Original Article

Assessment of children's potentials in dynamic of initial stage of sport training

ZAPOROZHANOV V.A.¹, BORACHINSKI T.¹, NOSKO Y.N.²

¹Jozef Rusiecki Olsztyn University College, POLAND

²Chernigiv National T.G. Shevchenko Pedagogical University, UKRAINE

Published online: September 28, 2015

(Accepted for publication september 12, 2015)

DOI:10.7752/jpes.2015.03079;

Abstract:

Purpose of the research: perfection of methodic approach to assessment of potentials of children, practicing gymnastic at initial stage in objective metric and subjective expressions. Material and methods: the researches covered female gymnasts of junior group (n=12, age - 6±1.2 years). For assessment of motor potentials five control indicators were used. Results: we showed the sense of approach, which permits to improve reliability of children's potentials' assessment. The approach is based on improvement of block of psycho-physical conditions indicators and subjective assessment of changes of gymnasts' rank position in training process's dynamic. Block of objective indicators of female gymnasts' psycho-physical condition has also been improved; we introduced indicators of kinesthesia, which characterizes muscular sense of trainees. We have shown purposefulness of distinguishing of gymnasts' individual psycho-physical bents by materials of every control indicator in the whole block. We have calculated matrix 5x5, characterizing degree of these indicators correlation with female gymnasts' sportsmanship. It permitted to quantitatively express degree of informative potential of the used control indicators. Conclusions: in general, results of the research witness about possibility of further improvement of approaches to assessment of gymnasts' potentials by widening of indicators' block.

Key words: gymnastic, children, assessment, potentials, dynamic, training.

Introduction

In modern conditions of physical education there exists opinion that effectiveness of training process depends to large extent on how this process meets requirements of individualization. In different forms and conceptions this opinion is expressed by many specialists (Zaciorskij, 1969; Platonov, Zaporozhanov, 1990; Boloban, Litvinenko, Otsupok, 2012; Lapszo, Giovanis, Prusik, Prusik, 2012; Nosko, Dejgun, Lyapin, Seroshtan, Nosko, 2014; Kozina, Iermakov, 2015). They showed that it is purposeful to realize individual approach in sportsmen's training from initial stages in compliance with requirements to controlled processes. In this case coach, in his pedagogical decision, shall base on the following: objective quantitative and qualitative assessment of trainees' individual features; information about results of the used plans, methods and means (Nosko, Nosko, 2014; Zaporozhanov, Kochanowicz, Kochanowicz, 2014; Khudolii, Iermakov, Prusik, 2015; Potop, & Cretu, 2015; Tereshchenko, Otsupok, Krupenya, Liauchuk, Boloban, 2013, 2015; Vahid, 2015).

However, practical experience shows that at initial stages of training with reception of children in sports schools and circles single preliminary testing is not sufficient. It does not permit to objectively assess children's individual bents and potentials in specific conditions in different kinds of sports. These difficulties are connected with natural individual peculiarities of human biological development in ontogeny, with different social conditions of life. Such conditions include features of family physical education at previous stages of child's development [Volkov, 1981; Lidor, Côté, & Hackfort, 2009].

Alongside with it in literature one can meet the data that in conditions of sportsmanship's formation specific informative potential of same indicators can substantially change [Zaporozhanov, Borachinski, 2013; Zaporozhanov et.al., 2014]. Underestimation of such specificity of some tests results in weakening of management decisions in process of sportsmen's training. It is connected with the fact that taken in such case coach's decisions are based on insufficiently reliable information (Zaporozhanov, 2013; Zaporozhanov et al., 2014).

In general, low reliability of assessment of children's individual features by materials of primary testing hinders organization of training process in the future. The same picture exists in assessment of sportsmen's potentials according to theoretical postulates of individualization. It was the reason of our researches, materials of which can be used in organization of children's individualized training process at initial stage.

The purpose of the research is perfection of methodic approach to assessment of potentials of children, practicing gymnastic at initial stage in objective metric and subjective expressions.

