

Development of Physical Abilities of Primary School Pupils Under the Influence of Aerial Acrobatics and Pylon Sports

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Abstracts. Strength, flexibility and endurance are important components in the training of aerial acrobatics and pole sports performers. To develop these qualities, as well as to improve the training program for elementary school students using aerial acrobatics and pole sports, it was decided to introduce a comprehensive training program that included elements of choreography, acrobatics, and technical training on the tools. The purpose of the study is an experimental verification of a complex program of physical and technical training for the development of power endurance by means of aerial acrobatics and pylon sports. The tasks of the research were: to conduct a pedagogical experiment on the basis of the School of Aerial Acrobatics «Chocolate», as well as «RedMoon», regarding the possibility of introducing a comprehensive program for the training of performers in aerial acrobatics and pylon sports; the level of physical training of students before the beginning of the pedagogical experiment and at the end; conduct a mathematical analysis of the obtained results. The research methods were analysis and generalization of literary sources, pedagogical experiment, methods of mathematical statistics. As a result of the introduction of a comprehensive program of physical and technical training by means of aerial acrobatics and pole sports, statistically significant changes in the development of strength endurance of experimental group (EG) girls compared to control group (CG) during physical exercises were established. Nevertheless, the experimental program almost did not affect the development of back flexibility, as well as the flexibility of the hip muscle of the leg, which allows us to draw conclusions about the need to improve the program and eliminate such shortcomings. Nevertheless, we can say that the program has a positive effect on the development of the performers' physical qualities. Thus, the pedagogical experiment makes it possible to determine the positive impact of a complex program of physical and technical training on strength endurance, flexibility, as well as on the development of their technical training when working on tools, choreographic, acrobatic capabilities.

Keywords: experimental program, pylon sports, aerial acrobatics, control group, experimental group, flexibility, strength, endurance, mathematical analysis.

I. Introduction.

Aerial acrobatics and pylon sports can have a positive effect on the development of physical qualities of primary school children. Strength qualities, strength endurance and flexibility deserve special attention for engaging in these activities. Therefore, we faced the need to conclude a comprehensive program and experimentally check its content for the development of physical qualities of students of 1-4 grades by means of aerial acrobatics and pylon sports, which will allow us to improve the training program in these areas.

II. Literature review

The method of teaching physical education for children of primary school age was considered in his works by L.V. Hnitetskyi. (2000), Dubogray O., Ochaguyeva I. (2000), Prysiazhniuk S.I. (2008) and others. Innovative approaches in teaching and education were considered by such scientists as Krasnova N.P. (2000), Pometun O.I. (2004), Smolina O.S. (2012). Circus art, and, accordingly, the sources of the emergence of aerial acrobatics on canvases and rings, as well as the method of performing exercises on these tools, were considered in their works by foreign researchers, Steven Santos in the book "Simply Circus. Introduction to Rigging Lyras and Trapeze Bars" (2013) and Pony Poison in the work "Simply circus. Aerial silk" (2013). And also such foreign scientists as Kashevarov V. and Orel D. (2018). Pole sports and methodological features of mastering this direction were considered in the works of Hanna Oleynyk "Dance on the pole" (2017) and Iryna Kartali in the book "Pole dance fitness" (2018). The rules of competitions in pylon sports and aerial acrobatics can be found on the official site of the Fusion Air Cup, where the evaluation system for these areas is located.

III. Materials and methods.

Aerial acrobatics and pole sports are an effective means of developing the strength qualities of performers, as well as endurance and flexibility. Scientists in the field of physical education have already studied the possibility of developing these qualities by means of aerial acrobatics and pole sports. However, the issue of developing a comprehensive program for the development of physical and technical training of performers in these directions, as well as checking its effectiveness, has not yet been addressed in modern scientific research. We used such Research methods as analysis and generalization of literary sources, pedagogical experiment, methods of mathematical statistics.

The purpose of the study is an experimental verification of a complex program of physical and technical training for the development of strength endurance and flexibility by means of aerial acrobatics and pylon sports.

Based on this, the following **tasks** were set:

- to conduct a pedagogical experiment on the basis of the School of Aerial Acrobatics «Chocolate» as well as «RedMoon», regarding the possibility of introducing a comprehensive program for the training of performers in aerial acrobatics and pylon sports;
- to determine the level of physical training of students before the beginning of the pedagogical experiment and at the end;
- to conduct a mathematical analysis of the obtained results.

