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Original Article

The implementation of the concept of individualization in training elite Female athletes with visual impairment in the sprint

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Abstract.
The aim of the work is to substantiate the application of the principles of individualization in the training of highly qualified athletes with visual impairment by the example of an elite athlete.
*Material and methods.Participant*s. The study involved a high-qualified athlete, specializing in short-distance running and long jump, the European Athletics Champion 2010; prize winner of the World Paralympic and Paralympic Games among athletes with visual impairments (T12 category) in 2016. Psychophysiological testing of the athlete took place in appropriate optical lenses. *The course of the study*. Individual characteristics of the psychophysiological state and results in running at 60 m, 80 m, 100 m, 120 m, 150 m and 200 m during five months of 2015 were analyzed. Parameters characteristic for determining the psychophysiological state, typological characteristics of the nervous system, indicators working capacity of the nervous system, attention indicators were analyzed with the help of computer programs for psychophysiological testing. *Mathematical processing*. Based on the results in the running on and psychophysiological indicators, a factor analysis was carried out using the main components method with Varimax rotation, multiple regression analysis by the linear model type in a step-by-step method; models of competitive performance as nonlinear sinusoidal regression using SPSS and Excel programs are compiled. *Results.* Four factors are identified in the individual structure of psychophysiological functions and effectiveness in running for short distances with the example of an elite sportswoman with visual impairment: 46.4% - "Fast work capacity", 8.2% - "Complicated reaction", 6.8% - "Attention ", 5.1% -" Stability ", 34% - other factors. A high contribution to the individual factor structure of psychophysiological functions and running performance of indicators reflecting the qualities characteristic of sprinters (speed of reaction and mobility of the nervous system) and nonspecific for sprinters of quality (working capacity and strength of the nervous system) is revealed. Compensatory mechanisms of visual deficiency have been identified to maintain high speed in short-distance running as psychophysiological functions: indicators characteristic of sprinters (speed of simple reaction and motility of the nervous system) and specific indicators (efficiency, strength of the nervous system). *Conclusions.* On the basis of mathematical models, the strengths of an athlete are highlighted, which tend to develop, and also compensate for the inadequacy of the visual analyzer.
Keywords: sprint, track and field athletics, vision, limited possibilities, psychophysiological functions

Introduction.

Theoretical generalization of literary sources has shown that there are various factors that determine the formation of the characteristics of athletes, on the basis of which an individual approach to the training of athletes in a sprint can be carried out (Brazil, Exell, Wilson, et al, 2017; Chebanu, Kozina, Timko, Grebneva, & Kolomiets, 2017; Chen, Zhou, Qian, & Gong, 2012). This is the basis of methodological approaches to solving the problem of finding ways to prepare elite sprinters in track and field athletics. This problem is especially topical for athletes with disabilities (Sobko, 2015), among which a special place is occupied by athletes with visual impairments (Fagher, Forsberg, Jacobsson, Timpka, Dahlstrom, & Lexell, 2016). Each elite athlete is a unique individuality (Znazen, Slimani, Miarka et al., 2017). The training process of each elite athlete has its own characteristics. In the case where the elite athlete has limited opportunities, individualization becomes particularly important. At present, the concept of individualization of training of athletes has been developed (Zhanneta, Irina, Tatyana, Olena, Olena, & Anna, 2015). According to this concept, in order to implement an individual approach, it is necessary: 1) to determine the individual structure of preparedness taking into account

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various indicators and to identify leading and backward factors; determination of regularities in the individual dynamics of competitive performance and forecasting the ups and downs of the athlete's functional state; 3) activation of mental and psychological aspects of training to improve sports skills using multimedia and psycho-regulatory technologies. The application of this concept has shown its effectiveness in the training process in sports games, martial arts, sports aerobics and other sports activities. It is logical to assume that the application of the concept of individualization will be effective in the process of preparing an elite athlete with a visual impairment in running for short distances. The first direction of the concept of individualization is the definition of the individual factor structure of the athlete's preparedness (Kozina, Shepelenko, Osiptsov, et al., 2017). The structure of the preparedness of athletes makes it possible to consider a group of athletes and each athlete as a dynamic system (or complex of systems) with precisely defined parameters and their mutual hierarchy. The structure of athletes' preparedness is a more complex characteristic of both the group and individual athlete, compared to a simple set of various fitness indicators. Therefore, the definition of individual characteristics of the structure of the preparedness of high-qualified sprinters with visual impairments is of great relevance.

