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Research article

CONTROL AND EVALUATION OF SPORTS PREPARATION OF 13–16-YEAR-OLD MALE COMPETITORS IN ARTISTIC GYMNASTICS

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ABSTRACT

This study was conducted to make changes to improve the system for assessing special physical and technical preparation. These changes applied to competitors aged 13–16 in artistic gymnastics. The age (13–16) covers a very important period in the gymnasts’ many years of sports training. These periods were targeted sports training and a period of sports improvement. Along with age-related development and changes in gymnasts’ psychological characteristics, their training was restructured entirely during these periods. At this age (13–16), the training process moved to a new, higher quality level. This level is characterized by the study of more complex exercises, connections, and entire combinations. Also, profound changes were observed in the training load in terms of volume and intensity as basic indicators of the training load. This implies a high level of physical qualities of gymnasts, which must be monitored and evaluated promptly. All this has also required optimizing the change methods known to date for controlling and assessing competitors’ preparation during these periods. In terms of sports training, according to famous authors, specialized physical and technical training was particularly important. That is why the subject of this study was how to control and successfully evaluate the indices, providing information about the level of technical and physical training at every moment of the gymnasts’ sports preparation. Furthermore, the unified program and methodology for training and practice in artistic gymnastics for men in the Republic of Bulgaria were established in 1987 (Yordanov, D. et al., 1987) and now require updating to address contemporary challenges faced by gymnasts.

Purpose of the study. After a long period during which 298 gymnasts were tested, changes were made to the system for the control and assessment of special physical and technical sports preparation by optimizing the existing normative tables (50-grade scale) and changing the indices.

Methodology. The research methods used were testing and registering the indices, subsequent statistical analyses, such as variance analysis, and the sigma method.

Expected results. The results of the study would help artistic gymnastics specialists in their practical work by enabling the preparation of gymnasts to be qualitatively evaluated and controlled at every moment of sports preparation, as well as enriching their theoretical preparation with upgraded normative tables.

Keywords: artistic gymnastics, specific physical and technical preparation, evaluation, upgraded normative tables.

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INTRODUCTION

In the modern development of artistic gymnastics, rational management of the training process is becoming increasingly important. According to Antsiperov (2008), achieving high technical and physical standards for gymnasts is becoming increasingly complex and time-consuming. A scientific, systemic, struc-

tural approach is needed in process management, one that “explores one of the main characteristics of the system – the structure with its elements and the interaction between structure and system” (Andreev, 2010). During the process of sports training, this would be reflected in a high level of motor (physical) qualities and in the performance of exercises with perfect

technique. Also, "...an important condition for shortening the path to high sportsmanship was the search and application in practice of more effective training methods" (Angelov, 2010). This has especially applied to methods for controlling and assessing gymnasts' technical and physical preparation at each stage of their training. Potop (2015), summarizing the opinions of various authors, concludes that "the concept of training high-class gymnasts (as a long-term controlled process) should be based on the unity of organizational, programmatic, and methodological foundations, material and technical equipment of the process. It can also be implemented through the systematic and integrated use of specific training methods. All this is carried out in combination with pedagogical and biological control". According to other authors (Terekhina, Borisenko, Kovrizhnykh, 2016), "objective assessment of all aspects of athletes' preparedness and functional systems of the body has always been the main goal of control," Hadjiev (1979), Hadjiev et al. (2011) express the opinion that the technical preparation of gymnasts was inextricably linked to physical preparation, which provided the basis on which gymnasts were able to perform the most difficult exercises and also competitive routines.

Based on control tests conducted over different years, Umarov and Eshtaev (2004, 2005, 2008, 2012) noted that intensifying special physical preparation would significantly enhance the development of gymnasts' basic motor qualities, despite a reduction in training time. This also allowed us to increase the time for mastering new, most complex exercises and combinations of gymnastics elements. This very important connection between the technique and conditioning of gymnasts required that their training be planned over a long period of time, Smolevski, Gaverdovski (1999); Gaverdovski (2002); Petrova (2022).

