METHODOLOGY OF CONSTRUCTING COMPLEXES OF EXERCISES OF ADAPTIVE PHYSICAL CULTURE BASED ON METHODS OF MIXED AND PSYCHOPHYSICAL TRAINING

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Abstract. *The aim of the study was to develop a methodology for constructing complexes of exercises in the field of adaptive physical culture and paralympic sports based on methods that take into account the psychoemotional factor, with a combination of exercises from various training systems.*

Keywords: *adaptive physical culture, para-Olympic sport, training process, psycho-emotional state, neurophysiology, psychophysical training.*

Introduction

Currently, complex methods based on combining traditional exercises with exercises from various non-traditional systems of health-improving gymnastics (such as aerobics, fitness, Pilates, breathing practices, stretching, yoga, etc.), the so-called mixed training, have become widespread. Also, methods based on taking into account the psychological and emotional factors are becoming widespread. Complexes of exercises and the methodology for constructing such trainings are called psychophysical training (PFT). It is based on the idea that in order to obtain maximum results, physical culture and sports methods should integrate the methods of mental self-regulation at the system level, consciously control the state of the whole organism, mood and emotions, and they can be considered as the development of mixed training methods.

The application of these techniques is especially promising in the field of adaptive physical culture (AFC) and Paralympic sports (PS). However, today there is no systematic approach to the construction of mixed (complex) and psychophysical training, including in the field of their adaptation to use for persons with disabilities. This determines the need for research in this area and evaluation of the effectiveness of this approach in practice.

Research methods. On the basis of the developed methodology, the most effective exercises were selected that satisfy the criteria selected according to the methodology from various training systems. From their basis, an original set of exercises was compiled that meets the requirement of maintaining a positive psycho-emotional balance and an experimental substantiation of the effectiveness of its use in the conditions of a pedagogical experiment was carried out.

Results and conclusion. The positive effect of the exercises according to the proposed method was established, which is expressed in a greater increase in the level of physical fitness, functional state and morphological and functional indicators in comparison with classes according to standard training programs. Practical recommendations have been developed that clarify the specifics of the application of the technique for athletes with disabilities. It is also important to note that the focus on the psychoemotional factor ensured that the classes brought more satisfaction and joy to the trainees and they developed a certain need for constant physical education and sports.

Methods

A wide range of exercises from different training systems were considered. At the same time, for each training system, their specific features were identified [1, 2, 3]. On the basis of the approved methods of classifying exercises [4, 5] for all exercises, a "exercise passport" was compiled according to a special template that fully describes this exercise, including its classification according to various criteria.

When selecting exercises, the main criteria were determined by the factor of their application for training people with disabilities [6, 7] and the use of the psychoemotional factor [8, 9, 10]. Also, taking into account such conditions as training phases, all-round development of all muscle groups and physical qualities of the trainees, on the basis of the selected exercises, nine subcomplexes were developed that formed the basis of the full complex.

It should be noted that this complex was developed for people with impaired vision and hearing and has its own specific indications and limitations. The general selection and recruitment criteria remain the same, but for other groups of persons with disabilities, their specific criteria should be applied.

To analyze the practical value of the developed complex, a nine-month pedagogical experiment was conducted with observation in two groups: experimental and control. At the beginning and at the end of the experiment the basic morphological and functional indices and indices of physical development were measured in all the trainees according to the approved methods [5]. Using the methods of mathematical statistics, these changes in indicators were analyzed and on their basis conclusions and recommendations were made [11].

Results and discussion

To select exercises from various training systems and bring them into a complex, widely used signs of systematization and classification of exercises were used. [12].

1) Classification of exercises according to the predominant effect on the development and improvement of qualities and abilities (Q). On this basis, exercises are distinguished for the development of speed, strength, coordination abilities, endurance, flexibility.
2) Classification of exercises by anatomical characteristics (M) by the involved muscle groups.
3) Classification of exercises by intensity (performed by the student) (I).
4) Classification of exercises by the pace of execution (T).
5) Classification of exercises according to the mode of muscle contraction (R) - dynamic (isotonic) and static (isometric).
6) Classification of exercises by the structure of movements (S) - cyclic, acyclic and mixed.
7) Classification of exercises according to the way of satisfying the energy demands of the body (working muscles) (E) - anaerobic, aerobic and mixed.