Material and methods

Results of systemic control testing in period 2010-2015 of girls groups in conditions of training process of specialized sport school of gymnastic profile (Olshtyn, Poland) were the material for the publication. Control tests were conducted in scientific laboratory of Olshtyn higher school in several successive direction. Their results were published in previous works [Borachinski, Zaporozhanov, 2010; Zaporozhanov, Borachinski, 2012; Zaporozhanov, 2013]. In this period we substantiated optimal complex of control indicators, quantitative and qualitative criteria of assessment of children's psycho-physical condition. Besides, we showed empiric reliability of diagnostic and prognostic assessments of girl gymnast of 6-13age. Materials of complex assessment at the beginning of year training cycle and at the end of it permitted to select from all tested those children, who were characterized by high potentials. However, as sport practice showed, assessment of potentials of this children contingent only by results of initial and final control testing turned out to be ineffective for determination of girl gymnasts' prospects [Borachinski et al., 2010; Zaporozhanov, 2012].

In this article we present the sense of approach, permitting to perfect reliability of assessment of children's potentials. This approach is based on improvement of block of psycho-physical conditions indicators and subjective assessment of changes of gymnasts' grade position in training process's dynamic. Results of testing of junior group girls (6.9±1.2 years' age) in dynamic of year training cycle served as material for this publication as well as analysis of their sport achievements after three years' cycle of training.

Registration of control indicators (1-5, table 1) was carried out, following commonly accepted conditions in physical education and sports. On the base of complex assessment of psychological condition children were ranked by materials of initial testing (rank **A**) and in the same way after one year of trainings in the school (rank **B**, fig. 1x). Besides, girl gymnasts were ranked by increment of results in complex of control indicators at the end of year cycle (%). In the same was ranking was conducted by kinesthesia. This state was expressed indirectly by value of comparability of repeated measurements in every control exercise. Results were expressed in the form of mean value (**K%**). Also ranking was conducted by sport indicators after three years of trainings (*).

General reliability of girl gymnasts group's measurements in control indicators was calculated with commonly accepted method of linear correlation – r_{tt} (see table1). Effectiveness of methodic approach to assessment of children's potential in general was determined by calculation of matrix 5x5 (see table 3) by method of rank correlation [Urbakh, 1964].

The study protocol was approved by the Ethical Committee of Jozef Rusiecki Olsztyn University College. In addition, children and their parents or legal guardians were fully informed about all the features of the study, and a signed informed-consent document was obtained from all the parents.

Results

As we can see in table 1, in general complex of control indicators permitted to characterize psycho-physical components of trainees' motor functions in compliance with requirements of gymnastics.

Table 1. General indicators of girl-gymnasts (n=12) by results of initial control

Control indicators	Results, M±δ	V%	Reliability of measurements, r_{tt}
PLT-frequency of movements, 25cycles, sec.	17.7±2.0	21.2	0.694 – low
SBJ-power of acyclic loco-motions in dynamic, cm.	140±14.5	20.1	0.771 – acceptable
Fmax –power of hand's flexors in static, N	5.04±0.67	58.8	0.548 – low
SHR-dexterity in conditions of time deficit, sec.	7.1±2.3	37.3	0.712 – acceptable
K – state of kinesthesia, %	18.8±3.2	18.6	0.603 – low

Notes: V% - Group coefficient of variation; r_{tt} – comparability of repeated measurements.

For example, indicator PLT – to large extent reflected processes of excitation and inhibition in central nervous system (CNS); SBJ – reflected speed-power abilities in conditions of single loco-motions of maximal power. F_{max} – power in static conditions; SHR – dexterity in conditions of time deficit; K% – state of kinesthesia. These control exercises' results witness about substantial individual distinctions at level of motor conditions of this group's gymnasts (see table 1). These peculiarities reflected in group variation coefficients of control indicators, which were within 20.1-58.3%. At the same time substantial non coincidence of results of girl gymnasts' repeated measurements (r_{tt}) took place in every of control indicator. It characterized low reliability of these measurements. However, substantial individual distinctions in motor skills permitted to objectively rank girl gymnasts: by results of initial testing – rank **A**; by results of final testing at the end of year cycle and by sport indicators after three years' trainings – rank **B** (see fig.1).

Rank A, Initial		Zone I				Zone II				Zone III			
D.A.	1	% *				K					X		
B.A.	2								K	% *			X
O.G.	3		K	% *					X				
J.D.	4							K			*	X%	
B.N.	5		% *	K			X						
M.A.	6									X	K	*	%
B.J.	7	K			% *			X					
M.K.	8					X	%	*		K			
R.Z.	9				X	K	*	%					
F.A.	10			X							%	K	*
R.A.	11		X		K	% *							
B.J.	12	X					K		% *				
Rank B, final		12	11	10	9	8	7	6	5	4	3	2	1

Fig.1. Results of initial (rank A) and final (rank B) testing: after one year of trainings, by complex of psych-physical fitness tests – X; by increment of results in tests - %; by kinesthesia indicator – K; by sport indicators after three years' trainings - *.

