Journal of Physical Education and Sport ® (JPES), Vol. 21 (issue 6), Art 474, pp. 3504 - 3510, December 2021
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

Original Article

«Help» methodology for improving coordination training effectiveness in acrobatics sports

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Published online: December 30, 2021
(Accepted for publication December 15, 2021)
DOI:10.7752/jpes.2021.06474

Abstract:
The analysis of modern scientific literature indicates insufficient knowledge of the variable component use in the sports training program for acrobat girls aged 11-12 for their coordination abilities and vestibular stability development. ***Research aim*** is to evaluate the effectiveness of «Help» methodology proposed by us for female athletes', aged 11-12, engaged in sports acrobatics at the stage of sports specialization, coordination abilities development. ***Materials and methods***. The participants of the research project were two groups of girls (n=20), aged 11-12, who were engaged in sports acrobatics. The main training sessions in the control (CG) and experimental group (EG) were conducted according to the Russian standard «Sports Acrobatics» (2014). In the annual training macrocycle of the experimental group, the method of performing exercises was expanded. A special set of sports equipment was selected: a balancing disc and a «Bosu» hemisphere, an agility ladder, a trampoline and a skateboard. All exercises on sports equipment were performed in the first half of the main part of the lesson. The skateboard and the «Bosu» hemisphere were additionally used in active games. We called the developed method of coordination training «Help», which is based on the principle of complicating the conditions for performing exercises. In both groups, stage-by-stage testing of the athletes' overall physical, coordination and technical fitness and vestibular stability was carried out. ***Results.*** After the research project completion, the athletes of the CG and EG had an improvement in the indicators values in all tests. The EG athletes, engaged in the «Help» method had more growth values in all tests than the CG athletes. The greatest increase was found in EG girls in tests characterizing general flexibility and speed endurance. At the end of the pedagogical experiment, a significant improvement in the tests of dynamic coordination and vestibular stability was also found in girls of both groups. The greatest increase in the indicators values of coordination tests was shown by EG athletes, engaged in «Help» experimental method. Training according to the experimental method significantly improved the indicators values in the tests of the EG athletes' technical readiness, compared with the CG. ***Conclusions.*** The results of testing «Help» method in sports acrobatics classes showed an increase in coordination qualities, vestibular stability, general and technical readiness in girls aged 11-12. The emergence of new complex coordination sports and their inclusion in major international competitions requires the sports community and scientists to search for new pedagogical technologies and techniques for training athletes.
Key Words*:* **acrobatics sports, pedagogical experiment, coordination training, training method**

Introduction

Sports acrobatics places high demands on an athlete's speed and strength qualities and flexibility, the presence of good orientation in space and time, sensorimotor coordination of movements and a sense of balance (Pavlenkovich, & Kazakova, 2018). In the process of training athletes in complex coordination sports, a significant role is assigned to their vestibular apparatus development, coordination abilities, a sense of balance, orientation in space and other motor qualities for the rapid development of technical skills and achieving high sports results (Chagas et al., 2017).

Acrobatic exercises are used to improve coordination abilities in many sports (Antonov et al., 2017; Bykova et al., 2017), especially where good coordination development is required in an athlete (Robert et al., 2017; Gerth et al., 2020; Miller et al., 2019). Previously, acrobatic training was successfully used by us to develop coordination abilities in taekwondo (Mischenko et al., 2020a) and at the initial stage of training young

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cyclists (Mischenko et al., 2020b). There is experimental evidence that the education of coordination abilities in children should begin as early as possible (Nazarenko, & Chinkin, 2015). Age-specific peculiarities of coordination abilities development in children have been established (Hertz et al., 1982). According to the researchers, coordination abilities are most effectively developed in children aged 7 to 12. Up to this age, the activity of the leading sensory systems in children is imperfect and unbalanced, the upper and lower extremities coordination when performing physical exercises is insufficient, which can often lead to sports injuries (Liakh, 2006).

An analysis of the scientific literature shows that there is no consensus among specialists on the use of the same methodological approaches to foster coordination and a sense of balance in an athlete (Khudyakov et al., 2014). The authors believe that well-developed coordination abilities are the foundation of high technical training and increase an athlete's potential in achieving athletic results (Mischenko et al., 2020b).

