

Specificity of the response of the body of children with motor limitations and cerebral palsy when performing active physical exercises using exercise equipment

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PhD, Associate Professor **N.A. Gross**¹PhD **T.L. Sharova**¹**A.V. Molokanov**¹¹Federal Scientific Center of Physical Culture and Sports (VNIIFK), Moscow

Corresponding author: volodchenkova.e.n@vniifk.ru

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Abstract

Objective of the study is to identify the features of functional adaptation of the body of children with cerebral palsy when performing physical activity using exercise equipment in rehabilitation sessions.

Methods and structure of the study. The study involved children with cerebral palsy of primary school age. Exercise machines and other methods of physical exercise included in the rehabilitation session were used. Heart rate (HR) (a total of 211 observations) was measured using a Polar RS 800 chest heart rate monitor continuously during one session.

Results and conclusions. The highest average HR values were found in children of GMFSC level III in seven (out of eight) types of physical activity. The highest average HR results were shown in "Jumps" in children of all levels: in children of levels I-II (135 ± 13.3 bpm), level III (142 ± 14.6 bpm), performed independently or with the help of the "Gross Simulator", in the group of levels IV-V - (139 ± 8.2 bpm), performed only in the "Gross Simulator". The maximum indicators from the ranges of HR values were noted in the group of children of levels I and II - ($166 - 85$) bpm. The highest HR values were noted in the physical activity in children of level III "Jumps independently or in the Gross Simulator" 142 ± 14.6 bpm and on the "Ellipse Simulator" - 134 ± 5.2 bpm; in children of I and II levels "Walking on knees in the "Gross Trainer" - 138 ± 8.7 beats/min; work. The results of the experiment open up prospects for understanding the processes of functioning of the body of a disabled child when using training devices. They can become a guideline for taking into account the sequence of arrangement of "Training devices" in order to avoid overtraining of the child's body, for the accumulation of data characterizing the functional response to physical activity using training devices.

Keywords: children with cerebral palsy, selection of physical activity, exercise machines, functional capabilities of the body, GMFCS levels, heart rate.

Introduction. One of the factors that can improve the level of development of motor and functional abilities of children with cerebral palsy is the use of exercise machines that, in a gym, allow for physical activity that is similar in nature to the main movement, regulate the direction of the impact, take into account the body's reaction to the load being performed, and correct the movement technique. Active exercises increase the body's resistance not only to physical, but also to everyday and social stress, and are aimed at improving the functional development of the body as a whole [1, 3, 5].

To develop functional capabilities, it is necessary to correctly select the physical activity that is adequate to the characteristics of the child's condition and motor abilities. If the selected exercises using exercise machines are consistent with the physiological capabilities of the body, then the load contributes to a favorable restructuring of the muscular and functional state in children with cerebral palsy. Inadequate loads lead to various pathological changes in the body, which emphasizes the importance of monitoring the functional state, reflecting the dynamics of the adaptation processes of a child with cerebral palsy [2, 4, 6, 7].



Objective of the study was to identify the specific reactions of children with motor impairments and cerebral palsy to active physical activity using exercise machines.

Methods and structure of the study. The study involved primary school-age children with cerebral palsy, grouped according to the level of development of gross motor functions of the international GMFSC scale. The first group included children of levels I and II who could walk independently. The second group included children of level III only, who could walk using additional devices (canes, pushchairs). The third group included children of levels IV and V of the GMFSC scale who could not walk independently.

Heart rate measurements during standard physical activity were taken continuously during the lesson using a Polar RS 800 chest heart rate monitor. Exercise machines: "Electric Treadmill", "Ellipse" Exercise Machine, "Gross Exercise Machine" Multifunctional Exercise Machine (to enable children from levels III to V of the GMFSC scale to perform dosed physical activity on the musculoskeletal system) were used in different sequences depending on the lesson plan. A total of 211 observations were conducted.

Results and conclusions. The influence of physical activity is revealed in the conditions of comparison with the initial state, which preceded the performance of these activities. To determine the characteristics of the body's reaction in children with cerebral palsy when performing active physical activity using exercise machines, the results of the heart rate (HR) after performing eight types of physical activity were analyzed. The results were considered from two positions: 1st – comparison of average HR values relative to the GMFSC scale levels, 2nd – comparison of average HR values between types of physical activity.

Comparison of HR values depending on the GMFSC scale levels showed that the highest average HR values for seven types of physical activity (except for the eighth – walking on knees) were noted in children of GMFSC level III, who can move independently with the use of additional devices (sticks, canes, pushchairs).

