Biomedical & Pharmacology Journal, March 2022. Vol. **15**(1), p. 49-57

Functional Characteristics of Young Men Who Regularly Experience Feasible Physical Activity

Ilya N. Medvedev[1], Ekaterina S. Kachenkova[2], Marina A. Ovchinnikova[3], Yulia V. Zbrueva[4] and Irina V. Kulkova[5]

[1]Faculty of Physical Education, Russian State Social University, Moscow, Russia.
[2]Department of Adaptology and Sports Training, Institute of Natural Science and Sports Technologies of the Moscow City Pedagogical University, Moscow, Russia.
[3]Department of Sports Medicine and Medical Rehabilitation Institute of clinical medicine. N. V. Sklifosovsky of the Sechenov First Moscow State Medical University (Sechenov University).
[4]Department of Forensic Medicine, Astrakhan State Medical University, Astrakhan, Russia.
[5]Department of Physical Education and Sports, Moscow Pedagogical State University, MPGU, Moscow, Russia.
*Corresponding Author E-mail: ilmedv1@yandex.ru

https://dx.doi.org/10.13005/bpj/2342

(Received: 26 June 2021; accepted: 10 January 2022)

In the modern world, college-age youth often have various somatic dysfunctions and pathologies. This places an additional burden on hospitals and further increases costs in the health care system. Moreover, this situation threatens to weaken the intellectual and general labor potential of the society. The emerging circumstance may negatively affect the state of the economy. Low functional characteristics of modern youth are directly related to their low physical activity. This leads to a weakening of the respiratory and cardiovascular systems in young people, greatly reduces the general functionality and forms the risk of developing pathology. Improvement of widely applicable schemes of dosed physical activity among young people, aimed at mass health improvement and increase in general working capacity, is becoming very urgent. The appointment of the scheme of systematic physical training developed by the authors with the use of simulators that activate the muscles of the trunk and extremities showed its greater efficiency in young men in terms of stimulating the functions of the heart and respiratory system. Against the background of regular trainings according to the tested scheme, the boys' physical performance increased and their functional reserves increased. The developed training technique made it possible to optimize hemodynamics, significantly increase resistance to hypoxia, heart and lung reserves, and also increase overall physical activity in young men studying at the university.

Keywords: Exercise equipment; Heart; Lungs; Muscle activity; Physical training; Young men.

In the modern world, college-age youth often have various somatic dysfunctions and pathologies. This creates an additional burden on hospitals and further increases costs in the health care system[1,2]. In addition, this situation threatens to weaken the intellectual and general labor potential of society[3]. The emerging circumstance may negatively affect the state of the economy[4].

Low physical activity as a result of deliberate avoidance of regular sports training is

considered the leading factor at the heart of the health disorders of modern youth[5,6]. This situation weakens the young organism, which causes the realization in it of any existing predisposition to dysfunction or pathology. This is aggravated by the increase in the body of young people with hypodynamia of atrophy processes and a high frequency of bad habits among them[7,8]. In these conditions, the cardiorespiratory system can be very vulnerable in adolescence, dysfunctions, which are a serious cause of the general weakening of the body and a long-term decrease in working capacity[9,10].

The pathology of the vascular and respiratory systems in men at any age is much higher than in women[11,12]. The situation is aggravated by the neglect of young people to prevent any pathology in themselves due to the erroneous belief that young age necessarily implies good health[13]. In addition, many young people live in the style of harmful health stereotypes in society. Only a small part of young people are engaged in various kinds of sports, unfortunately, not in all cases rationally[14,15], and not paying attention to scientifically grounded recommendations for these activities[16].

It is noticed that long-term, individually selected physical activity, especially of a cyclic nature, contributes to a significant improvement and a pronounced weakening of many pathological processes[17]. This is due to moderate stimulation of blood circulation and respiration during muscle training, and a decrease in the volume of adipose tissue in the body[18]. This is due to moderate stimulation of blood circulation, respiration and all types of metabolism during muscle training. Coming changes increase the body's resistance to all adverse environmental influences[19], help maintain high performance throughout the day and reduce the risk of acute respiratory infections[20].