IV. Results and discussions.

To determine the effectiveness of the complex program of physical and technical training, two groups were created - control and experimental. In the control group, the children engaged in technical training on the instrument during the lesson. In the experimental group, in addition to technical training, the children underwent acrobatic and choreographic training.

In order to check the impact of this program on the physical qualities of the students, a preliminary test was conducted to determine the level of flexibility, strength and endurance of the students.

In the course of the experiment, such indicators as the length of the bridge, the number of bends and extensions of the arms in the supine position, the maintenance of the body position in the supine position, the right, left and transverse splits in centimeters were measured.

In the course of the experiment, there were minor changes in the development of flexibility, but in the experimental group the changes were more noticeable (see Table 1, Table 2). Since at the beginning of the experiment, the calculated value of Student's t-criterion is less than the table value, this means that the flexibility of the two groups is homogeneous, the difference is unreliable ($p > 0.05$) [6, p.105].

Table 1 Development of flexibility in EG and CG during the experiment (bridge length, cm)

Participants of the experiment	Before experiment	After Experiment	Indicator change	t-Student's criterion	p
EG(n=15)	45,07 ±5,42	37,13±3,79	7,94	1,2	p>0,05
CG(n=15)	33,73±1,97	28±1,85	5,73	0,691	p>0,05

Table 2. Comparison of indicators of flexibility development during the experiment between EG and CG (bridge length)

Sex	Groups	Before experiment	t	p	After experiment	t	p
Girls	EG(n=15)	45,07 ±5,42	1,966	p>0,05	37,13±3,79	2,166	p<0,05
	CG(n=15)	33,73±1,97			28±1,85		

At the end of the experiment, there are noticeable changes. Since the estimated value of the Student's t-criterion is greater than the tabular value, it means that the physical development of EG and CG is not the same, the difference is significant ($p < 0.05$), while in the experimental group the shifts in the development of flexibility are more significant [6, p.106].

The next indicator, which was tested at the beginning and at the end of the experiment, was the flexion and extension of the arms in the supine position, for the number of times they could perform.

According to the obtained results, it can be concluded that at the beginning of the experiment the groups were homogeneous, the difference is unreliable. When re-testing after six months, the indicators changed significantly in the experimental group, the difference is reliable. Changes also occurred in the control group, but not as significant (see Table 3, Table 4)

Table 3. Indicators of the development of physical qualities of the experiment participants (n=30)

Strength endurance in EG and CG during the experiment (bending and extending the arms in a supine position, number of times)

Participants of the experiment	Before experiment	After experiment	Indicator change	t-Student's criterion	p
EG (n=15)	21,93±1,2	33,13±1,14	11,2	6,770	p<0,001

CG (n=15)	25,27±1,13	29,07±1,31	3,8	2,191	p<0,05
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Table 4. Comparison of indicators of endurance development during the experiment between EG and CG (flexion and extension of arms in supine position, number of times)

Sex	Groups	Before experiment	t	p	After experiment	t	p
Girls	EG(n=15)	21,93 ±1,2	2,02	p>0,05	33,13±1,14	2,239	p<0,05
	CG(n=15)	25,27±1,13			29,07±1,31		

The next indicator, which was used to measure strength endurance in EG and CG, was maintaining the body position in the supine position. At the beginning of the experiment, the groups are homogeneous, the difference is unreliable. During repeated testing, the indicators changed in both groups, however, in the experimental group, the shifts are much more significant, as evidenced by the high Student's t-criterion [6, p.107]. This means that the experimental program affects the development of strength endurance (see Table 5, Table 6).