This approach permitted to observe travelling of rank positions of every girl gymnast at the end of year cycle of training - from rank A – to the right, in rank B and indirectly judge about their potentials. In fig.1 we can see that at the end of year cycle (in spite of general increase of control testing results) the group of gymnasts with lower fitness (ranks 9-12) remained on their rank positions (X). By this indicator they were assessed objectively as having low level of fitness. In sub group of gymnasts with the highest fitness (ranks 1-4) there happened insufficient rank changes among girl gymnasts. These changes permitted to affirm that their initial assessment was fulfilled less objectively. The same situation took place in central part of gymnasts' group in rank A. In general, in our research coefficient of girl gymnasts' rank correlation at the beginning and at the end of year cycle was 0.623 ($p < 0.05$). This fact witnessed about low effectiveness of such approach to assessment of girl gymnasts' potentials.

The next approach to assessment of motor potentials of the tested we connected with girl gymnasts' ranking by indicator of test results' increment at the end of year cycle (%). As we can see in fig.1 and table 2 by this indicator correlation interconnection of initial and final testing's ranks with results' increment do not coincide in majority of girl gymnasts ($r = -0.189$ and 0.213 $p > 0.05$). For example, D.A. (who took first position by results of initial testing, rank A) turned out to be the weakest by rate of increment (%) and moved to 12th position in rank B. And on the contrary, girl gymnasts with weak fitness (ranks 9-12) demonstrated high rates of results' increment in control exercises. By this indicator they moved to 3-8th positions in rank B. Girl gymnast M.A. took leading position by rate of results growth (in rank A – 6, in rank B – 1).

Table 2. Character of correlations between rank positions of girl gymnasts (n=12) in conditions of the research

Ranks by results		1	2	3	4	5
1	Initial testing	X	0.623	-0.189	0.375	0.098
2	After one year's trainings (X)		X	0.213	0.083	0.411
3	By rate of increment for one year (%)			X	0.700	0.875
4	By kinesthesia (K)				X	0.799
5	By sport indicators (*)					X

Notes: critical value of rank correlation coefficients for n=12, with $r - 0.5 < 0.580$; with $r - 0.1 < 0.730$

Thus, the rate of results' increment in control indicators of girl gymnasts' psycho-physical condition in percents (%) witnessed that assessment of potentials only by metric indicators of initial and final testing (ranks A and B) was mistaken ($r = -0.189$ and 0.213 ; $p > 0.05$). This conclusion was duplicated in analogous way: by calculation of correlation coefficients between girl gymnasts' rank positions in initial and final testing (rank A and B) with their rank positions by sport results after three years' trainings (*). It also turned out to be mistaken ($r = 0.098$; $p > 0.05$).

In table 2 we showed that criteria of assessment of girl gymnasts' potentials were not initial measurements by themselves, but their increment in dynamic of training process.

Next step of the researches was connected with determination of girl gymnasts individual features on the base of analysis of their measurements in every of four control tests of psycho-physical condition. In table 3 we present the data of only four the best girl gymnasts by sport results after three years' trainings. However, material of the table opens general sense of this procedure, which permitted to detect individual bents of girl gymnasts to physical exercises of specific orientation.

For example, gymnast F.A. (leader by sport indicators) was initially ranked to tenth position as weakly trained. However, she demonstrated high rates of results' improvement in tests: SHR – dexterity in conditions of time deficit; SBJ – speed-power abilities.

Girl gymnast M.A. demonstrated relatively high rates of results' improvement in indicators of frequency of movements (PLT) and power in static conditions (F_{max}). The same data about every girl gymnast's psycho-physiological bents were considered in training process.

