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CARDIAC PUMP FUNCTION FEATURES IN WOMEN SYSTEMATICALLY ENGAGED IN FITNESS AND THOSE AT THE INITIAL STAGE OF MUSCULAR TRAINING.

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Abstract:

As our research showed, women being systematically engaged in fitness for one year had lower indices of heart rate and higher indices of stroke blood volume at rest, compared with women just starting their muscle training. In women who start muscle training the performance of the standardized muscular exercise in the form of the Harvard step test during the first two minutes results in the stroke volume and heart rate reaching the maximum values, and during the third minute - in a decrease in these indices. During the recovery period after the completion of the muscular exercises, the stroke volume and heart rate in this group of women do not decrease to the initial values within five minutes. The women of the experimental group engaged in fitness for one year, when performing a standardized muscular exercise, show a significantly higher response of the systolic blood volume than in the women of control group, and the frequency of the heartbeats undergoes less changes. After completing the muscular exercise these women have a significant decrease observed in the cardiac pump function of the heart and reach the level of the initial values by the fifth minute.

Keywords: *fitness, women, cardiac pump function, stroke volume, heart rate, systematic training*

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INTRODUCTION:

Nowadays, fitness classes are very popular among young people and adults. This is due to the fact that the people engaged in fitness are offered a wide range of methods and forms of training sessions. One of the most effective forms of training sessions aimed at fat burning is tracing [5].

Tracing (Tracy Anderson's method) is a mixture of pilates, aerobics and personal know-how by Tracey Anderson, a famous fitness trainer for Hollywood stars. She invented special exercises that involve small groups of muscles and allow achieving the most harmonious development of the whole body [10]. This system of training is for women of any age, with varying level of fitness [2, 9]. The program includes a dance-aerobic workout, strength training, aimed at working out the muscles of the whole body, as well as stretching exercises [3, 4, 6]. The main in the aerobic part of the class are the complexes of classical aerobic exercises that cause high productivity of the respiratory and cardiovascular systems [8]. The power part includes bodyweight exercises. These exercises are aimed at developing strength endurance and differ in locality, when a limited group of muscles is involved in the work. In this regard, the load turns to be more concentrated, and fatigue occurs more quickly [1].

All this ensures fat burning, body shaping, cardiovascular system training, development of strength and endurance, flexibility and mobility of the joints [7, 12].

The positive influence of this direction on the organism of those involved is beyond doubt. However, the effect of tracing on the cardiovascular system of women remains insufficiently studied.

Based on this, the objective of our research was to study the characteristics of the reaction of the heart rate of women engaged in fitness to a standardized muscular exercise.

MATERIALS AND METHODS:

Studies were conducted in the fitness studio "Malina" in Kazan. The study involved women aged 22 to 35 years who have different experience in fitness at a frequency of three times a week. The total number of subjects was 55, 29 of them were systematically engaged in tracing for one year and 26 were just beginning to engage in this type of fitness.

The heart rate was recorded at relative rest and during the standardized muscular exercise in the form of the Harvard step test using the Kubichek tetrapolar chest rheography method [11].

According to the technique, the electrodes were applied as follows: 2 current electrodes: the first one – on the head in the forehead area, the second – on the shin above the ankle joint; 2 measuring electrodes: the first - in the neck region at the level of the seventh cervical vertebra, the second - in the thoracic region at the level of the xiphoid process. Recording of the rheogram was automatically performed by RPKA 2 computer analysis re-application – 01 TS 9442-002-00271802-95, designed for operation as part of hardware and software complexes for medical purposes. The device is recommended for use in medical practice by the Committee for New Medical Technology of the Ministry of Health of the Russian Federation.

RESULTS:

Our studies showed that women of the control group, i.e. the beginners, had their heart rate at rest equal to 78.8±1.8 beats per minute, which is 10.7 bpm more than in the women of the experimental group engaged in fitness for one year (Table 1).

