ФІЗИЧНЕ ВИХОВАННЯ ТА СПОРТ

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VARIATION THE CHARACTERISTICS OF RUNNING WITH AUDIO STIMULATION IN TRAINED ATHLETES

Introduction. The human body is able to perceive and respond to stimulation of the main senses from the outside [3, p. 953]. An individual is able to arbitrarily choose a specific (with varying degree of awareness) rhythm of motor activity. Obviously, to effectively solve a specific motor task, the rhythm will be different. For example, cyclic locomotion (walking, running, etc.), which are everyday and simple for a healthy person. They have important practical significance for movement, development and control of preparedness and rehabilitation. We can say that the rhythmic performance of cyclic locomotion indicates their quality (economy and efficiency). Thus, in the area of bimanual coordination isolate rhythmic-auditory stimulation, which can stabilize internal coordination creating an effect called «anchoring». When a particular point in a cycle of movement (for example, placing a foot on a support) is synchronized with a metronome, an effect called anchoring may occur [1, p. 5; 2], which showed a more stable connection between the characteristics of the musculoskeletal system and the respiratory system during cyclic movements through locomotor respiratory coupling. Rhythmic motor actions can be combined with external acoustic stimuli (metronomes and music). This phenomenon is known as sensorimotor synchronization [6, p. 972]. At the same time, concentration on an external stimulus distracts from internal experiences (uncertainty, fatigue, laziness) [8, p. 54]. Showed an increase in time to fatigue due to the use of sound stimuli during exercise. It is assumed that this is due to the parallel processing of external and internal signals [5, p. 174]. That is, the main attention when performing physical work is transferred to external stimuli in an attempt to reduce the perception of signals about the tension of the musculoskeletal system and cardio-respiratory system. Also, this may be due to an increased level of relaxation as a result of an exact expectation of the upcoming movement. Perhaps there is a certain «rhythmic pattern» as the most effective strategy for solving a motor problem. The frequency of cyclic locomotion in recreational runners between 130 and 200 steps per minute (spm) [4, p. 530]. Perhaps we should speak only about the individual rhythm of movement. Auditory or visual stimulation is most commonly used in physical exercise. Thus, the *purpose of the current study* was to identify differences in the

running characteristics of students from different sports without and with auditory stimulation.

Methods and objects. *Object:* prepared athletes (boys n = 26 and girls n = 14) are practically healthy. Before the study, the participants (n = 40) were instructed about the rules and differences of tests № 1 and № 2.

Test № 1. Students (groups of 5 people) at the command «Go!" Performed a run for 1 min. in a free rhythm, which the test person had to independently raise every minute (only 4 m). The benchmark was the average heart rate (HR) and the average running speed (V № … min; m/s), which was reported to the test person at the end of each minute. Each subsequent minute, it was recommended to run at an elevated rhythm based on perceived running speed and physiological sensations. Running was performed on a platform with a ground covering, on a plot of 20 m with bright markings every meter, which was limited by cones. At the end of 1, 2, 3 minutes, HR (bpm) was recorded, the distance covered (Dist. after № … min; m) and Rating of Perceived Exertion (RPE after № … min; score) by Borg «6-20» (from 6 («Easy») to 20 («maximum effort»). After this, the test person returned to one of the cones for the start of the next minute of the run (a total of 15±5 s were used to record and report the indicators). As soon as all the test participants were ready, a signal was given to start running. At the end of 4 minutes or in case of refusal to continue, HR and Dist. were recorded after 1-4 min. Indicator changes were reported to test person only to select running speed.

Two hours later, the test person proceeded to perform a second test.

Test № 2. Students (groups of 5 people) at the command «Go!» Performed a run for 1 min. (4 min in total) to the rhythm of the metronome, which rises every minute (140, 150, 160, 170 bpm). Running was performed on the same platform as in test № 1. The digital metronome signal was fed through a portable audio system. At the end of 1, 2, 3 minutes record HR, Dist. after № …. min and RPE. At the end of each minute, the test person returned to one of the cones to start the next minute of the run (a total of 15 ± 5 s were used to record the indicators). As soon as all the test participants were ready, the signal was given to start running the race at a given rhythm. Recorded HR and Dist. after 1-4 min: at the end 4 m; in case of refusal to continue running; in case of apparent inconsistency with a given rhythm of running (>10 SPM).

Statistics. Statistical analysis was performed using the software package Statistica 10 (USA). The analysis of compliance of sample data with the normal distribution law was performed using the Kolmogorov-Smirnov test. Parametric and non-parametric methods of analysis were used to describe, assess interconnections, and differences in results: descriptive statistics; Pearson correlation coefficient; Mann-Whitney U-test; Student's t-test paired samples. For all analyzes, the level of statistical significance was set at $p<0,05$.