The prevention carried out in medical institutions cannot be pinned great hopes in terms of improving the health of young people, since it is designed in many respects to prevent age-related diseases in modern society. Restrictions on the sale of alcohol, tobacco and massive superficial monitoring of the health status of certain categories of the population are considered to be ineffective in terms of improving youth health. The most reliable strategy for preserving the health of young people is considered non-drug, nonspecific health improvement with the help of physical exercises. In this regard, it becomes very important to improve the widely applicable schemes of dosed physical activity among young people, aimed at mass improvement and increase in general working capacity.

Purpose: to evaluate the effectiveness of the author's program of cardiorespiratory system improvement in adolescence.

MATERIALS AND METHODS

The study was supported by the local ethics committee established at the Russian State Social University (protocol 15 dated May 11, 2017). The study was conducted from mid-May 2017 to September 2018.

The work was carried out on 43 young men aged 17-19 years. All examined young men had no pathology of internal organs, skin integuments and sense organs. Subjectively, they considered themselves to be completely healthy. All of them were randomly divided into two comparable groups: the experimental group and the control group. The boys of the experimental group (n = 21) underwent physical training according to the developed method. The control group included 22 young men who did not regularly exercise physically and continued to lead their usual way of life.

The scheme of physical activity proposed by the authors consisted of training for one year on modern simulators providing activation of the muscles of the trunk and limbs. During the first six months, the loads were training. Over the next six months, they acquired a stimulating focus.

In the first six months, classes were held 5 times a week with a duration of at least 40 minutes. At the beginning and at the end of the training, breathing exercises were performed. During the main part of the training, exercises were performed on the «Samozdrav» breathing simulator (Figure 1), manufactured by Samozdrav, Russia (five sets of 3 minutes each with 1 minute rest intervals), on the Cardio-Twister simulator (Figure 2) 15 minutes, on the GYROKINESIS, GYROTONIC simulator (Figure 3) for 12 minutes. During the first six months of training, one lesson during the week was carried out in the fresh air, for at least 40

minutes. These activities consisted of alternating short jogging at a free pace and walking at a pace of 50-60 steps for one minute on a horizontal surface.

Over the next six months, the number of lessons during the week was 6. The duration of one lesson in the second half of the year was at least 60 minutes. In addition to the loads of the first half of the year, 12 minutes of training on the Finnlo EllypsisSX1 simulator were introduced into the main part of the training (Figure 4). During this period, one lesson during the week was also carried out in the fresh air for at least 60 minutes. During the lesson on the street, 2 runs were carried out for at least 15 minutes each, and the rest of the time was occupied by race walking at a pace of at least 70 steps for one minute.

All boys of both groups were examined twice: at the beginning of the observation and one year later. The traditional methods were used to determine the pulse rate, blood pressure, systolic and diastolic values, the value of indicators in the Gench and Shtange tests, and the vital capacity of the lungs was measured after a 2-minute run on the spot. The level of general endurance in the test with running was assessed in all young men, the functional class of their aerobic abilities was recorded, and the course of recovery processes after the completion of muscular load was monitored (index of the Harvard step test). The state of motor abilities of the subjects was assessed with a pedometer according to the standard method.

In the course of health procedures, moderate physical activity of a strictly aerobic nature was always used (keeping the heart rate at a level not higher than 70% of the maximum was monitored). Admission to systematic physical

Table 1. Numerical results of the study

Parameters	Observation time	Experienced group, M±m, n=21	Control group, M±m, n=22
Resting pulse, beats / min	at the beginning	78.1±0.37	87.6±0.46
	in the end	62.7±0.39	85.1±0.41
		p<0.01	p_1<0.01
Pressure systolic blood pressure, mm Hg	at the beginning	139.2±0.73	140.0±0.67
	in the end	124.6±0.72	144.2±0.53
		p<0.05	p_1<0.05
Diastolic arterial pressure, mm Hg	at the beginning	83.3±0.35	83.0±0.41
	in the end	72.0±0.52	86.1±0.46
		p<0.05	p_1<0.05
Number of steps taken, thousand steps / day	at the beginning	4.8±0.07	4.9±0.10
	in the end	7.5±0.12	4.7±0.19
		p<0.01	p_1<0.01
Genche test, s	at the beginning	28.3±0.15	28.0±0.13
	in the end	39.8±0.24	28.5±0.28
		p<0.01	p_1<0.01
Stange test, s	at the beginning	43.6±0.42	47.1±0.36
	in the end	57.5±0.34	43.2±0.40
		p<0.01	p_1<0.01
Functional class of aerobic capacity, km	at the beginning	1.30±0.07	1.31±0.04
	in the end	1.61±0.06	1.36±0.10
		p<0.01	p_1<0.01
Vital capacity of the lungs after a two-minute run, l	at the beginning	1.3±0.05	1.3±0.10
	in the end	1.7±0.02	1.3±0.05
		p<0.01	p_1<0.01
Harvard step test index, points	at the beginning	52.6±0.22	53.4±0.29
	in the end	74.5±0.31	54.5±0.44
		p<0.01	p_1<0.01

