Journal of Physical Education and Sport ® (JPES), Vol.19 (4), Art 372, pp. 2453 - 2457, 2019
online ISSN: 2247 - 806X; p-ISSN: 2247 – 8051; ISSN - L = 2247 - 8051 © JPES

Original Article

Monitoring capabilities of 7-10-year-old children during the learning process at school

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Published online: December 31, 2019
(Accepted for publication: December 01, 2019)
DOI:10.7752/jpes.2019.04372

Abstract
The studies give reason to believe that the definition of functional capabilities of children 7-10 years using reflexometer methods omegametrii fairly accurately reflect the physiological processes that occur in the brain in a state of muscular rest, during exercise and during the early recovery period. With a certain degree of reliability methods allow the judge reserves the compensatory and adaptive processes of the child's body and are key to the complex monitoring functionality in the learning process at school. Effect of exercise capacity in regulatory mechanisms of children 7-10 years organism was traced by changing the overall functional state of the brain parameters (OFS brain). Before functional testing corresponding figures were within the physiological norm. The reaction of the central nervous system to physical stress was different. Most children 7-10 years figures omega-potential (OP) of the brain in a state of relative muscular rest are in the normal range. Analysis of the individual reactions of the brain according to physical stress omegametrii allowed children divided into two groups according to the reaction type: increasing and decreasing OP. It was revealed that the increase in omega-potential was observed in subjects with low and decrease - with high OP values. It can be concluded that the physical load do not cause CNS overreaction and activate converged changes omega-potential which are caused by initial values of constant potential.
Key words physical health, omegametriya, general functional state of the brain, functional testing, exercise.

Introduction

Recently, there is a tendency to deterioration of the health of children and youth in Ukraine (Bosenco & Samokish, 2014; Samokish, 2016), the number increases pupils and students, completely freed from practical physical education classes for health reasons, there are cases of death of school-age children in the classroom for physical education. This is due to various factors, among which is the leading physical health, which places high demands on the level of physical development, physical performance and functional capabilities of children and youth. That functionality is a key indicator of the state of physical health (Proskurov, 2015; Pryimakov, Iermakov, Samokish, Kolenkov and Juchno, 2016). The level of functionality is determined by the physiological reserves. Expansion of the functional reserves of the younger generation and the development of motor skills is the main task of physical training in educational institutions of different countries. During the age of formation of the human body functional reserves are growing at different rates depending on the age, sex, state of health, genetic inheritance, lifestyle and other external and internal factors. In theory and practice of physical education there is the problem of evaluation of functional abilities of children of the body through a variety of tests. indicators of physical fitness are mainly used to provide incomplete information about the functionality.

We have proposedand implemented in the educational process of physical education assessment methodology functionality, which enables to obtain sufficient information about the functional reserves (Samokish, Bosenko, Pryimakov and Biletskaya, 2017). The methodology responds to such important criteria as: the accuracy and informative value of the data, efficiency of performance of functional testing and health safety. Functional testing within the appropriate method allows to reveal not only indicators of physical performance and response of the cardiovascular system, but also allows you to set the regulatory and energy components of the reaction system of the human body. However, a comprehensive assessment of the functionality does not include indicators of the central nervous system of an organism of children, which are among the main components of functionality. Not studied the reaction of the central nervous system (CNS) of the child on the proposed functional testing, to be determined the degree of utilization of functional reserves of the central nervous system, which ensures the unity of the body and the integrity of its operations. It is our studies have been conducted in this direction.

Material & methods

For an assessment of the use of physiological body reserves, voltage regulator mechanisms, determining the economy and efficiency of physiological processes applied registration procedure simple visual-motor

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reaction (overall functional state of the brain (brain OFS)) and infraslow cerebral bioelectric processes (omegametry).

Investigation of the general condition of the brain was carried out using methods Loskutova (1977), which is based on static parameters of the distribution of time values of simple visual-motor responses. Reflexometer results were obtained using an automated device, "Lightning" (Bosenko & Shumeyko, 2007).

According to a special set of computer software reaction time values built variation curves (Fig. 1), Which allowed to determine such parameters OFS brain: functional level system (FLS) the reaction resistance (RR) level of functionality (LF). All these parameters are in units is given by:

$$FLS = \ln\frac{1}{Tmod \times \Delta T0{,}5}, \quad RR = \ln\frac{Pmax}{\Delta T0{,}5}, \quad LF = \ln\frac{Pmax}{\Delta T0{,}5 \times T0{,}5}.$$

The components of the above formulas are such indicators:

– Tmod - the most probable values of the modal class;
– Pmax - maximum likelihood, which corresponds to the boundary of the modal class;
– ΔT0,5 - reaction time range of 0.5 Pmax;
– T0,5 - values of reaction time, which meet ΔT0,5 mid-range.

