

**DETERMINATION OF THE INFLUENCE OF THE EXPERIMENTAL  
PROGRAM OF BASIC ELEMENTS ON THE FORMATION OF THE  
FACTOR STRUCTURE OF THE ASSIMILATION OF SPORTS  
ACROBATICS BY YOUNG NOVICE ATHLETES**

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**Purpose:** to study the influence of the experimental program on the formation of the factor structure of mastering the basic elements of the technique of young acrobats 6-7 years old.

**Material and methods:** the study involved young novice acrobats 6-7 years old school №4 in the amount of 19 people (10 guys and 9 girls). General and specific physical exercises and psychophysiological characteristics were used as tests. The factor analysis of the calculation was used, which was carried out by the statistical method developed and presented in the works of S. Spearman and G. Thompson.

**Results:** the conducted factor analysis made it possible to determine a number of factors that determine the quality of mastering the basic elements of sports acrobatics techniques by young athletes of 6-7 years old.

**Conclusions:** it was found that in the process of applying the experimental program, a redistribution of factors was carried out: 4 groups of factors were identified: psychophysiological, general preparatory, specially preparatory and others

in basic exercises ("swallow", "bridge", "standing on the shoulder blades", "forward roll", "wheel") in the direction of performing special preparatory exercises.

**Keywords:** sports acrobatics, basic exercises, young acrobats.

## **Introduction**

The level of development of modern acrobatics is characterized by exceptionally high sports achievements, a significant increase in competition among athletes, which necessitates the search for new ways to improve training, especially for novice athletes, in particular, when physical and technical readiness is formed.

When mastering individual elements of the technique, it is necessary to achieve a certain level of physical qualities, without which their implementation is impossible or there is a threat of mastering movements with significant errors, which will negatively affect their structural quality. To date, there are studies of Koval S.S. (2010), Kharchenko T.P., Mulik V.V. (2009) [5, 11] about mastering the complex development of motor qualities and mastering the elements of technique in young athletes at the stage of initial training in figure skating and football, which gave a positive effect.

Today there are several approaches to teaching individual elements of technology: start learning from simple and more complex elements [2, 4, 12, 14]; training should be carried out at the beginning of the lesson [1, 6, 13]; use special training exercises, etc. [3, 15].

The problem of evaluating the technique of performing any competitive exercise is a primary task in any kind of sports and professional labor activity. Its essence lies in the fact that it is necessary not only to determine the movement of the body or individual biokinematic links, but to carry out these actions with minimal energy consumption. The availability of modern technology has greatly simplified the solution of this kind of problem [8, 10].

This problem and its solution can be considered by the example of determining the level of mastering the basic elements of acrobatics at the initial stage of the

training process. At the heart of all types of acrobatics is the individual mastering of the basic elements of the technique of such exercises as: "swallow", "stand on the shoulder blades", "forward roll", "bridge". One of the objectives of the study was to establish a correlation between the use of each exercise for mastering the technique of basic elements. At the same time, the position was taken into account that for the effective mastering of basic elements, special preparatory exercises should correspond in terms of the structure of movement, the structure of efforts and the mechanisms of forming a united functional system that ensures their implementation [7, 9, 11, 12].

Therefore, the sequence and combination of the use of exercises for mastering the individual basic elements of acrobatics was established. At the initial stage, first of all, it is required to master the structure of movements (both in static poses and in the dynamics of execution), and the structure of efforts while holding the poses. Only after mastering the individual components of special poses is it possible to switch to dynamic efforts during the performance of first individual exercises, and then in combination. In this regard, it became necessary to determine motor actions and motor qualities at the expense of individual muscle groups, as well as the level of their manifestation when performing a separate exercise.

*Connection with scientific programs, plans, themes.* The study was carried out in accordance with the initiative theme of research work for 2016-2020. under the title "Psycho-sensory regulation of motor activity of athletes in situational sports" (state registration number № 0116U008943). The role of the author in the completed topic was to substantiate the methodology for mastering the basic elements of the technique of young acrobats at the initial stage of training.

**Purpose of the study** is to develop and experimentally implement programs for mastering the basic elements of acrobatics techniques by beginner athletes 6-7 years old.