Legend: p - significance of changes in parameters during the observation period in both groups, p_1 - significance of changes in parameters between groups at the end of observation.

training was possible if the young men had permission from a doctor and with the obligatory good general health.

The values of the considered indicators found during the observation were processed using the Student's t-test.

RESULTS

The numerical indicators obtained in the work are collected in Table 1.

The initial indicators of the surveyed boys in both groups were comparable. The values of their pulse at the time of the first study were at the level of the upper limit of the norm. The systolic blood pressure and the diastolic blood pressure were close to the high normal blood pressure.

In the outcome, all the examined patients had a low resistance to the development of hypoxia with low functional characteristics of the lungs. This was indicated by the low value of the vital capacity of the lungs, recorded after exercise. The low value of the Harvard step-test index at the beginning of the observation, which was present in all the boys, indicated that they had poor physical fitness in the outcome.

At the end of the study, the boys of the control group showed a tendency to negative changes in the recorded indicators.

Fig. 1. Breathing simulator "Samozdrav" (https://www.medspros.ru/i/product_i/2335_6_s.jpg).

Assessment of the somatic status of the experimental group, systematically performing physical exercises according to the tested scheme, showed at the end of the observation clear positive changes in the indicators taken into account in the work. As a result of regular muscle training in young men who made up the experimental group, the pulse value decreased by 25.3%, being 36.4% lower than the analogous indicator in the control at the time of completion of the study. Systematic muscular loads according to the author's scheme were accompanied in young men of the experimental group by a decrease in the value of systolic blood pressure by 11.7% and a decrease in the level of diastolic blood pressure by 15.6%. By the end of the study, these indicators were below the control values by 15.6% and 19.6%, respectively. As a result of regular muscular loads in young men who made up the experimental group, the indicator of motor activity increased by 56.2% and exceeded this parameter in the control by 59.6%. The indicator of Gench's test at the end of the study in physically exercising young

Fig. 2. Simulator «Cardio-Twister» (https://www.atlant-sport.ru/uploads/main_product_136671170301895100.png)

Fig. 3. Simulator «GYROKINESIS, GYROTONIC» (https://www.philbios.de/bilder/European%20Tower.jpg)

Fig. 4. Simulator «Finnlo EllypsisSX1» (https://rn-sport.com.ua/wa-data/public/shop/products/62/66/6662/images/11337/11337.970.jpg)

men increased by 40.6%, prevailing over the value of control by 39.6%. Similar changes were experienced in systematically exercising indicators of the Stange test. At the end of the observation, its value exceeded the outcome in the experimental group by 31.9%, being higher than the control by 39.1%. In the young men who entered the experimental group, the general aerobic capacity by the end of the study increased by 23.8% and began to prevail over the control indicators by 18.4%. This was due to a 30.8% increase in the volume of vital lung capacity recorded after a slight physical activity. By the end of the observation in the young men of the experimental group, this indicator began to exceed the control level by 30.8%. The value of the Harvard test index among the representatives of the experimental group increased by 41.6% over the observation period. This indicated the transition of the poorly trained in the outcome of the surveyed to the status of the average level of physical fitness. At the same time, the boys in the control group retained a low level of physical fitness. As a result, at the end of the study, the differences between the groups for this parameter were 35.7%.

DISCUSSION

In modern society, even in adolescence, low physical activity is often noted, which has a very negative effect on the health of the vascular system, heart and respiratory system[21]. This is due to the danger of lipid and carbohydrate metabolism disorders and excessive fat deposition in the body[22]. This situation is aggravated by the widespread prevalence of smoking among young people and unwillingness to follow a rational diet[23]. With low physical activity, this contributes to the acceleration of the development of existing dysfunctions and to the appearance in the near future of pathology in the cardiorespiratory system[24].

