

## IMPROVEMENT OF COMPREHENSIVE ASSESSMENT OF SPECIALLY TRAINED CHILDHOOD AND ADOLESCENCE GYMNASTS

Zaporozhanov V.A.<sup>1</sup>, Kochanowicz K.<sup>2</sup>, Kochanowicz A.<sup>2</sup>

Jozef Rusiecki Olsztyn University College, Poland<sup>1</sup>

Academy of Physical Education and Sports, Poland<sup>2</sup>

**Annotation.** In terms of the age of development and formation of sportsmanship athletes reliability and data set of benchmarks used in the management of the training process varies due to various circumstances. *Purpose:* to improve unit performance special psychophysical readiness gymnasts used in the management of the training process (n=38, n=44). *Material:* surveyed a group of gymnasts of children and youth of both sexes, members of the specialized sports schools for eight common indicators of psychophysical readiness. *Results:* reliability of measurements of these indicators and their information content in connection with the specific requirements of gymnastics metrically calculated using the methods of mathematical statistics. *Conclusions:* substantiated minimum set of the five most reliable informative indicators. The expediency of the calculation and use of the control system integrated assessment preparedness gymnasts, including index kinesthesia.

**Keywords:** gymnastics, control, integrated assessment, reliability, informativeness.

### Introduction

It is a common knowledge that effectiveness of pedagogic process, including children and teen agers, to a large extent is conditioned by reliability and informative character of control results, which permit to realize this process in compliance with requirements of management [1, 3, 4]. In this connection it is necessary to pay attention to purposefulness of further improvement of control indicators' system, used for diagnostic of trainees' fitness, according to specific requirements of a certain kind of sports, and for prognosis of sport potentials on further stages of training. At the same time there exists concept of diagnostic reliability of measurements and informative character of the used control indicators [3, 5]. Alongside with it in literature we can meet data that in conditions of sportsmanship's mastering by trainees specific informative character of one and the same control indicators substantially change [10, 19]. Underestimation of this feature of some tests and indicators results in reducing of taken management decisions' quality in process of sportsmen's many years' training, because the taken by coach decisions are based, in such cases, on insufficiently reliable information.

Alongside with it we can assume that information character of one and the same control indicators, used in everyday training process, can vary, depending on biological peculiarities of forming of children's and teenagers' motion functions in their ontogeny. These changes can be connected with sensitive character of different motion abilities' development, peculiarities of acceleration, which can likely influence on informative significance of the used indicators in conditions of children's growth. As far as the process of psycho-physical development and formation of a person is of wavelike character it can result in the fact that some control indicators, used for evaluation of trainees' condition, can have different informative character at different stages of sportsman's age progressing. This opinion was expressed, in different interpretations, by other authors as well [2, 6-9, 12-18, 20].

### Purpose, tasks of the work, material and methods

*The purpose of the research* is to improve block of indicators of gymnasts' special psycho-physical fitness, which are used in management of training process.

*The tasks of the research:*

- to metrically evaluate reliability of a number of commonly used control indicators, applied in conditions of age progressing and forming of gymnasts' sportsmanship;
- to ground informative character of these indicators in connection with specific requirements of sport gymnastic;
- to formulate complex of adequate indicators for objective evaluation of trainees' special fitness.

*The methods of the research:* we tested group of female gymnasts (n=38) of 11±4.0 years old and female gymnasts (n=44) of 12±3.2 years old, who study at children sport schools in Gdansk and Olstyn This contingent was formed in three age and qualification groups 9-10, 11-12, 13 and older years that permitted to increase identity of trainees, staff and, as a result, objectivity of marks, reliability and informative character of measurements.

Registration of control indicators was carried out in compliance with general metrological requirements, adopted in physical education and sports (see table 1). Group of control indicators included the most popular ones, which are used in practice for evaluation of gymnasts' fitness [10, 11].

So, we registered:

- speed-power abilities by value of relative force in elbow joints; time of reaching maximal force's value; keeping of maximal force value during 5 seconds (indicators 1, 2, 3); high jump from the spot on two legs (indicator 4). For registration we used strain gauge metering stand "Kettler" and strain gauge track "Globus";
- function of body balance was registered in test by Romberg before and after load at rate of seven rotations during 10 seconds around longitudinal axis of body (indicators 5, 6). For this test we used stand "Posturograf";

- time of motion response to light irritator and response of anticipation (indicators 7,8). We used computer program "Raptus".

For evaluation of the registered indicators' reliability we used method of linear correlation between results of repeated attempts (see table 1). These correlation coefficients -  $r_{tt}$  characterized compatibility of repeated measurements, i.e. reliability of every sport indicator.