### **Material and Methods of research**

Factor analysis was carried out on the basis of the stage of control tests. The obtained data, which serve as the basis for correlation analysis, is a measure of the

static relationship of two or more variables. At the same time, the classical Bravais-Pearson correlation coefficient is intended to characterize the tightness of communication in a two-dimensional distribution and a linear relationship between the studied indicators. Thus, correlation analysis is the starting material for factor analysis, the greater the value of  $r$ , the greater the tightness of the relationship between the features. Factor analysis consists in converting the intercorrelation matrix of tests into a matrix of factorial loads of lower dimension. Most often, when conducting factor analysis, the processing of the correlation matrix by the method of principal components is used, and the procedure for isolating the principal components is basically similar to rotation, which maximizes the variance (varimax) of the original space of variables.

### **Results of the research**

The conducted factor analysis allowed to determine a number of factors that determine the quality of mastering the basic elements of sports acrobatics by young athletes of 6-7 years old. So, by the beginning of the study, four groups of factors were identified that characterize the formation of the exercise "swallow" (Table 1).

The most significant is the psychophysiological factor (factor 1), the indicators of which affect the performance of the "swallow" and amount to 42,7% (Table 1) with a correlation level of indicators of 0,64-0,88.

The second factor is special-preparatory (26,0%), consisting of exercises that partially correspond to the structure of movements of this exercise with an average level of correlation. ( $t=0,42-0,64$ ).

The third factor - general physical fitness (20,2%) includes exercises that have below the average level of correlation ( $t=0,36-0,40$ ) of the influence of these exercises on the performance of the "swallow" exercise.

The fourth factor is made up of scattered other indicators (psychological, coordination and others) in the amount of 11,1% with an insignificant level of correlation of the impact on the performance of the specified exercise.

After the introduction of the author's program, the interest was redistributed for each of the factors (Table 2). Thus, the first factor (psychophysiological) decreased to

35,7%, which is 7,0% less, while the second factor (special training) increased to 35,0% (+ 9,0%), and the contribution of general physical training (the third factor) changed significantly (from 20,2% to 19,1%), as well as the fourth factor (other indicators), decreased to 10,2% of the total sample.

*Table 1*

**Factor structure of the formation of the basic exercise of sports acrobatics "Swallow" novice athletes, at the beginning and end of the study**

№	Indicators		F1	F2	F3	F4
1	Flexion and extension of the arms in the lying position	at the beginning			0,36	
		at the end			0,34	
2	Flexion and extension of the legs, keeping the angle in the hanging with the back to the gymnastic wall	at the beginning			0,38	
		at the end			0,36	
3	Long jump from a place with a push of both legs	at the beginning			0,40	
		at the end			0,38	
4	Bend forward while sitting on the floor with legs apart	at the beginning			0,39	
		at the end			0,39	
5	Running for 30m	at the beginning			0,28	
		at the end			0,29	
	Swing your leg while facing the gymnastic wall	at the beginning		0,42		
		at the end		0,56		
7	Maintaining balance, standing on one leg against the gymnastic wall	at the beginning		0,56		
		at the end		0,59		
8	Maintaining balance, standing on one leg from 3-4 s to 10-12 s	at the beginning		0,64		
		at the end		0,66		
9	Balance on two legs with closed eyes	at the beginning		0,48		
		at the end		0,54		
10	Balance on one leg with closed eyes	at the beginning		0,60		
		at the end		0,62		
11	Romberg's test is complicated	at the beginning	0,64			
		at the end	0,62			
12	Test Biryuk	at the beginning	0,68			
		at the end	0,66			
13	Equilibrium "swallow"	at the beginning	0,88			
		at the end	0,88			
14	Vestibular dynamic test	at the beginning	0,65			
		at the end	0,60			
15	Dynamic balance 1	at the beginning	0,60			
		at the end	0,58			
16	Dynamic balance 2	at the beginning	0,65			
		at the end	0,61			
17	Vestibular dynamic test	at the beginning	0,31			
		at the end	0,32			
%		at the beginning	42,7	26,0	20,2	11,1
		at the end	35,7	35,0	19,1	10,2

During the exercise "bridge", three main factors were formed. The most significant exercises of special physical training (37,6%), the components of psychophysiological training are 33.4%, general physical training – 18,3%, and other indicators – 10,7% (Table 2).