In all types of sports acrobatics, dynamic and static exercises are performed, which requires a special approach from the coach to the selection and rational distribution of means and methods for developing coordination abilities in a one-year training macrocycle. Performing various complex locomotions with rapid movement of the body, turns, jumps, series, somersaults and rolls, maintaining static-dynamic stability and monitoring the position of the trunk in space, require a well-developed sense of coordination and balance.

There are enough reports in the scientific literature about the methods and means of athletes' acrobatic training. Reports on the method of improving female athletes' aged 11-12, engaged in sports acrobatics at the stage of sports specialization, coordination ability are very limited. The coach, within the framework of his competence, has the right to use any available pedagogical technologies in his professional activity to increase the effectiveness of the training session, to diversify the methods and means of developing and educating an athlete's leading physical qualities (Wong et al., 2019). We believe that any innovative athlete training program is valuable if it is effective and positive sports results are achieved as a result of its application. Therefore, the topic and aim of the research chosen by us are relevant.

Research aim is to evaluate the effectiveness of «Help» methodology proposed by us for female athletes', aged 11-12, engaged in sports acrobatics at the stage of sports specialization, coordination abilities development.

Material & methods

The research project testing was carried out in Chelyabinsk (Russia) during the 2020-2021 academic year. Two groups of girls (n=20), aged 11-12, engaged in sports acrobatics at the stage of sports specialization, were invited to participate in the project. The main training sessions in the control (CG, n=10) and experimental groups (EG, n=10) were conducted by the circular training method 3 times a week for 2 hours, according to the Russian Federal Standard of sports training in the sport «Sports Acrobatics» (2014).

A variable component was added to the program of the annual training macrocycle for the experimental group, which allowed expanding the method of performing exercises. We called the developed method of coordination training «Help», which is based on the principle of complicating the conditions for performing physical exercises (Table 1). A special set of sports equipment was selected: a balancing disc and a «Bosu» hemisphere from BRADEX (Israel), an agility ladder, a trampoline, a skateboard for the athletes' coordination, vestibular (static) stability and general physical fitness development. All exercises according to the «Help» method were performed in the first half of the main part of the lesson (20 minutes) based on the method of non-strictly regulated exercises that were performed on sports equipment. The skateboard and the «Bosu» hemisphere were additionally used in active games.

Table 1. The schedule of the sports equipment use according to the «Help» method in the annual training macrocycle

Sports equipment	Months								
	September	October	November	December	January	February	March	April	May
Agility ladder	X	X	X	X	X	X	X	X	X
«Bosu» hemisphere	X		X		X		X		X
Balancing disc		X		X		X		X	
Skateboard	X	X	X	X	X	X	X	X	X
Trampoline	X	X	X	X	X	X	X	X	X

Exercises on the «agility ladder» were designed to increase agility, movement coordination, footwork speed, movement techniques and balance and they were performed at different pace of walking, running and jumping. Exercises on a skateboard, a balancing disk and a «Bosu» hemisphere were performed to develop the static stability of the body and motor coordination of athletes with and without the visual analyzer control. The trampoline was used to improve the technique of performing jumping acrobatic exercises, developing the athlete's motor memory and relieving muscle tension after physical exertion. During the exercises on the

equipment, safety precautions were observed. A step-by-step test was carried out to control the athletes' overall physical and technical fitness, coordination and vestibular stability (Table 2).

