FEATURES OF PHYSIOLOGY OF EXERCISES FOR LOCAL MUSCLE GROUPS AND EFFECTIVENESS OF THEIR USE IN FITNESS TRAINING

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Fitness training is a new trend in the field of physical culture. Recreation benefits of athletic training were always declared, however, practical experience persuaded otherwise. Often athletes at the peak of their sports form lose the protective function of their bodies and immunodeficiency arises (V.A. Levando, R.S. Suzdal'nitskii, 1998). No lesser problem is with the trainings of elderly people. As a rule, such people have high blood pressure and atherosclerosis, but they receive recommendations to engage in "cardio" training such as walking or running [2, 4]. Unfortunately, in this case, it leads to the growth of the blood pressure and too big increase of heart rate. Systolic blood pressure can reach up to 200 mm, and heart rate up to 150 bmp [4], while no one defines when the level of anaerobic threshold is reached.

It is therefore necessary to look for exercises that would not lead to a critical increase in blood pressure and heart rate. Obviously, the reduction of the number of the activated muscle groups gives a solution to the problem. Health should be improved by increasing the anabolic hormones in the blood. The execution of local strengthening exercises in the static-dynamic mode (without full muscle relaxation) causes pain - mental stress, output of pituitary hormones in the blood (growth hormone, ACTH, thyroid-stimulating, luteinizing and follicle stimulating hormones) (V.N. Seluyanov, 2009).

The purpose of the study was to explore the physiological response of women's organisms to the local strengthening exercises and evaluate the health effects of local strengthening dynamic and static-dynamic exercises.

Technology and organization of the study. Twenty adult women participated in the experiment. All subjects were trained under the health program, which included: basic polyarticular exercises on the major muscle groups in different versions. All of these exercises were performed in a dynamic mode.

Four local strengthening exercises were carried out in the static-dynamic mode: sitting knee flexion, sitting knee extension, bending arms, all of these exercises were performed in machines.

Static-dynamic exercises were performed on each machine with approximately 60 % of the maximal voluntary contraction (MVC), followed by the period of active rest in a dynamic mode for 60 seconds. Each exercise was repeated in 4 sets to reach the state of the local near-limit fatigue.

Every time training started with 10 minutes warm up on a treadmill or any other cardio equipment such as elliptical trainer, exercise bike, rowing machine. After cardio workout about 5 minutes were given to stretching the major muscle groups, and then followed the main part of the training session for 40-45 minutes in the gym. The main part of the dynamic strength training consisted of 6-12 exercises performed in 2 to 4 sets, with a weight of about 50-70 % MVC for 10 to 15 reps, with the active rest between the sets, which included walking around the gym and stretching the major muscle groups involved in the exercise. After the main part of the training followed the cool down part, consisting of 20 to 40 minutes of cardiosession on the listed above machines (treadmill, elliptical trainer, exercise bike and etc.) with the average and below-average intensity, in order to gradually reduce the intensity of the workout.

The experiment lasted 24 weeks. Testing was performed at the beginning and at the end of the experiment. As tests were selected following exercises:

1. Harvard step test for simplified program, for 3 min, with a height of 34 cm and a stair climbing rate of 25 steps per minute.
2. Measurement of heart rate and blood pressure before and after the next local strength exercises immediately and after 1.5 minutes of rest:

- Knee flexion sitting
- Knee extension sitting
- Bending arms in a simulator for biceps brachii
- Arm extension in a simulator for triceps muscles

Exercises were performed as a test in the dynamic mode for 15 reps.

We also measured wrist, forearm, shoulder, neck, chest, waist, pelvis, hip and calf circumferences.

The following skinfolds were measured by the caliper: on the back of the shoulder, under the shoulder blade, on the abdomen, on the front of the thigh, on the back of the leg. All the measurements were done on the right side of the body.

Test results of each test were recorded in the table, followed by the comparative analysis of the test results in the control and experimental groups by Student t-test for related samples and by the sign criterion, as well as a comparative analysis between the groups on a Student t-test for unrelated samples.

Results and discussion. Table 1 shows the measurement results of blood pressure and heart rate before local strengthening exercise performed in a dynamic mode, and after 1.5 minutes after it. It can be seen that the local strengthening exercises do not lead to the critical growth of the heart rate and blood pressure. Consequently, the local strengthening exercises can be used without compromising the health of elderly persons.

Table 1. *Heart rate and blood pressure before local strengthening exercise performed in a dynamic mode, and 1.5 minutes after it.*

Type of exercise	HR bpm before	BPsyst mm Hg before	BPdiast mm Hg before	HR bpm after	BPsyst mm Hg after	BPdiast mm Hg after	Weight, kg	Number of reps
Knee flexion	82	118	77	106	123	80	33	18
Arm flexion (biceps)	82	118	75	111	102	69	13	17
Arm extension (triceps)	87	101	71	108	105	67	13	20
Notes: HR – heart rate beats per minute BPsyst – Systolic Blood Pressure by Korotkov BPdiast -- Diastolic Blood Pressure by Korotkov Weight – resistance on a simulator.								

Table 2. *Indicators of functional skills and physical development in the group using the static-dynamic exercises*

Indicators	Before		After		p
VO2 max	46,1	4,4	50,5	4,0	<0.001
HR at knee extension	110	12	107	8,0	>0.05
HR at knee flexion	106	11	104	9,0	>0.05
BPsyst	123	8,0	113	10,0	<0.001
HR arm flexion (biceps)	112	12	112	13	>0.05
BPsyst	102	10	106	13,0	>0.05
Arm extension (triceps)	107	12	106	13	>0.05
BPsyst	104	10	105	8,0	>0.05
Total of fat folds	91,7	20	71,2	18	<0,001

Table 2 shows that after 24 weeks of strength training using local exercises statistically significant changes occurred in maximal oxygen consumption, accompanied by the drop in body weight by 3 kg ($p < 0.01$), probably due to the decrease in adipose tissue mass, as total of fat folds decreased statistically significantly

in all the parts of the body ($p<0.001$). Shoulder, neck, waist, pelvis and hip circumferences changed significantly ($p <0.05$-0,01).

When assessing the reaction of the cardiovascular system to local strengthening exercises, statistically significant changes were not found in heart rate and blood pressure, significant reduction in systolic blood pressure after the exercise was obtained only in the knee flexion.

Conclusions. Local strengthening exercises do not lead to an increase in heart rate and critical blood pressure, so can be used without compromising the health of elderly people.

Thanks to the use of local strengthening exercises for all major muscle groups of the human body, maximal oxygen consumption can be improved significantly and body weight can be reduced by 3 kg ($p < 0.01$) by decreasing adipose tissue mass ($p < 0.001$), and shoulder, neck, waist, pelvis and hip circumferences can be significantly decreased ($p <0.05$-0,01).

The reaction of the cardiovascular system to the local strengthening exercises is statistically insignificant (speaking of heart rate and blood pressure).

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