For evaluation of informative character of these indicators we used method of range correlation (see table 2). With it we compared ranges of the tested in control indicators and ranges of their sportsmanship. Matrixes were calculated, considering reliability of tests' measuring (see table 1). It permitted to increase accuracy of informative character's evaluation [3, 19, 20].

*Organization of the research.* The logic of our research was built, considering the fact that sport gymnastic belongs to groups of sports with complex coordination of movements. In this case coordination skills' condition can be regarded as main, key feature. As far as human coordination of movements is of complex character, conditioned by development of speed-power qualities, specific endurance, flexibility, kinesthesia and so on, we thought that coordination skills can be evaluated objectively with the help of complex of psycho-physical condition's indicators, which to less or large extent influence on organization of sportsmen's free movements. As test criterion, which complexly reflected level of these qualities, indicator of sportsmanship can serve.

Basing on the above said, for evaluation of informative character of control indicators we used methods of correlation analysis in conditions of separated calculation of matrixes for every of sex and age group of the tested.

### Results of the researches

Reliability of control measurements of the tested of different age, sex and qualification are presented in table 1 in the form of mean groups' values of linear correlation coefficients between metrical data of repeated measurements. As far as all correlation coefficients and indicators of measurements, variety made a difficult for processing data field we discussed only mean groups' values. However, even these, generalized materials were enough for us to affirm that in the groups of the tested there were gymnasts with different level of kinesthesia that resulted in low compatibility of repeated measurements' results in some indicators (see table 1).

Table 1

*Reliability of control tests' measurements by indicator of compatibility of repeated attempts' results ( $r_{tt}$ ) of different age female gymnasts (A) and gymnasts (B)*

	Control indicators		Correlation coefficients, variety					
			9-10	V%	11-12	V%	13-16	V%
1	Relative force, Fmax, KG/kg	A	0.555	32.3	0.699	19.2	0.683	11.8
		B	0.685	29.5	0.580	21.3	<b>0.709</b>	19.3
2	Timer of reaching of Fmax, m.sec.	A	<b>0.70</b>	21.8	<b>0.788</b>	19.0	<b>0.770</b>	13.2
		B	0.375	19.9	<b>0.800</b>	11.4	<b>0.799</b>	12.1
3	Time of holding 5 cek, Fmax, m.sec.	A	0.609	22.5	<b>0.707</b>	24.0	0.713	17.7
		B	0.459	42.2	0.400	21.7	<b>0.802</b>	38.3
4	High jump from the spot, cm	A	0.413	50.0	0.590	32.5	<b>0.791</b>	19.9
		B	0.230	25.5	0.420	19.3	<b>0.870</b>	28.5
5	Stability in rest, field, mm <sup>2</sup>	A	0.379	31.0	0.598	28.3	0.700	19.6
		B	0.079	40.6	0.603	23.0	<b>0.713</b>	20.8
6	Stability after load, field, mm <sup>2</sup>	A	0.200	33.0	0.688	21.8	<b>0.706</b>	19.0
		B	0.433	49.3	0.600	33.6	<b>0.740</b>	34.6
7	Time of motion response, m.sec.	A	0.661	39.7	<b>0.703</b>	22.3	<b>0.888</b>	11.4
		B	0.500	59.0	0.444	54.2	0.699	39.1
8	Anticipation response, m.sec.	A	0.479	48.6	0.491	34.0	<b>0.911</b>	10.6
		B	0.391	43.8	0.595	18.5	0.600	19.3

When discussing these data we oriented on commonly adopted in sport metrology limits of reliability's levels of control measurements, where accessible reliability was within correlation limits 0.700-0.790; middle – 0.800-0.890; good – 0.900-0.940; excellent – 0.950-0.990.

As we can see in table 1, depending on age and qualification we notice general trend of increasing of measurements' reliability that witness about development of gymnasts kinesthesia. For example, if in group of 9-10 year old sportsmen accessible reliability was only in one indicator of female gymnasts ( $r=0.701$ ), in group of 11-12 years old sportsmen – it was in five indicators ( $r=0.699-0.800$ ), and in group of senior age sportsmen – practically in all measurements. The same situation took place in indicators of control measurement results' variety (V%), that also reflected stability of measurements and increasing of muscular sense of the trainees.

Thus, already at 11-12 years old age, with period of training of 3-4 years, practically all eight control indicators can be used for complex evaluation of trainees' special fitness. Having calculated reliability of these indicators' measurements (see table 1) we could objectively evaluate informative character of every of these indicators. I.e. we could clear up to what extent these indicators, which reflect specific motion skills, are interconnected with gymnasts' sportsmanship. These data of range correlation coefficients are presented in table 2.

