MATHEMATICAL JUSTIFICATION OF THE SPORTS SELECTION OF JUMPERS IN THE WATER AT THE STAGE OF INITIAL TRAINING

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Abstracts

The relevance of the problem is determined by the fact that an athlete who possesses genetic and physiological abilities that were discovered in time can master a complex jumping program and execute it without error at a high technical level. Therefore, it is important to mathematically substantiate the criteria for selecting children in sports schools. ***The Purpose of the Study:*** To determine indicators affecting sports readiness, to calculate their prognostic significance and to form criteria for the selection of jumpers in the water at the stage of initial training. ***Material and Methods:*** The research was organized in three stages in the period from January 2020 to December 2021, with the determination of the normative assessment of technical readiness, the conduct of an ascertaining pedagogical experiment and factor analysis, the calculation of multiple regression equations relative to the total coefficient of difficulty of arbitrary jumps and the average coefficient of the complexity of jumps. 139 boys (10,98±0,1 years; range: 9–13 years) and 96 girls (11,02±0,1 years; range: 9–13 years) beginners (schoolchildren) took part in the study. The number of athletes is divided by age groups: boys – 9 years old (n=25); 10 years (n = 30); 11 years (n = 30); 12 years (n = 31); 13 years old (n = 23); girls – 9 years old (n=16); 10 years (n=23); 11 years (n=18); 12 years (n=21); 13 years old (n=18). The study was organized and carried out with athletes of the Junior High School (Lviv) and «Yantar» Junior High School (Novoyavorivsk). During the educational and training meetings, testing and measuring of anthropometric indicators, determination of the speed of a simple sensorimotor reaction and conscious self-regulation of sensorimotor activity, research of vestibular stability were carried out. All measurements were taken before training in the morning and in the afternoon at 9:00 and 15:00. ***Results:*** According to the results of the study, the indicators that have prognostic significance for the success of the sport's improvement of young jumpers at the stage of improving their sports training have been determined. To these indicators, we included: the total indicator of physical fitness, the amplitude of nystagmus during and after turning to the right, the speed of a simple motor reaction. The comprehensive assessment obtained by calculating multiple regression equations has a high prognostic value and is an effective method of predicting the success of the sport's improvement of young jumpers at the stage of initial sports training. ***Conclusions.*** It is proved that the comprehensive assessment obtained by calculating multiple regression equations has a high prognostic value and is an effective method of predicting the success of the sport's improvement of young jumpers at the stage of initial sports training.

Key words: selection, forecasting, jump into the water, equations, criteria, evaluation.

Артур Одеров, Сергій Романчук, Володимир Климович, Іван Пилипчак, Олексій Лещінський, Максим Кузнецов, Андрій Арабський, Тетяна Людовик, Олександр Тимочко. Математичне обґрунтування спортивного відбору стрибунів у воду на етапі початкової підготовки. *Актуальність* проблеми визначається тим, що спортсмен, який володіє своєчасно виявленими генетичними та фізіологічними здібностями, може засвоїти складну програму стрибків і безпомилково виконати її на високому технічному рівні. Тому актуальним є математичне обґрунтування критеріїв відбору дітей у спортивні школи. *Мета дослідження* – визначити показники, які впливають на спортивну підготовленість, розрахувати їх прогностичну значимість та сформувати критерії відбору стрибунів у воду на етапі початкової підготовки. *Матеріал і методи.* Дослідження організовано в три етапи в період із січня 2020 р. по грудень 2021 р. з визначенням нормативної оцінки технічної підготовленості, проведенням констатувального педагогічного експерименту та факторного аналізу, розрахунком рівнянь множинної регресії відносно сумарного коефіцієнта складності довільних стрибків і середнього коефіцієнта складності стрибків. У дослідженні взяли участь 139 хлопців (10,98±0,1 років; діапазон: 9–13 років) та 96 дівчат (11,02±0,1 років; діапазон: 9–13 років) початківців (школярів). Кількість спортсменів розподілено за віковими групами: хлопчики – 9 років (n=25); 10 років (n = 30); 11 років (n = 30); 12 років (n = 31); 13 років (n = 23); дівчата – 9 років (n=16); 10 років (n=23); 11 років (n=18); 12 років (n=21); 13 років (n=18). Дослідження організовано та проведено зі спортсменами ДЮСШ (м. Львів) і ДЮСШ «Янтар» (м. Новоявopiвськ). Під час навчально-тренувальних зборів проводили тестування та вимірювання антропометричних показників, визначення швидкості простої сенсомоторної реакції й свідомої саморегуляції сенсомоторної