The level of technical abilities and physi-

cal qualities was determined primarily through testing the gymnasts with various tests, which allowed them to be evaluated, their work planned and controlled at all periods and stages of preparation. The control and assessment of technical abilities in the training of gymnasts was carried out using various methods - biomechanical analysis of the technique (Andonov, 1985); method of ultra-urgent information through video control (Botova, and Mulkhmetova, 2017); modeling of movements (Kyuchukov, 2023; Soya & Zhuk, 2014; Zagrevskiy, 2000); competition method and control training in terms of the quality of competition routines (Umarov, 2022; Arkaev, 1997) and last but not least, the results of competitions, which provide a final expert assessment of the overall preparation of the competitors (Platonov, 2004). Authors such as Fink (2016), Hofmann (2016), Fink et al. (2021), Stan et al. (2003), and Sergiev (2019) proposed a number of tests for the control and assessment of specialized physical and technical preparation in artistic gymnastics.

The aim of the research was to update the system for control and evaluation of 13–16-year-old male gymnasts' special technical and physical preparation. The main *tasks* were to select suitable tests and methods for evaluating special physical preparation and to conduct testing with competitors. At the end of the study, a 50-grade scale was developed to evaluate special technical and physical preparation.

Object of the research: special technical and physical preparation. *Subject* of the research: The different indices (tests) that gave us information about the level of special technical and physical preparation.

METHODOLOGY

Organization of the research

We presented the organization of the research along its different stages, which follow

the above-mentioned tasks:

Stage one – 1.01.2015 – 1.03.2015: During this stage, we analyzed and selected the tests needed for the quality evaluation of the special physical preparation. The analysis and selection of the special physical preparation tests (14 tests) were based on the level of modern artistic gymnastics and the requirements competitors face in executing exercises on the different apparatuses.

Stage two – 2.03.2015 – 1.06.2019. During this stage, we conducted testing with competitors from all 13- to 16-year-old age groups. To evaluate special physical preparation, 60 13–16-year-old male gymnasts were tested. To assess technical preparation, we used the scores from all-around competition (the sum of 6 gymnastics apparatus – floor, pommel horse, rings, vault, parallel bars, and bar fix) from State Championships and “Bulgaria” Cups for the period from 2015 to 2019 - a total of 10 competitions. The number of participants in the study was as follows: juniors younger age - $n = 165$ competitors; juniors senior age - $n = 73$ competitors.

Stage three – 2.06.2019 – 01.09.2019.

During this stage, we analyzed the test results and designed normative tables for the control and evaluation of the different tests/indexes on a 50-grade (point) scale.

This research was conducted in compliance with all the ethical standards required for this type of research.

Research methods


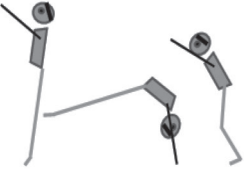



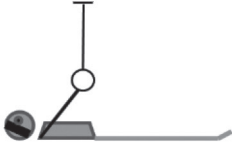
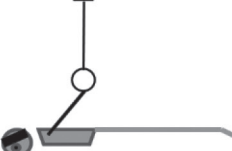
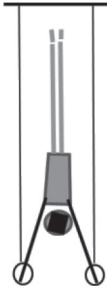
We used the following research methods: movement analysis and synthesis, sports pedagogical testing, and mathematical and statistical methods.


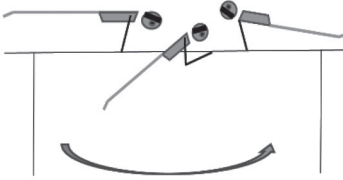
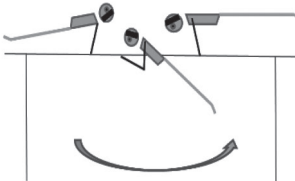
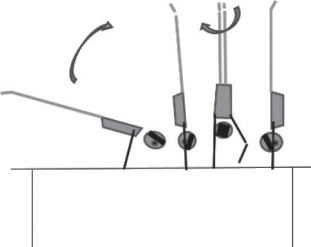
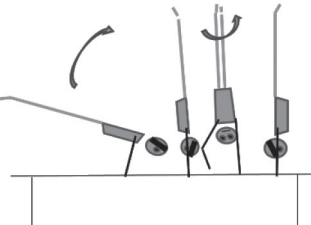
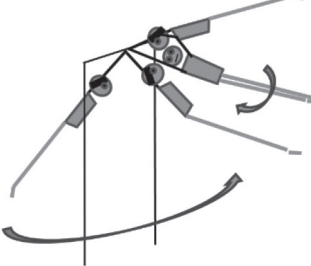
To design the normative tables, we used the sigma-digression method. According to this method for evaluating the condition of the researched subjects, the evaluated index was compared with the average level of the same index. The main characteristics used are the arithmetic mean and the standard deviation (Borukova, 2018). Tables 1 and 2 list the tests used for special physical preparation and their descriptions.