Table 2

*Informative character of indicators of female gymnasts (A) and gymnasts (B) as value of ranges' correlation in tests and in sum of all round events*

	Control indicators	Sport qualification (degree)			
		III	II	I and CMS	
1	Relative force, Fmax, KG/kg	A	0.588	0.691	<b>0.810</b>
		B	0.477	0.389	<b>0.759</b>
2	Timer of reaching of Fmax, m.sec.	A	0.539	0.611	0.603
		B	0.402	0.709	<b>0.800</b>
3	Time of holding 5 сек, Fmax, m.sec.	A	0.399	0.608	0.777
		B	0.513	0.485	0.696
4	High jump from the spot, cm	A	<b>0.714</b>	<b>0.752</b>	0.699
		B	0.577	0.688	0.755
5	Stability in rest, field, mm <sup>2</sup>	A	0.493	<b>0.709</b>	<b>0.801</b>
		B	0.517	0.689	<b>0.817</b>
6	Stability after load, field, mm <sup>2</sup>	A	0.202	0.600	<b>0.828</b>
		B	0.511	0.716	<b>0.883</b>
7	Time of motion response, m.sec.	A	0.402	0.029	0.616
		B	0.093	<b>0.712</b>	0.698
8	Anticipation response, m.sec.	A	0.613	0.609	<b>0.839</b>
		B	<b>0.590</b>	0.792	<b>0.880</b>
9	Sum of ranges in tests and all round events	A	<b>0.665</b>	<b>0.853</b>	<b>0.911</b>
		B	<b>0.781</b>	<b>0.889</b>	<b>0.900</b>

As we can see in table 2, it is possible to objectively evaluate special fitness, including coordination of gymnasts of both sexes with the help of complex evaluation. Here coefficients of correlation with level of sportsmanship turned out to be the highest and were 0.853-0.911. In conditions of many years' training informative character of stability indicators of female gymnasts – 0.828 and gymnasts – 0.883 steadily raised; response of anticipation – 0.839 and 0.880; relative force in elbow joints – 0.810 and 0.759. In parallel, in these conditions mechanism of kinesthesia of the tested improved and identity of staff of age group increased by indicator of measurements' reliability. It was witnessed by expressed reduction of mean values of variation coefficients (V%) from, 37.2 in younger groups up to 17.4 – in elder ones. It proved high informative character of kinesthesia indicator in conditions of our research and purposefulness of its metrological foundation for further application in general block of control measurements.

#### **Conclusions:**

As a result of our researches, for evaluation of gymnasts' special fitness we recommend complex of five the most informative indicators, which meet specific requirements of sport gymnastic and metrological requirements of reliability and informative character. They include indicator of relative force in elbow joints; stability in test by

Romberg after rotating load around longitudinal axis of body; anticipation response to moving object; sum of ranges of the tested in this complex.

We should like to attract attention to the fact that reliability indicator in every of exercises of this block can be regarded as characterizing the status of kinesthesia, i.e. muscular sense of a sportsman. Considering specific features of gymnastic we can conclude that objective metric characteristic of kinesthesia's status can be used in system of control both for evaluation of bent to gymnastic at initial stage of training and for current and stage-by stage control. However, using of these indicators requires additional metric foundation in different conditions of pedagogic control.