діяльності, дослідження вестибулярної стійкості. Усі вимірювання проводили перед тренуванням уранці та вдень о 9:00 та 15:00. ***Результати.*** За результатами дослідження визначено показники, які мають прогностичне значення для успішності спортивного вдосконалення юних стрибунів на етапі вдосконалення їхньої спортивної підготовки. До цих показників ми віднесли загальний показник фізичної підготовленості, амплітуду ністагму під час і після повороту вправо, швидкість простої рухової реакції. Комплексна оцінка, отримана шляхом розрахунку рівнянь множинної регресії, має високу прогностичну цінність і є ефективним методом прогнозування успішності спортивного вдосконалення юних стрибунів на етапі початкової спортивної підготовки. ***Висновки.*** Доведено, що комплексна оцінка, отримана шляхом розрахунку рівнянь множинної регресії, має високу прогностичну цінність і є ефективним методом прогнозування успішності спортивного вдосконалення юних стрибунів на етапі початкової спортивної підготовки. Зроблено висновки щодо донозологічного характеру порушень здоров'я.

Ключові слова: відбір, прогнозування, стрибок у воду, рівняння, критерії, оцінка.

Statement of the Problem and Analysis of the Latest Research. In the modern world, we are witnessing an increase in the popularity of Olympic sports, which has led to the formation of highly effective training systems for athletes in many countries of the world. Performances of professional athletes not only create their individual image, but also have socio-political significance for the state, sports club and commercial sponsoring organizations [10; 26; 52; 33]. Accordingly, the competition in every competition is increasing, especially in the international sports arena.

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. 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 [4; 5; 43] or were able to realize them through the long-term improvement process.

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 [2; 6].

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.

As evidenced by the scientific research of R. F. Akhmetov, V. S. Keller, V. M. Platonov, M. P. Pityn, M. Roztorguy and competitions of the highest level, winning results can be achieved only by talented athletes who have natural, genetic and physiological prerequisites for a specific type of sport [1; 18; 32; 39] and were able to implement them in a long-term training process [20; 25; 33; 34; 47].

In recent years, scientific schools have conducted many studies on the construction of the optimal structure of the long-term training process of athletes from various sports [36; 44; 52], duration of training periods during the year [17; 52; 53] training of athletes of various ages [37; 38], modeling and forecasting in sports [7; 22; 44; 45], individualization of the training process [3; 24; 35; 46; 48], age limits of the career duration of athletes [9; 11; 27; 37].

The systematic updating of sports records, the expansion of the international sports calendar in recent years thanks to commercial competitions have led to the individualization of the training process and competitive activity, increasing the loads on the body of an individual athlete, which requires the mobilization of functional reserves and psychological stability in the conditions of competitive activity. All this leads to the search for ways to select gifted boys and girls [12; 31; 41; 51], especially in the initial stages [13; 28; 42], substantiating the age limits of the development of their talents and abilities [29; 40; 50].

Today, the trend towards «rejuvenation» of sports and the complication of the diving program have led to an increase in the level of sports fitness of young athletes. The analysis of scientific works proved that the process of selecting athletes is not sufficiently disclosed, especially in complex coordination sports.

Coaches and athletes indicate that an athlete who has the appropriate abilities that were discovered in time can master a complex program of jumps and perform it flawlessly at a high technical level [16; 21; 49]. Therefore, the applied question regarding the correct selection of children for children's and youth sports schools is still relevant, which depends on the quality of training of the reserve of the country's national diving teams.

The Purpose of the Study. To determine indicators that affect sports readiness, to calculate their prognostic significance and to form criteria for the selection of divers in the water at the stage of initial training.