*Table 2*

**The factor structure of the formation of the basic exercise of sports acrobatics "Bridge" of novice athletes at the beginning and end of the study**

№	Indicators		F1	F2	F3	F4
1	Flexion and extension of the arms in the lying position	at the beginning			0,41	
		at the end			0,40	
2	Flexion and extension of the legs, keeping the angle in the hanging with the back to the gymnastic wall	at the beginning			0,43	
		at the end			0,41	
3	Long jump from a place with a push of both legs	at the beginning			0,27	
		at the end			0,26	
4	Bend forward while sitting on the floor with legs apart	at the beginning			0,34	
		at the end			0,32	
5	Running for 30m	at the beginning			0,26	
		at the end			0,27	
6	Swing your leg while facing the gymnastic wall	at the beginning		0,56		
		at the end		0,76		
7	Maintaining balance, standing on one leg against the gymnastic wall	at the beginning		0,54		
		at the end		0,58		
8	Maintaining balance, standing on one leg from 3-4 s to 10-12 s	at the beginning		0,60		
		at the end		0,72		
9	Balance on two legs with closed eyes	at the beginning		0,58		
		at the end		0,74		
10	Balance on one leg with closed eyes	at the beginning		0,64		
		at the end		0,72		
11	Romberg's test is complicated	at the beginning	0,54			
		at the end	0,52			
12	Test Biryuk	at the beginning	0,62			
		at the end	0,60			
13	Equilibrium "swallow"	at the beginning	0,40			
		at the end	0,41			
14	Vestibular dynamic test	at the beginning	0,47			
		at the end	0,45			
15	Dynamic balance 1	at the beginning	0,49			
		at the end	0,47			
16	Dynamic balance 2	at the beginning	0,51			
		at the end	0,50			
17	Vestibular dynamic test	at the beginning	0,41			
		at the end	0,43			
%		at the beginning	33,4	37,6	18,3	10,7
		at the end	27,9	43,8	18,2	10,1

The introduction of an experimental program for mastering the technique of performing the exercise of "bridges" to a greater extent increased the significance of special physical training exercises, which reached 43,8% (at the beginning of 37,6%) due to a decrease in the contribution of psychophysiological indicators (from 33,4% to 27,9 %) and general preparatory exercises, which remained at the same level (18,3 and 18,2%) (Table 2). Our indicators, which are not included in the first three factors, also underwent changes (from 10,7 to 10,1), which indicates a more specialized influence of the experimental method.

The stand on the shoulder blades requires the manifestation of the strength qualities of the muscles of the lower extremities and the abdominal press, as well as coordination of movements. At the beginning of the study, the psychophysiological parameters associated with maintaining the stand on the shoulder blades had the greatest contribution to the performance of this exercise. This especially concerns the performance of the Romberg ( $r=0,02$ ) and Biryuk ( $r=0,64$ ) and dynamic equilibrium ( $r=0,63$ ) tests included in factor 1 ( $r=0,58$ ; 37,0%) of total (Table 3). The second factor (special-preparatory) was formed by the indicators of special exercises ( $r=0,50$ ; 31,3%), and the third factor (general-preparatory) was formed by exercises that, in their structure of movements, do not correspond to individual elements of the specified special-preparatory exercise ( $r=0,36$ ; 11,6%) The remaining indicators, not included in the first three factors, were 11,6%.

The introduction of the experimental technique did not have a significant impact on the formation of the factor structure that affects the implementation of the "stand on the shoulder blades" (Table 3).

The first factor (psychophysiological) is more significant, the indicators of which have a significant impact on the coordination of movements ( $r=0,58$ ; 35,2%). The contribution of the second factor slightly increased (from 31,3% to 33,0%), leaving the third factor at the level of 20,4%, and the rest of the indicators – by 11,4%.

Performing the "forward rol" exercise depends mainly on the work of the vestibular analyzer, therefore the first factor consists of psychophysiological

indicators ( $r=0,56$ ; 36,9%) (Table 4). The average group indicator of the special preparatory factor is  $r=0,51$  (31,6%), and the general preparatory factor is 0,36 (20,05). The rest of the indicators are 11,5%.