Table 1. List of indexes /tests/characterizing special physical preparation

Tests /Indexes/	Units	Accuracy of measurement	Direction of increase
1. Floor – Saltos backwards tucked (within 15 sec)	number	1.0	+
2. Floor – from standing – Back handsprings	number	1.0	-
3. Pommel horse – Circles in cross support frontways	number	1.0	+
4. Pommel horse – Scissors forward	number	1.0	+
5. Pommel horse - Circles in side support	number	1.0	+
6. Rings – Hanging scale frontways (front lever) (hold)	sec	0.01	+
7. Rings – Hanging scale rearways (back lever) (hold)	sec	0.01	+
8. Rings – Handstand (hold)	sec	0.01	+
9. Rings – V-sit. (hold)	sec	0.01	+
10. Parallel Bars – Forward uprise to support	number	1.0	+
11. Parallel Bars – Backward uprise to support	number	1.0	+
12. Parallel Bars – Swing bwd. to handstand with ½ turn	number	1.0	+
13. Parallel Bars – Swing bwd. with ½ turn backwards in handstand	number	1.0	+
14. High Bar – Swing fwd with ½ turn	number	1.0	+

Table 2. Visualization and Description of the Tests.

№	Visualization of tests	Description of the tests
1.		<p>Floor – Saltos backwards tucked From standing position, saltos backwards tucked are executed. The number of saltos performed in 15 seconds is recorded.</p>
2.		<p>Floor – from standing – Back handsprings. From standing at the beginning of the straight line of the gymnastics square (12m), consecutive and continuous back handsprings are performed to the end of the square. The number of back handsprings performed within the square (12 meters) is recorded. The goal is to cross the 12m square with the minimum number of back handsprings.</p>
3.		<p>Pommel horse – Circles in cross support frontways. A maximum number of circles is performed. The number of cross support circles is recorded.</p>
4.		<p>Pommel horse – Scissors forward. A maximum number of cross scissors is performed. The number of cross scissors is recorded.</p>
5.		<p>Pommel horse - Circles in side support. A maximum number of circles is performed. The number of cross circles is recorded.</p>
6.		<p>Rings – Hanging scale frontways (front lever) (hold). From the inverted hanging position on the rings, a slow descent to the front lever. The holding time on the scale is recorded.</p>
7.		<p>Rings – Hanging scale rearways (back lever) (hold). From the inverted hanging position on the rings, a slow descent to the back lever. The holding time on the scale is recorded.</p>
8.		<p>Rings – Handstand (hold). From the support on rings, the body is raised to a handstand. The time for holding is recorded. The stopwatch starts when the body is straight and still, and the legs are together.</p>

9.		<p>Rings – V-sit. (hold). From the support on rings, the legs are raised to a V-sit. The time for holding is recorded. The stopwatch starts when the body is still and stops when the legs fall below 30°.</p>
10.		<p>Parallel Bars – Forward uprise to support. From support after a back swing, consecutive and continuous forward uprisings are performed. The number of forward uprisings is recorded. Monitor for straight arms in the final position. If the gymnast stops the performance for any reason, the test can be continued, but he must not fall from the apparatus.</p>
11.		<p>Parallel Bars – Backward uprise to support. From support after a front swing, consecutive and continuous backward uprisings are performed. The number of backward uprisings is recorded. Monitor for straight arms in the final position. If the gymnast stops the performance for any reason, the test can be continued, but he must not fall from the apparatus.</p>
12.		<p>Parallel Bars – Swing bwd. to handstand with ½ turn. On the parallel bars sequence of swing bwd. to handstand with ½ turn must be executed. The number of repetitions of the element is recorded. Additional swings are allowed.</p>
13.		<p>Parallel Bars – Swing bwd. with ½ turn backwards in handstand. On the parallel bars sequence of swing bwd. to handstand with ½ turn backwards must be executed. The number of repetitions of the element is recorded. Additional swings are allowed.</p>
14.		<p>High Bar – Swing fwd with ½ turn. On the high bar sequence of swing fwd with ½ turn must be executed. The number of repetitions of the elements is recorded. Additional swings between the repetitions are not allowed. The perfect technique of execution is monitored – the body must be straight or slightly bent during the turn. The test must be terminated in case of rough execution of the turns and lack of amplitude.</p>