Material and Methods. The research was organized in three stages in the period from January 2020 to December 2021, with the determination of the normative assessment of technical readiness, the conduct of a ascertaining pedagogical experiment and factor analysis, the calculation of multiple regression equations relative to the total CS of arbitrary jumps and the average CS of jumps. The study was organized and carried out with athletes of the Olymp-L State Youth Sports Association (Lviv) and the Yantar Youth Sports Academy (Novoyavorivsk). Testing and measurement of anthropometric indicators, determination of the speed of a simple sensorimotor reaction and conscious self-regulation of sensorimotor activity, research of vestibular stability were carried out during educational and training meetings. All measurements were taken before the start of training sessions in the morning and in the afternoon at 9:00 and 15:00. 139 boys and 96 girls took part in the research. The number of athletes was divided by age groups: boys – 9 years old (n = 25); 10 years (n = 30); 11 years (n = 30); 12 years (n = 31); 13 years old (n = 23); girls – 9 years old (n = 16); 10 years (n = 23); 11 years (n = 18); 12 years (n = 21); 13 years (n = 18). He research was organized in three stages with sequential and parallel solution of work tasks.

The first stage (January-December 2020) was aimed at the analysis, systematization and generalization of data from literary sources, domestic and foreign publications, scientific research on the issues of building a multi-year training process of athletes from various sports, the importance of natural, genetic and physiological endowments of young athletes in achieving high results in a specific sport, developing and applying criteria for selecting children in children's and youth sports schools in complex coordinated sports.

In order to determine the level of sports preparedness of young athletes aged 9–13, the protocols of competition results were analyzed, namely the protocols of the Ukrainian Youth Championships for the period from 2013 to 2020. Based on the results of the analysis of the competition protocols, the following indicators were determined:

the sum of the difficulty coefficients of all jumps in the program is an indicator of the difficulty of the competition program;

the sum of the difficulty coefficients of arbitrary jumps is an indicator of the number and complexity of arbitrary jumps;

the average difficulty coefficient of arbitrary jumps – the indicator of the complexity of arbitrary jumps;

the average score for performing mandatory jumps – an indicator of the quality of performing mandatory jumps;

the average score for performing arbitrary jumps of the program is an indicator of the quality of performing arbitrary jumps;

the sports result in points is an indicator of sports preparedness.

During the ascertainment experiment, we determined the level of development of strength, speed-strength fitness, flexibility and coordination, as well as the total indicator of physical fitness of young athletes, which characterizes the versatility of the development of physical fitness.

The physical development of young athletes was determined and analyzed based on height and body weight, arm and leg sizes, chest circumference, waist and hips, and the skin-fat fold index was calculated. A study of the functional state of the vestibular apparatus was carried out using a passive rotary test, as well as the amplitude, frequency and duration of nystagmus to assess vestibular stability.

At this stage, the processing of research materials also included factor analysis (principal component method with rotation of reference axes according to the varimax criterion), which was aimed at identifying relationships between different types of preparedness that characterize in detail the sports activities of young divers in the age periods from 9 up to 13 years old, and determining the differences between boys and girls of the same age.

To establish the necessary levels of development of indicators that determine the sports achievements of young divers, multiple regression equations were calculated that connect the prerequisites with the level of sports preparedness of boys and girls aged 9–13.

The multiple regression equations were calculated relative to the total CS of random jumps and the average CS of random jumps and had the following form:

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7,$$

where y is the calculated sports fitness indicator;

a is a constant;

b – regression coefficient;

x is the test result.

The methods of mathematical statistics were used in order to prove the regularities discovered in the research process. Mathematical and statistical calculations were carried out using computer programs, in particular «Excel», «SPSS», «STATISTICA 7» in the operating system «Windows Vista».

Research Results and Their Discussion. Based on the analysis of the results of competitions among children aged 9–13, we developed a normative assessment of the sports readiness of young divers (table 1, table 2). The estimate of the average coefficient of difficulty was formed by mathematically processing the results of the finalists of the European Championships, Championships and World Cups by calculating: «excellent» – the average coefficient of athletes who took 1st to 6th place; «good» – 7–12 places; «satisfactory» – qualified; «unsatisfactory» – did not pass the qualification.

Given the subjectivity of the judge's assessment, we did not make it our task to determine a normative assessment of the quality of jumping. Since the main task of the stage of advanced sports training is to master jumps with an average and high difficulty factor, the main criteria for the sports readiness of young athletes at this stage were determined: 1) the sum of the difficulty factors of jumps and 2) the average factor of difficulty of jumps. The first indicator, in addition to the complexity of the mastered elements, also characterizes their number.

When using a normative assessment, it should be taken into account that technical readiness should be assessed at the stage of initial training, which involves at least 2 years of sports experience.

