DOI 10.26773/smj.200602

ORIGINAL SCIENTIFIC PAPER

Priority Indicators of Sports Activity of Jumps in Water at the Stage of Advanced Sports Training

Serhii Romanchuk[1], Artur Oderov[1], Volodymyr Klymovych[1], Andrii Arabskyi[1], Orest Lesko[1], Serhii Fedak[1], Antonina Dunets-Lesko[2], Yurii Bobko[1], Oleh Olkhovyi[3] and Tetiana Liudovyk[1]

[1]National Academy of the Army, Department of Physical Education, Special Physical Training and Sports, Lviv, Ukraine, [2]Lviv State University of Physical Culture, Department of Theory and Methods of Physical Culture, Lviv, Ukraine, [3]Black Sea Petro Mohyla National University, Department of Olympic and Professional Sports, Mykolaiv, Ukraine

Abstract

An analysis of the sports activities of divers conducted over three years, with boys (n=104) and girls (n=102), has determined that the sports activities of such divers are in general similar. For instance, indicators of physical development and sports-technical preparedness are similar in significance and contribution to the factorial structure for boys (11.4–21.8%) and girls (12.8–22.6%). The indicators of nystagmus reactions to rotational loads in 10-year-olds are common for all groups (boys: 10.0%; girls: 6.9%) but differ in their place in the factorial structure and contribution to the total dispersion. Thus, in the boys' group, indicators of physical development and sports-technical preparedness remain valid throughout the study period, while girls aged 12 to 13 experience changes in the significance of the identified factors and the integration of factors' indicators, which makes their interpretation difficult. The analysis carried out will allow the development of an integrated assessment of athletic suitability, taking into account the rank correlation of the indicators of children's sports-technical preparedness by years of training.

Keywords: *indicators, analysis preparedness, age, boy, girl, diver, water*

Introduction

The popularity of Olympic sports in the modern world, its intense commercialization and professionalization, and the ever-increasing socio-political importance of athletes' successes have led in recent years to the formation of highly effective systems of training athletes (Tovstonoh, 2010). In the practice of modern sport, numerous scientific research studies testify that world-level results are accessible only to exceptionally gifted athletes who have clearly expressed natural inclinations to achievements in a specific sport (Platonov, 2013; Shinkaruk, 2013; Romanchuk & Arabsky, 2019) or were able to realize them through the long-term improvement process (Krasova, 2012).

The definition of sports fitness in diving has become especially important. In scientific studies, this issue has been little studied, and the development trends of this sport are such that there is a continuous process of complicating dives and increasing requirements for the quality of their performance.

Only an athlete who possesses sufficient abilities can master the programme of dives and execute it at a high technical level. The urgent issue in the training of divers is the correct selection for children's and youth sports schools, on which the quality of the national teams depends.

Purpose of the study is analyze the sports activity of divers boys and girls. Determine whether the sports activities of such divers are generally similar.

Methods

The following research methods were used: the analysis and generalization of literary sources, factorial analysis, and

Correspondence:

S. Romanchuk
National Academy of the Army, Department of Physical Education, Special Physical Training and Sports, Heroyiv Maydanu, 79012 Lviv, Ukraine
E-mail: asv-fpis@ukr.net

methods of mathematical statistics.

The use of the analysis and generalization of literary sources enabled obtaining concise and relevant information on the topic of the study. Attention was primarily paid to the study of issues such as the current state of selection of young athletes in various sports, the importance of physical development, and the physical, sports, and technical preparedness of young divers in the selection system, which facilitated the scientific reason for the problem raised and the specification of the subject basis of the study.

According to the program of youth sports schools, the stage of in-depth sports training includes classes in educational groups of children from 10–12 to 13–15 years old and lasts an average of four years (Table 1). In this regard, our comprehensive study involved a dynamic three-year observation of young divers aged 9–13 years old.

Table 1. Pedagogical experiment strategy

Survey stage	Age groups						
Stage 1	9	10	11	12	13		
Stage 2	9	10	11	12	13	14	
Stage 3	9	10	11	12	13	14	15

Legend: The arrows indicate the movement of athletes from one age group to another by stage of the study.

Thus, we studied five age sections of 9–13-year old children and five dynamic sections of children aged 9–11, 10–12, 11–13, 12–14, 13–15 years.

The study was conducted annually in January–March during the competitive period from 2016 to 2019. It was attended by children involved in diving in the Children's and Youth Sports School Number 3, Lviv. The dynamic experiment was attended by 104 boys and 102 girls.

