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Formation Of Teams In Gaming And Aesthetic Sports Based On Neurodynamic Features Of Athletes Using Multidimensional Analysis Methods.

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ABSTRACT

The aim of the work is to develop and justify the algorithm for completing teams using multidimensional analysis methods in team gaming and aesthetic sports. Material and methods. Participants. Aesthetic sports (aerobics). The study involved 24 athletes (aerobics). Game kinds of sports (basketball). The study involved qualified basketball players (n = 54, average age 21.3 years, average height 180 ± 4.16 cm, average weight - 73 ± 7.8 kg). Methods of determining the functional state of the body of athletes (blood pressure, indicators of variation pulsometry, testing on the treadmill) psychophysiological methods of investigation (determining the time of a simple and complex reaction in various modes of signal delivery); methods of determining physical development and physical fitness; method of determining vestibular stability; method of modeling, methods of mathematical statistics. Results. An algorithm is formulated for completing teams in team gaming and aesthetic sports according to individual psychophysiological and functional characteristics of athletes. The algorithm is a series of sequential actions, consisting of: 1 - a set of data reflecting the individual psycho-physiological and functional characteristics of athletes; 2 - carrying out factor analysis by the main component method; 3 - determination of individual factor values in the structure of athletes' preparedness; 4 - conducting a cluster analysis, identifying groups of sporoxes and compiling their characteristics; 5 - selection of optimal combinations of athletes according to their neurodynamic, functional and psychophysiological peculiarities. Conclusions. It is shown that on the basis of groups of athletes that were formed as a result of cluster analysis, it is possible to create pairs, troikas, five athletes for performances at competitions (aesthetic sports) and the implementation of tactical tasks (game sports.

Keywords: teams, game, aesthetics, equipment, team, neurodynamics.

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INTRODUCTION

Currently, the relevance of the development of spectacular sports is increasing [1; 6; 7; 9]. The most spectacular sports include sports games, boxing, aesthetic sports [10; 13; 14; 5; 16]. Many of these sports are team games [17; 18; 21; 22]. Game team sports (football, basketball, hockey, volleyball and others) attract attention with their dynamism, a variety of tactical situations, great coding of various technical techniques, attracting with their complexity and originality [27; 28; 29; 57]. Game sports cause great excitement among fans (fans) [58; 60]. Team game sports take their origin in antiquity, during the collective hunting of primitive people, which required the display of strategy and tactics. In team game sports, the most relevant is the optimal selection of players [32; 33; 34]. Athletes should find mutual understanding on the site [30; 31; 35]. For this, it is necessary to identify the features of their physical preparedness, as well as the characteristics of the development of psychophysiological and neurodynamic functions [11; 12; 24]. Identification of the peculiarities of psychophysiological and neurodynamic processes make it possible to clarify the playing functions of athletes, to select the players who most often go to each other for work in pairs and threes [32; 33; 34]. The identification of psychophysiological and neurodynamic features also makes it possible to select players for the implementation of paired, group and command tactical interactions [2; 34; 37].

Modern aesthetic sports unite in themselves not purely purely sports aspects, but also artistic, that is, elements of art [21; 22; 38; 39]. Many aesthetic sports originate in the field of art, for example, sports ballroom dances. There are aesthetic sports that originate in health-improving physical education systems, for example, sports aerobics [41; 42; 44; 46; 47]. In some sports, the most relevant is the selection of individual programs for solo performances (rhythmic gymnastics), in others the actual task is to select partners for paired performances (figure skating) and for group performances (sports aerobics) [48; 51].

In any case, there arises the problem of selecting a competitive program that is most suitable for a specific athlete in singles, for paired and group performances, as well as teamwork with the selection of the most optimal combinations of athletes in pairs and groups [34; 36; 55].

In modern scientific research [34; 54; 63] the problem of completing teams in team gaming and aesthetic sports remains practically unlighted. From the optimal selection of athletes for a particular competitive program depends largely on the success of the competition.

Currently, there is a large number of studies that show the effectiveness of the application of psychophysiological methods to determine the individual characteristics of athletes. Thus, in [32-34], the expediency of applying an individual approach in sports is justified. In the papers [29; thirty; 35] shows the effectiveness of the method of psychophysical evaluation of the intensity of physical activity. A number of studies are devoted to substantiating the methods of psychophysical training for optimizing the functional state of people of different ages, with different functional capabilities [25; 55], the effectiveness of the application of the methods of integral development in training athletes [34; 37].

Studies were conducted on the effectiveness of multidimensional analysis methods for the distribution of athletes by groups [34; 54; 55].

It is logical to assume that the application of psychophysical indicators and methods of multivariate analysis will be effective for the preparation and completion of teams in team gaming and aesthetic sports.

The aim of the work is to develop and justify the algorithm for completing teams using multidimensional analysis methods in team gaming and aesthetic sports.

MATERIAL AND METHODS

Participants.

Aesthetic sports (aerobics). The study involved 24 athletes (aerobics) - members of the national team and its reserve for sports aerobics in Kharkov.

Game kinds of sports (basketball). The study involved qualified basketball players (n = 54, average age 21.3 years, average height 180 ± 4.16 cm, average weight - 73 ± 7.8 kg). Athletes qualification: 1 rank (n = 28), candidates for the master of sports (n = 19), masters of sports (n = 9).

Organization of the study.

Game kinds of sports (basketball).

