

THE EFFECT OF DIFFERENT RHYTHM AND TEMPO OF AEROBICS CLASSES ON PSYCHOPHYSIOLOGICAL AND ELECTRONEUROMYOGRAPHIC CHARACTERISTICS

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Introduction. Currently it is still urgent to study the influence of central regulatory mechanisms on the processes of adaptation to training loads of those engaged in physical culture [1, 4]. Rhythm is an important factor that involves such mechanisms in the work [5, 6]. A system of rhythm and tempo accompaniment of aerobics classes affects both psychological state and physiological parameters of the body [3].

The purpose of the study was to analyze the effect of different rhythm and tempo of aerobics classes on psychophysiological characteristics of female students' body.

Object and research methods. The formed group involved 25 females aged 17-20 years. The examination was carried out when in the state of relative rest and after performing aerobic exercises of various rhythm and tempo: 115–125, 125–140 and 140–160 bpm.

Psychophysiological characteristics were studied using the hardware and software complex "NS-PsychoTest" ("Neurosoft" LLC, Ivanovo city). We evaluated arm muscle strength and endurance, functional status and motor asymmetry (dominant hand diagnostics) according to the "Dynamometry" methodology. The nervous system characteristics were studied using the tapping test, which is based on the change with time of the maximum tempo of arm movements and the analysis of the wave structure of the statodynamic characteristics of the initial time series. "Profile contact coordination study" was used to diagnose accuracy of aimed arm movements [2].

The data were statistically processed using the software STATISTICA 8.0, which implied determination of the sampling descriptive parameters, assessment of the normality of data distribution (Shapiro-Wilk's test) and comparative analysis of dependent (t-test for dependent samples, Wilcoxon matched pairs test) and independent samples (t-test for independent samples, Mann-Whitney test). $P \leq 0,05$ was taken as statistically significant difference.

Results and discussion. The tapping test was used to diagnose the strength of nervous processes, being an indicator of human working capacity.

According to the data of Table 1, individuals with the average-weak and average strength of nervous processes prevailed in the examined group before the load (46.1 and 38.5% accordingly). Low

strength of nervous processes was determined in 15.4% of the examined females, high strength was not registered. The load with the rhythm of 125-140 bpm did not influence the nervous processes characteristics. The rise of the rate up to 140-160 bpm made a great difference: the number of females with the low strength of nervous processes increased by 53.8%, and with the average-weak - by 15.4%. A decrease in the level of initial work speed was also observed with the rise of the rhythm and tempo accompaniment from the second (125-140 bpm) to the third one (140-160 bpm). Strength and endurance of arm muscles, functional status and motor asymmetry were estimated using dynamometry. According to the data of Table 2, a significant increase in the maximum muscle strength of right hand takes place with the rise of the rhythm and tempo from 125-140 up to 140-160 bpm, which indicates the optimization of the mechanisms of motor coordination. Also, there is an increase in the accuracy of regulation of efforts of right hand and maximum strengthening at the end for left hand.

When comparing the endurance coefficient of left hand before and after loads with various rhythm and tempo accompaniment, a statistically significant increase of the value was registered after performance of exercises with the rhythm and tempo of 140-160 bpm, which may be associated with the improvement of the regional blood flow.

Proceeding from the research data, the asymmetry coefficient of endurance reduces significantly after load with the rhythm and tempo accompaniment of 115-125 bpm, while the asymmetry coefficient of strength is statistically significantly different after load with the rhythm and tempo accompaniment of 115-125 and 125-140 bpm, which is indicative of less pronounced functional differences between the right and left hands of the subjects. The negative values of the asymmetry coefficient of strength and endurance after load with the rhythm and tempo accompaniment of 125-140 bpm prove that it is the left hand which is dominant for the subjects, and a further rise of the rhythm and tempo accompaniment to 140-160 bpm leads to the domination of the right hand. The "Profile contact coordination measurement" methodology was used to evaluate the impact of loads with various rhythm and tempo on psychomotor characteristics of female students. It helps estimate the accuracy and coordination of aimed arm movements. Proceeding from the data of Table 3, the number and frequency of touches per second after load with the rhythm and tempo accompaniment of 125-140 bpm were maximum, which indicates the decrease in the ability of the subjects to coordinate their movements. Further rise of the rhythm and tempo accompaniment of loads up to 140-160 bpm results in the increase of the indices due to optimization of the functional status of the subjects. The change in the rhythm and tempo accompaniment of aerobic classes did not influence the degree of sensor control over movements.