Table 1

**Estimation of the Sum of the Complexity Coefficients
Jumps of Young Jumpers 9–13 Years Old**

Age, *Years*	Rating			
	Perfectly Score and More	Fine (max.- min.)	Satisfactorily (max.- min.)	Badly
9	4,1	3,8–3,1	2,8–1,64	1,5
10	7,0	7,1–5,7	5,4–2,4	2,3
11	9,7	9,7–7,8	7,7–3,1	3,0
12	11	10,8–9,4	9,3–6,8	4,2
13	13,1	12,8–9,9	9,8–8,7	8,4

Table 2

**Estimation of the average Difficulty Factor
Jumps of Young Jumpers Aged 9–13 Years into the Water**

Age, *Years*	Rating			
	Perfectly Score and More	Fine (max.- min.)	Satisfactorily (max.- min.)	Badly
9	2,1	1,9–1,6	1,6–1,3	1,2
10	2,0	2,0–1,9	1,7–1,4	1,5
11	2,2	2,2–2,1	1,9–1,6	1,5
12	2,53	2,4–2,1	2,1–1,8	1,7
13	2,5	2,5–2,3	2,3–2,2	2,1

The developed assessment of sports readiness is the main criterion for determining the sports fitness of young divers.

Factor analysis (principal component method with varimax rotation of reference axes) was carried out to identify the relationships between different types of preparedness, which more fully characterize the sports

activities of young divers in the age periods from 9 to 13 years, and to determine the differences between boys and girls of the same age-criterion) [14; 43].

Factor analysis was applied to selected indicators that characterize various types of preparedness and features of the development of young athletes. The factors identified as a result of this analysis give a fairly complete picture of the structure of the sports activities of young divers aged 9–13. Given the fact that the number of factors selected by the program in each age group was large (from 14 to 18), and their contribution to the generalized variance was unequal, the first five to six factors from the set of indicators, which had the greatest factor weight, were interpreted.

The results of the factor analysis made it possible to determine indicators that have prognostic significance for the success of the sports improvement of young divers at the stage of advanced sports training, as well as their contribution to the structures of children's sports activities (table 3, table 4). These indicators can include: (1) the total indicator of physical fitness, (2) the amplitude of nystagmus during and (3) after turning to the right, (4) the speed of a simple motor reaction, as well as indicators of physical development: (5) weight, (6)) growth, (7) chest circumference.

To establish the necessary levels of development of indicators that determine the sports achievements of young divers, multiple regression equations were calculated that connect the prerequisites with the level of sports preparedness of boys and girls aged 9–13.

The multiple regression equations were calculated relative to the total CS of random jumps and the average CS of random jumps and had the following form:

$$y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + b_6x_6 + b_7x_7,$$

where y – is the calculated sports fitness indicator; a – is a constant; b – regression coefficient; x – is the test result.

So, for example, for 9-year-old boys, a regression equation was obtained that connects the prerequisites with the average CS of free jumps, which has the following form:

$$y_1 = 13{,}83 + 0{,}010x_1 - 0{,}043x_2 + 0{,}096x_3 - 0{,}009x_4 + 0{,}155x_5 - 0{,}147x_6 + 0{,}032x_7.$$

The multiple correlation coefficient for this regression equation is R = 0,835. The coefficient of determination, which indicates how well the tests used in this regression determine the average CS of random jumps, is R^2 = 0,697. So the tests used in this regression determine the average CS of random jumps by 69,7 %.

The regression equation, which relates the prerequisites of 9-year-old boys to the sum of CS of arbitrary jumps, looks like this:

$$y_2 = 42{,}52 + 0{,}029x_1 - 0{,}096x_2 + 0{,}240x_3 - 0{,}031x_4 + 0{,}444x_5 - 0{,}448x_6 + 0{,}117x_7.$$

The multiple correlation coefficient for this equation is R=0,828. The coefficient of determination, which indicates how much the control exercises used in this regression determine the total CS of free jumps, is equal to R^2=0,685.

This means that the indicators we used by 68,5 % determine the sum of CS of free jumps of 9-year-old boys.

To determine the possible level of sports preparation, the test results are substituted into the regression equation and the individually possible sports indicator is calculated (average difficulty factor and total difficulty factor of arbitrary jumps) (table 5, table 6).