In the structure of preparedness there are nonspecific factors that determine competitive performance. Of these non-specific factors, we separately isolated psychophysiological factors (Ilin, 1972, 1974; Korobeynikov, 2002; Lyzohub, Nechyporenko, Pustovalov, & Suprunovych, 2016; Kozina, Iermakov, Crełu, Kadutskaya and Sobyanin, 2017; Sindiani, Eliakim, Segev, Meckel, 2017). Psychophysiological functions and typological features are congenital characteristics (Korobeynikov, Mazmanian, Korobeynikova, & Jagiełło, 2011; Lyzohub, Nechyporenko, Pustovalov, & Suprunovych, 2016), and therefore are one of the main factors determining the main aspects of sports activities (Blecharz, & Siekanska, 2007; Boldak, & Guszkowska, 2013). A number of studies have shown the expediency of taking into account the psychophysiological functions of athletes for determining individual styles of wrestling in martial arts (Korobeynikov, Mazmanian, Korobeynikova, & Jagiełło, 2011; Liu, 2015), playing roles in sports games (Makuts, TB, & Vysochina, NL 2015; Kozina, Sobko, Yermakova, et al., 2016; Kozina, Prusik, Görner, Sobko, 2017; Kozina, Iermakov, Crełu, Kadutskaya and Sobyanin, 2017). and in other sports sports (Korobeynikov, Myshko, Pastukhova, Smoliar, 2017). Individual psychophysiological differences can be so pronounced that they will determine the necessary set of means and methods for training athletes. This problem is especially acute for athletes with disabilities (Sobko, 2015, Fagher, Forsberg, Jacobsson, Timpka, Dahlstrom, & Lexell, 2016), in particular, for athletes with visual impairment (Chebanu, Kozina, Timko, Grebneva, & Kolomiets, 2017). The second direction of the concept of individualization is connected with the definition of the regularities of the individual dynamics of the change in the sports form, which manifests itself in the individual laws of competitive performance (Zhanneta, Irina, Tatyana, Olena, Olena, & Anna, 2015). It is known that in connection with the regularities of recovery processes and individual fluctuations in the functional state, the dynamics of the sports form can not have the appearance of a straight line, it has a wavy character. Of great importance is the art of building sports training in the correct proportions of the natural vibrations of the sports form associated with the adaptation processes, internal and external factors affecting the athlete, with the amount of volume and intensity of training loads. However, at the present time, the ability to combine loads of a different orientation, not only in their interrelation with each other, but also in accordance with the individual laws of changing the functional state of the athlete, remains to a greater extent the art of the coach, based on his experience and intuition. The third direction of individualization involves the activation of the conscious aspects of the athlete in the process of preparation, since the movements are controlled by the central nervous system. Activation of this aspect automatically contributes to the individualization of the preparation process. For this purpose, specially developed multimedia, interactive technologies can be used, as well as special autogenic (psycho-regulatory) training (Zhanneta, Irina, Tatyana, Olena, Olena, & Anna, 2015). In this study, it was suggested that the application of the principles of the concept of individualization in relation to an elite athlete with visual impairment (sprint) will reveal individual features of the structure and patterns of the dynamics of the functional state and determine individual mechanisms for compensating for limited visual opportunities.

The aim of the work is to substantiate the application of the principles of individualization in the training of highly qualified athletes with visual impairment by the example of an elite athlete.

Materials and methods.

Participants. The study involved a high-qualified athlete, specializing in short-distance running and long jump, the European Athletics Champion 2010; prize winner of the World Paralympic and Paralympic Games among athletes with visual impairments (T12 category) in 2016. Psychophysiological testing of the athlete took place in the corresponding optical lenses.

The course of the study. Individual characteristics of the psychophysiological state and results in running at 60 m, 80 m, 100 m, 120 m, 150 m and 200 m during the five months of 2015 were analyzed.

The results in the race were recorded in training, as well as in official and unofficial competitions. A total of 36 results were analyzed. 1 day before the start, psychophysiological indicators were recorded using the computer program "Psychodiagnostics" and similar programs for psychophysiological testing. The parameters characteristic for determining the psychophysiological state, typological features of the nervous system, indicators of the efficiency of the nervous system, attention indicators (Kozina, Prusik, Görner, Sobko, 2017) were fixed:

- a set of indices for the time of a simple visual-motor reaction (mean of 30 attempts (ms), standard deviation (ms), number of errors); duration of exposure (signal) - 900 ms;

- a complex of indicators of a complex visual-motor reaction of selecting 1 element from three and selecting two elements from three (mean value of 30 attempts (ms), standard deviation (ms), number of errors); duration of exposure (signal) - 900 ms;

- a complex of indicators of a complex visual-motor reaction of selecting two elements out of three in the feedback mode, i.e. As the response time changes, the signal delivery time changes; "Short version" is carried out in the feedback mode, when the duration of exposure changes automatically depending on the response of the subject: after the correct answer, the duration of the next signal is reduced by 20 ms, and after the wrong one - increases by the same amount. The range of the signal exposure change during the test subject's operation is within 20-900 ms with a pause between exposures of 200 ms. The correct answer is to press the left (right) mouse button while displaying a certain exposure (image), or during a pause after the current exposure. In this test, the time to reach the minimum exposure of the signal and the time of the minimum exposure of the signal reflect the functional mobility of the nervous processes; the number of errors reflects the strength of the nervous processes (the lower these parameters, the higher the mobility and strength of the nervous system). The duration of the initial exposure is 900 ms; the amount of change in the duration of the signals with correct or erroneous responses is 20 ms; pause between the presentation of signals - 200 ms; the number of signals is 50. The indicators are fixed: the average value of the latent period, ms; root mean square deviation, ms; number of mistakes; time of test execution, s; minimum exposure time, ms; time of exposure to the minimum exposure, sec.