Testing the physical fitness of young athletes was carried out using a competitive method in groups. Anthropometric measurements, determining the speed of a simple sensorimotor reaction and conscious self-regulation of sensorimotor activity, and studies of vestibular stability were carried out in laboratory conditions at training facilities. All measurements were carried out before the start of training sessions at 9.00 am and at 3.00 pm.

To identify the relationships between different types of preparedness that more fully characterize the sports activities of young divers in the age periods from 9 to 13 years old and to determine the differences between boys and girls of the same age, a factorial analysis was carried out (the method of main components with reference axes rotation by the Varimax criterion).

Factorial analysis was applied to selected indicators characterizing various types of preparedness and developmental characteristics of young athletes. The factors highlighted as a result of this analysis give a relatively complete picture of the structure of sports activity of young divers of 9–13 years old. Considering that the number of factors identified by the program in each age group was large (from 14 to 18) and their contribution to the generalized dispersion was unequal, the most significant first five or six factors from the set of indicators that had the most considerable factorial weight were interpreted.

Results

As a result of factor analysis, it turned out that the structure of indicators characterizing the sports activity of divers changes with the age development of athletes of both sexes. Thus, in the group of 9-year-old boys and girls, 16 and 14 factors stood out, respectively, while the contribution of the six most significant was 69.2% (Table 2) and 70.3% (Table 3), respectively.

Table 2. The factorial structure of sports activities of 9–13-year-old boys involved in diving

№	9 years		10 years		11 years		12 years		13 years	
	Factor	**%**	**Factor**	**%**	**Factor**	**%**	**Factor**	**%**	**Factor**	**%**
1	Physical development	21.8	Sports and technical preparedness	19.3	Physical development	15.4	Physical development	16.7	Physical development	20.4
2	Sports and technical preparedness	15.0	Physical development	11.4	Autonomic reactions to rotational load	14.4	Physical and sports-technical preparedness	14.2	Sports and technical preparedness	14.2
3	Autonomic reactions to rotational load	10.4	Rate of sensorimotor reactions	9.7	Sports and technical preparedness	10.6	Ability to self-regulate sensorimotor activity	9.7	Autonomic reactions to rotating load	10.0
4	Nystagmus response to the rotational load	9.5	Autonomic reactions to rotating load	8.8	Rate of sensorimotor reactions	10.2	Rate of sensorimotor reactions	8.6	Rate of sensorimotor reactions	9.4
5	Ability to self-regulate sensorimotor activity	6.6	Nystagmus response to the rotational load	6.9	Nystagmus response to the rotational load	7.5	Autonomic reactions to rotational load	5.9	Ability to self-regulate sensorimotor activity	7.7
6	Learning ability	5.9	Physical development	5.8	Learning ability	5.9	Learning ability	5.7	Learning ability	6.2
	Total:	69.2		61.9		64.0		60.8		67.8

The first factor is interpreted as physical development, and its contribution to the generalized dispersion was 21.8% in boys (Table 2) and 22.6% in girls (Table 3). The most significant factorial masses are found in indicators characterizing the size and structure of the body. Quite high factorial masses in Factor 1 were obtained in exercising raising legs on the gymnastic wall (r=0.562), and bent-downs and straighten-ups with turning right and left (r=0.506) in boys and pull-ups on the horizontal bar (r=0.624) and supine leg lifts until touching the floor behind the head (r=0.631) in girls, which characterize strength and special speed-strength training.

Table 3. Scheme of the factorial structure of sports activities of 9–13 years old girls involved in diving

№	9 years		10 years		11 years		12 years		13 years	
	Factor	**%**	**Factor**	**%**	**Factor**		**Factor**	**%**	**Factor**	**%**
1	Physical development	22.6	Sports-technical preparedness	20.1	Physical development	18.6	Sports-technical preparedness	21.6	Rate of sensorimotor reactions	25.8
2	Sports-technical preparedness	14.3	Physical development	12.8	Rate of sensorimotor reactions	17.1	Ability to self-regulate sensorimotor activity	15.5	Sports-technical preparedness	17.9
3	Learning ability	10.6	Nystagmus response to the rotational load	10.0	Autonomic reactions to rotational load	12.1	Physical development	13.6	Physical fitness	16.6
4	Ability to self-regulate sensorimotor activity	9.3	Ability to self-regulate sensorimotor activity	7.9	Physical fitness	8.9	Nystagmus response to the rotational load	10.8	Physical fitness and Physical development	13.3
5	Nystagmus response to the rotational load	7.4	Physical fitness	6.9	Sports-technical preparedness	6.3	Rate of sensorimotor reactions	9.5	Physical fitness and Physical development	10.4
6	Rate of sensorimotor reactions	6.1	Learning ability	6.1	Ability to self-regulate sensorimotor activity	6.1	Physical fitness	8.9	Physical fitness and Physical development	10.0
	Total	70.3		63.8		69.1		79.9		94.0