Based on the calculated criterion, the suitability of a young athlete for diving is assessed. For this, the calculated indicator is compared with the data of the normative table of sports fitness (table 1 and table 2).

The calculated indicator of sports fitness may be higher than the one the athlete actually has at a specific moment. This shows that the athlete has not yet used all the opportunities that he can realize in the future. If the calculated indicator is lower than the actual one, this rather indicates a certain compensation of accounting factors by others (for example, psychological characteristics of a young athlete). The cases given in the last example occur only occasionally. However, if a young athlete has a low level of physical fitness and other indicators, the prospects for growth in the coming years are small.

The verification of the effectiveness of the comprehensive assessment of sports fitness, obtained by calculating multiple regression equations, was carried out by rank correlation of the calculated indicators of sports fitness at the beginning of the observation with the true data on the success of sports activities by years of study (table 7).

Table 3

Scheme of the Factor Structure of Sports Activities Diving Boys Aged 9–13

Factor No	9 Years		10 Years		11 Years		12 Years		13 Years	
	Factor Identification	Contribution to the Total Variance, %	Factor Identification	Contribution to the Total Variance, %	Factor Identification	Contribution to the Total Variance, %	Factor Identification	Contribution to the Total Variance, %	Factor Identification	Contribution to the Total Variance, %
1	Physical Development	21,7	Sports Fitness	19,3	Physical Development	15,4	Physical Development	16,7	Physical Development	20,4
2	Sports and Physical Fitness	15,1	Physical Development	11,4	Vegetative Reactions to Rotational Load	14,4	Sports and Physical Preparedness	14,2	Sports Fitness	14,2
3	Vegetative Reactions to Rotating Load	10,3	Speed of Sensorimotor Response	9,7	Sports Fitness	10,6	The ability to Self-Manage Sensorimotor Activity	9,7	Vegetative Reactions to Rotating Load	10,0
4	Nystagmus Reactions to Rotating Load	9,4	Vegetative Reactions to Rotational Load	8,8	The Speed of Sensorimotor Response	10,2	The Speed of Sensorimotor Response	8,6	The Speed of Sensorimotor Response	9,4
5	The ability to Self-Manage Sensorimotor Activity	6,5	Nystagmus Reactions to Rotating Load	6,9	Nystagmus Reactions to Rotating Load	7,5	Vegetative Reactions to Rotational Load	5,9	The ability to Self-Manage Sensorimotor Activity	7,7
6	Learnability	5,8	Physical Development	5,8	Learnability	5,9	Learnability	5,7	Learnability	6,2
7	Together	68,8		61,9		64,0		60,8		67,8

Table 4

Scheme of the Factor Structure of Sports Activities Diving Girls 9–13 Years Old

Factor No	9 Years		10 Years		11 Years		12 Years		13 Years	
	Factor Identification	**Contribution to the Total Variance, %**	**Factor Identification**	**Contribution to the Total Variance, %**	**Factor Identification**	**Contribution to the Total Variance, %**	**Factor Identification**	**Contribution to the Total Variance, %**	**Factor Identification**	**Contribution to the Total Variance, %**
1	Physical Development	22,6	Sports Fitness	20,1	Physical Development	18,6	Sports Fitness	21,6	The Speed of Sensorimotor Response	25,8
2	Sports Fitness	14,3	Physical Development	12,8	The Speed of Sensorimotor Response	17,1	The Ability to Self-Manage Sensorimotor Activity	15,5	Sports Fitness	17,9
3	Learnability	10,6	Nystagmus Reactions to Rotational Load	10,0	Vegetative Reactions to Rotational Load	12,1	Physical Development	13,6	Physical Fitness	16,6
4	The Ability to Self-Manage Sensorimotor Activity	9.3	The Ability to Self-Manage Sensorimotor Activity	7.9	Physical Fitness	8.9	Nystagmus Reactions to Rotational Load	10.8	Physical Fitness and Physical Development	13,3
5	Nystagmus Reactions to Rotational Load	7,4	Physical Fitness	6,9	Sports Fitness	6,3	The Speed of Sensorimotor Response	9,5	Physical Fitness and Physical Development	10,4
6	The Speed of Sensorimotor Response	6,1	Learnability	6,1	The Ability to Self-Manage Sensorimotor Activity	6,1	Physical Fitness	8,9	Physical Fitness and Physical Development	10,0
	Together	70,3		63,8		69,1		79,9		94,0