- a complex of indicators of a complex visual-motor reaction of selecting two elements out of three in the feedback mode, i.e. As the response time changes, the signal delivery time changes; "Long version" is carried out in the feedback mode, when the duration of exposure changes automatically depending on the response of the subject: after the correct answer, the duration of the next signal is reduced by 20 ms, and after the wrong one - increases by the same amount. The range of the signal exposure change during the test subject's operation is within 20-900 ms with a pause between exposures of 200 ms. The correct answer is to press the left (right) mouse button while displaying a certain exposure (image), or during a pause after the current exposure. In this test, the time to reach the minimum exposure of the signal and the time of the minimum exposure of the signal reflect the functional mobility of the nervous processes; the number of errors reflects the strength of the nervous processes (the lower these parameters, the higher the mobility and strength of the nervous system). In addition, the total time of the test reflects a combination of strength and mobility of the nervous processes. The duration of the initial exposure is 900 ms; the amount of change in the duration of the signals with correct or erroneous responses is 20 ms; pause between the presentation of signals - 200 ms; the number of signals is 120. The indicators are fixed: the average value of the latent period, ms; root mean square deviation, ms; number of mistakes; time of test execution, s; minimum exposure time, ms; time of exposure to the minimum exposure, sec.

The indicators of mental working capacity were also determined according to the Schulte test. In this test, the subject needs in the 5X5 tables of 25 digits (from 1 to 25) arranged in random order, in order to mark the numbers from 1 to 25. After passing the first table, the second with a different order of digits immediately appears, and so on. In total, the subject passes 5 tables. Fixed the time of work on each table of five (min.), The efficiency of work as the arithmetic average of the time of operation on five tables (min.), The performance of the nervous system as a private time of work on the fourth and first tables, and the workability of the nervous system as a private work time for the second and the first tables. To determine the attention indicators, the Bourdon test was used. In this test, a table with letters in which you want to mark a specific letter. The test results are evaluated according to the following indicators: number of errors; time of the test; the rate of execution (expressed in terms of the number of rows worked and the number of errors made during the time interval of work); concentration of attention, which is estimated from the result of dividing the number of rows of the table viewed by the subject by the number of errors (omissions or erroneous deletions of unnecessary signs); stability of attention, which is estimated by dividing the number of letters in the scanned part of the proof-reading table by the time spent for it; Attention switching is calculated from the result of dividing the number of erroneously worked rows by the total number of rows and multiplying by 100%.

The response time of the selection for the signals appearing at various points of the screen according to the program "Button selection" ("Ermakov test") was also determined.

The dynamics of the competitive performance of a high-qualified athlete at international competitions from 1997 to 2015 in the 400m, 200m, 100m and 60m races was analyzed. Mathematical models of non-linear regression describing the dynamics of the athlete's competitive performance in the long-term period are compiled. Based on the models obtained, a forecast of the results for 2016-2017 is compiled. Models of competitive performance as nonlinear sinusoidal regression in the annual cycle of preparation for the Paralympic Games of 2016 among athletes with visual impairments (category T12) are made. Recommendations are given for adjusting the training process in accordance with the obtained natural patterns of changes in the functional state of the athlete. The analysis of the competitive performance of the athlete in 2016 compared with the forecasted results is carried out. Mathematical processing of results. Based on the results in the run on and psychophysiological indicators, a factor analysis was carried out using the method of main components with Varimax rotation with Kaiser normalization using the SPSS program. Based on the results in running at 100 m, 200 m and psychophysiological indicators, a multiple regression analysis was performed by the type of the linear model in a step-by-step method using the SPSS and EXCEL programs. The dynamics of the competitive performance of a high-qualified sportswoman at international competitions from 1997 to 2015 in running at 200 m and 100 m was analyzed. Mathematical models of nonlinear regression describing the dynamics of the competitive performance of a sportswoman in the long-term period were compiled. Based on the models obtained, a forecast of the results for 2016-2017 is compiled. Models of competitive performance as nonlinear sinusoidal regression in the annual cycle of preparation for the Paralympic Games of 2016 among athletes with visual impairments (category T12) are made. Recommendations are given for adjusting the training process in accordance with the obtained natural patterns of changes in the functional state of the athlete. The analysis of the competitive performance of the athlete in 2016 compared with the forecasted results is carried out.