The second factor in both groups is identified as sports-technical preparedness. The contribution of the second factor to the total dispersion was 15.0% for boys and 14.3% for girls. The highest factorial weight was obtained by the following indicators of sports-technical preparedness: the sum of the complexity coefficients for the entire programme (rb=0,921; rg=0,979), the sum of the complexity coefficients of free dives (rb=0.929; rg=0.976), the average complexity coefficients of a free program (rb=0.930; rg=0.976), the average score for an free programme (rb=0.849; rg=0.969), and the sports result in points (rb=0.837; rg=0.958). In addition, in the group of boys, physical fitness indicators: the horizontal body holding (r=0.688) and the total indicator of physical fitness (r=0.652) have a high factorial weight. Thus, the common and main factors in the structure of the motor activity of 9-year-old divers are the factors of physical development and sports-technical preparedness.

For the next four factors that we considered, there are significant differences for 9-year-old boys and girls.

For boys, the third factor is interpreted as autonomic reactions to a rotational load. The contribution of this factor to the total dispersion was 10.4%. A high factorial mass was obtained by heart rate during rotations to the left (r=0.891), after rotations to the left (r=0.849), during rotations to the right (r=0.866), after rotations to the right (r=0.922) which were measured during vestibular resistance studies.

The fourth factor for boys (9.5% of the total dispersion) was identified as a factor of nystagmus response to the rotational load. The highest factorial weight was obtained by the indicators of the frequency of nystagmus after rotation to the left (r=0.821), the frequency of nystagmus during rotation to the left (r=0.858), the amplitude of nystagmus during rotation to the left (r=-0.740), the frequency of nystagmus after rotation to the right (r=0.588) and the amplitude of nystagmus after rotation to the right (r=0.714), which characterize the nystagmus reactions to a rotational load.

The fifth factor was interpreted as the ability to self-regulate sensorimotor activity; its contribution to the total dispersion was 6.6%. Significant factorial mass was obtained by the average rate of the motor reaction in the third task (r=0.549) and the range of indicators in the third task (r=0.871) that characterize the difference between the response time when setting to a record and keeping the optimal reaction speed, which is one of the indicators of the ability to self-regulate.

The sixth factor was 5.9% of the total variance. The highest factorial weight was obtained by the indicators of the index of the technical improvement rate (r=0.861) and the learning index (r=0.855); therefore, the factor was interpreted as a learning ability factor.

In the girls' group, the third factor was identified as a learning ability factor. Its contribution to the total dispersion was 10.6%. Significant factorial weight was obtained by indicators of the index of technical improvement rate (r=-0.921) and the learning ability index (r=-0.915).

The fourth factor in girls (9.3% of the total dispersion) was identified as the ability to self-regulate sensorimotor activity.

The greatest factorial weight is indicators of self-regulation ability (r=-0.915). Significant factorial weight in this factor is also shown by indicators of active vestibular tests (r=-0.682), heart rate during rotations to the right (r=-0.586), forearm length (r=-0.596), chest excursion (r=0.600), and subcutaneous fat (r=-0.771).

In the fifth factor, indicators characterizing the nystagmus reaction to rotational loads have the most significant factorial weight: the amplitude of nystagmus during rotation to the left (r=0.660), the amplitude of nystagmus after rotation to the left (r=0.799), the amplitude of nystagmus during rotation to the right (r=0.768) and the amplitude of nystagmus after rotation to the right (r=0.831). Indicators of physical fitness also have significant factorial weight: an upward jump without the help of hands (r=0.636), an increase in the jump upward with the help of hands (r=0.609) and 20-metre run (r=0.586). The factor is interpreted as nystagmus response to rotational loads and corresponds to the third factor in the group of boys. The contribution of the factor to the total dispersion is 7.4%.

