The use of indicators of the functional state of the 16-17-year-old high school girls as a criterion for selecting physical activity when doing fitness in schools

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Abstract. The article presents the results of the use of fitness programs to optimize the functional state of the body, adaptation and health of high school girls 16-17 years old, experiencing fatigue from training loads.

Keywords: physical education, physical exercise, training loads, psychophysical fatigue, fitness program, heart rate variability, regulatory systems, physiological adaptation, health

1. Introduction

Physical culture has significant creative multidimensional potential to enhance the physical, socio-psychological, spiritual, and moral human health [2, 4, 7]. Currently, physical culture (PC) is developing very actively and attracting an increasing number of people from different age groups. It becomes the fundamental basis of a healthy lifestyle and allows one to develop suffifiect health parametres, eventually extending a human life [1, 2, 4].

Regular physical exercises are the impersonal of modernity in the field of public health at all stages of individual development (ontogenesis) of a person, that is, health training should be included in the life of a person from an early age. Classes of people of different ages are organized on the basis of theoretical and methodological developments of physical culture [10], among which the leading factor is the selection of *load parameters* (size, intensity, duration, etc.) affecting the organism, determined *on the basis of an individual approach* [2, 5, 6].

With all the variety of types and means of improving physical culture and mass sports, a significant part of the developed innovative technologies is widely used in the field of fitness. The industry of fitness services most quickly responds to the ever-changing sociocultural needs of society and creates optimal conditions for the development of new directions and types of motor activity [5, 6, 9].

Fitness companies include in their programs a variety of wellness practices, including aerobics and step aerobics, which are one of the most popular and accessible fitness programs [1, 3, 6].

Therefore, we conducted a study on the possibility of using fitness classes at the lessons of PC in a mass school, taking into account the requirements for ensuring safety for the health of students. High school students form a surveyed group due to high academic loads that have personal-psychological and social significance for students [2, 4, 7, 10].

The purpose of the study is to improve the functional performance of high school girls during fitness as a modern health system.

Our research sets the folloing tasks:

1. To study changes in functional parameters using the allocation of types of vegetative regulation (VR) of the cardiovascular system (CVS) for selecting the parameters of the motor load for the high school girls during fitness classes.
2. To create a set of exercises for fitness to optimize the functional state based on the typology of vegetative regulation of the high school students.
3. To conduct an experimental study in order to determine the effectiveness of the impact of various technologies of fitness complexes on the indicators of students' adaptation and health.

The study sets the following hypothesis. It is assumed that the use of modern systems of recovery will help to improve the functional state in the high school students: prevention of fatigue in preparation for the exam, reduce stress, increase the adaptive capacity and reserves of the body.

2. Materials and Methods

The study was conducted in three stages on the basis of the Municipal Budget Educational Organization of school No 90 (Togliatti).

In the first period of the study (September – October 2018) ,the scientific sources were studied, the methods for the experiment were carried out, the pedagogical observations were made.

In the second period (November 2018 – January 2019), the functional state of the schoolgirls was determined, and the fitness exercises to optimize the functional state of the students were selected. In the main group (MG), 25 girls of 10-11 grades were offered, in addition to the two main lessons of physical culture, with one lesson in power aerobics and one lessen of myofascial release (a set of exercises to relax the muscles).

A total of 25 girls of 10-11 grades of the same school in which classes were held according to the standard educational program are included in the comparison group (CG).

Heart Rate Variability Analysis (HRV)

To determine the functional state of the cardiovascular system (CVS) in schoolgirls, the Varicard 2.51 software and hardware complex (APC) was used, ensuring the implementation of all the basic methods of HRV analysis:

- Formation of medical and physiological conclusions about the state of the vegetative regulation of the blood circulation with an assessment of the degree of tension of the body's regulatory systems;
- Saving the results of the analysis and the initial data of HRV, (ECG, series of cardiointervals) in the data bank for accessing them for the purpose of a detailed analysis or comparative evaluation [8].

Table 1 lists the selected fitness exercises for classes in the PC classes in a general school for the schoolgirls of 10-11 classes.

Table 1. The complex of exercises for muscle relaxation – Myofascial release.