Table 3. Individual features of control tests results' improvement in year cycle (%) and girl gymnasts' sportsmanship rank after three years trainings

n/n	Control indicators	Girl gymnasts			
		M.A.	J.D.	F.A.	B.A.
1	PLT-frequency of movements, 25cycles, sec.	23.5	11.5	18.2	20.9
2	SBJ-power of acyclic loco-motions in dynamic, cm.	12.4	22.7	20.3	5.3
3	Fmax –power of hand's flexors in static, N	17.8	28.7	16.2	22.7
4	SHR-dexterity in conditions of time deficit, sec.	2.4	1.7	2.9	1.5
5	K – state of kinesthesia, %	11.7	12.6	10.3	12.1
	rank	2	4	1	3
	Final rank by control indicators	64.6	57.0	56.1	50.4
		1	2	3	4
	Sport rank after three years' trainings	2	3	1	4

Discussion

Thus, main results of the research permit to make some generalizations.

The main motivation for this article was the fact that in scientific-research and pedagogic practice control tests there are used control tests, reliability of which is not substantiated in connection with specific requirement of some kinds of sports and with main tasks of researches. The obtained in these cases information is a priori accepted as confident, without objective metric assessment of measurements' reliability.

In our work we based on ideas that reliability of control tests' results cannot be constant. It is in direct connection with aims of control, tasks of testing, condition and specificities of the tested contingent. In this connection assessment of reliability of control results facilitates objectiveness of taken pedagogic decisions in conditions of sport training (Boloban et al., 2012; Zaciorskij, 1969; Ivashchenko, Yermakova, Cieslicka, Zukowska, 2015; Ivashchenko, Khudolii, Yermakova, Pilewska, Muszkiet, Stankiewicz, 2015).

In general, results of our research agree with opinion of specialists about purposefulness of such metrological procedure of assessment of contingent's features in connection with requirements of chosen kind of sport and prognosis of sportsmanship's growth [Volkov, 1981; Zaporozhanov, 2013]. For such purposes the method of calculation of objective metric assessments, presented in works by Zaporozhanov (2013) and Platonov et al. (1990) can be used.

Effectiveness of children's training process at initial stage is directly connected with the fact to what extent this process will be individualized, considering specific potentials of trainees. In this aspect our results supplement the data, received by Volkov (1981); Platonov et al. (1990); Brooker, & Daley-James (2013); Marina, & Torrado (2013).

Realization of individual approach in training process is possible under the following conditions:

- Objective metric assessment of children's psycho-physical condition with the help of control indicators, which reflect specific requirements of the chosen kind of sports;

- Subjective assessment of special indicators' increment rate in training process.

Such approach permits to more effectively select junior sportsmen in gymnastic (Boloban et al., 2014; Zaporozhanov et al., 2014). With it great significance is acquired by empiric reliability of diagnostic and prognostic assessments of girl gymnasts (Borachinski et al., 2010; Zaporozhanov et al., 2012, 2013). From these positions our research differs to some extent from other results (Marsh, Chanal, & Sarrazin, 2006; Baumgarten, & Pagnano-Richardson, 2010; Kozhanova, 2013; Makarova, 2013; Rudd, Farrow, Barnett, Berry, Borkoles, & Polman, 2014; von Laßberg, Rapp, & Krug, 2014; Abdollahipour, Wulf, Psotta, & Palomo, 2015; Reppa, & Theodorakou, 2015).

For assessment of motor conditions we used five control indicators in our research. Their reliability and informative potential were substantiated statistically in several positions:

- By metrical assessment of psycho-physical condition, calculated on the base of materials of initial testing;

- By analogous assessment after first year cycle of training;

- By subjective indicators (rank changes of girl gymnasts' positions in dynamic of year training cycle;

- By sportsmanship after three years trainings.

Such approach permitted to reliably assess girl gymnasts' potentials by increment of metric measurements in percents. Observation of testing successiveness in dynamic of training process was a compulsory condition.

Conclusions

Results of pedagogic observation over motor potentials and sport fitness of girl gymnasts' group permit to make the following generalizations:

- Complex of control indicators, realized in our research, met metrological requirements and permitted to objectively assess girl gymnasts' psycho-physical condition. These indicators characterized individual features of motor structure. On this base they permitted to optimize sportsmen's training process;
- Metrical assessment of comparability of results of control indicators' repeated measurements permitted to substantiate reliability of kinesthesia coefficient and purposefulness of its usage in whole control block;
- We have shown that assessment of children's potentials with formation of initial training group was ineffective only by results of single testing. However, such assessment improved substantially with successive testing of girl gymnasts in dynamic of training process by value of metrical measurements in percents. It is witnessed by high correlation of girl gymnasts' rank by growth rate of control indicators with test-criterion – rank by sportsmanship.