Results.

The results of factor analysis showed that the number of factors whose eigenvalue is greater than 1 is equal to 10 (Table 1). At the same time, on the chiselled diagram of the eigenvalues of the factors, which is also called the "slope of the hill" (Figure 1), we can distinguish four main factors that form the so-called "slope" in the diagram. Thus, 4 main factors were identified, the percentage of which from the total dispersion was 46.4% for the first factor, 8.2% for the second factor, 6.8% for the third factor, 5.1% for the fourth factor, and 34% for the other factors (Fig. 1).

Table 1

The matrix of the components of the factor analysis after rotation according to the Varimax method of the indices of the psychophysiological state and the results in the run of the elite athlete with visual impairment (the number of tests = 36, the number of factors included in the factors = 27 out of 43)

Indicators	Factors			
	1	2	3	4
The effectiveness of work in the Schulte test (cu)	0,993*			
Operating time on the 4th Schulte table (min.)	0,992			
Working time on the 5th Schulte table (min.)	0,988			
Working time on the 2nd Schulte table (min.)	0,985			
Working time on the 3rd Schulte table (min.)	0,983			
Working time in Bourdon test (min.)	0,983			
Functionality of the nervous system according to the Schulte test (cu)	0,98			
The time of a simple visual-motor reaction (ms)	0,96			
Operating time on the 1st Schulte table (min.)	0,958			
The response time of selecting one element from three (ms)	0,94			
Running 100 m (s)	0,935			
Total working time for Schulte test (min.)	0,892			
Running 150 m (s)	0,885			
Running 60 m (s)	0,883			
The minimum exposure time of the signal in the test with feedback at 120 signals (ms)	0,835			
Total test execution time with feedback at 120 signals (s)	0,816			
Total test execution time with feedback at 30 signals (s)	0,807	-0,408		
Running 200 m (s)	0,794			
Running 80 m (s)	0,644			
"Ermakov test" (number of correct answers for 15 s)	0,627	-0,414		
The response time in the feedback test at 30 signals (ms)		0,866		
Running 120 m (s)	0,577	0,737		
The response time of the selection of two elements of three (ms)		0,716		
A test for the response time of the selection of two elements of three (number of errors)			0,882	
Test for a simple visual-motor reaction (number of errors)			0,75	
The mean square deviation in the test for the response time of the selection of one element of three (ms)				0,932
The mean square deviation in the test with feedback at 120 signals (ms)				0,793

* Note: the correlation coefficients between the test scores and factors are only greater than 0.4

The first factor included such indicators as the effectiveness of work in the Schulte test, the time of work on the first, second, third, fourth, fifth tables of Schulte, the total time and performance of the nervous system according to the Schulte test, the time of work in the Bourdon test, motor reaction time, the response time of selecting one element of three, the minimum exposure time of the signal in the feedback test at 120 signals, the total test execution time with feedback at 120 signals, the total test execution time with feedback at 30 signals crystals; running time of segments 60 m, 80 m, 100 m, 150 m, 200 m, the number of correct responses to signals in the "Ermakov test" (Table 2). Thus, the first factor included the results of running through practically all segments, the psychophysiological indices associated with the time of simple reaction, the mobility of the nervous system (the minimum exposure time of the signal), as well as the performance of the nervous system (Shulte test results, overall test time with feedback). Based on the indicators that were included in the first factor, the name was given the first factor "Fast work capacity".

The second factor included the following indicators: the response time of the selection of two elements of the three, and the running time of the segment 120 m (Table 2). Based on these indicators, the second factor was called "Complicated reaction".

The third factor included indicators of the number of errors in the test at the time of the reaction of selecting two elements out of three and the number of errors in the test for a simple visual-motor reaction (Table 2). Based on these indicators, the third factor was called "Attention".

The fourth factor included such indicators as the standard deviation in the test for the reaction time of the selection of one element of three and the standard deviation in the test with feedback at 120 signals (Table 2). Based on these indicators, the fourth factor was called "Stability".

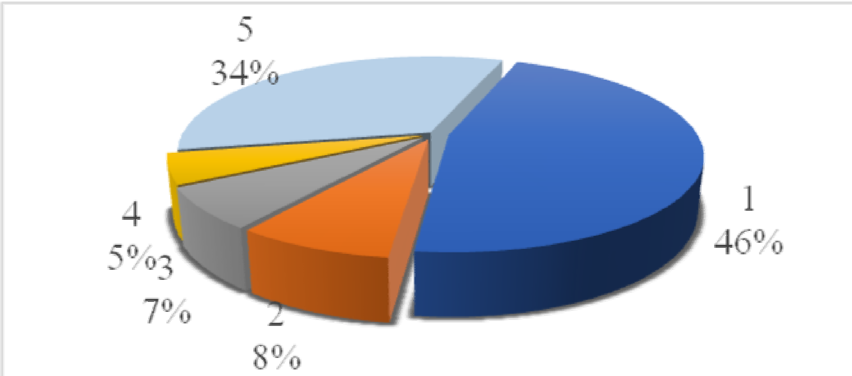

Fig. 1. Individual factor structure of psychophysiological functions in the relationship of performance in running for short distances in elite track-and-field athletes with visual impairment (number of tests = 36, number of factors included in factors = 27 of 43):