Pedagogical testing was conducted on 12 tests used in the national teams of Ukraine and Russia [34]. During each test, 3 attempts were given, the best result was recorded. Tests were conducted during 2-3 training sessions. The time was recorded by an electronic stopwatch.

Methods for determining the functional state of the body of athletes. Arterial pressure was determined using a general-purpose membrane monitor in the sitting position. The measurements were made twice with an interval of at least 5 minutes, the average result in mm Hg was recorded. Art.

Parameters of variation pulsometry. For the analysis of vegetative regulation of cardiac activity, one of the methods of mathematical analysis of heart rate variability - variational pulseometry was used. The signal was recorded on a portable cardiographic device called CardioLab XT EP Recording System. Its basis is 3; 6; 12-channel cardiograph + phonocardiograph Cardio CE + on the basis of the PAQ 3870 handheld computer with the Bluetooth wireless information transmission module. The recording was carried out for 5 minutes in the supine position after a 5-minute rest.

Method for determination of operability by the submaclimal test of the Bollunda-Scheldrand (PWC170). This test is approved by the WHO to determine the physical fitness for achieving a heart rate of 170 beats-min $^{-1}$ (the power of physical exertion is expressed in kgm / min or W). This load level is also an indicator of PWC170.

The study was conducted on the Kettler AX1 bicycle ergometer.

Determination of adaptive capabilities of the body. Biochemical methods of blood analysis were used to determine the effectiveness of the adaptive systems of the body. The study was conducted with the help of an endocrinologist on the basis of the Institute of Medical Radiology. As the analyzed indicators were taken: the concentration of cortisol, the concentration of insulin, the concentration of the optoid peptide β-endorphin, which regulates the activity of adaptive systems of the body, and the concentration of hemoglobin, the stress index of adaptive systems.

Methods of recording psychophysiological indicators [36; 50; 52; 56; 59]. Computerized research methods were used to register psychophysiological indices. As the psychophysiological indicators, the speed of a simple reaction to sound, the speed of a simple reaction to light, and the determination of the frequency of movements were determined by the method of the "Tipping test" [36; 53].

Method for determining the kinesthetic sensitivity threshold. The sensitivity of the kinesthetic analyzer was measured by a kinesthesiometer. The minimum weight gain is recorded by the experimenter as the discrimination threshold (d). After this, the original messenger is installed. During the study, 16 discrimination thresholds are measured at minute intervals. Of all the values, the average threshold is calculated. It is used as an indicator of the constant level of sensitivity of the kinesthetic sensory system.

Aesthetic sports (aerobics).

Methods of research: methods of determining the functional state of the body of athletes (blood pressure, parameters of pulsometry [54, 55], testing on the treadmill) psychophysiological methods of investigation (determining the time of a simple and complex reaction in various modes of signal delivery) [36; 61; 62]; methods of determining physical development and physical readiness [36; 64]; method of determining vestibular stability; method of modeling, methods of mathematical statistics with the use of computer programs "EXEL" and "SPSS".

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Method of modeling (Gaming and aesthetic sports). In our study, models of athletes with different features of the preparedness structure were created. Two types of models were developed: mathematical and graphic. Mathematical models were created on the basis of the results of factorial and cluster analysis of the individual structure of athletes' preparedness. These models were also displayed graphically.

Statistical analysis.

The digital material obtained during the research was processed using traditional methods of mathematical statistics. For each indicator, the arithmetic mean X, the standard deviation S (standard deviation) were determined.

In the mathematical processing of the primary materials of this study, in addition to calculating the primary statistics, factorial and cluster analysis of the test indicators was carried out. The received data were processed by the standard methods of mathematical statistics with the help of programs for processing the results of scientific research Microsoft Exel "Data Analysis", SPSS.

RESULTS

Theoretical justification for completing teams based on the neurodynamic and psychophysiological characteristics of athletes and the application of multivariate analysis. To justify this provision, it is necessary to dwell on the methodological foundations for determining the psychophysiological functions of athletes for selecting competitive programs and completing teams in aesthetic sports.

Theoretical generalization of literary sources showed that there are various factors that determine the formation of individual characteristics of athletes, on the basis of which an optimal combination of teams in gaming and aesthetic sports can be carried out. This is the basis of methodological approaches to solving the problem of finding ways to optimally complete the teams, taking into account the individual characteristics of athletes. In our opinion, the most adequate methodological basis for this study will be the integrated application of the system approach, the theory of functional systems by P.K. Anokhin [3], the general theory of training athletes [5; 19; 20; 43; 49], as well as the algorithm for individualizing the training of athletes Zh. Kozina [32-34] and the psycho-physiological foundations of sports activity, presented in the works of G.V. Korobeinikov [24] (Fig. 1).

