



Cardiometric characteristics of physical load in men and women aged 50-59 years when performing tests of the all-russian physical and sports complex "ready for labor and defense"

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Abstract

Objective of the study was to identify the cardiometric characteristics of physical activity when performing tests of the All-Russian physical culture and sports complex "Ready for Labor and Defense" (GTO).

Methods and structure of the study. We studied the response of the cardiovascular system (CVS) to physical activity in the period of preparation for testing the GTO and directly during testing. The experiment involved 50 men and 50 women aged 50 to 59 years with different levels of physical activity. Heart rate indicators during training sessions and testing were recorded using individual "wearable" fitness gadgets. Contradictions were revealed between the zones of intensity of loads during preparation and testing, the most energy-intensive types of tests were identified, these include endurance exercises and "swimming". The obtained data of the CVS response to physical activity in the classes in preparation for testing and when performing GTO tests will optimize the pedagogical process of training, taking into account the functional preparedness of the population and the level of complexity of the tests performed.

Keywords: *adult population, heart rate, load, physical fitness, tests of the GTO complex.*

Introduction. Improving the physical health of the population is one of the fundamental tasks of the state policy of the Russian Federation [6]. The participation of the population in various physical culture and sports and health and fitness activities, including the events of the All-Russian Physical Culture and Sports Complex "Ready for Labor and Defense" (GTO), is designed to help maintain the physical activity of the population, aimed at maintaining health, increasing the number of citizens, systematically engaged in physical culture and sports, to increase the level of physical fitness of the population through the improvement of physical qualities, maintaining working capacity and slowing down the influence of age-related changes on the regression of vital motor skills and abilities.

When choosing physical exercises to prepare for testing, each person sets himself two tasks: prepare for testing and, while maintaining his "sports" form, perform all types of tests in accordance with the standards of the age group. The implementation of the test preparation program contributes to an increase in physical activity in the weekly cycle of the motor regime, proportional to the increase in physical activity (PA).

The control of adaptive responses of the body to physical activity in mass physical culture is carried out mainly by heart rate (HR), since pulse monitoring is the most accessible control method that allows measurements, both by palpation and using remote means. The level and response of heart rate to physical activity make it possible to objec-



tively judge the functional state of a person's cardiovascular system, individual load tolerance directly determining physical performance [1, 2]. At the same time, it should be taken into account that the goal of preparing for testing the GTO is not the maximum result in individual types, but the optimal and comprehensive improvement of physical qualities in certain types of tests in accordance with the number of types of tests and standards that ensure the receipt of an insignia [4]. Due to the fact that the adult population prepares for testing mostly on their own, the study of a person's CVS response to various physical exercises during the testing of the GTO complex is relevant from the standpoint of individualizing loads, determining the boundaries of the functional capabilities of one's body, and optimizing the construction of the training process.

Objective of the study was to identify the cardiometric characteristics of physical activity when performing tests of the All-Russian physical culture and sports complex "Ready for Labor and Defense" (GTO).

Methods and structure of the study. We studied the CVS response to various physical activities during the period of preparation for the tests and directly in testing, including the recovery time, in men and women aged 50-59 with different levels of motor activity, admitted to the tests of the complex. The studied contingent belongs to the age category of the IX stage of the GTO (average age - 54 and 55 years) and is characterized by average values of physiological parameters normal for this age group: body mass index - 27.7 and 26.4; the value of heart rate at rest - 70 beats / min and 72 beats / min. The calculated values of maximum heart rate (HR_{max}) in terms of average age correspond to 166 beats/min for men and 165 beats/min for women [8].

Preparation for testing was carried out in the course of a comprehensive self-training according to individual programs, including the number of compulsory physical exercises and exercises of

choice, which will allow you to get a badge of distinction. The duration of classes is at least 1.5 hours, two to four classes per week. The assessment of physical readiness was carried out in accordance with the levels of complexity of the GTO [5]. Heart rate registration during training sessions and testing was carried out using individual "wearable" fitness gadgets (Samsung Health; Huawei Health; Mi Fit and Mi Health; Apple Health). The results of the timing were transmitted after each lesson and processed by the method of mathematical statistics (Excel 2010).