In the whole, results of the research witness about possibility of further perfection of approaches to assessment of children's (gymnasts) potentials. Such approach is oriented on widening of block of indicators, characterizing somatic-morphological type of supreme nervous functioning, biological age; children's motivation for gymnastic training.

Conflict of interest

The authors declare that there is no conflict of interests.

References

- Abdollahipour, R., Wulf, G., Psotta, R., & Palomo Nieto, M. (2015). Performance of gymnastics skill benefits from an external focus of attention. *Journal of Sports Sciences*, 33(17), 1807–1813. <http://doi.org/10.1080/02640414.2015.1012102>
- Baumgarten, S., & Pagnano-Richardson, K. (2010). Educational Gymnastics: Enhancing Children's Physical Literacy. *Journal of Physical Education, Recreation & Dance*, 81(4), 18–25. <http://doi.org/10.1080/07303084.2010.10598460>
- Boloban, V.N., Litvinenko, Y.V., Otsupok, A.P. (2012). Assessment criteria for static-dynamic balance of sportsman's body and system of bodies in kinds of sports with complex coordination. *Physical education of students*, 4, 17–24.
- Borachinski, T., Zaporozhanov, V.A. (2010). Assessment criteria for individual motor abilities of girls, practicing sport gymnastic. *Pedagogics, psychology, medical-biological problems of physical training and sports*. 10, 97–103.
- Brooker, S., & Daley-James, D. (2013). Using ICT to improve children's planning, performing and evaluating skills in gymnastics, in a year 2 class, to enhance their technique. *Education*, 41(1), 32–38. <http://doi.org/10.1080/03004279.2012.710097>
- Ivashchenko, O.V., Khudolii, O.M., Yermakova, T.S., Pilewska, Wieslawa, Muszkieta, Radoslaw, Stankiewicz, Blazej. (2015). Simulation as method of classification of 7-9th form boy pupils' motor fitness. *Journal of Physical Education and Sport (JPES)*, 15(1), 142–147. <http://dx.doi.org/10.7752/jpes.2015.01023>
- Ivashchenko, O.V., Yermakova, T.S., Cieslicka, M., Zukowska, H. (2015). Discriminant analysis in classification of motor fitness of 9-11 forms' juniors. *Journal of Physical Education and Sport (JPES)*, 15(2), 238–244. <http://dx.doi.org/10.7752/jpes.2015.02037>
- Khudolii, O.M., Iermakov, S.S., Prusik, K. (2015). Classification of motor fitness of 7-9 years old boys. *Journal of Physical Education and Sport (JPES)*, 15(2), 245–253. <http://dx.doi.org/10.7752/jpes.2015.0238>
- Kozhanova, O.S. (2013). Compatibility of sportswomen at selection in commands on group exercises of artistic gymnastics accounting their functional condition. *Physical education of students*, 1, 33–36. <http://dx.doi.org/10.6084/m9.figshare.156354>
- Kozina Z.L., Iermakov S.S. (2015). Analysis of students' nervous system's typological properties, in aspect of response to extreme situation, with the help of multi-dimensional analysis. *Physical Education of Students*, 3, 10–19. <http://dx.doi.org/10.15561/20755279.2015.0302>
- Lapszo, J., Giovanis, V., Prusik, Kr., Prusik, Ka. (2012). Balance control contributors – The relationships between leg strength and balance control ability in seniors. *Acta of Bioengineering and Biomechanics*, 3, 3–8.
- Lidor, R., Côté, J., & Hackfort, D. (2009). ISSP position stand: To test or not to test? The use of physical skill tests in talent detection and in early phases of sport development. *International Journal of Sport and Exercise Psychology*, 7(2), 131–146. <http://doi.org/10.1080/1612197X.2009.9671896>