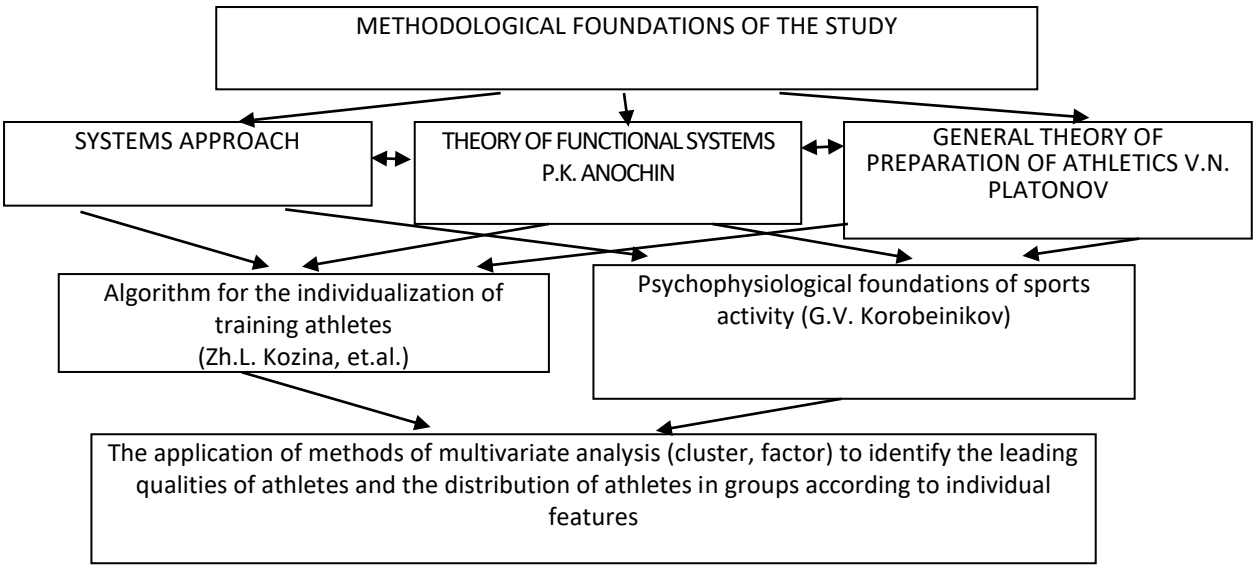

Fig 1: Methodological basis of the study

As a result of the combination of these concepts, multidimensional analysis methods were used, in particular, factor analysis to determine the structure of athletes' preparedness and cluster analysis to identify

the leading qualities of athletes and the distribution of athletes in groups according to individual features of functional standing, complex preparedness and psychophysiological characteristics.

To complete teams in gaming (on the example of basketball) and aesthetic sports (for example, sports aerobics) for performances in various competitive categories, we developed an algorithm for determining the individual factor structure of the athletes' preparedness and the possibilities for combining athletes in groups for interaction and work in training [34; 36; 55]. This algorithm is in fact the basis for the principles of completing the teams of programs in gaming and aesthetic sports. The algorithm consists of the following stages:

- testing of athletes, including a set of tests of at least 10;
- determination of the general structure of athletes' preparedness by factor analysis. Identification of the main factors and drawing up their characteristics;
- determination of individual factor values of the preparedness structure for each athlete.
- Conducting a hierarchical cluster analysis of test scores. Selection of teams in gaming and aesthetic sports based on groups formed as a result of cluster analysis;
- on the basis of individual factor values and cluster analysis, compilation of characteristics of the formed groups of athletes, as well as the development of training programs.

In our research, in connection with the tasks set for the substantiation of the algorithm for determining the individual characteristics of athletes as the basis for the formation of groups for performances in sports aerobics, we conducted factor analysis by the method of the main components for determining the factor structure of preparedness in gaming (by the example of basketball) and aesthetic sports example of sports aerobics), as well as cluster analysis of indicators of complex preparedness, functional status and psychophysiological indicators her.

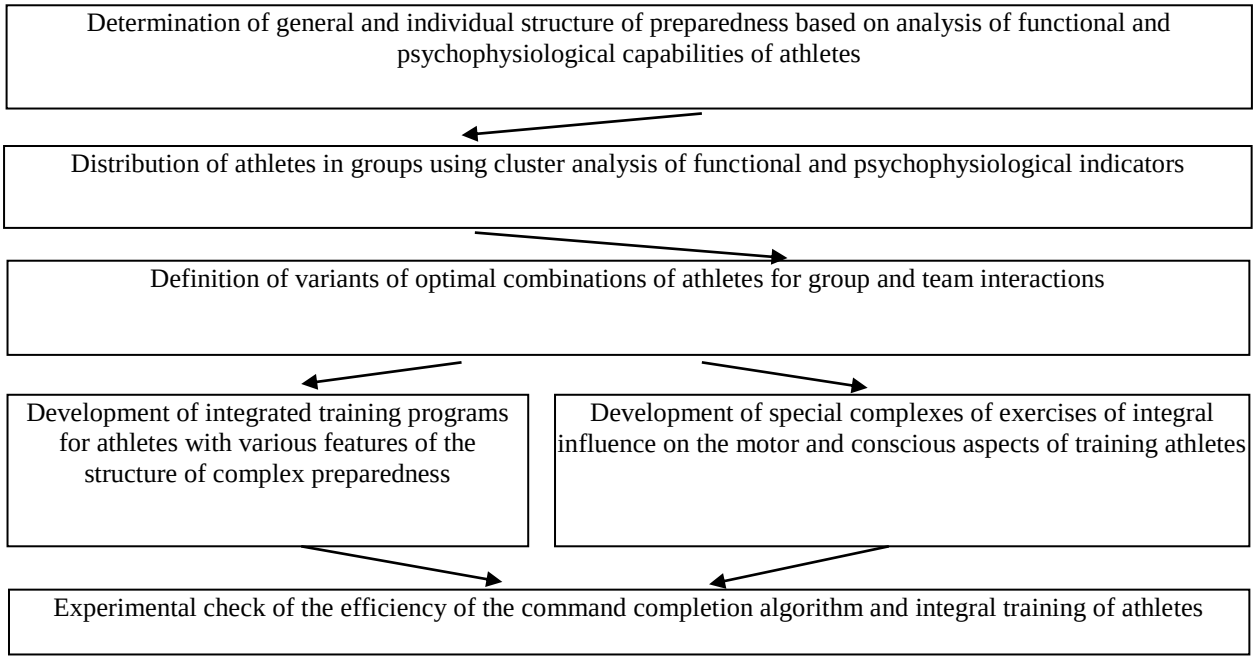

Fig 2: Scheme of the procedure for conducting experimental studies to substantiate the effectiveness of the algorithm for completing teams and integral training of athletes in gaming (on the example of basketball) and aesthetic sports (for example, sports aerobics)