Results of the study and their discussion. An analysis of the indicators of the response of heart rate to physical activity in persons of both sexes of the second mature age made it possible to identify the pulse limits of the intensity of the load during training for the performance of GTO tests: in men, the average heart rate values range from 85.9 ± 3.2 beats / min to 143.9 ± 16.8 beats/min; in women - from 89.1 ± 7.8 beats/min to 122.4 ± 13.1 beats/min. Comparison of the obtained results with the value of HR_{max} for this age showed that the pulse limits of the load in men cover 52-87% of HR_{max} , in women - from 54-74% (Table 1) [8].

The data obtained make it possible to interpret physical activity during the entire period of preparation for testing as work within the boundaries of moderate power: the minimum load corresponds to the recovery zone, the maximum - to the aerobic power zone [3,7]. Work within these limits of heart rate is characterized by a stable state of aerobic metabolism - increased respiration and blood circulation in proportion to the intensity of work and the absence of accumulation of anaerobic decay products [3]. At the same time, it has been shown that performing a load with an intensity exceeding the maximum age-related pulse (approximately 166 beats/min for men and 165 beats/min for women) requires an increase in the duration of the recovery (rest) period to three to four days, which limits the

Table 1. The reaction of the cardiovascular system to physical activity in the process of preparing for testing in men and women aged 50-59 years when performing various physical exercises included in the content of the GTO complex (n=100)

Gender	X HR in the process of training for the performance of GTO tests (beats / min)			
	HR_{min}		R_{max}	
	abs	Percentage of HR_{max}	abs	Percentage of HR_{max}
Men (n=50)	85,9±3,2	51,7%	143,9±16,8	86,7%
Women (n=50)	89,1±7,8	54%	122,4±13,1	74,1%



Table 2. Responses of the cardiovascular system to physical activity during the performance of tests of the GTO complex among men and women aged 50-59 years

Contingent	Indicators	Running 2 km	High/low bar pull-ups	Flexion and extension of the arms in emphasis lying on the floor	Lean forward	Raising the body from a prone position	Skiing 5/2 km	Swimming 50m
Men	X fulfilled standard ±m	13,0±1,0	5,7±2,8	10,9±4,2	1,2±2,8	17,9±5,7	36,4±9,6	1,20±0,2
	X heart rate when fulfilling the standard (beats / min) ± m	160,8±5,4	94,0±14,13	111,2±7,4	70,8±9,3	110,6±19,6	160,7±4,9	157,3±8,4
Women	X fulfilled standard ±m	18,50±1,3	6,9±4,3	5,7±2,4	8,3±1,1	13,5±4,4	25,20±1,8	1,30±0,1
	X heart rate when fulfilling the standard (beats / min) ± m	162,3±6,3	122,4±6,4	122,5±6,8	73,9±6,6	133,8±5,5	165,2±6,6	157,5±13,4

number classes no more than twice a week, thereby lengthening the period of preparation for testing, in some cases provoking a refusal to further prepare for testing.

Thus, the training of the adult population aged 50-59 is characterized by low physical loads of a complex nature, stimulating the development of various physical qualities and motor skills.

At the same time, the response of the cardiovascular system to physical activity during tests exceeds that in preparation for testing: in men it is 71-161 beats/min, in women it is 74-165 beats/min, which approaches the upper limits of HR_{max} at this age (Table 2).

It is important to note the different costs of GTO tests: the most energy-intensive types are 2 km running, skiing and swimming.

