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#### **ASSESSMENT OF THE PUPIL'S ORGANISM RESPONSE TO PHYSICAL LOAD IN THE CONTEXT OF WORKING CAPACITY**

**Abstract.** Provision of scientific evidence for rational planning of physical activity and successful teacher guidance during regular physical training classes needs updated criteria for assessment of functional characteristics and motor capabilities of a growing body at different stages of school education. Physical exercises at the lessons of physical training may be compared with a powerful weapon, and under certain circumstances they can lead to functional disorders in the pupil's organism.

In today's education system, the practice of physical education does not provide sufficient control over the functional state of the children's organism in the process of performing activity involving considerable physical load. Consequently, the teacher fails to monitor the development of the child's body or to maintain its fitness at the required individual level.

In 2012, the Ministry of Education and Science issued guidelines for methods of medical control and pedagogical supervision in planning physical training classes. It suggests that functional tests should be carried out in laboratory conditions; however, the authors assess the intensity level of said tests as unreasonably high, which can result in a negative response by a youth body. The guidelines recommend assessing the functionality of the cardiovascular system of schoolchildren after the physical load of 20 squats in 30 seconds followed by functional body recovery.

With this in mind, the objective of the given paper was to study the response of the contemporary 10-15 year old pupils' organism to the physical load designated by the Ministry of Education and Science. The authors of the article measured HR frequency with the help of intervalometer in order to calculate heart rate variability after the abovementioned workload.

The results of the undertaken studies show that the intensity level of dynamic physical load performed by pupils aged 10—15 (20 squats in 30 seconds) is disproportionately high for the described ages, which can result in a setback in the process of adaptation of the pupils' organism systems, especially among boys and girls at the age of puberty.

**Keywords:** pedagogical control; physical exercises; physical load; Physical Training lesson; methods of teaching Physical Training; Physical Training methods at school.

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The aim and the purpose of physical training in education [10, p. 21] consist in the formation of a new healthy generation of citizens possessing the culture of health preservation and capable of implementing new ideas of social development. Physical training at school is one of the factors of health preservation.

We may say that tomorrow the future will be determined by man's health. Such program and the solution of health preservation problems will acquire the primary importance for the development of applied solutions in the field of physical education.

In order to achieve this main goal we must take a radically new approach to the questions of development and preservation of the pupils' health in physical education. Training and self-education of specialists who take pains to raise the level of their professional development in the field of physical training for preservation of the pupils' health becomes especially important.

In the context of professional training of specialists in the field of physical education, it is important to pay attention not only to specific professional problems (anatomical specificity, physiology of children and teenagers, development of their physical capabilities) but also to pedagogical problems in general. Pedagogy provides physical training teachers with fundamental knowledge. According to A.S. Belkin [1, p. 2], the gap between theory and

practice in pedagogy is caused by inadequate development of information service in our country. The vast majority of secondary and higher school teachers get to know about the achievements of pedagogical science accidentally, on their own initiative, or from separate courses of lectures, seminars, symposiums, conferences, etc. They have no access to dissertation materials. Many wonderful scientific ideas are kept on the shelves of archives and libraries practically unused.

Thus, the existing system of physical education in school practice lacks systematic control of the functional state of the pupils' organism **under the natural conditions** in the process of physical load and management of the given processes. Such system of control and management must show what should be changed and what could be left unchanged in the course of development or support of the child's organism at the necessary level.

The functional control of children at physical training lessons is treated as a secondary part of work in the course of curricula design and in the physical training teacher's practical activity: it is either excluded from the curricula or included in their variable part taught by visiting medical specialists.

In the existing physical training programs [4], nothing is said about control and assessment of indirect parameters which are the most important in the given context (because

they change very quickly); it is only mentioned that the physical preparedness should be managed.

It is known from special literature [3, p. 135; 2, pp. 23—24] that, on the one hand, the growing organism of schoolchildren is characterized by the following peculiarities of functional provision in the course of applying physical load: 1) a limited range of reserve capabilities of both vegetative and metabolic systems of the organism; 2) low effectiveness of the systems of vegetative provision (effectiveness shows the relation between the final result and the effort needed for its achievement); 3) a low level of anaerobic-glycolytic component of physical work capacity (time of work – from 0.5 to 3 minutes). On the other hand, there is a problem of qualifications in pedagogical diagnostics. Pedagogical diagnostics [1, pp. 189—190] should necessarily be part and parcel of the core of pedagogical terminology for the study of physical education because control and assessment constitute the process of recognition of various states of the pupils' organism and should be taken as a foundation for the theoretical model of diagnostic supposition which could make the process of functional system management easier. On the basis of correct diagnostics, it is possible to add new or limit the intensiveness of the existing pedagogical intervention upon the system of the pupil's organism, it is easier to exercise control as it is possible to pass from the empirical to the theoretical sphere of management [8, pp. 346—348] and find not only the

why but also the how [1, p. 2].

It follows from what has been said above that, firstly, control and assessment of correspondence of morphological and functional capacities and their changes in the course of physical preparation of schoolchildren especially at the age of puberty becomes especially urgent [13, p. 35; 15, pp. 10, 13—15]. Physical development at this age is characterized by certain degradation of regulation of vitally important functions because of activation of the processes of puberty.