Table 2. Types of the athletes' staged testing

Overall physical fitness	Dynamic coordination (Starosta, 1978)	Static stability	Technical fitness
Tests			
1. Run 30 m from standing start, s 2. Shuttle run 3x10 m, s 3. Forward bend from a sitting position, cm 4. Standing long jump, cm 5. Rope jumps, number of times for 20 s	1. From two legs to two with the help of hands (to the right), degrees 2. From two legs to two with the help of hands (to the left), degrees 3. From one leg to one, with the help of hands (from the right), degrees 4. From one leg to one, with the help of hands (from the left), degrees	1. Romberg test -2, s.	1. Three somersaults forward, s 2. Walk in handstand, cm 3. Four turns on the gymnastic bench, s

A qualitative assessment of the girls' motor coordination was carried out using an indicative motor coordination assessment scale (Starosta, 1978). The materials of the pedagogical experiment were processed by statistical methods (licensed version of STATISTICA 10.0, MS Exsel 2010) with the calculation of the arithmetic mean, its error and sigma deviation. The reliability between the differences in the values of the indicators was determined using the Wilcoxon matched pairs test and Mann-Whitney U-test criteria.
We obtained the consent of parents for their children to participate in the experiment. The research does not violate international ethical norms and rules for conducting scientific experiments.

Results

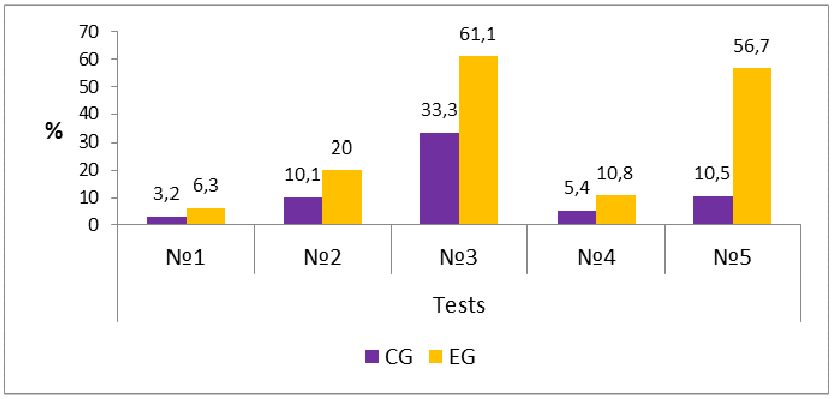
Before to the pedagogical experiment beginning in the control (CG) and experimental (EG) groups, there were no statistically significant differences between the results obtained in tests characterizing the overall physical fitness of girls (Table 3).

Table 3. The stage control results of the athletes' overall physical fitness (M ± m)

№ теста	Тест	CG (n=10)		EG (n=10)	
		Before the experiment	After the experiment	Before the experiment	After the experiment
1	Run 30 m from standing start, s	6,3±0,16	6,1±0,15	6,4±0,16	6,0±0,15*
2	Shuttle run 3x10 m, s	8,9±0,21	8,0±0,16	9,0±0,38	7,2±0,58*
3	Forward bend from a sitting position, cm	9,3±1.6	12,4±1,8	9,5±1,8	15,3±2,0*
4	Standing long jump, cm	152,5±6,60	160,7±7,23	151,2±7,27	167,5±8,12*
5	Rope jumps, number of times for 20 s	38,0±2,56	42,0±2,93	37,0±2,43	58,0±3,12*

Note - .* the values difference is reliable ($p < 0.05$)

At the end of the experiment, there was an improvement in the indicators values of the athletes' overall physical fitness in both groups. A significant improvement in the indicators values in all tests was recorded only in the experimental group. The value of the increase in test indicators in the CG and EG is presented in Table 3 and in Fig.1.



Note: 1, 2, 3, 4, 5 - test numbers

Fig. 1. The increase in the indicators values of general physical fitness of CG and EG athletes at the end of the experiment (%)

The athletes of the experimental group, engaged in the «Help» method, had more growth values in all tests than the athletes of the control group. The greatest increase (> 50%) was found in EG girls in tests characterizing general flexibility (test No. 3) and speed endurance (test No. 5).

The results of dynamic coordination and vestibular stability testing in athletes of CG and EG before and after the pedagogical experiment are shown in Table 4.