1 - the first factor, "High-speed performance";
2 - the second factor, "Complicated reaction";
3 - the third factor, "Attention";
4 - the fourth factor, "Stability"

To reveal the degree of influence of psychophysiological functions on the athletic result in running on 100 m and 200 m, multiple regression analysis was performed by a step-by-step method.

The step-by-step method of multiple regression analysis allows one to involve the analyzed indicators in the model in turn. Based on the results of the analysis of the coefficients in the obtained multiple regression model to describe the influence of psycho-physiological functions at the time of running a 100m elite athlete with a visual impairment, we have chosen the fifth model, because it contains 5 figures (the largest number of all received models) with significant coefficients and the presence of a 2-factor with Beta values greater than 0.4. As a result, the following regression equation was obtained:

$$y=5,808+0,019x_1+0,001x_2+0,006x_3-0,006x_4+2,09x_5, \quad (1)$$

Where:
y - running time of an elite athlete with a visual impairment of 100 m;
x1 - time of simple visual-motor reaction SVMR (ms),
x2 - the time of the minimum exposure of the signal in the test with feedback at 120 signals (MSE_120 (ms)),
x3 - the time of the minimum exposure of the signal in the test with feedback at 30 signals (MSE_30 (ms));
x4 is the response time of the selection of 2 signals from three (ChR (ms));
x5 - time of work on the third table in the Shulte test (ScT_3 (min)).

Подставив средние значения результатов психофизиологического тестирования атлетки (табл. 2) в данное уравнение, получаем:

Run_100 m (s) = *5,808+0,019*·238,08+*0,001*·383,31+*0,006*·434,22-*0,006*·435,81+*2,09*·0,52
Run_100 m (s) = 12,20

The relationship between running time 100 m and psychophysiological indicators is presented in Figure 2. For visual presentation, the psychophysiological indices of the first and second models were chosen, since they appear at the first steps of multivariate regression analysis. Graphical representation of these indicators indicates a high relationship between the running time of a 100 m segment of the time of a simple visual-motor reaction, between 100 m run time and the minimum signal exposure time in a feedback test with 120 signals, and between all three parameters 2).

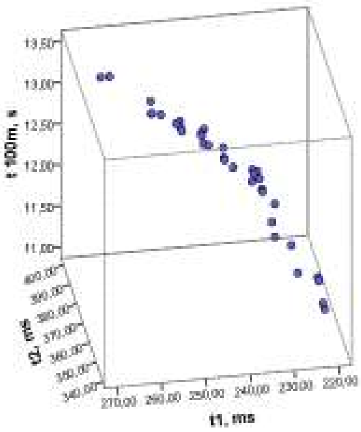

Fig. 2. The relationship of running time 100 m, the time of a simple visual-motor reaction and the time of the minimum exposure of the signal in the test with feedback at 120 signals (source: drawing by the authors):
t 100 m, s - the running time of the section is 100 m (s);
t1- time of simple visual-motor reaction, average value for one test of 30 signals (ms);
t2- time of the minimum exposure of the signal in the test with feedback at 120 signals (ms)

Table 2

The results of repeated testing of an elite athlete with visual impairment

Indicators	N	Minimum	Maximum	*x*	S	m
Run_100 m (s)	36	11,37	13,2	12,20	0,47	0,08
MSE_120 (мс)	36	345	400	383,31	15,21	2,53
SVMR (ms)	36	222	265	238,08	11,42	1,90
MSE_30 (ms)	36	420	452	434,22	8,71	1,45
ChR (ms)	36	420	452	435,81	9,70	1,62
ScT_3 (min)	36	0,35	0,69	0,52	0,10	0,02
Run_200 m (s)	36	23,78	30,50	26,20	1,84	0,31
MSE_120_t (s)	36	256,00	310,00	279,56	16,27	2,71
MSE_30_t (s)	36	59,00	70,00	66,17	3,50	0,58
MSE_120_t (s)	36	71,00	80,00	75,83	2,44	0,41

*Notes:
Run_100 m - running time of the section is 100 m (s);
SVMR is the time of a simple visual-motor reaction, the average value for one test of 30 signals (ms) (time of a simple visual-motor reaction);
MSE_120 - the time of the minimum exposure of the signal in the test with feedback at 120 signals (ms) (minimum signal exposure);
MSE_30 - the time of the minimum exposure of the signal in the test with feedback at 30 signals (ms) (minimum signal exposure);
ChR - the reaction time of the choice of two signals of three (ms) (choice reaction);