The main criteria for the selection of exercises, determined by the PFT method itself and the peculiarities of its application for persons with disabilities, were safety and maintaining a positive emotional background. Therefore, exercises with increased injury risk and intensity of performance, as well as exercises of a monotonous nature, were immediately eliminated.

Also, based on the classifications of exercises, a universal template-passport of exercises was developed. On the basis of the main defining classification signs - according to the predominant effect on the development and improvement of qualities and abilities, according to the muscle groups involved, according to the intensity and pace of performance - a classification

diagram was also built for each exercise. Based on this template, passports were compiled for all selected exercises. An example of an exercise passport is presented in Table 1.

Table 1.

Example of an exercise passport.
(Abbreviations: EM - exercises with movement, EC - exercise classification).

EM-1	Jumping with oblique knee lifts			
EC for qualities (Q)	Q1. Force. Q2. Speed. Q4. Agility.			
EC by muscle groups (M)	M3. Abdominal and pelvic muscles. M4. Muscles of the thighs and buttocks. M5. Muscles of the forearms and hands. M6. The muscles of the legs and feet.			
EC by intensity (I)	I3. Great intensity.			
EC by tempo (T)	T4. Quick.			
EC by mode (R)	R1. Dynamic.			
EC by structure (C)	C1. Cyclical.			
EC for energy supply (E)	E3. Mixed.			
Description of execution	Spread your legs wide, bend your arms at the elbows near the body, your back is tilted forward. Begin doing side-to-side jumps, shifting your body weight from one leg to the other. Raise your thigh high to parallel with the floor. The body does not remain static, but turns towards the knee. In these exercises, it is very important to catch your pace.			
Reps	30 reps on each side (60 total).			
System	classic			
Note	Benefits of Exercise: This is a super effective cardio exercise for weight loss. It accelerates the metabolic processes of the body and helps to additionally load the lower abdominal muscles, oblique muscles of the abdomen, thighs and buttocks, leg extensors. The exercise, which is easy at first glance, is of high intensity. How to simplify: To simplify this at home cardio exercise, do gentle step without jumping to change sides.			
Classification	Q	M	I	T

diagram	1	2	3	4	5	1	2	3	4	5	6	3	4	5	6	1	2	3	4	5
	●	●		●				●	●	●	●	●							●	

Based on the analysis of various complexes and systems of exercises, a scheme was developed for the use of psychophysical training exercises in the training process of persons with disabilities.

Classes were divided into three stages: beginner, intermediate advanced. At each stage, a separate group of exercises is used with increasing characteristics in terms of complexity and physical load. This allows you to smoothly increase the load while maintaining psycho-emotional balance.

In addition, when selecting exercises for the complex, the exercises themselves were individually divided into three phases: warm-up, main part and cool-down, each of which allows you to achieve certain goals in the course of the lesson.

As a result, a set of exercises was created, consisting of nine subcomplexes ranked in three stages of the entire course of classes and three phases within the classes. For each subcomplex, classification diagrams were created on the basis of exercise passports, allowing you to control the subcomplexes for their balanced development of all muscle groups and developed qualities and compliance with the tasks being solved in terms of increasing loads and the pace of execution (an example is presented in Table 2).

Table 2

Summary classification diagram of a set of exercises for a group with an initial level of training, part of the lesson - Preparatory part (warm-up) (PW - initial / warm-up).

Exercises	**Q**					**M**						**I**				**T**				
EM-10																				
ES-65																				
ES -53																				
ES -12																				
ES -7																				
ES -15																				
ES -90																				
ES -17																				
ES -39																				
ES -47																				
ES -81																				
ES -24																				
ES -23																				
ES -45																				
ES -62																				
EL-50																				
ES -29																				
EL -85																				
ES -69																				

Classification accounting in the diagram was carried out according to the following parameters: developed qualities (Q), involved muscle groups (M), intensity of performance (I) and pace of performance (T).

Below are the results and analysis of the pedagogical experiment. The total number of lessons and the total time of lessons, the intensity of physical activity during the pedagogical experiment in both experimental (experimental and control) groups were practically the same. Differences in training between the experimental and control groups were expressed in the use of various programs (complexes) of exercises for training during the training. For the experimental group, the developed complex of psychophysical training was used. In the control group, classes were conducted according to a widespread and generally accepted training program.