RESULTS AND DISCUSSION

The unified programme and methodology for training and practice in artistic gymnastics for men, introduced in 1987 (Yordanov, D. et

al, 1987), includes the following tests for the 13–16-year age group:

1. Parallel Bars - Piked body, straight arms press to handstand with straddle legs

2. Parallel Bars - straight body, bent arms, press to handstand.
3. Parallel Bars - from upper arms hang, legs rise to V- upper arms support, legs horizontal.
4. Rings - Cross for 15- and 16-year-olds
5. Rings - Inverted cross for 16-year-olds
6. Rings – Hanging scale frontways (front lever)
7. Floor - From standing, Long jump from two legs
8. Jump upward from the supine position through a squat
9. Parallel Bars – Forward uprising to support.
10. Pommel horse - Circles in side support for 14-, 15-, and 16-year-olds
11. Floor - Shuttle for 14-, 15-, and 16-year-olds

From the test battery, it can be seen that tests № 6, 9, and 10 are part of the 1987 unified

program for evaluating special physical preparation. The other tests are designed to provide general physical preparation for 13–16-year-olds. With the addition of further tests (Table 2), we believe the system for monitoring and evaluating gymnasts in this age group will be optimized to address the new challenges athletes face today.

Table 3 shows the variation analysis of the results of the special physical training tests. We were primarily interested in analyzing the coefficient of variation (V%), which indicates the homogeneity of the group. According to the coefficient of variation, the group was strongly non-homogeneous ($V > 20\%$) along all tests. Taking the range ($R = \max - \min$) into account, we could say this allows for an accurate design of normative tables that can include both low and high results.

Table 3. Variation analysis of the indices of special physical preparation – 13–16-year-old gymnasts.

№	Indexes/Parameters	Mean	SD	V%	Min	Max	As	Ex
1.	Floor – Saltos backwards tucked	10.67	2.73	25.63	0	15	-1.97	7.45
2.	floor – from standing – Back handsprings Pommel horse – Circles in cross support	6.20	1.30	20.92	4	9	0.72	-0.22
3.	frontways	29.30	9.56	32.64	7	50	-0.16	0.35
4.	Pommel horse – Scissors forward	31.40	11.16	35.54	6	70	0.92	4.51
5.	Pommel horse - Circles in side support	28.80	5.86	20.34	18	42	0.60	0.02
6.	Rings – Hanging scale frontways (front lever) (hold)	2.21	3.03	137.24	0	15	2.78	10.43
7.	Rings – Hanging scale rearways (back lever) (hold)	9.67	5.65	58.42	2	28	1.58	3.36
8.	Rings – Handstand (hold)	20.81	11.68	56.13	2	49	0.56	-0.15
9.	Rings – V-sit. (hold)	29.57	10.45	35.35	11.4	62.62	0.93	2.35
10.	Parallel Bars – Forward uprising to support	18.63	6.61	35.50	5	30	0.00	-0.64
11.	Parallel Bars – Backward uprising to support	15.93	5.54	34.77	6	31	0.39	0.67
12.	Parallel Bars – Swing bwd. to handstand with ½ turn	7.60	4.20	55.24	1	18	0.72	0.67
13.	Parallel Bars – Swing bwd. with ½ turn bwd in handstand	2.47	2.49	100.85	0	9	0.94	0.31
14.	High Bar – Giant swing bwd with ½ turn	11.47	6.32	55.14	3	30	1.26	1.96

Note. Bold indicates the values of $As > As_a$ and $Ex > Ex_a$.

Table 4 shows the results of the variation analysis of technical preparation. For the first group, Juniors, younger age (13–14-year-olds),

the coefficient of variation (V%) showed that the group was relatively homogeneous, it was between 10% - 20%, while for the 2nd group

(juniors, senior age (15–16-year-olds), according to the coefficient of variation (V%) - the sample was homogeneous. V% ranged from 0% to 10%. As with the indexes for special physical training, so with technical prepara-

tion: considering the Min and Max values from the variation analysis, we can say that we have low and high results, which helped create the normative tables.