The structure of this series of studies is shown in Fig. 2. At the first stage of this series of studies, a definition was made of the functional and psychophysiological capabilities of athletes. Further, with the help of factor analysis, the command and individual factor structure of athletes' preparedness was determined. After that, with the help of cluster analysis of indicators, the distribution of athletes on clusters was carried out and the analysis of possible variants of manning of commands was carried out. All possible combinations of

athletes for performances in different competitive categories were discussed with the trainers. Based on the data obtained, training programs were developed for all groups of athletes received, as well as for individual training. Training programs for athletes were also developed taking into account their individual functional and psychophysiological features [4; 24].

Results of experimental studies

Game team sports (on the example of basketball).

A comprehensive testing of qualified basketball players was conducted on 26 pedagogical, psychophysiological, biochemical indicators. The obtained data were processed using the methods of factor and cluster analysis, on the basis of which individual factorial models of players were built and individual programs for the training of qualified basketball players were developed.

To determine the individual structure of preparedness, on the basis of which it is possible to optimize the training process, it is first necessary to determine the overall structure of athletes' preparedness. These objectives in the study served as a factor analysis, with which a large number of variables (in our case - 26), was reduced to a smaller number of independent quantities, which are called factors.

In the general structure of preparedness of basketball players, six factors were identified (Table 1).

The full characteristics of the factors are presented in Table 1. We will expand the content of each factor.

Table 1: The factor structure of the preparedness of basketball players (the correlation coefficients are greater than 0.4) (n = 28)

Indicators	Components (factors)					
	1	2	3	4	5	6
The threshold of kinesthetic sensitivity (g)	0,97					
Body length (cm)	0,91					
Body weight (kg)	0,85					
Speed jump ability (the number of jumps in 20s)	-0,84				0,40	
Leap from the place (cm)	0,82					
PWC170 (kgm / min)	0,63		0,51	0,46		
Shuttle run, the sum of 3 attempts (s)	-0,62			-0,60		
Penalty Shots (% hits)	0,51					
Time of reaction to light (ms)		0,95				
Sound Response Time (ms)		0,95				
Variational range of RR-intervals in the heart rate (c)		-0,74				
Running time 6 m (s)	-0,58	-0,61	-0,43		0,51	
The strength of the nervous system (on a 12-point scale)		0,60			-0,48	
The hemoglobin content in the blood (g · l-1)			0,95			
Time of protective movement (s)	0,43		-0,83			
Accuracy of shots from an average distance (%)			0,82			
PWC170 relative (kgm · min-1 · kg-1)			0,75			
The concentration of cortisol in the blood (nmol · L-1)	-0,44		-0,73			
Running time 2 • 28m (s)			-0,71	-0,52		
The stress index in the heart rhythm (cu ..)		0,52	-0,58		0,44	
Jump from takeoff (cm)				0,95		
The concentration of insulin in the blood (pmol · l-1)		-0,41		0,85		
Throwing a stuffed ball from a place (m)			0,60	0,75		
Throwing a printed ball with a take-off (m)	0,54			0,66		

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Mo in terms of heart rate (s)				0,65		
The concentration of cortisol in the blood (nmol · L-1)					0,87	
The amplitude of the mode in terms of heart rate (%)				0,47	0,62	
Speed technology (c)		0,51				0,80
Tepping test (the number of clicks in 1 s)			-0,53			0,75
The sum of factor loads	7,00	6,90	5,58	4,71	4,56	3,23
The contribution of the factor to the total dispersion	35,48	29,94	14,30	9,76	5,67	4,83

Selection method: Analysis of main components
Rotation method: Varimax with Kaiser normalization
Rotation is carried out for 11 iterations

On the basis of factor analysis, the structure of basketball training was determined, in which there were six clearly expressed factors.

The first factor: morphofunctional development.
The second factor is the strength of the nervous system.
The third factor: special endurance.
The fourth factor: speed and strength.
The fifth factor: vegetative regulation of functions.
Sixth factor: speed capabilities.

To determine the individual structure of basketball preparedness, individual factor values were calculated, which are presented in Table 2. Each individual factor value can vary from -3 to +3. In our study, the first factor (morphofunctional development) is most pronounced in athletes Nos. 3 and 7 (Table 2, Figure 3). The third factor (strength of the nervous system) is most manifest in athletes № 5 and 3. The third factor (special endurance) is most evident in athlete № 4, the fifth factor (vegetative regulation of functions) is most evident in athlete № 2, the sixth factor (speed capabilities) most pronounced in athlete No. 3 (Table 2, Figure 3).

To clarify the gaming functions of basketball players, a hierarchical cluster analysis of the test scores was applied. In a hierarchical cluster analysis, each particular case forms its own separate cluster. At each step, two separate clusters, closest to each other in their structure, are combined into one cluster. The stages of clustering are shown in Table 3. Table 3 shows that in the first step, players # 3 and # 7 were combined into one cluster.

