Bateevo, P. Kyzim [11], twists / turns in rhythmic gymnastics is one of the main of basic groups of components of competitive compositions in each all-around event, and their clear implementation requires athletes of a high level of development to maintain balance. However, the problem of cornering technique remains relevant today, since the complexity of performing this type of exercise lies in its biomechanical features, which provide for a number of spatio-temporal characteristics. The study also confirms the conclusions of V. Sutula, A. Deineko, A. Ryabchenko [1], A. Mullagildina [5], A. Aftimichuk, A. Krazhdan [9], G. Andreeva [10] and other scientists that the constant complication of the components of competitive activity and the ultimate realization of the individual capabilities of gymnasts result in the exhaustion of reserves for improving their sportsmanship and require the search for new ways to increase results. Specialists L. Karpenko [6], A. Aftimichuk, A. Krazhdan [9], V. Sosina, A. Dovganovska [12] emphasize that the ability to maintain a stable position of the body plays a universal role in rhythmic gymnastics – it is necessary as a base for mastering competitive exercises. Therefore, the results of the study led to the assumption that the level of development of the ability to maintain balance by athletes 13–15 years old affects the technique of cornering in the competitive program.

Prospects for further research are to introduce the developed author's methodology for developing the ability to maintain balance by young gymnasts in the educational process of the Children's and Youth Sports School, Children's and Children's Sports School, clubs and specialized educational institutions to further improve it.

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Information about the Authors

Alfiia Deineko: *PhD (Physical Education and Sport); Kharkiv State Academy of Physical Culture: Klochkivska str. 99, Kharkiv, 61058, Ukraine.*
ORCID.ORG/0000-0001-7990-7999
E-mail: snosocio@gmail.com

Olha Riabchenko: *Kharkiv State Academy of Physical Culture: Str. Klochkovsky 99, Kharkov, 61058, Ukraine.*
ORCID.ORG/0000-0003-2868-0637
E-mail: riabchenko.ov@gmail.com