Table 5. Strength endurance in EG and CG during the experiment (keeping the body position in a lying position, s)

Participants of experiment	Before experiment	After experiment	Indicator change	t-Student's criterion	p
EG (n=15)	125,33±11,66	288,0±18,18	162,67	7,53	p<0,001
CG(n=15)	198,47±36,18	215,33±28,01	16,86	0,37	p>0,05

Table 6. Comparison of strength endurance indicators during the experiment between EG and CG (maintaining the body position in the supine position)

Sex	Groups	Before experiment	t	p	After experiment	t	p
Girls	EG (n=15)	125,33±11,66	1,92	p>0,05	288,0±18,18	2,18	p<0,05
	CG (n=15)	198,47±36,18			215,33±28,01		

The next indicator which we tested EG and CG was the flexibility of the hip joint, namely the right longitudinal split, cm. It should be noted that we measured this criterion taking into account the margin (that is, "+" in the split), as well as when the child is not yet sits on the split, we put "-" in front of the value. That is, we used both positive and negative values in the calculations. According to the results of the calculations, stretch marks improved almost equally in both groups. This suggests that both EG and CG paid enough attention to this (see Table 7, Table 8).

Table 7. Development of flexibility in EG and CG during the experiment (right twine, cm)

Participants of experiment	Before experiment	After experiment	Indicator changes	t-Student's criterion	p
EG (n=15)	2,53±2,31	4,33±1,03	6,86	2,713	p<0,05
CG(n=15)	5,47±1,45	0,67±1,97	6,86	2,401	p<0,05

Table 8. Comparison of indicators of flexibility development during the experiment between EG and CG (right split, cm)

Sex	Groups	Before experiment	t	p	After experiment	t	p
Girls	EG (n=15)	- 2,53±2,31	1,076	p>0,05	4,33±1,03	2,253	p<0,05
	CG (n=15)	- 5,47±1,45			-0,67±1,97		

As for the left side, the indicators have changed little, although there are small shifts. This suggests that when performing exercises on the aerial silks, pylon, performers usually develop good stretches on one leg, while the other is almost not stretched. Thanks to the analysis of the results, the development of the flexibility of both joints should be given equal importance to prevent injuries and displacements in the spine (see Table 9, Table 10).

Table 9 . Development of flexibility in EG and CG during the experiment (left split, cm)

Participants of experiment	Before experiment	After experiment	Indicator changes	t-Student's criterion	p
EG (n=15)	-4,7±1,47	-4,47±1,17	0,23	0,124	p>0,05
CG(n=15)	3,47±3,69	4,73±3,42	0,83	0,252	p>0,05

Table 10. Comparison of indicators of flexibility development during the experiment between EG and CG (left split, cm)

Sex	Groups	Before experiment	t	p	After experiment	t	p
Girls	EG(n=15)	-4,7±1,47	2,071	p>0,05	-4,47±1,17	2,546	p<0,05
	CG (n=15)	3,47±3,69			4,73±3,42		

The next indicator was measured transverse twine, see. At the beginning of the experiment, the groups were homogeneous, the difference is not reliable. At the end of the experiment, the indicators did not change much in the experimental group, on the other hand, in CG the changes are more significant and the difference is reliable. That is, classes on aerial canvases and pylon have a positive effect on the development of the hip joint (Table 11, Table 12)

Table 11. Development of flexibility in EG and CG during the experiment (transverse split, cm)

Participants of experiment	Before experiment	After experiment	Indicator changes	t-Student's criterion	p
EG (n=15)	-5,6±1,83	-2,73±1,39	2,87	1,945	p>0,05
CG(n=15)	0,6±2,61	3,0±2,29	2,4	2,546	p<0,05

Table 12. Comparison of indicators of flexibility development during the experiment between EG and CG (transverse split, cm)

Sex	Groups	Before experiment	t	p	After Experiment	t	p
Girls	EG (n=15)	-5,6±1,83	1,945	p>0,05	-2,73±1,39	2,145	p>0,05
	CG (n=15)	0,6±2,61			3,0±2,29		

V. Conclusions.

Thanks to the conducted research, a significant impact on the development of flexibility and strength endurance was determined in both groups. Nevertheless, the experimental program almost did not affect the development of back flexibility, as well as the flexibility of the hip joint of the leg, which allows us to draw conclusions about the need to improve the program and eliminate such shortcomings. Nevertheless, we can say that the program has a positive effect on the development of the performers' physical qualities. Thus, the pedagogical experiment makes it possible to determine the positive impact of a complex program of physical and technical training on strength endurance, flexibility of the hip joint, as well as on the development of their technical training when working on tools, choreographic, acrobatic capabilities.

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There are no conflicts of interests in the research.

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