ScT_3 - time of work on the third table in the Schulte test (Shul_3) (min) (Schulte table);
MSE_30_t_min (s) - the time of the minimal exposure of the signal in the test with feedback at 30 signals
MSE_120_t_min (s) - the time to reach the minimum exposure of the signal in the test with feedback at 120 signals
MSE_120_t (s) - test execution time with feedback at 120 signals
N - number of tests

Similarly, the effect of psychophysiological indices on the running time of a distance of 200 m was analyzed. As a result, the following regression equation was obtained:

$y=10,13+0,045x_1+0,017x_2+0,001x_3+0,008x_4$, (2)

Where:

y - elapsed time elitist athlete with a visual impairment of 200 m;

x1 is the time of a simple visual-motor reaction (mean time of minimum exposure for the minimum exposure of the signal in the test with feedback at 120 signals (SNP_exp) (ms),

x2 is the total test execution time with feedback at 120 signals (SNP_sup) (s) (ms),

x3 - time of the output to the minimum exposure of the signal in the test with feedback at 30 signals (FPSS_v) (s);

x4 is the time to reach the minimum exposure of the signal in the test with feedback at 120 signals (SNP_v) (s)

Substituting the average values of the results of psycho-physiological testing of the athlete (Table 2) in this equation, we obtain:

Run 200 m (s) = *10,13+0,045*238,08+0,017*279,56+0,001*75,83+0,008*66,17*
Run 200 m (s) = 26,20

The relationship between running time of 200 m and psychophysiological indicators is presented in Figures 1-3. For visual presentation, the psychophysiological indices of the first and second models were chosen, since they appear at the first steps of multivariate regression analysis. Graphical representation of these indicators indicates a high relationship between the running time of a 200 m segment of the time of a simple visual-motor reaction, between 200 m run time and the total test execution time with feedback at 120 signals, and between all three parameters (Fig. 3).

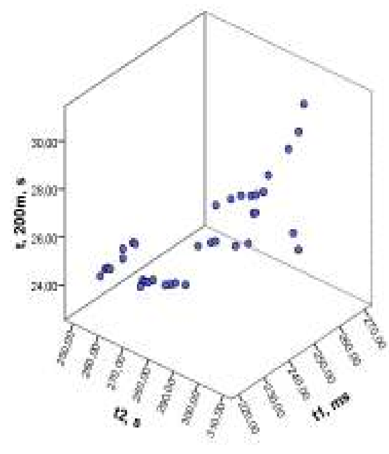

Fig. 3. The relationship between the running time of 200 m, the time of a simple visual-motor reaction and the total time of the test with feedback at 120 signals (source: drawing by the authors):
t 200 m, s is the running time of the 200 m section (s);
t1- time of simple visual-motor reaction, average value for one test of 30 signals (ms);
t2- total test execution time with feedback at 120 signals (s)

According to the second principle of the concept of individualization, polynomial regression curves were analyzed for the period from 1997 to 2015, the productivity at 200 m, 100 m. The athlete's competitive performance from 1997 to 2015 at a distance of 200 m is described by the polynomial regression equation (Figure 4) , R2 = 0.71, which indicates a high accuracy of the regression approximation. If we extend this curve according to the regression equation further, we get a performance forecast at a given distance. We can see that by the middle of 2016, according to the forecast, there was expected stabilization and even a slight decrease in the effectiveness at a given distance (Figure 4). For successful performances at the Paralympic Games in 2016, it was necessary to increase the effectiveness at this distance.

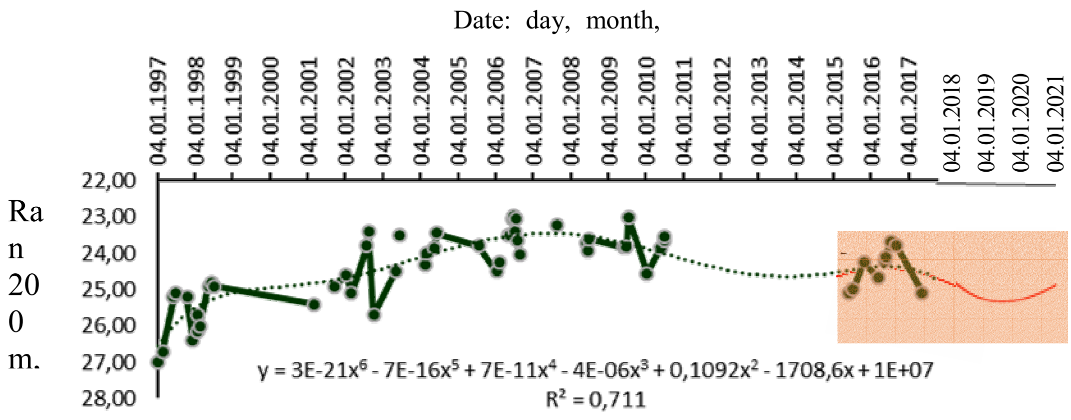

Fig. 4. Individual competitive performance of an elite athlete at a distance of 200 m:
Points on the dotted curve - results in international competitions;
The dotted curve is a graph of the polynomial regression describing the dynamics of competitive performance since 1997 by 2015;
The solid curve, the shaded section of the graph - the performance forecast from 2015.