Table 4. *Variation analysis of the indices of special technical preparation – 13–16-year-old gymnasts.*

№	Age groups	Mean	SD	V%	Min	Max	As	Ex
1.	Juniors, younger age (13-14-year-olds)	67.74	9.09	13.42	43.5	89.35	0.05	-0.28
2.	Juniors, senior age (15-16-year-olds)	65.14	6.15	9.44	52.55	78.3	-0.21	-0.52

The specifications for each index for special physical and technical preparation were shown in Tables 5 and 6. They were distributed on a 50-grade scale. The competitor receives a certain number of points for each achievement.

The sigma method for evaluation enabled the quantitative evaluation of the condition of the researched indices. The values were calculated based on the average level for each of the researched combinations, which served as a prerequisite for designing specification tables for controlling sports preparation. The received values are specified and presented in a 50-grade point system (from 1.0 to 50.0, with 1.0 in between). This enabled the comparison of achievements across different tests and indexes, measured in sec, m, kg, number, etc. The average level was 25 points. If a higher quality (e.g., time to run a distance) corresponds to a lower value of the result along a given index, the scale is reversed (Tsarova, 2013; Borukova, 2018).

The normative tables allowed us to quickly evaluate an individual on a particular index immediately after testing. Also, the 50-grade point system enabled the evaluation of a smaller increase in achievement, which, on the one hand, practically facilitated optimal management of the training process and, on the other hand, positively influenced athletes' motivation. For example: test № 6 – if the competitors have achieved a result of 7.01 sec, they get

41 points. If needed, the results from the tests were made even in favor of a competitor (in an upward direction).

There were a few options on how to calculate the total score based on all indices of special physical preparation:

- ✓ The sum of the number of points received along all indices. Thus, the maximum number of points is 700.
- ✓ The use of an average score index – mean arithmetic value – the total number of points from all the tests is divided by 14. Thus, the maximum number of points is 50.
- ✓ The third approach required more profound studies. We should establish the factor weights for each index; i.e., each index would have a different weight when calculating the total grade. However, this would be the subject of future research.

At this stage, we could successfully use the first two options to calculate the total score for evaluating the special physical and technical preparation.

To assess the special technical preparation, it is sufficient to refer to the points obtained from the specification table corresponding to the all-around result in the competition. The subject of additional research is to prepare normative tables assessing the level of technical preparation of each gymnastic apparatus from the all-around competition.

Table 5. Normative table – 13–16-year-old Male Gymnasts, special physical preparation