Table 4. Stage-by-stage control results of the athletes' dynamic coordination and vestibular stability (M±m)

Test№	Test	CG (n=10)		EG (n=10)	
		Before the experiment	After the experiment	Before the experiment	After the experiment
Dynamic coordination					
1	From two legs to two with the help of hands (to the right), degrees	274,23±12,34	338,31±12,42*	275,79±12,42	379,27±12,54*
2	From two legs to two with the help of hands (to the left), degrees	259,34±11,18	336,24±12,23*	257,18±11,2	367,58±12,45*
3	From one leg to one, with the help of hands (from the right), degrees	217,25±9,57	278,15±9,61*	219,83±9,62	358,52±9,75*
4	From one leg to one, with the help of hands (from the left), degrees	215,56±8,97	269,19±9,32*	214,23±9,12	344,61±9,47*
Vestibular stability					
5	Romberg test -2, s.	11,4±1,21	14,2±2,32	11,2±1,19	19,6±3,28*

Note - .* the values difference is reliable ($p < 0.05$)

After the experiment, there was an improvement in the values of vestibular stability and dynamic coordination tests in athletes of both groups ($p < 0.05$). he greatest increase in the coordination tests values was shown by EG athletes who trained according to the experimental «Help» method. They registered a significant increase in indicators in tests No. 3 and No. 4 (> 50%) and in the Romberg -2 test (75.0%), Table. 4 and Fig.2.

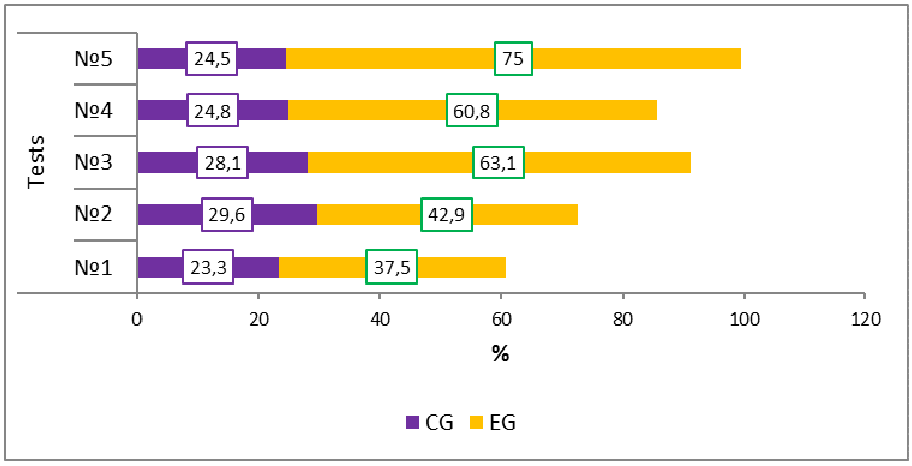


Fig. 2. The increase in the indicators values of the athletes' coordination abilities and vestibular stability at the end of the experiment (%)

Confirmation of the proposed by us experimental technique «Help» effectiveness is the results of a milestone assessment of the athletes' coordination abilities on the Starosta scale (1978) at the beginning and at the end of the experiment (Tables 4 and 5).

Table 5. Milestone assessment of the athletes' coordination abilities on the Starosta scale (1978)

Test number	CG (n=10)		EG (n=10)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
1	Satisfactory	Good	Satisfactory	Excellent
2	Unsatisfactory	Good	Unsatisfactory	Excellent
3	Unsatisfactory	Satisfactory	Unsatisfactory	Excellent
4	Unsatisfactory	Satisfactory	Unsatisfactory	Excellent

After the pedagogical experiment, the coordination qualities according to the Starosta scale (1978) in all athletes of the experimental group are evaluated as «excellent». Successful performance at competitions in sports acrobatics largely depends on the technique of performing complex coordination exercises and series, especially when the athlete is in the air. In our study, the girls' technical competence was determined by three tests (Table 6).

Table 6. The athletes' technical fitness indicators values (M ±m)

Test	CG (n=10)		EG (n=10)	
	Before the experiment	After the experiment	Before the experiment	After the experiment
Three somersaults forward, s	6,7±1,31	5,2±1,23	6,8±1,22	3,5±1,23*
Walk in handstand, cm	168,4±8,54	185,4±8,82	167,9±8,34	216,9±8,97*
Four turns on the gymnastic bench, s	8,9±1,38	7,2±1,24	9,2±1,41	5,6±1,11*

Note - .* the values difference is reliable ($p < 0.05$)

Training according to the experimental method «Help» proposed by us significantly improved the values of the technical fitness tests of EG athletes, compared with CG.