The functional level of the system characterizes the strength of tonic nonspecific effects. The greater the FLS, the higher the level of the central nervous system function. RR reflects the degree of stability of the functional state of the CNS. The greater stability of the reaction, the less reaction time scatter. On level functionality (LF) can be seen on the brain's ability to form a high functional level and stably hold it. Named parameters OFS brain are closely linked.

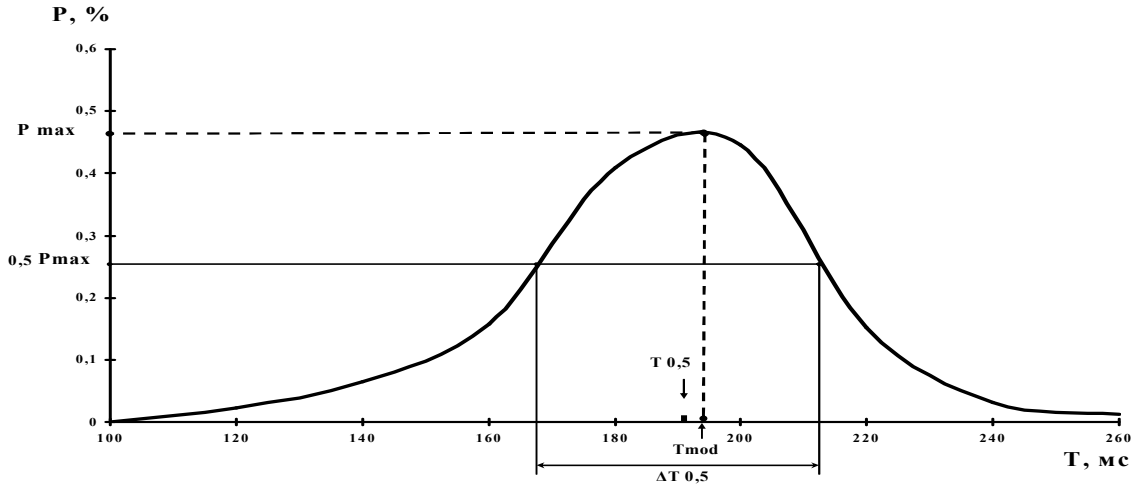

Fig. 1. The variation curve of values of simple visual-motor reaction by the procedure Loskutova

The studies were conducted in the first half of the day in a state of relative muscular rest, during functional testing and the early recovery period after exercise. Near the child were a block from the light stimulus and reactive button. The main task of the child was quick to respond by pressing a button in response to the flash lamp.

Measurement of omega-potential (OP) performed by a device (Sychev, Shcherbakova, Baryshev, Kostenko, 1980), comprising an indicator (calibration in mV) and the two chlorine-silver electrode. The active electrode is located in the upper part of the head (on the international system 10 × 20), and the indifferent - in the palm of the left hand.

Assessment of functional brain capacity in a state of relative peace was carried out in three bands change OP:

– Low - 1-19 mV;
– average - 20-40 mV;
– high - 40-60 mV.

Increasing OD, after exercise, and 25% is considered a normal increase of more than 25% was evaluated as the intensity of the brain function. If the OD is not changed by exposure or load is reduced compared to baseline values by more than 25%-this indicates brain reactivity due to high overvoltage (Sychev et al., 1980). OD measurement was conducted under conditions of relative muscular rest, during exercise and recovery in the early period.

Statistical research data processing is performed on the following parameters:

– mean value (M);
– standard error of the mean (m).

In a study of children 7-10 years (boys (n = 80) and girls (n = 85)) were involved, which according to medical examination is healthy.

Results

Data analysis reflexometer that displays probabilistic and statistical principle of the brain shows that the background functional state of the brain is normal for most children 7-10 years (Table). So, most of the results of children 7-10 years old (88%) during the study were within the established limits according to Loskutova (1977) (RR = 1,0-2,8; FLS = 4,2-5,5; LF = 2,7-4,8). It should be noted that the parameter RR - 100% of children 7-10 years of settled results to the regulatory boundaries.

After performing the physical activity indicators studied in children 7-10 years have changed in different ways: in one case, all the results were increased in the second - is reduced. In this figure the functional level of the system (FLS) describe mechanisms which reflect tonic tension nonspecific effects. Its growth reflects the improvement of the work of these mechanisms. The second indicator (RR) characterizes the state of the mechanism of stabilization of nerve processes and therefore increase reflects the increased stability of the functional state of the system. Indicator functionality level (LF) of the nervous system, increasing, indicates the formation of a high functional level and ability to hold it steady. Reduction of the above indicators, according to many authors, indicates a low activity of the brain.