#### References:

1. Bernshtejn N.A. *O lovkosti i ee razvitii* [On dexterity and its development], Moscow, Physical Culture and Sport, 1991, 276 p.
2. Volkov L.V. *Fizicheskie sposobnosti detej i podrostkov* [Physical abilities of children and adolescents], Kiev, Health, 1981, 120 p.
3. Godik M.A. *Sportivnaia metrologiia* [Sport metrology], / M.A. Годик. -М.: ФизС, - 1988.-192 с.
4. Zaciorskij V.M. *Kibernetika, matematika, sport* [Cybernetics, mathematics, sports], Moscow, Physical Culture and Sport, 1969, 199 p.
5. Liakh V.I. *Koordinacionnye sposobnosti: diagnostika i razvitie* [Coordination abilities: diagnosis and development ], Moscow, TVT Division, 2006, 290 p.
6. Baumgarten S., Pagnano-Richardson K. Educational Gymnastics. *Journal of Physical Education, Recreation & Dance*. 2010, vol.81(4), pp. 18-25. doi:10.1080/07303084.2010.10598460.
7. Bradshaw E., Hume P., Calton M., Aisbett B. Reliability and variability of day-to-day vault training measures in artistic gymnastics. *Sports Biomechanics*. 2010, vol.9(2), pp. 79-97. doi:10.1080/14763141.2010.488298.
8. Gautier G., Thouwarecq R., Larue J. Influence of Experience on Postural Control: Effect of Expertise in Gymnastics. *Journal of Motor Behavior*. 2008, vol.40(5), pp. 400-408. doi:10.3200/JMBR.40.5.400-408.
9. Griggs G., McGregor D. Scaffolding and mediating for creativity: suggestions from reflecting on practice in order to develop the teaching and learning of gymnastics. *Journal of Further and Higher Education*. 2012, vol.36(2), pp. 225-241. doi:10.1080/0309877X.2011.614929.
10. Kochanowicz K. *Basics of process control sports training in gymnastics* [Podstawy kierowania procesem szkolenia sportowego w gimnastyce]. Gdansk, AWF, 2006, 199 p.
11. Kochanowicz K. *Comprehensive control in gymnastics* [Kompleksowa kontrola w gimnastyce sportowej]. Gdansk, AWF, 1998, 211 p.
12. Law M.P., Côté J., Ericsson K.A. Characteristics of expert development in rhythmic gymnastics: A retrospective study. *International Journal of Sport and Exercise Psychology*. 2008, vol.5(1), pp. 82-103. doi:10.1080/1612197X.2008.9671814.
13. Marian C., Ion M. Acrobatic Training of Junior Athletes in Gymnastics. *Procedia - Social and Behavioral Sciences*. 2012, vol.46, pp. 4165-4168. doi:10.1016/j.sbspro.2012.06.219.
14. Nicole L. Rhythmic Gymnastics. *Proceedings of the Musical Association*. 1909, vol.36(1), pp. 1-17. doi:10.1093/jrma/36.1.1.
15. Pérez-Soriano P., Llana-Belloch S., Morey-Klapsing G., Perez-Turpin J.A., Cortell-Tormo J.M., van den Tillaar R. Effects of mat characteristics on plantar pressure patterns and perceived mat properties during landing in gymnastics. *Sports Biomechanics*. 2010, vol.9(4), pp. 245-257. doi:10.1080/14763141.2010.537675.
16. Potop V.A., Grad Rafal, Omelyanchik O.A., Begajlo Marta, Boloban V.N., Element nodes of sports equipment double back flip factions and double back flip hunched performed gymnast in floor exercise. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2014, vol.7, pp. 23-30. doi:10.6084/m9.figshare.1015381
17. Potop V.A., Rafal G., Boloban V.N., Otsupok A.P., Biomechanical characterization dismount from balance beam on the basis of the analysis of key elements of sports equipment. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2013, vol.12, pp. 58-66. doi:10.6084/m9.figshare.880619
18. Purnell M., Shirley D., Nicholson L., Adams R. Acrobatic gymnastics injury: Occurrence, site and training risk factors. *Physical Therapy in Sport*. 2010, vol.11(2), pp. 40-46. doi:10.1016/j.ptsp.2010.01.002.
19. Zaporozhanov V.A. About reliable indicator of proprioception in agility control. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2013, vol.4, pp. 21-25. doi:10.6084/m9.figshare.693023
20. Zaporozhanov V.A., Boraczyński T. On the transfer of skills skill in different conditions of motor activity. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2013, vol.9, pp. 25-28. doi:10.6084/m9.figshare.749693

---

**Information about the authors:**

**Zaporozhanov V.A.:** ORCID: 0000 0001 8167 7408; nikola-@ukr.net; Jozef Rusiecki Olsztyn University College; Bydgoska 33, 10-243 Olsztyn, Poland.

**Kochanowicz K.:** ORCID: 0000-0002-8107-601X; kochbo@o2.pl; Academy of Physical Education and Sports; ul. K.Gurskiy 1, 80-336 Gdansk, Poland.

**Kochanowicz A.:** ORCID: 0000-0002-5104-827X; andrzejkochanowicz@o2.pl ; Academy of Physical Education and Sports; ul. K.Gurskiy 1, 80-336 Gdansk, Poland.

---

**Cite this article as:** Zaporozhanov V.A., Kochanowicz K., Kochanowicz A. Improvement of comprehensive assessment of specially trained childhood and adolescence gymnasts. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2014, vol.10, pp. 3-7. doi:10.5281/zenodo.10482

The electronic version of this article is the complete one and can be found online at: <http://www.sportpedagogy.org.ua/html/arhive-e.html>

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (<http://creativecommons.org/licenses/by/3.0/deed.en>).

---

Received: 10.04.2014  
Published: 05.05.2014