Dicussion

In the process of improving athletes' coordination abilities, additional reserves of the body are revealed (Antonov et al., 2017; Bykova et al., 2017; Robert, et al., 2017; Miller et al., 2019; Gerth et al., 2020). Therefore, any research, expanding sports specialists' and coaches' knowledge about methods and ways to improve athletes' coordination abilities is valuable and seems relevant. The low results of testing the girls' initial level of coordination abilities obtained by us coincide with the results of other scientists' study. Vaskan et al. (2019), Galan et al. (2019) report an insufficient level of static balance in modern youth. Doletsky et al. (2019) consider human inactivity to be one of the reasons for low coordination fitness. Earlier, we obtained successful results of testing new means and methods of coordination training in taekwondo (Mischenko et al., 2020a) and in mountain biking (Mischenko et al., 2020b). A positive result was obtained from other authors on the study of coordination qualities in complex coordination sports (Robert, et al., 2017; Gerth et al., 2020; Miller et al., 2019). In sports acrobatics, coordination abilities, vestibular stability, speed-strength qualities and flexibility of an athlete, his\her psychomotor state are very important qualities.

The sports specialists' task is to develop and test new pedagogical technologies, methods and techniques of the training process, the end result of which is a well-developed physical qualities of an athlete and his\her successful performance at competitions. Therefore, the research direction we have chosen is relevant for other sports. In the scientific literature there is information about the use of an «agility ladder» in the training process in complex coordination sports (Bykova et al., 2017) and sports equipment, creating an unstable foot support (Liakh, 2006). The results of testing our «Help» method in the annual training macrocycle for girls aged 11-12 in sports acrobatics using a «Bosu» hemisphere, an agility ladder, a trampoline, a balancing disc and a skateboard showed that the girls of the experimental group had significantly increased coordination abilities compared to athletes whose training was conducted according to the Russian federal standard « Acrobatics sports » (2014).

When testing girls aged 11-12 for dynamic coordination of movements, we established the reliability of an increase in all indicators values in the experimental group, which coincides with the statement of Liakh (2006) about a favorable sensitive age period (from 7 to 12 years) for children's coordination abilities development. Training according to the experimental technique «Help» proposed by us increased the speed of movement, agility, speed and strength endurance, vestibular stability, dynamic coordination of movements of athletes, compared with the results of testing in the control group. We believe that the use of the experimental «Help» method in the annual training macrocycle for the coordination, vestibular stability, general physical and technical fitness development has shown its effectiveness as well as other pedagogical technologies of the modern training process, reported by researchers Boichuk et al. (2018), Wong et al. (2019) and Gryaznykh et al. (2021).

Conclusions

To improve coordination, technical and general physical fitness, vestibular stability of girls aged 11-12 in the annual training macrocycle in sports acrobatics, we tested the experimental method «Help», based on the principle of complicating the conditions for performing physical exercises on sports equipment (balancing disc and a «Bosu» hemisphere, agility ladder, trampoline and skateboard).

The milestone testing showed that the girls, engaged in the «Help» method, had significantly increased coordination abilities, vestibular stability, basic motor qualities, technical readiness, than the athletes, engaged only in the standard program. The assessment of the athletes' of the experimental group coordination qualities was higher than that of the control one. The development of coordination abilities in humans has a conjugate potentiated effect on other motor qualities formation, especially in athletes.

The results of our pedagogical experiment confirmed the opinion of other researchers that the age period from 7 to 12 years is the main one for the education of coordination abilities in children's sports.
The positive results of testing the «Help» method for coordination and vestibular stability development in sports acrobatics allow us to recommend it for use in other sports. Modern sport is constantly being improved, sports results are changing rapidly, and therefore, the relevance of conducting experimental studies aimed at studying athletes' coordination capabilities does not disappear in the scientific sports environment.

Conflicts of interest. The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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