From this it follows that these players are the closest in their structure of preparedness, which must be taken into account when conducting trainings and games. For example, these players can be paired in training sessions, they can go on to replace a friend in the game or, conversely, they can play simultaneously on the site depending on the training tasks.

Table 2: Examples of individual values of the factors of athletes of the basic team

№ athlete	Factors					
	1	2	3	4	5	6
1	-0,11	0,70	-0,02	1,67	-0,23	-1,34
2	0,56	-0,39	-0,86	0,39	1,86	0,57
3	1,03	1,14	-0,10	0,01	-0,99	1,34
4	0,00	-0,58	2,15	0,01	0,33	0,27
5	-1,96	0,79	-0,26	-0,68	0,21	0,34
6	-0,33	-1,75	-0,72	0,19	-1,17	0,20
7	0,82	0,10	-0,19	-1,60	-0,01	-1,37

So, in the first cluster, the "center", the athlete № 1, Pn entered, into the second cluster, the "extreme attackers" included athletes №№ 3, 7, 4, 6, 2. It should be noted that athlete No. 2 joined the cluster " extreme attackers "last, so it can be regarded as a player whose function is transitional between the extreme attacker and the center. In the third cluster, "defenders", one athlete No. 5 entered.

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Table 3: Fragment of the order of agglomeration in the cluster analysis of the test scores of basketball players

Step	Clustering		Coefficients	Step on which the cluster appears last		Next step
	Cluster 1	Cluster 2		Cluster 1	Cluster 2	
1	3	7	27,483	0	0	2
2	3	6	37,926	1	0	3
3	3	4	46,644	2	0	4
4	2	3	52,279	0	3	5
5	1	2	68,268	0	4	6
6	1	5	91,713	5	0	0

Thus, as a result of cluster analysis, the functions of basketball players were refined, which sometimes causes some difficulties for coaches when working with athletes with implicit playing roles. The obtained distribution corresponds to the models of interrelation of physical qualities presented in the concept of individualization of the athletic training process in game sports. Thus, the centers are distinguished by the pronounced development of the factor "Speed-strength qualities". Speed-strength qualities, this is the multiplication of the force by the speed (F • V). The extreme attackers are distinguished by the development of the factor "Special endurance" and "Speed-strength qualities". Speed is the predominance of V (speed) in multiplying the force by speed. Special endurance in basketball is the predominance of the product V • t (speed, manifested over time). Defenders are distinguished by the development of speed abilities (V) and special endurance (V • t). Thus, the theoretical model of the relationship between the development of physical qualities was experimentally confirmed.

At the next stage of the study, the individual values of the preparedness factors and the results of the cluster analysis were combined and individual profiles of basketball players were compiled with a refinement of their gaming functions, which is shown in Figure 3.

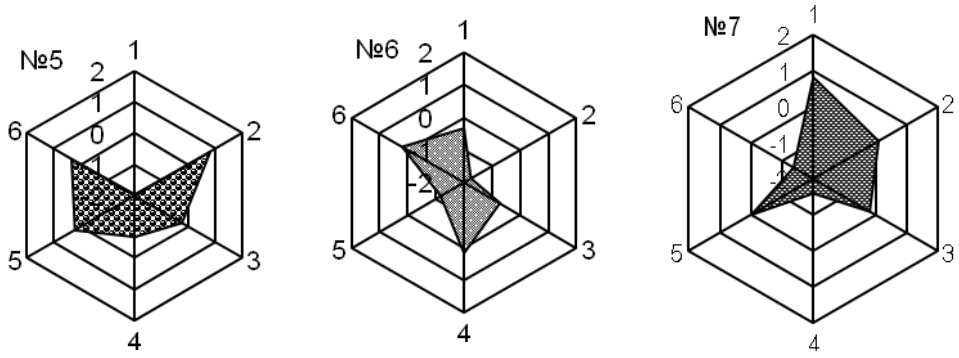

Fig 3: Individual values of factors of athletes of the basic structure of the team: №№ 6,7 - attacking, №5 – defender

Names of factors: 1 - morphofunctional development; 2 - strength of the nervous system; 3 - special endurance; 4 - speed-power qualities; 5 - vegetative regulation; 6 - speed capabilities (the value of 0 corresponds to the average severity of the factor, negative values correspond to the expression of factors below the average, positive values correspond to the expression of factors above the average)

In addition, the analysis of the reliability of the differences in the results of testing different players on the t-criterion of the Student showed that more than two-thirds of the test results differ significantly among the representatives of different playing roles, not only in terms of tests for physical and technical training, but also in biochemical and psychophysiological indicators [34].

Aesthetic sports (by the example of aerobics). A factor analysis of the obtained indicators of the complex preparedness of women was carried out. During the factor analysis, the indicators were excluded, consciously correlating with each other (17 factors were selected for factor analysis).

With the help of factor analysis carried out by the method of main components, 4 main factors were identified in the structure of the complex preparedness of women by the method of "rocky talus" of Kettel. To characterize each factor, the indicators included in it were analyzed.

Each sportsman had an individual factor structure of preparedness. To determine the optimal variants of combining athletes for performances, a cluster analysis was performed on the test indices.