Table 5

Multiple Regression Equation to Define Sports Training of Boys Aged 9–13

Age, *Years*	Indicator of Sports Readiness	Free Member	Total Indicator of Physical Fitness	Amplitude of Nystagmus During Rotations to the Right	Amplitude of Nystagmus After Rotations to the Right	The Speed of a Simple Motor Reaction	Mass	Growth	Chest Circumference	Multiple Correlation Coefficient	Coefficients Entity of the Determiner Tions, %
	y	a	b1	b2	b3	b4	b5	b6	b7	R	D
9	y1	13,83	0,010	-0,043	0,096	-0,009	0,155	-0,147	0,032	0,835	69,7
	y2	42,52	0,029	-0,096	0,240	-0,031	0,444	-0,448	0,117	0,828	68,5
10	y1	3,048	0,025	-0,003	-0,003	0,003	-0,032	0,003	-0,052	0,638	40,7
	y2	37,477	0,070	-0,080	-0,034	-0,001	0,063	-0,187	-0,169	0,720	51,8
11	y1	0,168	0,013	-0,038	0,006	-0,005	0,081	-0,080	0,149	0,798	63,6
	y2	-6,344	0,037	-0,111	-0,003	-0,015	0,195	-0,192	0,479	0,800	64,0
12	y1	-1,639	0,008	0,003	-0,003	0,001	0,004	0,001	0,36	0,678	46,0
	y2	-14,950	0,033	-0,138	-0,016	0,013	0,038	0,023	0,184	0,602	36,2
13	y1	0,971	0,009	0,008	-0,011	-0,002	-0,009	-0,006	0,028	0,634	40,2
	y2	-8,603	0,066	-0,008	-0,093	-0,001	0,018	0,088	-0,016	0,580	33,6

Table 6

**Multiple Regression Equation for Determining Sports Readiness
of Girls Aged 9–13**

Age, *Years*	Indicator of Sports Readiness	Free Member	Total Indicator of Physical Fitness	Amplitude of Nystagmus During Rotations to the Right	Amplitude of Nystagmus After Rotations to the Right	The Speed of a Simple Motor Reaction	Mass	Growth	Chest Circumference	Multiple Correlation Coefficient	Coefficients Entity of the Determiner Tions, %
	y	a	b1	b2	b3	b4	b5	b6	b7	R	D
9	y1	-8,350	0,009	-0,108	0,036	0,004	0,253	-0,017	0,072	0,772	59,6
	y2	-25,192	0,028	-0,325	0,110	0,011	0,759	-0,050	0,218	0,772	59,6
10	y1	0,228	0,010	0,097	-0,109	0,002	0,022	0,001	-0,009	0,687	47,2
	y2	-2,632	0,034	0,246	-0,318	0,006	0,013	0,010	0,031	0,703	49,4
11	y1	-4,930	0,024	-0,027	0,008	0,006	0,054	0,063	-0,099	0,748	55,9
	y2	-26,284	0,112	-0,110	-0,024	0,019	0,162	0,230	-0,239	0,707	49,9
12	y1	-2,419	0,008	-0,054	0,026	-0,0002	-0,016	0,043	-0,027	0,572	32,8
	y2	-30,184	0,062	0,417	-0,549	0,005	0,032	0,286	-0,135	0,656	43,0
13	y1	-3,946	0,011	-0,008	0,056	-0,002	-0,097	0,046	0,022	0,765	58,5
	y2	-55,336	0,150	-0,299	0,467	-0,004	-0,467	0,632	-0,380	0,887	78,9

Table 7

Rank Correlation of Sports Fitness Indicators,
Obtained by Calculating Multiple Regression Equations, with True Years of Study