Muscle Relaxation Exercises	Methodical instructions
1. Myofascial adductor release	Extend the thigh and place the foam roller in the groin area, face down with a tilt of the body on the floor
2. Myofascial release of the popliteal muscles	Place the foam roller under the popliteal muscles, and keep the pelvis free. Feet can be put crosswise, so that only one leg is located on the roller. Rolling from the knee to the gluteal region.
3. Myofascial release of the quadriceps	The body is located face down with a slope, quadriceps muscle on the roller. Maintain the spine straight (with contraction of the abdominal muscles and tension of the buttocks) to prevent the compensatory response of the lower back. Rolling from the pelvic bone to the knee, trying to influence the lateral outer side of the thigh.

In the third period (February 2019), the processing of the obtained material was carried out.

3. Results

Determining the response of the functional systems of high school girls to the impact of a fitness program is important, since the pubertal and early postpubertal age of high school girls is characterized by the instability of neurohormonal regulatory systems and their destabilizing effect on the cardiovascular function. This causes individual fluctuations in motor capabilities and portability of motor loads. Therefore,a careful monitoring of the girls' health status (16-17 years old) with motor loads during fitness exercises is required.

At the beginning of the pedagogical experiment (PE), the data on the state of tension of the regulatory systems in the MG and CG were obtained. The premorbid functional states are observed in both groups, which manifest as a result of overworking the body under the influence of training loads. In the MG, the sixth functional class is defined, and it is the fifth functional class in the CG (Fig. 1 and 2).

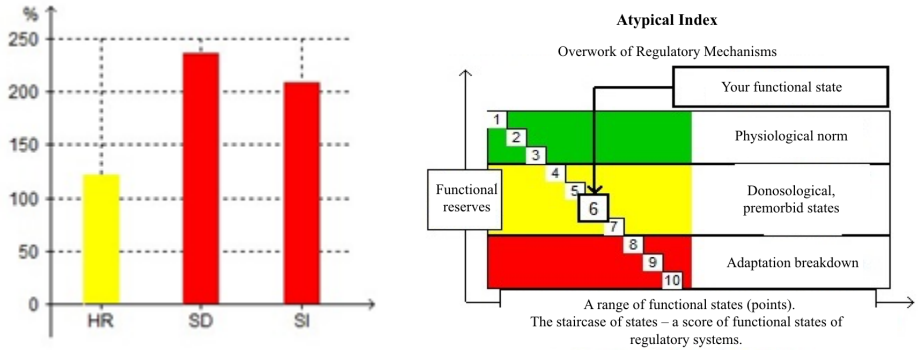

Figure 1. Indicators of the functional state in the MG at the beginning of the study.

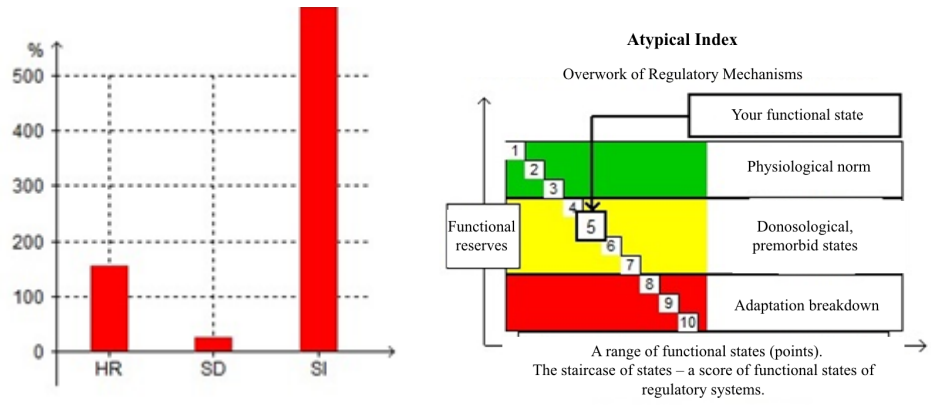

Figure 2. Indicators of the functional state in the CG at the beginning of the study.

Both groups are characterized by the impaired activity of the cardiovascular system (CVC), most of them have arrhythmia and tachycardia (both the MG and the CG) (Fig. 3).