Points	Test 1. (n/15sec)	Test 2. (n)	Test 3. (n)	Test 4. (n)	Test 5. (sec)	Test 6. (sec)	Test 7. (sec)	Points	Test 8. (sec)	Test 9. (sec)	Test 10. (n)	Test 11. (n)	Test 12. (n)	Test 13. (n)	Test 14. (n)
50	16	4	53	59	43	9.71	22.42	50	49.81	55.70	33	30	18	9	27
49	-	-	52	58	-	9.41	21.91	49	48.65	54.65	32	29	-	-	26
48	-	-	51	57	42	9.11	21.40	48	47.49	53.61	31	-	17	8	-
47	-	-	50	55	-	8.81	20.89	47	46.33	52.56	-	28	-	-	25
46	15	-	49	54	41	8.51	20.38	46	45.17	51.52	30	-	-	-	24
45	-	-	48	53	40	8.21	19.87	45	44.01	50.47	-	27	16	-	23
44	-	-	47	52	-	7.91	19.36	44	42.85	49.43	29	26	-	7	-
43	-	-	46	51	39	7.61	18.85	43	41.69	48.38	-	25	15	-	22
42	-	-	45	50	-	7.31	18.34	42	40.53	47.34	28	25	-	-	21
41	14	-	44	49	38	7.01	17.83	41	39.37	46.29	-	24	14	-	-
40	-	-	43	48	-	6.71	17.32	40	38.21	45.25	27	24	-	6	-
39	-	-	42	47	37	6.41	16.81	39	37.05	44.20	26	-	-	-	20
38	-	-	41	45	36	6.11	16.30	38	35.89	43.16	-	23	13	-	-
37	13	5	40	44	-	5.81	15.79	37	34.73	42.11	25	-	-	-	19
36	-	-	39	43	35	5.51	15.28	36	33.57	41.07	-	21	12	5	18
35	-	-	38	42	-	5.21	14.77	35	32.41	40.02	24	-	-	-	17
34	-	-	37	41	34	4.91	14.26	34	31.25	38.98	-	20	11	-	16
33	-	-	36	40	33	4.61	13.75	33	30.09	37.93	23	-	-	-	-
32	12	-	-	39	-	4.31	13.24	32	28.93	36.89	22	-	-	4	-
31	-	-	35	38	32	4.01	12.73	31	27.77	35.84	-	19	10	-	15
30	-	-	34	36	-	3.71	12.22	30	26.61	34.80	21	-	-	-	14
29	-	-	33	35	31	3.41	11.71	29	25.45	33.75	-	18	9	-	-
28	-	-	32	34	30	3.11	11.20	28	24.29	32.71	20	-	-	-	13
27	11	-	31	33	-	2.81	10.69	27	23.13	31.66	-	17	-	-	-
26	-	-	30	32	29	2.51	10.18	26	21.97	30.62	19	16	8	-	12
25	-	6	29	31	28	2.21	9.67	25	20.81	29.57	18	-	-	-	-
24	-	-	28	30	27	2.12	9.34	24	20.02	28.76	-	15	7	-	11
23	10	-	27	29	27	2.03	9.01	23	19.23	27.95	17	-	-	-	-
22	-	-	26	28	27	1.94	8.68	22	18.44	27.14	16	14	-	-	10
21	-	-	25	27	-	1.85	8.35	21	17.65	26.33	-	-	-	2	-
20	-	-	24	26	26	1.76	8.02	20	16.86	25.52	15	13	-	-	9
19	9	-	23	25	25	1.67	7.69	19	16.07	24.71	-	-	-	-	-
18	-	-	22	24	-	1.58	7.36	18	15.28	23.90	-	-	-	-	8
17	-	-	21	23	24	1.49	7.03	17	14.49	23.09	13	11	5	-	-
16	8	-	20	22	-	1.40	6.70	16	13.70	22.28	-	-	-	-	-
15	-	-	19	21	23	1.31	6.37	15	12.91	21.47	-	10	-	-	7
14	-	-	18	20	-	1.22	6.04	14	12.12	20.66	11	-	4	-	-
13	-	8	17	19	-	1.13	5.71	13	11.33	19.85	-	-	-	-	-
12	7	-	16	18	22	1.04	5.38	12	10.54	19.04	10	-	-	-	6
11	-	-	15	17	21	0.95	5.05	11	9.75	18.23	-	9	-	-	-
10	-	-	-	16	20	0.86	4.72	10	8.96	17.42	9	-	3	1	5
9	-	-	14	15	-	0.77	4.39	9	8.17	16.61	8	8	-	-	-
8	6	-	13	14	-	0.68	4.06	8	7.38	15.80	-	7	-	-	-
7	-	9	12	13	19	0.59	3.73	7	6.59	14.99	7	-	-	-	4
6	-	-	11	12	18	0.50	3.40	6	5.80	14.18	-	6	2	-	-
5	5	-	10	11	-	0.41	3.07	5	5.01	13.37	6	-	-	-	-
4	-	-	9	10	17	0.32	2.74	4	4.22	12.56	-	-	-	-	3
3	-	-	8	9	16	0.23	2.41	3	3.43	11.75	5	5	-	-	-
2	-	-	7	8	-	0.14	2.08	2	2.64	10.94	4	4	-	-	-
1	4	10	6	5	15	0.05	1.75	1	1.85	10.13	3	4	1	-	2

Table 6. Normative table – 13–16-year-old Male Gymnasts, technical physical preparation – all-around competition.

Points	Juniors younger age (13–14-year-old) all-around	Juniors senior age (15–16-year-old) all-around
50	90.49	80.39
49	89.58	79.78
48	88.67	79.17
47	87.76	78.56
46	86.85	77.95
45	85.94	77.34
44	85.03	76.73
43	84.12	76.12
42	83.21	75.51
41	82.30	74.90
40	81.39	74.29
39	80.48	73.68
38	79.57	73.07
37	78.66	72.46
36	77.75	71.85
35	76.84	71.24
34	75.93	70.63
33	75.02	70.02
32	74.11	69.41
31	73.20	68.80
30	72.29	68.19
29	71.38	67.58
28	70.47	66.97
27	69.56	66.36
26	68.65	65.75
25	67.74	65.14
24	66.83	64.53
23	65.92	63.92
22	65.01	63.31
21	64.10	62.70
20	63.19	62.09
19	62.28	61.48
18	61.37	60.87
17	60.46	60.26
16	59.55	59.65
15	58.64	59.04
14	57.73	58.43
13	56.82	57.82
12	55.91	57.21
11	55.00	56.60
10	54.09	55.99
9	53.18	55.38
8	52.27	54.77
7	51.36	54.16
6	50.45	53.55
5	49.54	52.94
4	48.63	52.33
3	47.72	51.72
2	46.81	51.11
1	45.90	50.50