The research results were analyzed in three groups of physical condition and development, physical development and anthropometric indicators of the trainees. For all indicators, the average value measured at the beginning of classes in both groups was approximately the same.

Comparison of the dynamics of changes in both groups at the beginning and at the end of classes is presented in Tables 3, 4 and 5.

Table 3

Comparison of the dynamics of changes in the indicators of physical development and health status of athletes with disabilities from the experimental and control groups from the beginning to the end of training

№	Statistical parameters	Dynamics of changes in the experimental group			Dynamics of changes in the control group		
		Average at the end of training	Student's t-criterion	Signifi-cance level P	Average at the end of training	Student's t-criterion	Signifi-cance level P
1	Height, (cm)	176,8	0,8	P > 0,05	176,1	0,6	P > 0,05
2	Body weight, (kg)	70,4	0,5	P > 0,05	69,4	0,3	P > 0,05
3	Resting heart rate	75,2	2,9	P < 0,05	77	2,2	P < 0,05
4	BP mm Hg Systolic	114,6	3,8	P < 0,05	117,1	2,3	P < 0,05
5	BP mm Hg Diastolic	75	3,4	P < 0,05	77,1	2,3	P < 0,05
6	Dynamometry of the left hand	35,8	3,9	P < 0,05	33,3	2,4	P < 0,05
7	Dynamometry of the right hand	37	4	P < 0,05	34,6	2,6	P < 0,05
8	Stange test, (sec)	55,6	4,1	P < 0,05	50,1	2,1	P < 0,05
9	Gench test, (sec)	43,8	4,9	P < 0,05	38,3	3	P < 0,05

10	Orthostatic test (lying pulse)	70,9	2,8	P < 0,05	72,7	2,4	P < 0,05
11	Orthostatic test (standing pulse)	80,7	4,5	P < 0,05	84,6	3,4	P < 0,05
12	Difference orthostatic test	9,8	7,8	P < 0,05	11,9	4,9	P < 0,05
13	Rufier sample index	5,8	4,7	P < 0,05	7,4	2,9	P < 0,05

In general, the experimental group showed the best growth dynamics, especially in terms of Stange's test, Gench's test, the difference in the orthostatic test and the Rufier's test index. That allows us to assume a better development of the respiratory and cardiovascular systems in those involved with the use of a complex of psychophysical training.

Table 4

Comparison of the dynamics of changes in the indices of physical fitness of athletes with disabilities from the experimental and control groups from the beginning to the end of training

№	Statistical parameters	Dynamics of changes in the experimental group			Dynamics of changes in the control group		
		Average at the end of training	Student's t-criterion	Signifi-cance level P	Average at the end of training	Student's t-criterion	Signifi-cance level P
1	Flexion and extension of the arms in the lying position	30,3	7,6	P < 0,05	26,9	4,4	P < 0,05
2	Raising the torso from position lying, hands behind head	38	5,6	P < 0,05	33,8	2,7	P < 0,05
3	High bar pull-up	11,2	4,3	P < 0,05	9,5	2,2	P < 0,05
4	Hanging leg raises	12,8	6,2	P < 0,05	10,9	3,4	P < 0,05
5	Squat on two legs	55,3	6,6	P < 0,05	53,4	4,5	P < 0,05
6	Long jump from a place, (cm)	220,2	6,1	P < 0,05	214,1	4,7	P < 0,05
7	Long jump with a run, (cm)	299,5	3,9	P < 0,05	289,4	2,4	P < 0,05
8	Running 100 meters, (sec)	13,8	2,3	P < 0,05	14,1	2,1	P < 0,05
9	Bend forward, from	5,6	8,4	P < 0,05	3,5	4,4	P < 0,05

	a standing position on a gymnastic bench, below bench level (cm)						

Analysis of the data given in Table 2 shows that as a result of the 9-month experiment, there was a significant improvement in physical development in all indicators in both groups. It should be noted that, in general, the experimental group showed the best growth dynamics. The least significant difference is observed in the indicators: running on 100 meters, which is associated with less influence on this indicator of better development of general flexibility and strength indicators of the upper and middle parts of the body.