The same regularity is characteristic for a distance of 100 m. Competitive performance of an athlete from 1997 to 2015 at a distance of 100 m is also described by the polynomial regression equation, R2 = 0.66, which indicates a sufficient accuracy of the regression approximation. If we extend this curve according to the regression equation further, we get a performance forecast at a given distance. We can see that by the middle of 2016, according to the forecast, as well as for a distance of 200 m, stabilization and even some decrease in the performance at a given distance was expected (Figure 3). For successful performances at the Paralympic Games in 2016, it was necessary to increase the effectiveness at this distance.

Thus, on the basis of factor analysis, multiple regression of the indicators of the psychophysiological state and results in running for short distances, and also on the basis of regression models of performance and analysis of the predicted result at different distances, the athlete's strengths were highlighted, which tend to develop. Such strengths are explosive force, starting speed, speed endurance. Of the psychophysiological characteristics, the strengths of the reaction are the speed, mobility and strength of the nervous system. Apparently, in this case the strength of the nervous system acts as a compensatory factor of limited visual possibilities, since it is not a typical characteristic of a sprinter. On the basis of the received data, practical recommendations were given for the preparation of an athlete for the Paralympic Games of 2016.

Discussion.

The results confirmed the hypothesis put forward in this study that the application of the concept of individualization will be effective in the process of preparing an elite athlete with visual impairment in short-distance running. The purpose of the work was to justify the application of the principles of individualization in the training of athletes of high qualification on the example of an elite athlete.

As a result of factor analysis by the main component method, it was revealed that the majority of psychophysiological indicators entered into one, the first factor, which amounted to 46% of the total total variance. This indicates a high structured work of the body athletes of high qualification. Similar data were obtained by us earlier in studies of the structure of the preparedness of basketball players (Kozina, Sobko, Yermakova, et al., 2016). It was revealed that with the increase in the level of sportsmanship, athletes increase the number of correlation links between different types of preparedness; there are interrelations between those indicators that were not previously interconnected. This is consistent with the patterns of development of self-organizing systems, in which the structure of their structure and functioning becomes more complicated and improved as they develop (Anokhin, 1963; 1973; Anokhin, & Shuleikina, 1977). Since the athlete is a self-organizing system, a high number of interrelated indicators indicate a high level of functioning of his organism as a self-organizing system.

According to the indicators included in the first factor, we can conclude that the athlete in question has a high-speed endurance factor, since the first factor includes a large number of indicators that reflect the performance of the nervous system (Lyzohub, Nechyporenko, Pustovalov, & Suprunovych, 2016). These indicators also reflect the strength of the nervous system, which is somewhat divergent from the literature data, which describes a set of indicators of the nervous system of the sprinter (Ilin, 1972, 1974), including reaction speed, mobility and weakness of the nervous system. In literary data (Ilin, 1972, 1974; Korobeynikov, 2002; Lyzohub, Nechyporenko, Pustovalov, & Suprunovych, 2016; Korobeynikov, Korobeynikova, Iermakov, Nosko, 2016; Korobeynikov, Korobeynikova, Romanyuk, Dakal, & Danko, 2017), it is emphasized that the strength of the nervous system is more characteristic of endurance sports.

However, the data obtained by us testify to the ability of the examined athlete to prolong the work of the nervous system, hence, the strength of her nervous system. This may be due to its individual characteristics, as well as the development of compensatory mechanisms associated with a lack of visual analyzer. The examined athlete is also characterized by a high ability to develop speed at a distance.

The high efficiency of the nervous system, revealed in the examined athlete, can also be a compensatory mechanism for the failure of visual function. This confirms the second part of the hypothesis put forward that athletes with visual impairment increase the influence of psychophysiological factors as compensatory mechanisms of limited visual possibilities.

The obtained regression models with the involvement of 1 to 5 psychophysiological indicators also indicate the presence of a high degree of influence of psycho-physiological indicators on the result in running at 100 m and 200 m in the elite athlete. This is evidenced by high values (close to 1) of the R-square, as well as high reliability of the regression models obtained and individual coefficients of the regression equations.