In a hierarchical cluster analysis, each particular case (athlete) first forms its own separate cluster. At each step, two separate clusters, closest to each other in their structure, are combined into one cluster. Firstly, the athletes closest to the analyzed parameters are united, then the athletes, similar to them according to the analyzed indicators, join the newly formed pairs. Thus there are groups of athletes, which can be considered as groups of the most similar in their structure of preparedness. The stages of clustering are shown in Table 4.

It can be noted that the cluster structure of the athletes is more complex compared to male athletes. This can be associated with a large number of analyzed subjects, since in sports aerobics, more women than men. This can also be associated with a wide variety of types of sports activities in aerobics. In aerobistok cluster groups are not clearly expressed, there are intermediate options. There are also athletes who are different from all formed groups, and therefore can hardly enter into any group. Consider the resulting clusters (groups) of athletes.

From Table 4, as well as from the dendogram (Figure 4), it can be seen that at the first step aerobists No. 17 and 24 were combined into one cluster.

From this it follows that these athletes are close in their structure of complex preparedness. This must be taken into account when picking teams for performances in various competitive categories, developing competitive programs, selecting tools and methods in the training process.

Table 4: The order of agglomeration in the cluster analysis of the indices of psychophysiological testing of aerobics athletes (n = 24)

Association in clusters of athletes (according to conditional numbers)			Coefficients
Step, №	Cluster 1	Cluster 2	
1	17	24	,000
2	16	23	,000
3	15	22	,000
4	4	8	**51,158**
5	1	19	54,987
6	4	21	71,573
7	20	24	71,865
8	2	17	85,334
9	18	20	90,160
10	7	10	104,215
11	1	6	111,569
12	4	16	131,550
13	1	13	135,590
14	13	14	169,041
15	7	19	195,335
16	2	12	**270,578**
17	7	20	299,583
18	3	10	316,255
19	1	9	379,291

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20	1	7	381,478
21	5	15	505,204
22	1	2	538,594
23	3	5	**1683,142**

At the next stage of the cluster analysis the athletes Nos. 16 and 23 joined together. This means that they are close to each other in the structure of preparedness, but differ from the previous combined pair (Nos. 17 and 24). At the third step, the athletes numbered 15 and 22, on the fourth - the athletes №№ 4 and 8, on the fifth - the athletes №№ 1 and 19. At the sixth step athletes №№ 4 and 8 are joined by athlete № 21, joining with aerobystka № 4.

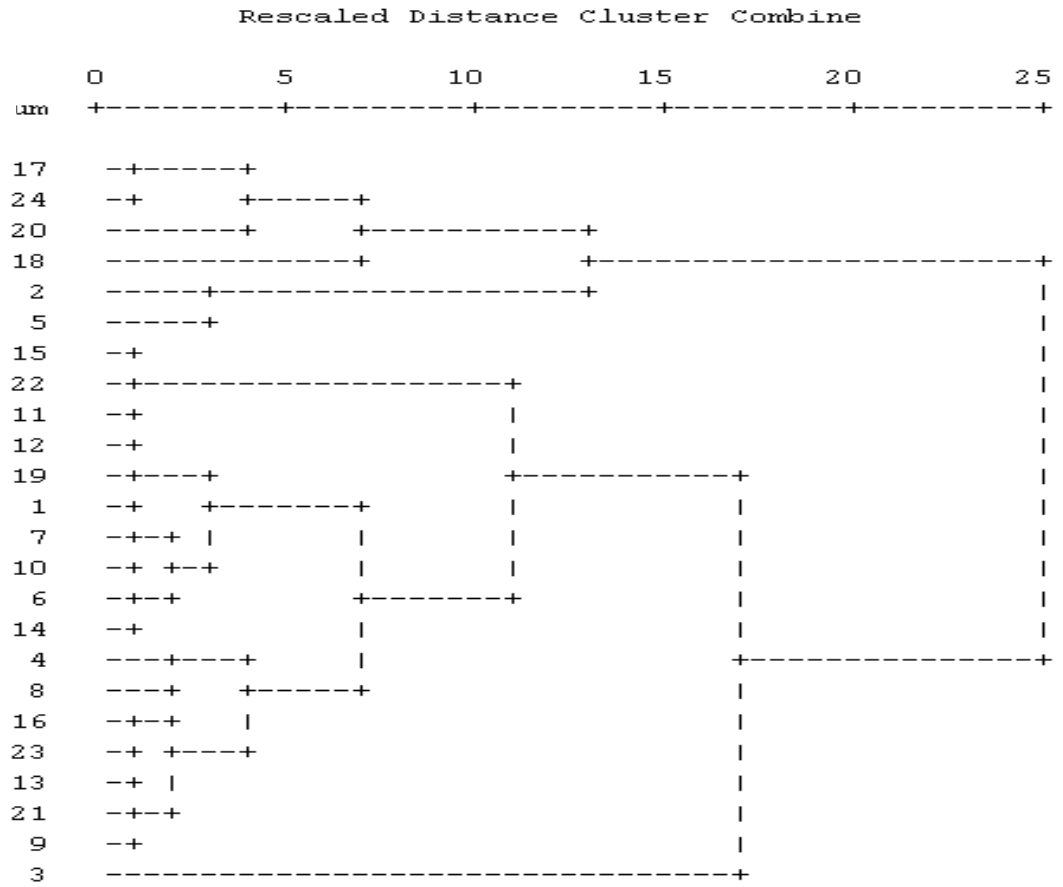

Fig 4: Dendogram of combining aerobic athletes in clusters (women):

Rescaled Distanse Cluster Combine - the scale of conditional differences between subjects when they are combined;

Num is the conditional number of the subject

Thus, starting with the sixth step, there is an addition to the already existing pairs of new athletes. So, in the seventh step, the athletes №№ 20 and 24 are combined, thereby expanding the first pair (Nos. 17 and 24). At the eighth step, this group is increased by the addition of athlete No. 2 to athlete No. 17, at the ninth step athlete No. 18 is added to this group, combining with athlete No. 20 (Table 4). Thus, a group of athletes appears, which is also seen from the dendogram (Fig. 4).