It is well known that the cardiovascular system (CVS) demonstrating the level of the pupil's organism response to dynamic physical load is one of the first organism systems demonstrating response to physical load. It may seem that it is enough to measure the heart rate (HR) in children practicing sport in order to control physical load. In reality, the HR itself measured randomly cannot help the teacher understand what is going on within the pupil's organism at the time of measuring. The HR can provide reliable information only if we know the functional state of each separate pupil with the help of a functional test. The inadequacy of the given method may become clear when the average value of HR of the whole class is determined on the basis of measuring HR of one pupil. The matter is that the group of pupils doing exercises at a lesson of physical training may include pupils with a good heart and bad muscles and with good muscles and a bad heart [11]; there may be also allergic pupils in the group. It means that it is impossible to determine the response of the whole

group to physical load on the basis of condition of one pupil.

Secondly, the existing system of education in the field of physical culture in practice provides inadequate control of the functional state of the pupils' organism in the process of their performing physical exercises. As a result, the pedagogue cannot effectively manage the education process and the process of development or preservation of the organism at the desired individual level.

Thirdly, general education schools today pay little attention to the functional assessment of the pupils' organism [6], which may tell badly on the state of health of some children in the process of their performing one more exercise from the complex "Ready for Work and Defense" (GTO) [14].

In the fourth place, the fourth edition of the program of the general education institution in physical training of schoolchildren in 2008-2011 [4; 5] does not specify the priority of functional assessment of the pupils by the physical training teacher. In this case, the teacher uses the conclusions of the school health centers which conduct observations once a year. This practice has a negative effect on the final result, i.e. during lessons of physical training. As a result, we observe the growing number of lethal cases among children doing exercises at physical training lessons.

The letter of the Ministry of Education and Science of the Russian Federation of 2012 [12] provides guidelines in the methods of "medico-pedagogical control of organization of physical training lessons". It says, in particular,

that the change of the group of medical permission to attend physical training lessons for a pupil is determined by the school doctor-pediatrician on the basis of a report given by the physical training teacher in accordance with **the peculiarities of dynamics of the health parameters and the functional capacities**. There arises a question what methods are to be used by the teacher to reveal these functional parameters and determine their dynamics. The existing physical education programs do not answer this question. They recommend carrying out laboratory functional tests which, to our mind, presuppose a too high level of intensity, which can result in a negative response by a schoolchild organism [12], when, for example, the cardiovascular system of schoolchildren is studied after the physical load of 20 squats in 30 seconds followed by functional body recovery.

In order to prove the hypothesis aimed at solution of one the basic problems of physical education – health improvement – we carried out a research to check the response of the contemporary pupils' organism to the physical load designated by the Ministry of Education and Science [12].

We examined general education school children of Ekaterinburg aged 10-15 (54 pupils).

The study included the performance of physical dynamic load of 20 squats in 30 seconds (which corresponds to the functional test of the Ministry of Education and Science of the Russian Federation).

To complete the main task of our research of the organism response after the abovementioned workload, we

measured the heart rate frequency with the help of intervalometer [7, p. 53]. This measuring method consists in getting palpatory information 5 seconds after the load because, according to the undertaken study [7, p. 50], HR indicator has significant deviations during the next 5 seconds of restitution, so the data received 10 seconds after the load radically differ from those obtained after the first 5 seconds. The analysis of the material is based on the method of data grouping, i.e. on intergroup and ingroup comparison.

First we compared the HR indicators in the groups of children aged 10-11, 12-13 and 14-15. It is seen from the table that HR diminishes with age both during rest and immediately after the load; this tendency was also described in special literature [15, p. 215]. We can also see that in each of the three groups, especially in girls, the final response of the organism on HR is higher than the aerobic threshold.

Both special literature [2, pp. 23—24; 13, p. 35] and our own research [7, pp. 93—94] show that the increase of the test load both in laboratory and natural conditions brings about controversial response of the organism to physical load in terms of HR frequency as this response depends on preparedness of the cardiovascular and nervous and muscular systems for taking physical load without violating homeostasis.

As it is seen from the table, in three age groups, especially from 12 to 15 years of age when the development of the cardiovascular system lags behind the growth of muscles and bones, the HR frequency is above average by 50-60% in boys and 25-50% in girls. The final results are influenced by the initial HR indicators. Thus, the average indicator of initial HR in girls of pre-puberty ages (10-11) is 122 bpm, which influences the final HR frequency reaching about 196 bpm.

*Table.*

Comparative data about HR frequency in schoolchildren aged 10-15  
in the process of physical dynamic load

Age, years	Sex, number of those tested.	HR frequency indicators, bpm				%
		Critical values for assessment of HR frequency indicators				
		Initial indicator	Lower than average	Average	Higher than average	
10—11	Boys - 5	94	116—132	132	132—153	60
	Girls - 17	122	121—148	148	148—196	
12—13	Boys - 10	96	95—133	133	133—188	50
	Girls - 10	109	120—148	148	148—188	
14—15	Boys - 6	88	109—123	123	123—146	50
	Girls - 4	104	125—143	143	143—171	

The initial HR indicator in the group of girls aged 12-13 does not only influence the final HR but is also a factor increasing it due to load and brings about overriding aerobic metabolism threshold (in 65% of cases of the group under observation).

The results of the undertaken studies show that the intensity level of dynamic physical load performed by pupils aged 10—15 (20 squats in 30 seconds) is disproportionately high for the described ages, which can result in a setback in the process of adaptation of the pupils' organism systems, especially among boys and girls at the age of puberty.

**Conclusions.** Our study shows that the functional test (20 squats in 30 seconds) recommended by the Ministry of Education and Science of the Russian Federation exceeds the physiological functional capacities of the organism of schoolchildren of pre-puberty and puberty ages and needs to be corrected for testing their physical conditions.

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