*Table 3*

**The factor structure of the formation of the basic exercise of sports acrobatics "Stand on the shoulder blades" ("Birch") of novice athletes at the beginning and end of the study**

№	Indicators		F1	F2	F3	F4
1	Flexion and extension of the arms in the lying position	at the beginning			0,35	
		at the end			0,36	
2	Flexion and extension of the legs, keeping the angle in the hanging with the back to the gymnastic wall	at the beginning			0,41	
		at the end			0,44	
3	Long jump from a place with a push of both legs	at the beginning			0,37	
		at the end			0,36	
4	Bend forward while sitting on the floor with legs apart	at the beginning			0,39	
		at the end			0,41	
5	Running for 30m	at the beginning			0,27	
		at the end			0,27	
6	Swing your leg while facing the gymnastic wall	at the beginning		0,32		
		at the end		0,34		
7	Maintaining balance, standing on one leg against the gymnastic wall	at the beginning		0,48		
		at the end		0,52		
8	Maintaining balance, standing on one leg from 3-4 s to 10-12 s	at the beginning		0,49		
		at the end		0,50		
9	Balance on two legs with closed eyes	at the beginning		0,58		
		at the end		0,64		
10	Balance on one leg with closed eyes	at the beginning		0,65		
		at the end		0,67		
11	Romberg's test is complicated	at the beginning	0,62			
		at the end	0,62			
12	Test Biryuk	at the beginning	0,64			
		at the end	0,63			
13	Equilibrium "swallow"	at the beginning	0,51			
		at the end	0,50			
14	Vestibular dynamic test	at the beginning	0,52			
		at the end	0,54			
15	Dynamic balance 1	at the beginning	0,60			
		at the end	0,60			
16	Dynamic balance 2	at the beginning	0,63			
		at the end	0,62			
17	Vestibular dynamic test	at the beginning	0,52			
		at the end	0,53			
%		at the beginning	37,0	31,3	20,1	11,6
		at the end	35,2	33,0	20,4	11,4



The use of a specialized program largely influenced the formation of the second factor, the indicators of which increased from 31,6% to 33,0%, but the first (psychophysiological) factor remained the leading factor (36,9 and 36,7%). At the same time, the general preparatory factor and other indicators decreased from 20,0% to 19,2% from 11.5% to 11,1% (Table 4).

*Table 4*

**The factor structure of the formation of the basic exercise of sports acrobatics "forward roll" of novice athletes athletes as of the beginning and end of the study**

№	Indicators		F1	F2	F3	F4
1	Flexion and extension of the arms in the lying position	at the beginning			0,34	
		at the end			0,31	
2	Flexion and extension of the legs, keeping the angle in the hanging with the back to the gymnastic wall	at the beginning			0,40	
		at the end			0,38	
3	Long jump from a place with a push of both legs	at the beginning			0,36	
		at the end			0,32	
4	Bend forward while sitting on the floor with legs apart	at the beginning			0,42	
		at the end			0,40	
5	Running for 30m	at the beginning			0,26	
		at the end			0,25	
6	Swing your leg while facing the gymnastic wall	at the beginning		0,38		
		at the end		0,45		
7	Maintaining balance, standing on one leg against the gymnastic wall	at the beginning		0,46		
		at the end		0,48		
8	Maintaining balance, standing on one leg from 3-4 s to 10-12 s	at the beginning		0,60		
		at the end		0,66		
9	Balance on two legs with closed eyes	at the beginning		0,58		
		at the end		0,68		
10	Balance on one leg with closed eyes	at the beginning		0,52		
		at the end		0,56		
11	Romberg's test is complicated	at the beginning	0,54			
		at the end	0,60			
12	Test Biryuk	at the beginning	0,52			
		at the end	0,58			
13	Equilibrium "swallow"	at the beginning	0,48			
		at the end	0,46			
14	Vestibular dynamic test	at the beginning	0,63			
		at the end	0,68			
15	Dynamic balance 1	at the beginning	0,60			
		at the end	0,68			
16	Dynamic balance 2	at the beginning	0,62			
		at the end	0,66			
17	Vestibular dynamic test	at the beginning	0,56			
		at the end	0,60			
%		at the beginning	36,9	31,6	20,0	11,5
		at the end	36,7	33,0	19,2	11,1

Table 5

**The factor structure of the formation of the basic exercise of sports acrobatics "Wheel" of novice athletes at the beginning and at the end of the study**