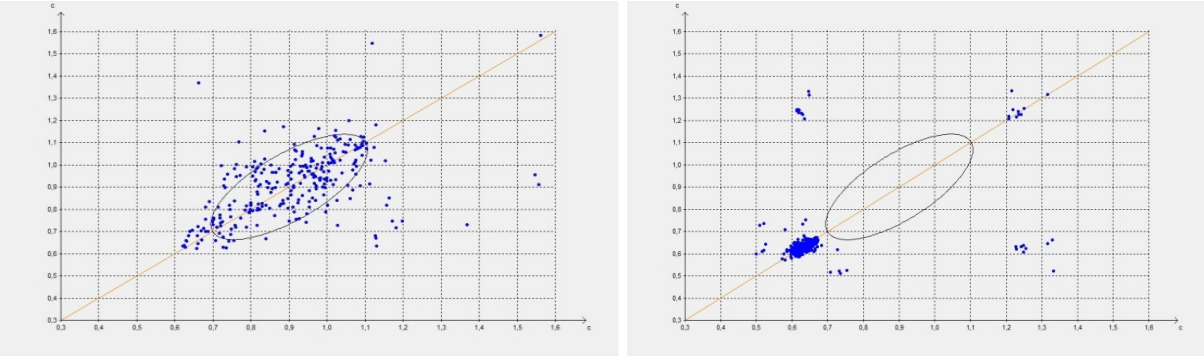

Figure 3. Scattergamma indicators of heart rate variability in the 16-17-years-old high school girls.

At the formative stage of the PE, in order to optimize the functional state in the MG, in addition to two main lessons a week, the high school girls performed power aerobics and a set of exercises to relax the muscles (myofascial releasing).

At the control stage of the PE (the end of our study), the girls in the MG had an improvement in the functional parameters of the organism. Under the influence of classes *in additional fitness programs,* the MG girls' transition to the third functional class of states was observed. The third functional class characterizes *the physiological norm*. Unlike the main group, the data on a significant deterioration of the physical state of the body indicating the transition to the sixth functional class is observed in the CG. The sixth functional class is characterized by a premorbid state, which is a consequence of mental and psychophysical (hypokinesia) fatigue from the training loads of girls (Fig. 4. and Fig. 5.).

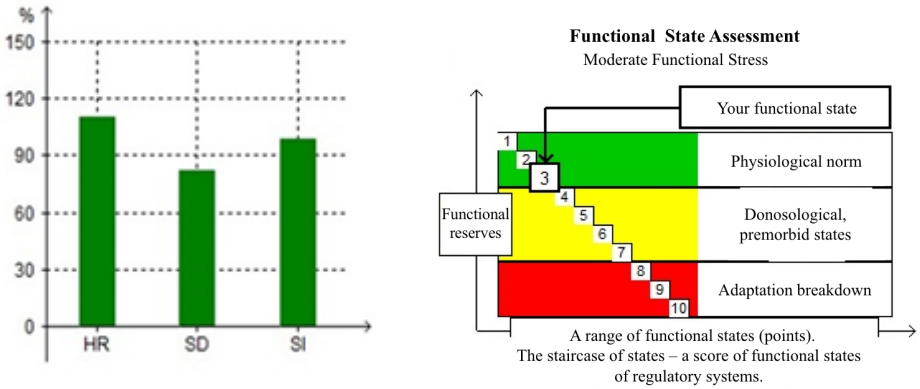

Figure 4. Indicators of the functional state in the MG at the end of the study for the 16-17-years-old girls.