At the tenth step of the cluster analysis, a new pair of athletes No. 7 and 10 is formed, at the eleventh step, an aerobics number 6 is added to the pair of athletes Nos. 1 and 19. Next, at the twelfth step, to troika No. 4; 8 and 21 are joined by athlete No. 16. It joins athletics No. 4. The group of aerobics №№ 16 and 23 is expanding. As a result, a group of athletes №№ 4 is formed; 8; 16; 23; 21.

At the next stages to the group of athletes №№ 1; 19 and 6 through the addition of athlete № 13 (step 13), aerobists of group №№ 4 are joined; 8; 16; 23; 21. At the fourteenth step an intermediate version is added to them - athlete No. 14, joining with athlete No. 13 (Table 4).

At the fifteenth step the group of aerobics №№ 1 expands; 19 and 6 by adding the athletes Nos. 7 and 10.

As a result, the following groups are distinguished:
- athletes number 17; 24 and close to them on the structure of training athletes number 2; 18; 20;
- athletes number 16; 23; 4; 8; 21
- athletes №№ 13 and 14, similar in structure to the readiness for aerobics №№ 16; 23; 4; 8; 21
- athletes №№ 15 and 22 and close to them in structure of readiness athletes №№ 5; eleven; 12;
- athletes number 1; 19; 6; 7; 10.

Unlike the other athletes № 9 and № 3. They are the last added to existing groups with large cluster coefficients. They can be separate clusters.

Thus, in our study we can identify several clusters (groups) of athletes.

Based on the analysis, we chose to combine the athletes into 8 groups. Of these groups, two groups form athletes, who represent independent clusters. There is also one group of athletes with an intermediate structure of preparedness. If we assume that the last three groups can belong to the compositions of other groups, then the clusters formed can also be 5.

So, we got 8 clusters, i.e. 8 groups of aerobics. Figure 4 shows the affiliation of each athlete to a particular cluster.

At the athletes №№ 17; 24; The most pronounced factor is the "Mobility of the nervous system" (Figure 2). This obzachaet that these athletes can be combined into pairs, triplets to compete in the programs. They are suitable programs in which emphasis is placed on speed. To accentuate the story lines of performances to these athletes, such musical works as "Flight of the Bumblebee" (NA Rimsky-Korsakov) (NA Rimsky-Korsakov, "Polyet shmelya"), "Joke" (S. Bakh) ("Suite No 2 - Badinerie "(JS Bach))," The Turkish March "(V. Mozart) (The Turkish March (V. Mozart) and others.

For performances in the composition of five people, athletes of the first group can be joined by the athletes of the same cluster No. 20 and 18 who are close in structure to them (Figure 4). They, in addition to the high severity of the factor "Mobility of the nervous system," there is a high severity of the "Parasympathicotonia" factor.

In the storylines for such athletes, it is advisable to select programs that correspond to music combining speed, lightness and lyrics, for example, as in V. Mozart's Mozart Symphony in G Major. The next group of athletes are the aerobists No. 16; 23; 8; 4; 21 (Figure 4). They have the most pronounced "Force" factor. They are suitable programs with an emphasis on force elements, for example, static retention of partners in different positions. In addition, these athletes can perform in combination with athletes from other groups as a partner. For programs for the athletes of the "power" plan, such musical works as Symphony No. 5 (L. Beethoven) and others are suitable.

The aerials of this cluster are similar to the aerobists No. 13 and 14. They form a separate cluster. They have the most pronounced factors in the structure of preparedness are "Strength" and "Parasympathicotonia". Programs suitable for music are suitable for them, for example, "Sonata No. 23," Apassionata "(L. Beethoven) (" Sonata N ° 23, "Appassionata" "(L. Beethoven), works of blues character, etc. The next cluster form athletes Nos. 15 and 22. Their structure of preparedness is also with a high intensity of the "Strength." In addition to the "Force" factor, these athletes have the "Sense of Time" factor (Figure 2). These athletes can form a pair, can be added to sprtsmenkam previous clusters (Nos. 13, 14 and Nos. 16, 23, 8, 16, 21) .In connection with the high severity of the factor "Strength These Female athletes may make aerobistkami from other clusters as a "power" component of the program.