In Table 7, we present the correlation between the tests for special physical preparation and technical preparation (competition results). The data from 20 of the examined gymnasts were included. The Pearson correlation

coefficient (r) was used to calculate the relationship:

- between the individual tests (in points) according to the developed normative tables and the results achieved in the all-around

competitions and on individual apparatus.
 – between the total number of points achieved by the athletes across all tests, according

to the developed normative tables, and the competition results.

Table 7. *Correlations between the tests and competition results*

	All around	Floor	Pommel horse	Rings	Volt	Par. bars	High bar
Test 3 pts.	.36	.38	.41		.40	.26	
Test 6 pts		.33					
Test 10 pts							.38
Test 12 pts			.36	.35			
Test 13 pts	.31	.33	.31				
Test 14 pts		.49				.36	
Total pts (\sum 1-14)	.23	.27	.15	.15	.03	.25	.24

As shown in Table 7, only six tests exhibit a moderate correlation, ranging from $r = .2$ to $.4$. Only in Test 14 do we observe a significant correlation ($r = .49$) with the floor exercise results, which, in our opinion, is due to random factors.

The correlation coefficient (r) shows that there is no significant, high, or very high relationship between the overall test results and the competition outcomes. This is understandable in the context of competitive routines, where performing a sequence of high-difficulty elements differs significantly from executing a single exercise as part of a test battery. Additionally, many factors affect competition results, and we cannot exclude the psychological preparation of the athletes, which becomes crucial when competitors have otherwise equal abilities.

In fact, the test battery provides more information about basic special physical preparation, the development of which is often neglected in the planning of gymnasts' training. The proposed test battery highlights the importance of this basic special physical preparation, as it is directly related to technical preparation in younger gymnasts aged 11–12. However, in gymnasts aged 13–16, basic apparatus-related physical preparation is often overlooked in training plans. This, in

turn, leads to the accumulation of errors in the execution of basic skills during subsequent stages of long-term preparation. Therefore, periodic testing of athletes with the proposed battery can help maintain their conditioning and basic technical preparation. A high level of both special and general physical preparation forms the foundation for injury prevention in artistic gymnastics. Furthermore, the proposed test battery can be refined and expanded over time by adding basic exercises, particularly in injury prevention.

The same study was conducted with 11-12-year-old gymnasts, whose results were not subjected to correlation analysis. However, because most tests (exercises) from the test battery are part of their competitive routines, stronger correlations might be expected.

Below are competitive results for several of the tested athletes:

David Huddleston – Olympian (Tokyo 2020); Parallel bars finalist at World Cup Osijek, Croatia (2021); Parallel bars finalist at World Cup Mersin, Turkey (2021).

Daniel Trifonov – Vault finalist at the Youth World Championships in Antalya, Turkey (2023); Vault and horizontal bar finalist at the Men's Challenge World Cup in Szombathely, Hungary (2024); National Champion of Bulgaria (2025).

Yordan Alexandrov – Bronze medalist on horizontal bar at the FIG World Cup in Mersin, Turkey (2022).

CONCLUSIONS

The results obtained are interesting to specialists, as they could be viewed as a database. The control and evaluation system has not been updated in this way since 1987. The test results would help update the normative tables for observing, tracking progress, and evaluating the special physical preparation. Based on the testing, collected information, and specification tables prepared, we could improve the management and evaluation of competitors' temporary special physical preparation at each stage of preparation. We would also be able to evaluate (notice) the most minor changes (increase) in the indices during the preparation, both in positive and negative aspects.

The normative table for the special technical preparation was the new one. As we said above, it was necessary to prepare normative tables assessing the level of technical preparation for each gymnastic apparatus in the all-around competition.

In conclusion, we could say that collecting more data (testing) would improve the precision of these normative tables, making them more informative. Because the researched individuals were some of the best in the age group 13-16 years, we can claim that the results from the tests could be considered model characteristics for the gymnasts of this age (13-16) as regards special technical and physical preparation.

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