It is known that already in adolescence it is especially important to reduce the risk of onset of developing diseases, using feasible regular physical activity. They are able to strengthen local and general immunity, as well as improve hemodynamics. These effects provide general strengthening of the body and increase the level of labor activity in young people[25,26]. It is noticed that feasible muscular loads intensify vital processes in the body, reduce the amount of fat[27] and inhibit

the development of pathology in it[28,29]. Great importance in this is attributed to the strengthening of the functioning of the cardiovascular and respiratory systems, which provide all cells of the body with metabolites and oxygen[30]. Even after a single muscular load, the activity of the organs of the cardiorespiratory block increases, the volume of blood vessels is normalized, the rheological parameters of the blood are optimized, and the metabolism in the whole body is enhanced[31].

Despite the fact that the positive effect of regular muscular activity on the functional capabilities of many organs is known[32], the question of the effect on the heart and lungs of young men of systematic non-excessive physical exertion on modern simulators has been poorly studied. The lack of unambiguous information about the change in the state of their body in the process of regular training indicates that the issue of the effect of regular muscle loads on the general somatic status in adolescence has not been resolved. This circumstance was the reason for the preparation and implementation of this work[33].

In the study, the effectiveness of the tested muscle load methodology based on the use of a number of special simulators was clarified. There is reason to believe that the applied complex of physical activities contributed to the comprehensive strengthening of the body of those involved. The results obtained are consistent with previous studies on the possibility of significant strengthening of the muscular system in conditions of its regular and rational training[34]. This, as shown by previous studies, is always accompanied by the strengthening of the bone tissue of the skeleton, primarily in its vulnerable areas[35]. Normalization of parameters of the cardiorespiratory system with general improvement of the whole organism was registered in those who trained according to the tested scheme of physical loads. The effect obtained should be associated with a pronounced increase in the reserves of the exercising, primarily the heart and lungs. There is no doubt that the processes of microcirculation, glycolysis and oxidative phosphorylation are intensified in these organs, which is very important in increasing the functional activity of these organs[36]. It is clear that due to the applied scheme of loads on simulators in the cardiorespiratory system of young men, a balance of anabolism and catabolism was achieved, which ensured its strengthening[37,38]. This effect largely develops due to the strengthening of the antioxidant defense of this system, which, under conditions of physical exertion, demonstrates great capabilities in conditions of the influence of unfavorable environmental factors on the body[39].

It can be considered that with feasible systematic physical training using simulators, the process of entering the blood plasma of a number of biologically active substances and hormones is enhanced, leading to the stimulation of the whole organism[40,41]. In addition, the applied scheme of physical training, apparently, activates neurophysiological processes, providing a strict balance of the activity of the sympathetic and parasympathetic parts of the autonomic nervous system and increasing the level of adaptation of internal organs to physical activity[42,43].

Considering the results achieved in young men in both groups, it becomes clear that the tested program has a serious advantage over leading a lifestyle habitual for a modern person with weak muscle activity. It clearly stimulates the functional properties of the trainees' organism, transferring them to a physiologically more beneficial level[44]. Based on earlier studies[45], there is reason to assert that the complex strengthening of the musculoskeletal and cardiorespiratory systems as a result of regular rational physical activity at a young age provides a balance of excitation and inhibition processes in the nervous system, optimizing psychological parameters and increasing the intelligence of trainees[46,47]. In this regard, the author's program of physical training deserves attention from the side of trainers and can be recommended for mass use in educational institutions with the aim of general somatic improvement of youth.

CONCLUSION

Preserving the health of young people is a serious problem in modern society. For this purpose, it is necessary to systematically increase its physical activity, aimed at minimizing any disorders in the cardiopulmonary system already in adolescence. The high need of society to preserve health and high potential of working capacity among young people has always kept this issue in the center of attention of researchers. For a

long time, there has been a search for effective options for the prevention of the consequences of low physical activity and the pathology that has occurred against its background in young people. The authors applied the method of increasing the muscle activity of young men through the integrated use of the «Samozdrav» breathing exercise machine, as well as the «Cardio-Twister», «GYROKINESIS, GYROTONIC» and «Finnlo EllypsisSX1» exercise machines. This exercise pattern was able to stimulate the functional state of the cardiovascular and pulmonary systems of all examined patients. The technique of muscle loads tested by the authors on the simulators was able to stimulate the functional state of their cardiovascular and pulmonary systems. In this regard, it can be considered that the proposed technique is effective in terms of activating the functional properties of the cardiorespiratory system in adolescence and creating conditions for maintaining high working capacity of young people.