Result. All participants were able to complete the test № 1 and № 2. The measured running characteristics and heart rate had a different approximation to the normal distribution law. Based on the results of the Kolmogorov-Smirnov test, an appropriate statistical criterion was chosen to compare the results.

The coefficient of variation of heart rate in the group of young men during 4 minutes of running decreased (CV = 13,96; 10,62; 7,51; 7,53), and in the group of girls it changed in a wave-like manner (CV = 11,59; 9,26; 10,09; 11,59). The group variation of the running distance in the group of young men decreased in the third and fourth minutes, and increased in the second minute of the test (CV = 13,97; 24,07; 17,10; 10,66), while in the group of girls it increased (CV = 5,90; 8,67; 12,12; 12,40). The average running speed had a similar dynamics, as well as the running distance of the subjects of both groups. The coefficient of variation in the number of steps per minute in the subjects of both groups increased (CV male: 1.62; 1.59; 1.56; 2.53; CV female: 1.11; 1.32; 1.28; 1.73), and for RPE decreased (CV male: 15,76; 13,53; 14,99; 6,86; CV female: 40,67; 11,61; 11,29; 4,76).

The kinematic characteristics and physiological responses recorded during the run without audio stimulation are presented in Table 1. The coefficient of variation of heart rate in the groups decreased (CV male: 15.10; 10.99; 9.57; 7.57; 7.39; CV female: 13.42; 11.94; 11.62; 7.32). Group variation of distance running in test groups dynamically changed (CV male: 16,05; 22,72; 16,85; 3,54; CV female: 14,74; 15,42; 5,58; 17,93). The average running speed of the test person of both groups had a similar dynamics, as well as the distance of the run. The coefficient of variation in the number of steps per minute of test person of both groups dynamically changed (CV male: 6,44; 5,09; 3,52; 4,45; CV female: 1,84; 4,19; 1,21; 3,64), and for RPE decreased (CV male: 14,50; 20,03; 11,95; 6,00; CV female: 18,49; 21,83; 8,02; 6,61).

Comparison of test results № 1 between groups revealed the reliability of differences ($p < 0,05$) for: heart rate in the first minute of the race; running distance in the second and fourth minutes.

Comparison of the results of test № 2 between the groups revealed the reliability of differences ($p < 0.05$) for: heart rate in the first minute of the race; running distance in the first, second and fourth minutes; average run speed in the third minute; total number of steps in the third minute.

Calculation of the correlation relationship between similar running characteristics performed with and without audio stimulation. In the group of young men revealed a significant correlation for: heart rate at the first (r=0,79), the second (r=0,96), the third (r=0,80) and the fourth (r=0,41) minutes of running; distance running at the second (r=0,84) and the third (r=0,88) minutes. In the group of girls, a significant correlation was found for: heart rate at the first (r=0,56), second (r=0,59) and third (r=0,77) minutes of running; running distance in the fourth (r=0,58) minute. For all other indicators, no significant correlations were found.

Conclusions. Similar physiological reactions were recorded in boys and girls on exercise, which increases in steps, regardless of the method of stimulation. At the same time, there are certain differences in the strategy of movement, depending on the method of stimulation. This confirms the complex effect of the imposed rhythm on the performance of cyclic locomotion. We expected significant differences between running characteristics with and without auditory stimulation. However, a large number of reliable differences between the results, including for boys and girls, were not found. This may be due to the preparedness of the subjects, as well as indicate the inconsistency of the data, which requires in-depth research. At this stage,

we are inclined to think that the selected metronome frequencies are convenient for running with a load that rises stepwise.

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МЕТОДИ ФІЗИЧНОЇ РЕАБІЛІТАЦІЇ НА СУЧАСНОМУ ЕТАПІ ПРИ АМПУТАЦІЯХ

Причиною ампутацій нижніх кінцівок в осіб молодого і середнього віку в більшості випадків є травми. В переважній більшості випадків ампутації нижніх кінцівок унаслідок травм виробляється особам чоловічої статі у віці 30-40 років [2, с. 65].

Після ампутації головна мета для людини – відновити навички догляду за собою, не відчувати себе безпорадною. Почати варто з малого – навчитися ходити по квартирі з підтримкою, потім пробувати зайнятися звичними справами, гігієнічними процедурами і т.д., в цьому допомагають фізіотерапевтичні процедури, що поліпшують кровообіг, відновляють тонус м'язів, знімають біль, зменшують набряк [4, с. 215].

Реабілітація – суспільно необхідне, функціональне, соціально-трудове відновлення хворих та інвалідів, що здійснюється комплексним проведенням державних, громадських, медичних, психологічних, педагогічних, професійних, юридичних та інших заходів.