During the first minute of the standardized muscular exercise in the form of a Harvard step test, the heart rate in the control group of women increased by 65.7 bpm and reached 144.5±2.1 bpm ($P<0.05$). At the second minute of exercise, this indicator increased by another 6.5 bpm ($P<0.05$). However, these women had a decrease in the heart rate by 7.7 bpm at the third minute of exercise, compared to the values of the heart rate recorded during the second minute of muscular exercise and amounted to 144.3±1.9 ($P< 0.05$). The experimental group of women systematically engaged in fitness for one year, during the first minute of muscle exercise, showed increase in their heart reaching 122.7±4.5 bpm ($P<0.05$), which is 11.1 bpm less than the index of the heart rate of the control group ($P<0.05$). Further, this indicator also increased and by the end of the third minute of the exercise was 133.1±5.5 bpm. Thus, we recorded the greatest increase in heart rate during the muscular exercise in the control group of women.

In the recovery period after the end of the muscular exercise, the heart rate decreased significantly in women newly engaged in fitness. At the first minute of recovery, the heart rate in women of the control group decreased by 19.3 bpm, compared to the values recorded at the third minute of exercise, and was 123±3.6 beats per minute ($P<0.05$). During the subsequent minutes of recovery, a steady decrease in the heart rate was also observed, but at a slower rate, and at the fifth minute of recovery this index was 100±4.0 bpm. The women of the experimental group systematically engaged in fitness for one year showed a decrease in the heart rate by 16 bpm at the first minute of the recovery process, compared with the values recorded at the third minute of the muscular exercise, which was 117.1±3.7 bpm ($P<0.05$). During the following minutes, these women, compared to the control group, had a more rapid decrease in heart rate observed, and at the fifth minute of recovery this index was 69.4±3.5 bpm. Thus, the heart rate in women of the experimental group after the

completion of the muscular load practically decreases to the initial level, whereas in the control group the heart rate does not recover to the level of the initial values. Moreover, the difference between the values of the heart rate, recorded at the fifth minute of recovery, and the initial data at rest in women of the control group was 22.2 bpm (P<0.05). While this difference in women engaged in fitness for one year was 2 times less than in the control group, and was 8.9 bpm.

According to our studies, the stroke volume of women engaged in fitness increases as the fitness level rises. If the stroke volume at rest was in the control group, i.e. beginners engaged in fitness, is recorded at 47.7±2.1 ml, then in women engaged in fitness for one year this index is higher by 20.1 ml (Table 2). During the first minute of the muscular exercise in the form of the Harvard step test, the systolic volume increased by 21.2 ml as compared to the initial data (P<0.05). At the second minute of the muscular exercise the stroke volume increased insignificantly. However, these women had a 14.2 ml decrease in stroke volume during the third minute of muscular exercise, compared to the value of the systolic volume recorded at the second minute of muscular exercise (P<0.05). The women of the experimental group showed a significant increase in the systolic volume by 30.0 ml during the first minute of the muscular exercise, as compared with the initial data (P<0.05). At the second minute of the Harvard step test, the stroke volume increased by another 5.6 ml, compared with the values of the first minute of muscle exercise and amounted to 103.4±1.9 (P<0.05). At the third minute of the muscular exercise, the stroke volume in these women did not undergo significant changes in comparison with the previous minute. Thus, the women of the experimental group, during the first two minutes of the muscular exercise, had increase in their stroke volume, and by the second minute it reached its maximum and remained at this level until the end of the third minute of exercise. Many researchers consider a high response of stroke volume as a favorable factor when the body responds to physical activity with an increase in the myocardium contractility, that is, an increase in the stroke volume. While the women of the control group had increase in their stroke volume only at the first two minutes of the muscular exercise, and during the third minute there was a significant decrease in this indicator. In our opinion, this indicates a low level of fitness of these women. Due to the high heart rate, the duration of the diastolic pause decreases, which in turn leads to a decrease in the blood filling of the heart and in the stroke volume.