Table 3

Comparison of the dynamics of changes in anthropometric indicators of athletes with disabilities from the experimental and control groups from the beginning to the end of classes

№	Statistical parameters	Dynamics of changes in the experimental group			Dynamics of changes in the control group		
		Average at the end of training	Student's t-criterion	Signifi-cance level P	Average at the end of training	Student's t-criterion	Signifi-cance level P
1	Neck circumfe-rence	38,3	0,2	P > 0,05	38,3	0,7	P > 0,05
2	Chest circumfe-rence, inhale	98,1	1,1	P > 0,05	97,4	1,0	P > 0,05
3	Chest circumferen-ce, exhalation	91,0	0,7	P > 0,05	90,6	0,6	P > 0,05
4	Chest circumferen-ce, pause	93,3	1,0	P > 0,05	92,9	0,8	P > 0,05
5	Chest excursion	7,0	6,0	P < 0,05	6,8	4,0	P < 0,05
6	LVC	3861,5	6,5	P < 0,05	3708,3	4,1	P < 0,05
7	Right shoulder circumferen-ce, tense	32,9	2,6	P < 0,05	32,1	1,4	P > 0,05
8	Right shoulder circumferen-ce, at rest	30,0	2,3	P < 0,05	29,2	1,2	P > 0,05
9	Left shoulder circumferen-ce, tense	32,6	2,6	P < 0,05	31,8	1,5	P > 0,05

10	Left shoulder circumferen-ce, at rest	29,8	2,3	P < 0,05	29,0	1,2	P > 0,05
11	Waist circumferen-ce	78,2	0,4	P > 0,05	77,9	0,4	P > 0,05
12	Right thigh circumferen-ce	55,2	2,4	P < 0,05	55,3	2,5	P < 0,05
13	Left thigh circumferen-ce	55,0	2,3	P < 0,05	55,1	2,5	P < 0,05
14	Right shin circumferen-ce	37,0	0,7	P > 0,05	37,0	0,8	P > 0,05
15	Left shin circumferen-ce	37,0	0,7	P > 0,05	36,8	0,8	P > 0,05

The analysis of the data given in Table 6 shows that the experimental group showed significantly better growth dynamics in terms of indicators: and chest excursion 4.7 versus 3.2 and LVC 4507.7 versus 4416.7. The best dynamics in all indicators of shoulder circumference is also obvious.

Thus, the use of the developed methodology based on a complex of psychophysical training led to a noticeable increase in the indicators of physical development and health status, physical fitness and anthropometry of athletes with disabilities.

The proposed methodology based on a complex of psychophysical training for athletes with disabilities allows to achieve better development of the cardiovascular and respiratory systems, general flexibility and strength characteristics of the upper and middle parts of the body.

Conclusion

1. Analysis of special literature on physical culture and sports technologies indicates the great popularity and demand for various types of exercise complexes based on mixed training and PPT, however, no research works on their use for persons with disabilities have been found in existing sources.

2. The main factors influencing the effectiveness of the use of training loads in the developed methodology of physical culture and sports lessons with persons with disabilities when using PFT exercises have been determined: 1) the number of repetitions; 2) the intensity of the exercise; 3) the content of the complex; 4) the number of exercises; 5) the magnitude of the load; 6) the size of the rest intervals; 7) volitional efforts.

3. The main criteria for the selection of exercises are determined and the division of the set of exercises into subcomplexes for the initial, intermediate and advanced stages of training is substantiated. The criteria for the selection of exercises were identified and the division of classes into three phases was substantiated: warm-up, main part and cool down.

4. The conducted 9-month pedagogical experiment showed the advantage of using the developed methodology based on a complex of psychophysical training in the training process for athletes with disabilities.

Application of the developed complex of psychophysical training showed the effectiveness of its use, providing the best growth of all indicators in comparison with standard training

complexes. For most of the indicators, this was statistically reliable. The most significant benefits were seen in the development of the cardiovascular and respiratory systems. It also improves overall flexibility and muscle development in the upper and mid-body.

5. The pedagogical experiment confirmed the effectiveness of the application of the developed methodology of physical culture and sports training PFT and a set of exercises based on it for persons with disabilities. The set of exercises made it possible to significantly increase not only the level of physical development, but also the level of physical fitness, to achieve the optimal level of functional state and health in general. It is also important to note that the focus on the psychoemotional factor ensured that the classes brought more satisfaction and joy to the trainees and they developed a certain need for constant physical education and sports.

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