Table. OFS brain indicators of child 7-10 years (M ± m)

Indicators	The functional status of children (n = 165)	
	The relative muscular rest	Early recovery period after exercise
RR	1.1 ± 0.09	1.32 ± 0.1
FLS	4.1 ± 0.12	4.19 ± 0.12
LF	2.4 ± 0.11	2.56 ± 0.14

One of the informative methods for studying brain activity is omegametry. It is an integral and universal method that can be used to assess functional status, stress resistance of the human body, to establish compensatory and adaptive capacity of key regulatory systems and reserves of their compensation (Ilyukhina, 1997). With this method it is possible to determine the functionality of the body of the child when subjected to physical stress.

The results obtained in different functional states indicate that the majority of surveyed children 7-10 years of omega-potential was in the range of 20 to 40 mV, which is considered to be an optimal level of leakage slow brain processes (Fig. 2). So, 91% of children 7-10 years have seen an optimal level of brain activity in a state of relative muscular rest. During the exercise the number of children with an optimal condition was reduced to 82%. However, in the early recovery period after exercise the number of children with optimal results omegametry increased to 88%.

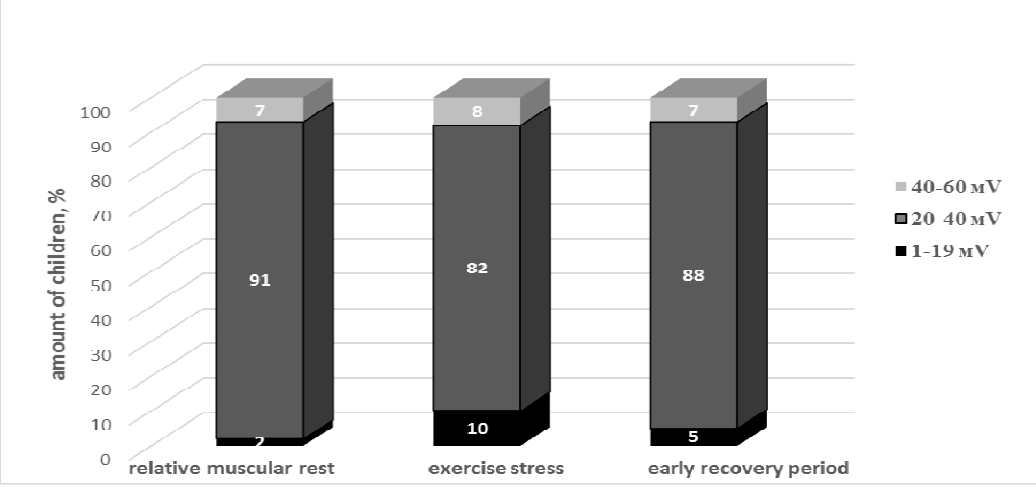

Fig. 2. Indicators of omega-potential of children 7-10 years (n = 165) in different functional states

Discussion

Effect of exercise capacity in regulatory mechanisms of children 7-10 years organism was traced by changing the overall functional state of the brain parameters (OFS brain). Before functional testing

corresponding figures were within the physiological norm. The reaction of the central nervous system to physical stress was different.

The main type of response in healthy children with no risk factors was an increase in value OFS brain parameters. The amount of change was greatest indicators for resistance response (RR) - 53.6%, reflecting the stability violation state, the average degree of change observed by the level of functionality (LF) - 23.8%, and most low - on the functional level of the system (FLS) - 12.9%, which characterizes the activity of nonspecific brain structures. A significantly smaller decrease in the number of children observed indicators OFS brain baseline shifts indicators OFS brain were smaller and were: RR - 7.1%; LF - 26.3%; FLS - 14.6%. Orientation of brain responses to physical activity, as shown by earlier studies we conducted, it was determined the initial functional state: at low values OFS brain performance exercise caused their growth and high - decrease. All figures in both types of reactions to the load does not extend beyond the standard range. Significant change indicators and, accordingly, the voltage regulation of brain OFS mechanisms mentioned in the first type of reaction due to its lower starting value. Thus, the exercise in most cases caused optimal response of the central system of the body of children 7-10 years old. the first mentioned type of reaction due to its lower starting value. Thus, the exercise in most cases caused optimal response of the central system of the body of children 7-10 years old. the first mentioned type of reaction due to its lower starting value. Thus, the exercise in most cases caused optimal response of the central system of the body of children 7-10 years old.

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Conclusions

The studies give reason to believe that the definition of functionality with reflexometer methods omegametry fairly reflects the physiological processes that occur in the brain in a state of muscular rest, during exercise and during early recovery after it. With a certain degree of reliability methods allow the judge reserves the compensatory and adaptive processes of the child's body. Methods extend and supplement the information obtained through other approaches human research capabilities, and can be used by teachers of physical culture to control the level of functionality for the educational process in the school. Further studies aimed at determining the central nervous system of students characteristics of adaptation to physical stress.

Conflict of interest

The author states that there is no conflict of interest.

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