The maximum HR value was observed in children of level III (142 beats / min.) after jumping load, which can be considered a good result, since it indicates sufficient adaptation of the cardiovascular system to physical activity. In the group of children of levels IV and V (who cannot move independently) and in the group of children of levels I and II (who can move in-

dependently), the average HR values were slightly lower than in children of level III, but close to each other – 139 and 135 beats / min., respectively. Children of levels IV and V have serious limitations in motor activity. Their HR of 139 bpm may be associated with lower physical activity and adaptation to the load, which explains the lower value compared to children of level III. Children of levels I and II have minimal motor limitations and can perform physical activity almost as well as their healthy peers. Their HR of 135 bpm may be associated with better adaptation of the cardiovascular system to physical activity.

The specified HR values were detected when performing the same type of motor activity – "Independent Jumps and in the "Gross Simulator" and were the highest among the other seven types of physical activity, as indicated by the large values of their percentage ratios relative to the initial level: in the group of levels I and II – 53%, level III – 48% and the combined group of levels IV and V – 60%. High values of HR increase are not unexpected for disabled children. In the study of D.A. Afanasyeva and L.M. Kielvinen, confirmed the ability of children to walk on the "Treadmill" in the "Gross Trainer" in the aerobic mode from 125 to 163 beats / min, which was equal to 50-55% of the maximum heart rate [1].

Comparison of the ranges of maximum-minimum heart rate values in the GMFSC levels showed that the highest values were in the group of children of levels I and II (166-85 beats / min). Close to them, values were noted in children of level III (160-121) beats / min, in the group of children of levels IV and V (147-129) beats / min.

Comparison of the average heart rate values in each type of physical activity showed that the highest intensity value was noted in the "Independent Jumping or in the Gross Trainer" option: 142 ± 14.6 bpm in children of level III. The values of 139 ± 8.2 and 135 ± 13.3 bpm corresponded to the combined groups of levels IV and V and the group of levels I and II of the GMFSC scale. Next, in descending order of the highest values, comes "Walking on the knees in the Gross Trainer" with the maximum indicator in children of levels I and II - 138 ± 8.7 bpm and work on the "Ellipse Trainer" – 134 ± 5.2 bpm in children of level III. The same values of 124 ± 11.6 were noted in "Walking on a treadmill" and "Walking on knees" performed independently or using the "Gross Trainer" by children of level III.

The highest percentage values of the increase in heart rate values relative to the initial level were re-



vealed in the following types of physical activity: 60% – "Jumps in the Gross Trainer" in the group of children of levels IV and V of the GMFCS scale; 57% – "Walking on knees in the Gross Trainer" in the group of children of levels I and II; 53% – "Jumps in the Gross Trainer" of children of levels I and II; 48% – "Jumps in the Gross Trainer" of children of level III; 40% – work on the "Ellipse" trainer of children of level III.

The maximum increase of 60%, noted in the group of children of IV and V levels of the GMFCS scale, is associated with the high coordination complexity of performing jumping movements in this category of children. The increase values of 57 and 53%, noted in the group of children of I and II levels, indicate a high intensity of physical activity even for more mobile children, but at the same time, it allows to increase the level of development of functional capabilities. At the same time, it is necessary to emphasize the importance of adhering to an individual approach to dosing physical activity and the need to monitor the body of children with cerebral palsy during its implementation.

The least intense types of physical activity include "Gymnastics", "Stretching", Pose "Heron", where the obtained percentages of increase in heart rate ranged from 4 to 14%, relative to the initial level. Thus, the results of the study allowed to highlight a little-studied area – the peculiarities of the reaction of the body of children with cerebral palsy when performing active physical activity using exercise machines. Active physical exercise is a rather unusual regime for the body of children with cerebral palsy, which reacts with an increase in heart rate to specific exercises using exercise equipment. The results of the study made it possible to identify exercise equipment, the use of which contributes to an increase in the intensity of physical activity due to their high energy consumption, which contributes to functional adaptation with a focus on individual capabilities.

Conclusions. The average HR values in children with different levels on the GMFCS scale vary depending on the type of physical activity and their level of motor abilities:

- Children of GMFCS level III, when performing jumping movements from eight types of physical activity in the Gross Simulator, recorded the highest average HR values - 142 bpm.

- In children of levels IV and V (unable to move independently) and in children of levels I and II (able to move independently), the average HR values were

lower than in children of level III, but close to each other: 139 and 135 bpm, respectively.

- The highest percentage increase in HR values relative to the initial level were found in the following types of physical activity: "Jumps in the Gross Simulator" in the group of children of levels IV and V – 60%, levels I and II – 53%, level III – 48%. "Walking on the knees in the Gross Trainer", in the group of children of levels I and II – 57%. Work on the Ellipse Trainer for children of level III – 40%.

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