- Makarova, O.V. (2013). Quantitative estimation of the state of vault feet gymnasts on the different stages of the long-term training. *Physical education of students*, 5,69-72. <http://dx.doi.org/10.6084/m9.figshare.771119>
- Marina, M., & Torrado, P. (2013). Does gymnastics practice improve vertical jump reliability from the age of 8 to 10 years? *Journal of Sports Sciences*, 31(11), 1177-1186. <http://doi.org/10.1080/02640414.2013.771816>
- Marsh, H. W., Chanal, J. P., & Sarrazin, P. G. (2006). Self-belief does make a difference: A reciprocal effects model of the causal ordering of physical self-concept and gymnastics performance. *Journal of Sports Sciences*, 24(1), 101-111. <http://doi.org/10.1080/02640410500130920>
- Nosko, M.O., Dejkun, M.P., Lyapin, V.P., Seroshtan, V.M., Nosko, Y.N. (2014). Methodic of movements' formation in training process. *Bulletin Chernihiv National Pedagogical University*. 118(1),240-243.
- Nosko, M.O., Nosko, Y.N. (2014). Peculiarities of physical development of primary school pupils. *Bulletin Chernihiv National Pedagogical University*. 118(3),205-211.
- Potop, Vladimir, & Cretu, Marian. (2015). Biomechanical characteristics of the synchronization of key elements of sport technique of the complex dismounts off beam. *Journal of Physical Education and Sport (JPES)*, 15(2),324-329. <http://doi.org/10.7752/jpes.2015.02049>
- Platonov, V.N., Zaporozhanov, V.A. (1990). *Theoretical aspects of selection in modern sports. Selection, control and prognostication in sport training*. Kiev.
- Reppa, G. P., & Theodorakou, K. (2015). The Effect of Creative Gymnastics Intervention on Physical Activity Self-Efficacy in Primary School Students. *Creativity Research Journal*, 27(1), 96-101. <http://doi.org/10.1080/10400419.2015.992687>
- Rudd, J., Farrow, D., Barnett, L., Berry, J., Borkoles, E., & Polman, R. (2014). A pilot study to evaluate the efficacy of the "Launchpad" gymnastics programme at developing children's motor coordination and fundamental movement skills. *Journal of Science and Medicine in Sport*, 18, e11. <http://doi.org/10.1016/j.jsams.2014.11.034>
- Tereschenko, I.A., Otsupok, A.P., Krupenio, S.V., Levchuk, T.M., Boloban, V.N. (2013). Evaluation of freshmen coordination abilities on practical training in gymnastics. *Physical education of students*, 3,60-71. <http://dx.doi.org/10.6084/m9.figshare.663628>
- Tereshchenko, I.A., Otsupok, A.P., Krupenya, S.V., Liauchuk, T.M., Boloban, V.N. (2015). Coordination training of sportsmen, specializing in sport kinds of gymnastic. *Physical education of students*. 3,52-65. <http://dx.doi.org/10.15561/20755279.2015.0307>
- Urbakh, V.Iu. (1964). *Bio-metrical methods*. Moscow: Science.
- Vahid Saleh. (2015). The relationship between floor exercise landing deduction, anthropometric characteristics and balance in 6 to 8 years old gymnasts. *Science of Gymnastics Journal*, 7(2), 25-32
- Volkov, L.V. (1981). *Physical abilities of children and adolescents*. Kiev: Health.
- von Laßberg, C., Rapp, W., & Krug, J. (2014). Patterns of anterior and posterior muscle chain interactions during high performance long-hang elements in gymnastics. *Journal of Electromyography and Kinesiology*, 24(3), 359-366. <http://doi.org/10.1016/j.jelekin.2014.03.003>
- Zaciorskij, V.M. (1969). *Cybernetics, mathematics, sports*. Moscow: Physical Culture and Sport.
- Zaporozhanov, V.A. (2013). About reliable indicator of proprioception in agility control. *Pedagogics, psychology, medical-biological problems of physical training and sports*. 4,21-25. <http://dx.doi.org/10.6084/m9.figshare.693023>
- Zaporozhanov, V.A., Borachinski, T. (2012). Empiric reliability of diagnostic and prognostic assessments of physical condition of children, practicing spoors. *Pedagogics, psychology, medical-biological problems of physical training and sports*. 11,38-42.
- Zaporozhanov, V.A., Borachinski, T. (2013). On the transfer of skills skill in different conditions of motor activity. *Pedagogics, psychology, medical-biological problems of physical training and sports*. 9,25-28. <http://dx.doi.org/10.6084/m9.figshare.749693>
- Zaporozhanov, V.A., Kochanowicz, K., Kochanowicz, A. (2014). Improvement of comprehensive assessment of specially trained childhood and adolescence gymnasts. *Pedagogics, psychology, medical-biological problems of physical training and sports*. 10,3-7. <http://dx.doi.org/10.5281/zenodo.10482>