The sixth factor in girls was identified as a factor of the rate of sensorimotor reactions; its contribution to the total dispersion of the sample is 6.1%. The most significant factorial mass was obtained by the indices of the rate of sensorimotor reactions: the minimum reaction time to a light stimulus (r=-0.876) and the average indicator of the maximum reaction rate to a light stimulus (r=-0.904).

At the age of 10 years, 17 and 18 factors stood out in the groups of boys and girls, respectively; the contribution of the most significant six was 63.8% for girls and 61.9% for boys. As in 9-year-old athletes, the first two factors in the groups of boys and girls have the same interpretation. The first factor is identified as sports-technical preparedness. The contribution to the total dispersion in boys was 19.3%, in girls 20.1%. The highest factorial mass in both groups was obtained by such indicators of sports-technical preparedness: the sum of the complexity factors for the entire program (rb=0.932; rg=0.922), the sum of the complexity factors of free dives (rb=0.950; rg=0.926), the average complexity coefficient of a free programme (rb=0.933; rg=0.928), the average mark for a free programme (rb=0.819; rg=0.933) and the sports result in points (rb=0.901; rg=0.906) as well as the sport experience (rb=0.529; rg=0.933) and sports qualification (rb=0.675; rg=0.760). In addition, in the group of boys, a significant factorial weight belongs to the indicator of raising legs on the gymnastic wall (r=0.551) which characterizes the strength of the muscles of the flexors of the body while in girls' the indicator of oncoming bending to a high angle (r=-0.691) which characterizes special speed-power qualities.

The second factor is identified as a factor in physical development. The contribution of this factor in boys is 11.4%, and 12.8% in girls (of the total dispersion of the sample). The largest factorial mass in both comparative groups was obtained by indicators of physical development (Rmen=0.938-0.563; Rwomen=0.866-0.506). In the group of boys, a significant factorial weight was also obtained by the indicators of jumping upwards without the help of hands (r=0.562) and with the help of hands (r=0.639), characterizing jumping ability. The third factor in the group of boys is identified as a factor in the rate of sensorimotor response. The contribution of the factor to the total dispersion was 10.6%. The greatest factorial mass was obtained by the sensory-motor reaction rate indices (r=0.950) and a 20 m run (r=0.639), which characterizes the speed of movements. The fourth factor in boys, whose contribution was 8.8% of the total dispersion of the sample, was identified as a factor of autonomic reactions to a rotational load. The highest factorial mass was obtained for heart rate with a standard rotation test (r=0.911–0.653). The fifth factor (6.9% of the total dispersion) is identified as nystagmus response to a rotational load. Significant factorial mass was found for indicators of the frequency and amplitude of nystagmus (r=0.890–0.653). The sixth factor in the group of boys in its content corresponds to the second factor. A significant mass was obtained by excursions of the chest (r=0.918) and relative bone mass (r=0.739). The contribution of the factor to the total dispersion of the sample is 5.8%.

The third factor in the group of girls was identified as nystagmus response to rotational loads. Its contribution is 10% of the total dispersion of the sample. The most significant mass is of indicators of nystagmus reactions to a rotational load (r=-0.876–0.528). The fourth in the group of girls was a factor that can be interpreted as the ability to self-regulate sensorimotor activity. The contribution of the factor to the total dispersion is 7.9%. The fifth factor was 6.9% of the total variance and was interpreted as physical fitness. Indicators of physical fitness (r=0.887–0.538) and the total indicator of physical fitness (r=0.866) received a significant factorial mass. The sixth factor stood out among girls, which we interpreted as learning ability. Its contribution amounted to 6.1% of the total dispersion.

Summarizing the above findings, it can be stated that, like 9-year-olds, 10-year-old boys and girls have the same identification and approximately the same contribution to the total dispersion with first two factors: sports and technical preparedness and physical development. Common to children of this age is the factor of nystagmus reactions to a rotational load. This factor in the group of girls with a contribution of 10% to the total dispersion ranks third while in the boys' it occupies the fifth position with a contribution of 6.9% to the total dispersion.

At the age of 11, only 17 factors stood out in the group of boys; the contribution of the most significant six was 64.0% of the total dispersion of the sample. For girls of this age, the total number of identified factors is 15; the contribution of the most significant five factors is 63.0% of the total dispersion.