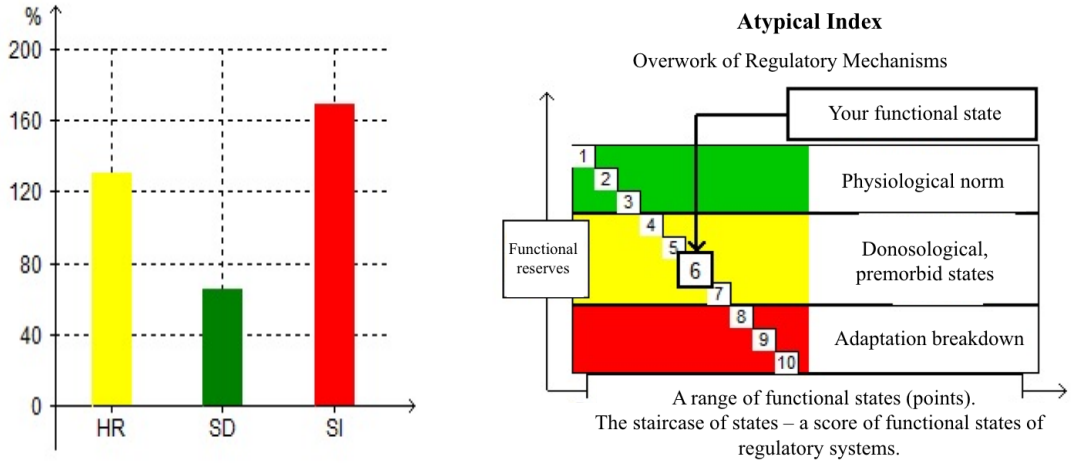

Figure 5. Indicators of the functional status in the CG at the end of the study for girls 16-17 years old.

At the end of the study, most patients in the MG had normocardia, and tachycardia and arrhythmia were observed in the CG (Fig. 6, 7).

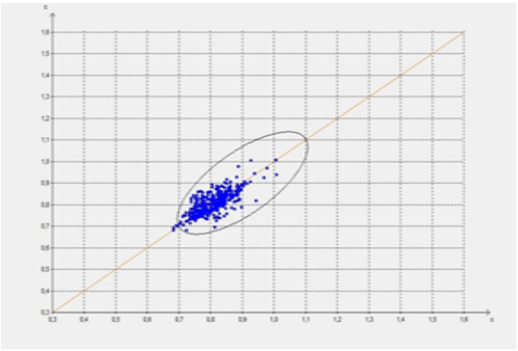

Figure 6. CVS indicators of normocardia and tachicordia at the end of the study in the MG.

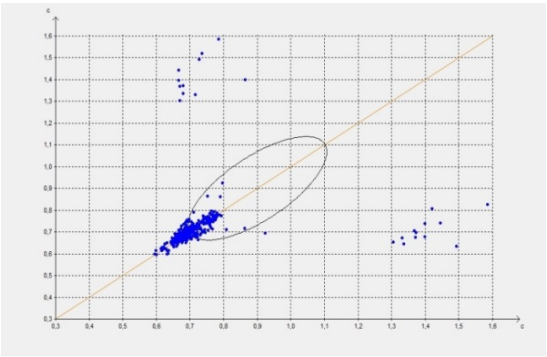

Figure 7. CVS indicators of arrhythmias at the end of the study in the CG.

The use of the Myofascial release exercises, a set of exercises to relax the muscles after power aerobics in the MG, helps to optimize the functional state and improve the activity of the cardiovascular system in the MG in contrast to the CG. Exercise aerobics in the MG contribute to the stabilization of the physical condition, preventing its deterioration. The group of those engaged only in the standard school curriculum of physical culture and not engaged in fitness had a deterioration in adaptation and health indicators, since the physical load on the standard physical education classes was insufficient and poorly motivated the girls to be active.

Our research shows that the use of health and fitness technologies in the school curriculum has helped to improve and optimize the physical condition, adaptation, and health of those involved in fitness. While the high school girls not using the fitness program had a deterioration in their health condition under the influence of training loads.

4. Conclusion

1 It has been established that the use of a set of physical exercises, including relaxation exercises, in addition to aerobic power loads, contributes to the improvement of cardiorespiratory indicators in the MG (in contrast to the CG).

2 The use of fitness programs that include certain exercises (aerobic, strength, relaxation), aimed at relieving the psychophysical fatigue obtained from training loads by the high school girls,

contributes to the normalization and optimization of the functional state of those engaged in the MG (in contrast to the CG).

3 Training high school girls only in the standard school curriculum is insufficient to prevent the negative impact of high training loads on health; it *cannot prevent* the disruption of adaptive capacity and depletion of students' functional reserves.

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