ACKNOWLEDGEMENT

The team of authors thanks the administration of the Russian State Social University for the opportunity to conduct research on its basis.

Conflict of interest

No conflict of interest is declared.

Sources of financing

The study was conducted at the expense of the authors.

Ethics Committee Resolution

The study was approved by the local ethics committee of the Russian State Social University on May 11, 2017 (protocol ¹5).

REFERENCES

1. Oganov, R.G., Maslennikova, G.Ya. Mortality from cardiovascular and other chronic non-infectious diseases among the working-age population of Russia. *Cardiovascular therapy and prevention*, **3**: 4-8 (2002).
2. Vorobyeva, N.V., Zavalishina, S.Yu., Mal, G.S., Grishan, M.A., Lazurina, L.P., Fayzullina, I.I. Physiological Features of Platelets in Aging Outbred Rats. *Indian Journal of Public Health Research & Development*, **10**(8): 1925-1929 (2019)
3. Mal, G.S., Zavalishina, S.Yu. Functional Platelet Activity During Ontogeny in Rats. *Indian Journal of Public Health Research & Development*, **10**(8): 1915-1919 (2019)
4. Gundarov, I.A. The menace of demographic crisis of human resources in Russia and means of its overcoming. *Health Care of the Russian Federation, Russian journal*, **61**(1): 5-10 (2017)
5. Apanasenko, G.L., Popova, L.A. Medical valeology. Rostov-on-Don: "Phoenix", 248 p. (2000)
6. Makhov, A.S., Alifirov, A.I. Formation of chess player's dynamic stereotype in competitive period. *Teoriya i Praktika Fizicheskoy Kultury*, **11** : 92 (2017)
7. Shalnova, S.A., Deev, A.D., Oganov, R.G. Factors affecting mortality from cardiovascular diseases in the Russian population. *Cardiovascular therapy and prevention*, **4**(1) :4-9 (2005)
8. Alifirov, A.I., Belov, M.S. Education development trends within elective academic chess courses. *Teoriya i Praktika Fizicheskoy Kultury*, **5** : 39 (2017)
9. Prilipko, N.S. The need for medical rehabilitation of the adult population of various age groups in stationary conditions. *Healthcare of the Russian Federation*, **1**(60) : 23-27 (2016)
10. Zavalishina, S.Yu., Makhov, A.S. Functional changes in body of asanas practicing adolescents. *Teoriya i Praktika Fizicheskoy Kultury*, **3** : 84: (2020)
11. Kachenkova, E.S., Krivitskaya, E.I. Wellness training program for men 50-65 years old who are at risk of cardiovascular diseases. *Scientific notes of the University P.F. Lesgaft*, **1**(167): 146-151 (2019).
12. Karpov, V.Yu., Zavalishina, S.Yu., Dorontsev, A.V., Skorosov, K.K., Ivanov, D.A. Physiological Basis of Physical Rehabilitation of Athletes after Ankle Injuries. *Indian Journal of Public Health Research & Development*, **10**(10): 2051-2055 (2019)
13. Zavalishina, S.Yu., Karpov, V.Yu., Dorontsev, A.V., Kaldarikov, E.N., Koziakov, R.V. Functional Features of the Body in the Presence of Scoliosis. *Indian Journal of Public Health Research & Development*, **10**(10): 2008-2012 (2019).
14. Karpov, V.Yu., Zavalishina, S.Yu., Ryazantsev, A.A., Nazarova, I.V., Shulgin, A.M. Physiologically Based Approaches to the Rehabilitation of Scoliosis. *Indian Journal of Public Health Research & Development*, **10**(10): 2040-2044 (2019).
15. Palvinskaya, L.V., Prikhodko, V.I. Correction of functional disorders of the cardiovascular system by means of physical training. *Scientific notes*

of the Belgorod State University of Physical Culture, **11**: 230-237 (2008).