Initial Age of the Subject Groups, *Years*	Sex	Years of Study		
		1	2	3
Average CS of Free Jumps				
9	Guys n = 25	0,776	0,854	0,904
	Girls n = 16	0,698	0,869	0,808
10	Guys n = 30	0,604	0,799	0,957
	Girls n = 23	0,707	0,804	0,988
11	Guys n = 30	0,857	0,891	0,958
	Girls n = 18	0,805	0,888	0,959
12	Guys n = 31	0,784	0,907	0,915
	Girls n = 21	0,777	0,899	0,923
13	Guys n = 23	0,822	0,950	0,969
	Girls n = 18	0,811	0,897	0,905
The Sum of CS of Arbitrary Jumps				
9	Guys n = 25	0,763	0,893	0,941
	Girls n = 16	0,666	0,805	0,884
10	Guys n = 30	0,777	0,879	0,955
	Girls n = 23	0,701	0,799	0,899
11	Guys n = 30	0,804	0,889	0,907
	Girls n = 18	0,799	0,876	0,940
12	Guys n = 31	0,779	0,905	0,923
	Girls n = 21	0,799	0,970	0,943
13	Guys n = 23	0,880	0,901	0,951
	Girls n = 18	0,900	0,923	0,951

The given data indicate that there is a highly probable relationship between the calculated indicators of sports readiness and the true ones by years of study, and the closeness of the relationship increases from one year of study to another. Based on this, it can be stated that the comprehensive assessment obtained by calculating multiple regression equations has a high prognostic value and is an effective method of predicting the success of the sports improvement of young divers at the stage of advanced sports training.

Discussion. We supplemented the scientific research of M. A. Buts [8] that the morphofunctional status of an athlete largely determines the possibility of achieving high sports results. The conducted factor analysis made it possible to identify the factor of physical development, which was formed by morphological indicators. The value of this factor changes according to age development, but its contribution to the total variance remains quite high, which allows us to consider the physical development of young athletes as one of the leading factors. We determined that in the group of 9-year-old boys, the factor identified as physical development has the largest contribution to the generalized variance of the sample – 21,8 %; at 10 years – the factor of physical development has the second largest contribution to the total variance – 11,4 %, and at 11, 12 and 13 years the contribution of the factor of physical development increases, respectively 15,4 %, 16,7 % and 20,4 %.

In order to determine the characteristics of the physical development of young water jumpers, the results obtained by us were compared with the results of scientific research by O. V. Drozd [15], namely: with data on the physical development of schoolchildren who are not engaged in any of the sections, young athletes – gymnasts and swimmers. The analysis of research results showed that in terms of height and weight, divers occupy an intermediate position between the indicators of schoolchildren and gymnasts. The chest circumference of divers is unbelievably larger than that of gymnasts and schoolchildren. All indicators of the physical development of swimmers are equal to the upper limit of the average level of schoolchildren, which are the standard for assessing the physical development of children.

By comparing the physical development data of girls engaged in diving with schoolgirls and gymnasts, we supplemented the results of S. M. Klimakova's research [19] (and found that female athletes are at the

lower limit of the average height and weight indicators of schoolgirls who do not play sports, but somewhat prevail in terms of gymnasts. The chest circumference of 9–10-year-old female athletes is slightly larger, and in 11–13-year-old girls, it is slightly smaller than the average indicators of girls who do not play sports, while the indicators of gymnasts are at the lower limit of the average level of schoolgirls.

We improved the research of A. Zhuk [54], namely, we found that an athlete who does not possess a high level of jumping and special speed-strength qualities, which are harmoniously combined with a high level of flexibility and coordination of movements, will not be able to perform jumps with multiple rotations. So, it has been proven that only an athlete with a certain level of physical fitness can master complex jumps, that is, motor learning.

The developed author's criteria of sports fitness are a guideline for determining the suitability of young athletes for diving.

Complex author's criteria, based on the calculation of regression equations, made it possible to compare the level of prerequisites with the level of sports preparation.

Indicators that have prognostic significance and those that did not show it were included in the criteria of sports fitness of 9–13-year-old athletes – divers. The calculated regression equations take into account the relationship between these indicators at different stages of age development.

The selected indicators do not determine sports achievements in age groups to the same extent, as evidenced by the coefficients of determination. Differences in age changes, physical and sports readiness between boys and girls are also taken into account.

Conclusion. It is proved that the comprehensive assessment obtained by calculating multiple regression equations has a high prognostic value and is an effective method of predicting the success of the sports improvement of young divers at the stage of initial sports training.

To achieve the goal of the study, we established the necessary levels of development of indicators that determine the sports achievements of young divers, calculated multiple regression equations that connect the prerequisites with the level of sports preparedness of boys and girls aged 9–13.

Prospects for Further Research in this Direction 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.

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