When performing the tests “running 2 km”, “running skiing 2/5 km” in women, the average heart rate is within the limits of heart ratemax, in men it is 97% of heart ratemax. At the same time, for women, the result in the 2 km run according to the standards of the IX (1) stage corresponds to a level below the bronze mark, in the IX (2) stage - to the bronze mark; in cross-country skiing - to the silver mark. For men, in the 2 km run of the IX (1) stage, the result corresponds to a silver sign, in the IX (2) stage - to a bronze sign: in skiing in the IX (1) stage - to a silver sign, in IX (2) stages - to a gold one.

The test “swimming 50 m” is characterized by almost the maximum age level of heart rate (95% for men and women). The average value of the standard for men of the IX level is within the limits of the silver mark, for women in the IX (1) stage it corresponds to the gold mark, and in the IX (2) stage - to the silver mark.

When performing the tests “pulling up on a high / low crossbar”, “flexion and extension of the arms in an emphasis lying on the floor”, “lifting the body from a prone position”, a slight increase in heart rate was observed in people of both sexes within a moderate load zone.

Conclusions. In the course of the study, it was found that the fulfillment of test standards (tests) leads to an increase in heart rate to maximum and above maximum values, creating a risk of a strained CVS reaction and injury, limiting the possibility of performing GTO tests, especially in endurance tests.

Taking into account the cardiometric characteristics of physical activity when performing tests of the GTO complex will allow you to effectively create training programs based on the level of functional fitness of men and women aged 50-59, which will contribute to the performance of tests for distinctions with the formation of positive motivation for the further continuation of systematic physical exercises, maintaining the achieved level of physical and functional fitness.



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References

1. Bodin O.N., Polosin V.G., Balakhonova S.A. Prognozirovaniye maksimalnoy chastoty serdechnykh sokrashcheniy dlya rascheta intensivnosti fizicheskikh nagruzok [Forecasting the maximum heart rate for calculating the intensity of physical activity]. *Izmereniye. Monitoring. Upravleniye. Kontrol.* 2013. No. 1 (3). pp. 50-54.
2. Vorobyov L.V. Analiz i kontrol serdechnoy deyatelnosti pri fizicheskikh nagruzkakh [Analysis and control of cardiac activity during physical exertion]. *Mezhdunarodnyy zhurnal prikladnykh i fundamentalnykh issledovaniy.* 2016. No. 8-3. pp. 378-382. Available at: <https://applied-research.ru/ru/article/view?id=10038> (date of access: 03.04.2022).
3. Kots Ya.M. Sportivnaya fiziologiya [Sports physiology]. Textbook for institutes of physical culture. Moscow: Fizkultura i sport publ., 1998. pp. 25-40.
4. Poliatlon [Polyathlon]. Study guide. Tyumen: Avanpost publ., 2001. pp. 91-94
5. Ob utverzhdenii gosudarstvennykh trebovaniy Vserossiyskogo fizkulturno-sportivnogo kompleksa «Gotov k trudu i oborone» [On approval of the state requirements of the All-Russian physical culture and sports complex “Ready for work and defense”]. Order of the Ministry of Sports of the Russian Federation of February 12, 2019 No. 90. Available at: <https://www.garant.ru/products/ipo/prime/doc/72093512/> (date of access: 03.04.2022).
6. Ob utverzhdenii strategii razvitiya fizicheskoy kultury i sporta v Rossiyskoy Federatsii na period do 2030 goda [On approval of the strategy for the development of physical culture and sports in the Russian Federation for the period up to 2030]. Decree of the Government of the Russian Federation dated November 24, 2020. No. 3081-r. Available at: <http://static.government.ru/media/files/Rr4JTrK-DQ5nANTR1Oj29BM7zJBHXM05d.pdf> (date of access: 02.17.2022).
7. Jansen Peter CHSS, laktat i trenirovki na vy-noslivost [Heart rate, lactate and endurance training]. Murmansk: Tuloma publ., 2006, pp. 34-38.
8. The science of exercise prescription: Martti Karvonen and his contributions. *BCMJ.* Vol. 59, No. 1, January February 2017. pp. 38-41.