Conclusion. The increase of the rhythm and tempo accompaniment of aerobics classes to 140 bpm results in the reduced strength and mobility of nervous processes, indicating the reduced psychophysiological adaptability, which is an indicator of efficiency of actions and optimal performance. At the same time, in case of the rhythm and tempo accompaniment of the class of 140-160 bpm an

increase in the strength of nervous processes, in muscle strength and endurance is observed, the increased rhythm and tempo accompaniment of classes from 115-125 to 125-140 bpm leads to motor coordination disturbance. Further rise of the rate up to 140-160 bpm increases the accuracy of movements.

All the above indicates the phased nature of adaptive adjustments when changing the rhythm and tempo structure of load. Along with fatigue, being developed with the increase of the tempo of the class, when the tempo is over 140 bpm, central regulatory mechanisms get involved in the process, that provide adaptation to loads, which is shown in stronger and better coordination of movements, as well as changes in the structure of motor asymmetries.

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Table 1. *Diagnostic indices of strength of nervous processes in female students*

Indices under study		Before load	After load with RTA 1	After load with RTA 2	After load with RTA 3
Types of	Strong	0	0	0	15,4

nervous system, %	Average	38,5	30,7	30,7	15,4
	Weak	15,4	30,7	30,7	53,8
	Average-weak	46,1	38,6	38,6	15,4
Level of initial work speed, Hz		6,55 (6,15;7,11)	7,17 (6,65;7,47)	6,68* (6,31;7,09)	6,09* (5,19;6,72)

Comments. RTA 1 – rhythm and tempo accompaniment of 115-125 bpm.

RTA 2 – rhythm and tempo accompaniment of 125-140 bpm.

RTA 3 – rhythm and tempo accompaniment of 140-160 bpm.

* – statistically significant difference ($p < 0.05$) of index after load with RTA 2 and RTA 3.

Table 2. Indices of strength and endurance of arm muscles, functional status and motor asymmetry in female students

Indices under study	Before load	After load with RTA 1	After load with RTA 2	After load with RTA 3
Maximum muscle strength of right hand	22 (17,5;29,75)	22 (19,5;29,75)	20,5↓ (18,25;29,75)	25,5*** (20,5;27,75)
Endurance coefficient for left hand	77↓ (69,00;86,5)	69,00 (66,00;88,00)	79,00 (71,50;81,50)	91,00* (70,00;99,50)
Regulation of muscle efforts of right hand	0,00↓ (0,00;8,25)	12,7 (0,00;33,2)	1,00 (0,00;5,56)	3,70* (0,00;27,15)
Asymmetry coefficient of strength	6,54 (0,06;15,57)	7,89*** (2,35;17,3)	6,67** (-3,66;11,62)	5,88 (2,1;13,95)
Rate of maximum strengthening at the end for left hand	12 (8;15,5)	12 (7;15)	12↓ (9;13,5)	14*** (9;16)
Asymmetry coefficient of endurance	2,10** (1,50;9,84)	0,62* (-0,74;2,54)	-0,04 (-2,52;2,66)	0,44 (-4,28;3,67)

Comments. RTA 1 – rhythm and tempo accompaniment of 115-125 bpm.

RTA 2 – rhythm and tempo accompaniment of 125-140 bpm.

RTA 3 – rhythm and tempo accompaniment of 140-160 bpm.

* – statistically significant difference ($p < 0,05$) of index as compared to index before load.

** – statistically significant difference ($p < 0,05$) of index as compared to index after load with RTA 1.

*** – statistically significant difference ($p < 0,05$) of index as compared to index after load with RTA 2.

↓ – significant decrease of index as compared to index after load with RTA 3.

Table 3. Diagnostic indices of accuracy of arm movements of female students

Indices under study	Before load	After load with RTA 1	After load with RTA 2	After load with RTA 3
Number of touches	45,00 (25,50;53,50)	33,00*** (27,50;43,50)	50,00** (36,50;59,00)	40,00 (33,00;52,00)
Number of touches per second	1,90 (1,05;3,15)	1,90 (1,45;2,90)	2,50↑ (1,30;2,95)	1,90*** (1,25;2,30)
Total time of touches	2,18 (0,90;3,49)	1,63 (1,03;2,63)	2,58 (1,65;3,34)	2,28 (1,32;3,35)
Time of touches per second	0,10 (0,05;0,20)	0,10 (0,10;0,10)	0,10 (0,10;0,15)	0,10 (0,10;0,10)

Comments. RTA 1 – rhythm and tempo accompaniment of 115-125 bpm.

RTA 2 – rhythm and tempo accompaniment of 125-140 bpm.

RTA 3 – rhythm and tempo accompaniment of 140-160 bpm.

* – statistically significant difference ($p < 0,05$) of index as compared to index before load.

** – statistically significant difference ($p < 0,05$) of index as compared to index after load with RTA 1.

*** – statistically significant difference ($p < 0,05$) of index as compared to index after load with RTA 2.

↑ – significant increase of index as compared to index after load with RTA 3.

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