In the recovery period after the muscular exercise there was an unreliable decrease in the stroke volume in the control group of women. During the first minute of recovery, the stroke volume decreased by 2.4 ml, compared to the index recorded at the third minute of the muscular exercise and amounted to 59.9±2.3ml. Further, a slight decrease in the stroke volume also occurred, and by the fifth minute of the recovery period this index was 57.9±2.3ml. In the recovery period, after the muscular exercise, the women of the experimental group experienced a significant decrease in their stroke volume. The greatest decrease in stroke volume occurred at the first minute of the recovery process. The stroke volume decreased by 17.2 ml, compared to the values recorded at the third minute of the muscular exercise and amounted to 85.1±1.8 ml (P<0.05). During the second minute the stroke volume decreased by 8.7 ml, and by the third minute – by another 5 ml and was 71.4±2.2 ml (P<0.05). By the fourth minute of the recovery process, the stroke volume was approximately at the level of the initial values and amounted to 70.2±1.9. Thus, the women systematically engaged in fitness for one year showed a more rapid recovery of the stroke volume compared with the control group of women.

Table 1: Changes in the heart rate of women during fitness training

HR (bpm)									
Test subjects	**at rest**	**exercise**			**recovery**				
		1′	**2′**	**3′**	**1′**	**2′**	**3′**	**4′**	**5′**
Control group	78.8±1.8	144.5±2.1*	151±0.9*	144.3±1.9*	123±3.6*	109.9±2.4*	102.4±2.1	101.3±3.6	100±4.0
Experimental group	68.1±2.2#	122.7±4.5*#	131.8±5.1*	133.1±5.5	117.1±3.7*	98.6±4.5*	82.18±4.7*	71.6±3.8*	69.4±3.5

* the reliability of the differences compared to the previous value (P<0.05)
# the reliability of the differences compared to the value of the previous group (P<0.05)

Table 2: Changes in the stroke volume of women of the control and experimental groups

Stroke volume (ml)									
Test subjects	**at rest**	**Exercise**			**recovery**				
		1′	**2′**	**3′**	**1′**	**2′**	**3′**	**4′**	**5′**
Control group	47.7±2.1	67.9±2.7*	76.5±2.4*	62.3±1.9*	59.9±2.3	57.7±2.4	58.1±1.9	56.7±2.1	57.9±2.3
Experimental group	67.8±2.2	97.8±1.8*	103.4±1.9*	102.3±2.3	85.1±1.8*	76.4±2.4*	71.4±2.2*	70.2±1.9	66.7±2.1

* the reliability of the differences compared to the previous value

SUMMARY:

- Systematic fitness training for one year contribute to a significant increase in the stroke volume at rest and the formation of an athletic bradycardia in women.

- The response of the stroke volume in women being systematically engaged in fitness for one year is much higher during the Harvard step test, and the heart rate is lower than that of the control group of women.

- The women of the experimental group, after the completion of the muscular exercise, showed decrease in their stroke volume and heart rate to about the level of the initial values by the fifth minute, while in the control group women these data were not recovered to the baseline values within five minutes after the end of the muscular exercise.

CONCLUSION:

Comparing the changes in heart rate and stroke volume of women, systematically engaged in fitness and newly engage in muscle training, we found the following features.

As our research showed, women being systematically engaged in fitness for one year had lower indices of heart rate and higher indices of stroke blood volume at rest, compared with women just starting their muscle training. Consequently, systematic fitness training contributes to the steady formation of an athletic bradycardia. It should also be noted that the newly engaged women more likely response to muscular exercise with changes in their heart rate, while the indicators of stroke volume undergo less changes compared to women systematically engaged in fitness.

Moreover, the women of the experimental group, after the completion of the Harvard step test, recovered their cardiac pump function almost up to the level of the initial values by the fifth minute of rest. Whereas, the women of the control group, after completion of the muscular exercise, during all five minutes of rest, had their stroke volume and heart rate remaining at a high level without decrease to the baseline by the fifth minute. Consequently, systematic tracing classes, i.e. one of the varieties of fitness, greatly contribute to the improvement of the cardiac functions of those involved in this activity.

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