In literary data (Ilin, 1972, 1974; Korobeynikov, 2002; Lyzohub, Nechyporenko, Pustovalov, & Suprunovych, 2016), it is pointed out that there is a psychophysiological complex of a sprinter characterized by high speed of simple reaction, weakness and mobility of the nervous system. This provision is confirmed by our research only partially. The speed index of a simple visual-motor reaction, which is included in all regression models, really reflects the typical psychophysiological complex of the sprinter. In addition, the minimum signal exposure time in the test for the rate of a complex reaction in feedback mode at 30 signals reflects the mobility of the nervous system (Lyzohub, Nechyporenko, Pustovalov, & Suprunovych, 2016). However, the most significant coefficients were also the time index of the minimum exposure of the signal in the test for the rate of a complex reaction in the feedback mode at 120 signals, the total test time for the test of the complex reaction in the feedback mode at 120 signals, the time exponent for the minimum exposure signal in the test with feedback at 120 signals, the time exponent on the third table in the Schulte test. These indicators reflect not only the mobility of the nervous system, but also its ability to work for a long time (Lyzohub, Nechyporenko, Pustovalov, & Suprunovych, 2016).

This fact contradicts the description of a typical psychophysiological complex of a sprinter (Ilin, 1972, 1974, Lyzohub, Nechyporenko, Pustovalov, & Suprunovych, 2016), since it indicates the ability of the examined athlete to prolong the nervous system, hence the strength of her nervous system. This may be due to its individual characteristics, as well as the development of compensatory mechanisms associated with a lack of visual analyzer. The examined athlete is also characterized by a high ability to develop speed at a distance. This requires the ability to work and the stability of the nervous system, which is reflected in the high importance of psycho-physiological indicators characterizing these qualities (Korobeynikov, 2002; Lyzohub, Nechyporenko, Pustovalov, & Suprunovych, 2016). The high efficiency of the nervous system, revealed in the examined athlete, can also be a compensatory mechanism for the failure of visual function. This confirms the second part of the hypothesis put forward that athletes with visual impairment increase the influence of psychophysiological factors as compensatory mechanisms of limited visual possibilities.

The data obtained supplement the results of studies by Ilin (1972), Lyzohub, Nechyporenko, Pustovalov, & Suprunovych (2016), Korobeynikov, Mazmanian, Korobeynikova, & Jagiełło, (2011) on the presence of psychophysiological features of representatives of various sports. For the first time, the influence of psychophysiological indices characterizing the efficiency of the nervous system on the result in running for short distances is shown. For the first time, theoretical positions have also been formulated on the mechanisms of limiting the speed of running in athletes with visual impairments and possible ways of compensating their limited abilities in sprinting.

The results obtained make it possible to make the following recommendations for practical work. Since the surveyed athlete is characterized by pronounced mobility of the nervous system and a high speed of simple reaction, in the training process it is expedient to focus on the development of the starting speed and the ability to change the degree of tension and relaxation of the muscles. The examined sportswoman is also characterized by the expressed strength of the nervous system. Therefore, it also needs to concentrate on maintaining speed at a distance for the development of its strong quality, which also acts as a compensation for lack of sight. Development of strengths of the athlete provides additional information to the central nervous system about the movement of the athlete, as a result of which the danger signaling is blocked due to the lack of a visual analyzer, and the speed of the athlete's run does not decrease.

It should be noted that in the training process of the examined athlete these recommendations were taken into account. As a result, at the Paralympic Games in 2016, the athlete showed results that were slightly higher than the forecast according to the regression models, became the World Champion and the silver medalist of the Paralympic Games in 2016.

Further studies require verification of these provisions on other sprinters with visual impairments.

Conclusions.

1. Four factors have been singled out in the individual structure of psychophysiological functions and effectiveness in running for short distances with the example of an elite sportswoman with visual impairment, whose contribution to the total total dispersion was 46.4% for the first factor ("Fast work capacity"), 8.2% for the second factor ("Complicated reaction"), 6.8% for the third factor ("Attention"), 5.1% for the fourth factor ("Stability"), 34% were other factors.

2. High correlation between psychophysiological indices and performance in running for short distances in an elite athlete with visual impairment is shown. A high contribution to the individual factor structure of psychophysiological functions and running performance of indicators reflecting the qualities characteristic of sprinters (speed of reaction and mobility of the nervous system) and nonspecific for sprinters of quality (working capacity and strength of the nervous system) is revealed.

3. The models of multiple linear regression between the results in running at 100 m and 2009 m in the elite athlete with visual impairment and psychophysiological indices are made. Compensatory mechanisms of visual deficiency have been identified to maintain high speed in short-distance running as psychophysiological functions: indicators characteristic of sprinters (speed of simple reaction and motility of the nervous system) and specific indicators (efficiency, strength of the nervous system).

4. Mathematical models of non-linear regression describing the dynamics of the competitive performance of an athlete in the long-term period are compiled. Based on the models obtained, a forecast of the results for 2016-2017 is compiled. Based on the regression models of performance and analysis of the predicted result at different distances, the strengths of the athlete are highlighted, which tend to develop.

Conflict of interest. The authors state that there is no conflict of interest.

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