The first factor in both groups was identified as a factor in physical development. The contribution of this factor to the total dispersion of the sample was 18.6% in girls and 15.4% in boys. The most significant factorial mass was obtained by indicators of physical development characterizing the longitudinal and transverse dimensions of the body and the structure of the body (r=-0.914-(-0.511)). In addition, a significant factorial mass in the group of boys was obtained by indicators of physical fitness, raising legs on the gymnastic wall (r=0.538) and oncoming bending to a high angle (r=0.507), which characterize strength and speed-strength qualities.

The second in boys with a contribution of 14.4% of the total dispersion, was a factor that we identified as autonomic reactions to a rotational load. The most significant mass refers to indicators of heart rate during rotations to the left (r=0.912), after rotations to the left (r=0.900), during rotations to the right (r=0.924), after rotations to the right (r=0.954). The third factor in the group of boys was identified as sports-technical preparedness. The contribution of this factor to the total dispersion was 10.6%. In addition to such indicators of sports and technical preparedness as the sum of the complexity factors for the entire program (r=0.885) and the sports result in points (r=-0.890), a significant factorial mass was obtained by the indicators of the sport experience (r=0.506) and sports qualifications (r=0.695). The fourth factor for boys is distinguished as the rate of sensorimotor reactions factor. Its contribution to the total dispersion is 10.2%. A significant factorial mass is noted in the indicators of the speed of sensorimotor response (r=0.874–704), as well as in the indicators characterizing the ability to self-regulate sensorimotor activity (r=0.646–606). The fifth factor in boys was interpreted as a nystagmus response to a rotational load. The contribution of the factor to the total dispersion was 7.5%: and the sixth factor was identified as learning ability; its contribution to the total dispersion was 5.9%.

In 11-year-old girls, the second factor was identified as the speed of the sensorimotor response. The contribution of this factor to the total dispersion was 17.1%. The most significant mass was obtained by the indicators of the minimum reaction time to a light stimulus (r=-0.809), and the average indicator of the maximum reaction rate to a light stimulus (r=-0.883). The third factor in 11-year-old girls was the factor of autonomic reactions to a rotational load. The contribution of the factor to the total dispersion was 12.1%. The greatest factorial weight was obtained by resting heart rate (r=-0.811), during rotations to the left (r=-0.906), after rotations to the left (r = -0.811), during rotations to the right (r = -0.829), after rotations to the right (r=-0.877). The fourth factor in this group was identified as physical fitness, with 8.9% of the total dispersion. The most significant factorial weight was obtained by indicators characterizing power and speed-power qualities (r=0.828-525). In addition, indicators of nystagmus reactions to a rotational load to the left (r=0.583) and to the right (r=0.822), as well as a sporting result in points (r=0.808) also have significant weight. The fifth factor in the group of girls is identified as sports-technical preparedness. The contribution of this factor was 6.3% of the total dispersion. Significant factorial weight was obtained by indicators of the sum of complexity factors and average ratings (r=0.959-0.8465) as well as technical improvement rate indices (r=0.953) and learning ability index (r=0.581).

Thus, at the age of 11, the factor of physical development is the most significant and common for boys and girls. Also common for both groups are the factors of autonomic reactions, sports-technical preparedness and speed of sensorimotor reactions; however, they differ in their contribution to the total dispersion and accordingly in significance for the motor activity of boys and girls. Therefore, physical fitness indicators for girls are combined in the fourth factor, while for boys only two indicators (characterizing power and speed-power capabilities) are included with significant factorial weight in the first factor. As can be seen from the data presented, at the age of 11, a certain restructuring of the factorial structure is observed and as well as significant differences in the factorial structures of boys and girls.

At the age of 12, the differentiation of factorial structures of boys and girls continues. Although individual factors are similar in identification, they differ in their contribution to the total dispersion. Thus, in the group of boys of this age, the first factor was interpreted as physical development, the contribution of the factor to the total dispersion was 16.7%. In 12-year-old girls, the first factor is identified as sports-technical preparedness. Factor 1 has absorbed a large amount of information about girls' motor activity; its contribution to the total dispersion was 21.6%.