№	Indicators		F1	F2	F3	F4
1	Flexion and extension of the arms in the lying position	at the beginning			0,50	
		at the end			0,51	
2	Flexion and extension of the legs, keeping the angle in the hanging with the back to the gymnastic wall	at the beginning			0,46	
		at the end			0,48	
3	Long jump from a place with a push of both legs	at the beginning			0,42	
		at the end			0,40	
4	Bend forward while sitting on the floor with legs apart	at the beginning			0,41	
		at the end			0,40	
5	Running for 30m	at the beginning			0,29	
		at the end			0,28	
6	Swing your leg while facing the gymnastic wall	at the beginning		0,41		
		at the end		0,43		
7	Maintaining balance, standing on one leg against the gymnastic wall	at the beginning		0,61		
		at the end		0,62		
8	Maintaining balance, standing on one leg from 3-4 s to 10-12 s	at the beginning		0,60		
		at the end		0,61		
9	Balance on two legs with closed eyes	at the beginning		0,58		
		at the end		0,64		
10	Balance on one leg with closed eyes	at the beginning		0,56		
		at the end		0,58		
11	Romberg's test is complicated	at the beginning	0,65			
		at the end	0,65			
12	Test Biryuk	at the beginning	0,62			
		at the end	0,63			
13	Equilibrium "swallow"	at the beginning	0,60			
		at the end	0,56			
14	Vestibular dynamic test	at the beginning	0,66			
		at the end	0,67			
15	Dynamic balance 1	at the beginning	0,62			
		at the end	0,64			
16	Dynamic balance 2	at the beginning	0,65			
		at the end	0,67			
17	Vestibular dynamic test	at the beginning	0,53			
		at the end	0,56			
%		на початок	40,3	28,8	21,4	10,2
		на кінець	40,8	29,3	21,3	8,6

The most difficult exercise to perform is the "Wheel", during which motor activity involves the movement of different parts of the body in space (Table 5). Therefore, the first factor takes the leading place (40,3%) in the formation of the dynamic structure of movements. Through the use of Romberg's tests ( $r=0,65$ ) and

Biryuk ( $r=0,62$ ), as well as the vestibular-static test ( $r=0,66$ ) and dynamic balance 1 ( $r=0,62$ ) and dynamic equilibrium 2 ( $r=0,65$ ). Factor 2 (special preparatory) has an average correlation index  $r=0,55$  and 28,8% of the total variance. General preparatory (factor 3) has 21,4%, and other indicators – 10,2% of the total variance.

The use of the experimental technique left the significance of the factors at the same level (the first factor – 40,3 and 40,8%), the second – 28,8 and 29,3%; the third – 21,4 and 21,3%. Along with this, the content of other factors decreased – from 10,2 to 8,6% (Table 5).

### **Conclusions / Discussion**

In the course of the study, it was found that under the influence of the experimental methodology, the percentage of factors that determine the quality of mastering the basic elements of sports acrobatics by young athletes of 6-7 years old were reorganized.

In the exercise "Swallow" at the beginning of the study, factor 1 (psychophysiological) was 42,7%, factor 2 (special preparatory) – 26,0%, factor 3 (general physical fitness) – 20,2%, factor 4 (other indicators) – 11,1%. By the end of the study, factor 1 was 35,7%, factor 2 – 35,0%, factor 3 – 19,1%, factor 4 – 10,2 %.

In the exercise "Bridge": factor 1 – 33,4% at the beginning of the study, 27,9% at the end of the study; factor 2 – 37,6% and 43,8%, respectively; factor 3 – 18,3% and 18,2%, respectively; in factor 4 – 10,7% and 10,1%, respectively.

In the exercise "Stand on the shoulder blades": factor 1 – 37,0% and 35,2%; factor 2 – 31,3% and 33,0%; factor 3 – 20,1% and 20,4%; factor 4 – 11,6 % and 11,4 %.

In the "Forward roll" exercise: factor 1 – 36,9% and 36,7%; factor 2 – 31,6% and 33,0%; factor 3 – 20,0% and 19,2%; factor 4 – 11,5% and 11,1%.

In the exercise "Wheel": factor 1 - 40.3% and 40.8%; factor 2 – 28,8% and 29,3%; factor 3 – 21,4% and 21,3%; factor 4 – 10,2% and 8,6%.

Thus, the use of special auxiliary exercises for each basic exercise contributed to an increase in the value of the factor that determines special physical preparedness (factor 2).

**Prospects for further research.** The obtained results make it possible to purposefully use separate special-preparatory exercises when constructing training in basic acrobatic exercises for young novice athletes.

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