Of particular interest is a group of aerobics with the greatest severity of the "Parasympathicotonia" factor, Nos. 19; 1; 7; 10; 6. As you know, people and with the predominance of the parasympathetic part of the autonomic nervous system in the regulation of the vegetative balance differ not only in their propensity for relaxation, asthenia, emotionality, but also for dreaminess, imagination, contemplation, and figurative perception. This means that for this group of athletes, a pronounced story line aimed at the transfer of deep feelings and experiences. In their training process, emphasis should be placed on the development of imaginative thinking and the ability to transmit by motions various plot structures of the program. Suitable for these athletes are such subject programs as, for example, the "Seasons" (P. Tchaikovsky), the waltzes of J. Strauss, certain works by F. Chopin (F. Chopin). It should be noted that the presence of the storyline in the program of performances in sports aerobics and the ability to convey this storyline in the movements displays the performance of athletes to a new performing level. This essentially raises the level of performance. Athletes who perform programs with a pronounced story line usually occupy a leading position in world championship championships. Therefore, in the training of aerobic athletes, it is important to pay attention to the development of figurative thinking, the ability to transmit different images through movements. It is this ability that is leading in athletes with the most pronounced factor of "parasympatitis". An athlete # 3 is also singled out in a separate cluster. It has approximately the same severity of all factors. It can be combined with any other clusters, and also successfully perform in single programs.

DISCUSSION

In our work, the methodology is used, presented in [32-34] for individualization in game sports. We applied an algorithm for determining the specificity of the preparedness of various athletes. In particular, we used part of the first direction, that is, the determination of the factor structure of athletes' preparedness. This is the first step to determining the individual characteristics of the factor structure of athletes' fitness and the definition of groups of athletes for teaming up for performances in different competitive categories. From this point of view, the system of combination of command and individual approach to the process of training athletes-aerobists, presented in our work, is an extension and addition of knowledge, presented in [32-34].

The problem of gender differences is part of the problem of individual characteristics of people. In sports physiology [8; 23; 45] and sports medicine, individual differences are classified according to the characteristics of the response to the load from the cardiovascular and nervous systems [4; 24; 40]. In our work, the application of a wide range of indicators of integrated preparedness allows us to combine physiological, psychological and psycho-physiological indicators into a single integrated assessment of the individual characteristics of athletes.

In aesthetic sports (by the example of sports aerobics), athletes are grouped into groups for performances in various competitive categories [36; 54; 55]. The optimal selection of the composition of such teams depends on the success of the performances at the competitions. It should be noted that if there are recommendations for the training of athletes in aerobics, questions of gender differences concerning other individual characteristics (psychological, physiological, psychophysiological) of athletes are almost not covered, although this issue is important for ensuring the success of performances at competitions. Therefore, we applied the algorithm of determining the leading factors, including a wide range of analyzed indicators in the structure of athletes' preparedness, is a new approach to the problem of individualization of training.

Let us consider the psychological conditions for the practical implementation of this system.

The first step is accepting the athlete's responsibility for his training. That is, it is necessary to realize deeply that only man himself is responsible for his fate in sport. It should be noted that the coach must also take responsibility for training the athlete. This means a deep awareness of the task and the realization that no one but himself will do what is planned.

The second step and the necessary condition is the focus on the highest possible result and the belief that its achievement is real and possible. This means that, first of all, it is necessary to focus on a high athletic result for a particular athlete. This means that the athlete and the trainer must believe that achieving the goal is a reality.

These two conditions contribute to the formation of the directed movement and development of the system, which is the athlete and the team. This provides a certain organization of the preparation process, the necessary redistribution of energy, a decrease in entropy.

Next, determine the leading factors of the athlete's preparedness. This can be done by comparing certain indicators of preparedness, and also mathematically by means of factor analysis. In addition, to determine the leading direction of training can be by intuitive following the direction that is closer to the athlete, focusing on what you like. This will entail not only the development of leading factors, but also the "pulling" of lagging factors, and for each athlete the redistribution of the emphasis on the "leading" and "lagging" components should be individual. Then, a cluster analysis is used to distribute the athletes to groups for completing teams for performances in different competitive categories.

Thus, the training of athletes in aesthetic sports (on the example of sports aerobics) is based on a systematic approach, is, on the one hand, an extension of the data presented in [24; 32-34; 55], and, on the other hand, with new data for generalizing the regularities of the teams' completing in gaming and aesthetic sports. In our study, an attempt was made to give recommendations on the optimal selection of athletes, the search for optimal combinations of athletes for performances in different competitive categories using multidimensional analysis and modeling methods. This is the novelty of this study. The formed groups of athletes were characterized from the position of the leading factors in their individual factor structure of preparedness. Based on the characteristics of the functional and psychophysiological state, recommendations were developed for each group of athletes on the selection of appropriate storylines when creating programs for competitive performances.

Thus, the objectives set in this study were met, the goal of achieving bent. This gives prospects for further development of this problem from the point of view of deepening the bases of typologization of athletes in team gaming and aesthetic sports, as well as the means and methods of training athletes of various types in sports aerobics.

CONCLUSIONS

1. An algorithm is formulated for completing teams in team gaming and aesthetic sports according to individual psychophysiological and functional characteristics of athletes. The algorithm is a series of sequential actions, consisting of: 1 - a set of data reflecting the individual psycho-physiological and functional characteristics of athletes; 2 - carrying out factor analysis by the main component method; 3 - determination of individual factor values in the structure of athletes' preparedness; 4 - conducting a cluster analysis, identifying groups of sporoxes and compiling their characteristics; 5 - Selection of competitive programs according to the psychophysiological and functional characteristics of athletes.

2. It has been shown that on the basis of the groups of athletes that were formed as a result of cluster analysis, it is possible to create pairs, troikas, five athletes for performances at competitions (aesthetic sports) and the implementation of tactical tasks (game sports.It has been shown that for an optimal combination of athletes can be selected according to similar qualities (they are representatives of one cluster), and by different qualities (representatives of different clusters) .The principles of constructing competitive programs for athletes of each group are developed.

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