The second factor in the group of 12-year-old boys is identified as a factor of physical and sports-technical preparedness. The contribution of the factor to the total dispersion was 14.2%. In girls, the second factor is interpreted as the ability to self-regulate sensorimotor activity. Its contribution to the total dispersion was 15.5%. The factor, also identified as self-regulation ability, was the third in the group of boys of this age. Its contribution to the total dispersion was 9.7%. In the girls' group, there was the third factor, interpreted as physical development. Its contribution was 13.6% of the total dispersion. The fourth factor in 12-year-old boys was identified as the rate of sensorimotor reactions; the contribution of the factor was 8.6% of the total dispersion. The fourth factor for the girls was the nystagmus response to the rotational load, whose contribution to the total dispersion was 10.8%. The fifth factor in girls was identified as the rate of sensorimotor reactions. The contribution of this factor was 9.5% of the total dispersion. In boys of this age, the fifth factor is interpreted as an autonomic reaction to a rotational load. The sixth factor in boys is identified as learning ability. Its contribution is 5.7% of the total dispersion. In the sixth factor in girls, the most significant factorial weight was obtained by indicators of physical fitness. The contribution of this factor to the total dispersion was 8.9%.

According to the data provided, it can be concluded that the differences in the factorial structure of girls and boys at the age of 13 are even more pronounced. Girls of this age have an increase in the integration of indicators in factors, making their identification difficult. In boys of this age, the factorial structure is similar to that of 12-year-olds, and indicators in factors stand out differentially. Perhaps the differences in the factorial structures of boys and girls aged 11–13 years old are associated with different periods of the onset of puberty, and the integration of indicators found in factors in girls is explained by the interdependence of indicators during intense puberty development.

Discussion

According to the data provided, it can be concluded that the differences in the factorial structure of girls and boys at the age of 13 are even more pronounced. Girls of this age have an increase in the integration of indicators in factors, making their identification difficult. In boys of this age, the factorial structure is similar to that of 12-year-olds, and indicators in factors stand out differentially. Perhaps the differences in the factorial structures of boys and girls aged 11–13 years old are associated with different periods of the onset of puberty, and the integration of indicators found in factors in girls is explained by the interdependence of indicators during intense puberty development.

In summary, we can say that the results of factor analysis showed changes in the factor structure of sports activity with age development in both boys and girls. Moreover, changes in the factorial structure of girls are more significant, which is associated with different dates of the onset of puberty for boys and girls.

The results of the factorial analysis also indicate that the sports activities of boys and girls aged 9–11 years are mostly similar. Thus, factors of physical development and sports-technical preparedness are similar in significance and contribution to the factorial structure in boys and girls. The factors of nystagmus reactions to rotational load in 10-year-olds are common to all groups but differ in their place in the factorial structure and the contribution to the total dispersion.

Changes in the factorial structure in the age aspect in boys are less pronounced than in girls. In particular, in boys, factors of physical development and sports-technical preparedness remain relevant throughout the study period, while girls aged 12–13 experience changes in the significance of the identified factors and the integration of indicators within factors, which makes their interpretation difficult.

The analysis provides the basis for a differentiated approach to assessing the athletic suitability of boys and girls.

Prospects for further research are to develop an integrated assessment of athletic suitability obtained by calculating the multiple regression equations, taking into account the rank correlation of the indicators of sports and technical preparedness at the beginning of the observation with the valid data on the success of sports activities by years of training.

Acknowledgements
There are no acknowledgements.

Conflict of Interest
The authors declare that there is no conflict of interest.

Received: 21 December 2019 | **Accepted**: 11 March 2020 | **Published**: 01 June 2020

References

Klymovych, V., Korchagin, M., Olkhovyi, O., Romanchuk, S., & Oderov, A. (2019). Motivation of forming students healthcare culture on principles of interdisciplinary integration. *SportMont, 17*(3), 79-83. doi:10.26773/smj.191017.

Krasova, I. (2012). Improvement of technical training in jump acrobatics through the impact on the sensorimotor coordination of athletes. *Slobozhansky scientific and sports bulletin*, *5*(2), 27-32.

Oderov, A., Romanchuk, S., Fedak, S., Kuznetsov, M., Petruk, A., Dunets-Lesko, A., et al. (2017). Innovative approaches for evaluating physical fitness of servicemen in the system of professional training. *Journal of Physical Education and Sport, 17*(Suppl. 1), 23-27. doi:10.7752/jpes.2017.s1004.

Platonov, V. (2013). Forcing the long-term training of athletes and Youth Olympic Games. *Science in Olympic Sports*, *2*, 36-37.

Shinkaruk, A. (2013). Justification of an integrated approach to the development of a selection program in cyclic sports. *Theory and methodology of physical education and sports*, *1*, 24-25.

Tovstonoh, A. (2010). Individualization of training athletes as the basis for achieving a high sports result. *Young Sports Science of Ukraine*, *14*(1), 322-327.