16. Evgrafov, I.E., Kuznetsov, Z.M. The physical condition and health of men of the second mature age, engaged in a program of physical culture and health improvement. *Theory and methodology of physical culture*, **3**: 90-92 (2010).
17. Karpov, V.Yu., Zavalishina, S.Yu., Romanova, A.V., Komarov, M.N., Sharagin, V.I. Congenital Heart Defects in Children and the Main Approaches to Rehabilitation After their Surgical Treatment. *Indian Journal of Public Health Research & Development*, **10**(10): 1303-1307 (2019).
18. Ogawa, M., Tanaka, N., Yoshiko, A., Oshida, Y., Koike, T., Akima, H. Relationship between physical activity time and intramuscular adipose tissue content of the thigh muscle groups of younger and older men. *Scientific Reports*, **11**(1): 19804 (2021).
19. Karpov, V.Yu., Zavalishina, S.Yu., Gusev, A.V., Sharagin, V.I., Petina, E.S. Physical Rehabilitation of Girls with Neurocirculatory Dystonia. *Indian Journal of Public Health Research & Development*, **10**(10): 2045-2050 (2019).
20. Shilenok, V.N. Comparative assessment of the effectiveness of physical training and some medications in hypertensive patients: dissertation of the candidate of medical sciences. Kursk, 139 p. (1997).
21. Zavalishina, S.Yu., Makurina, O.N., Mal, G.S., Tkacheva, E.S. Influence of Systematic Football Training on Adolescent Functional Characteristics. *Biomedical & Pharmacology Journal*, **14**(2): 533-540 (2021).
22. Nørregaard, J., Gram, M., Vigelsø, A., Wiuff, C., Kuhlman, A.B., Helge, J.W., Dela, F. The effect of reduced physical activity and retraining on blood lipids and body composition in young and older adult men. *Journal of Aging and Physical Activity*, **23**(4): 489-495 (2015).
23. Amosov, N.M., Bendet, Ya.A. Physical activity and heart. Kiev. Health, 216 p. (1989).
24. Zavalishina, S.Yu. Physiological reaction of blood counts in lactating cows to the use of catosal. IOP Conf. Series: Earth and Environmental Science. IV International Scientific Conference: AGRITECH-IV-2020: Agribusiness, *Environmental Engineering and Biotechnologies.* **677**: 042068. (2021).
25. Karpov, V.Y., Zavalishina, S.Y., Dorontsev, A.V., Svetlichkina, A.A., Kozjakov, R.V., Yanpolsky, E.A. Physiological Response of the Physical Capabilities of Adolescents with Sensorineural Hearing Loss to Regular Adaptive Handball. *Biomedical & Pharmacology Journal*, **14**(1): 99-103 (2021).
26. Makurina, O.N., Vorobyeva, N.V., Mal, G.S., Skripleva, E.V., Skoblikova, T.V. Functional Features of Hemocoagulation in Rats with Experimentally Formed Arterial Hypertension in Conditions of Increased Motor Activity. *Prensa Med Argent*, **104**(6). DOI: 10.41720032-745X.1000323 (2018)
27. Arias-Tellez, M.J., Acosta, F.M., Migueles, J.H., Pascual-Gamarra, J.M., Merchan-Ramirez, E., De Lucena Martins, C.M., Llamas-Elvira, J.M., Martinez-Tellez, B., Ruiz, J.R. Higher physical activity is related to lower neck adiposity in young men, but to higher neck adiposity in young women: An exploratory study. *International Journal of Sport Nutrition and Exercise Metabolism*, **31**(3): 250-258 (2021)
28. Karpov, V.Yu., Zavalishina, S.Yu., Dorontsev, A.V., Voronova, N.N., Shulgin, A.M., Sharagin, V.I., Koz'yakov, R.V. Influence of Regular Feasible Physical Activity on the Platelet's Functional Activity of the Second Mature Age People. *Systematic Reviews in Pharmacy*, **11**(8): 439-445 (2020).
29. Vorobyeva, N.V., Khabibulina, T.V., Skripleva, E.V., Skoblikova, T.V., Zatsepin, V.I., Skriplev, A.V. Effect of Lipid-lowering Therapy and Regular Exercise on the Fibrinolytic System in Patients with Metabolic Syndrome. *Prensa Med Argent*, **105**(1). DOI: 10.41720032-745X.1000327 (2019)
30. Kachenkova, E.S., Kulkova, I.V., Zavalishina, S.Yu., Tkacheva, E.S. Health-improving training of 50-60 year-old males in prevention of cardiovascular diseases. *Teoriya i Praktika Fizicheskoy Kultury*, **9**: 62-64 (2020).
31. Zavalishina, S.Yu., Pravdov, D.M., Bakulina, E.D., Eremin, M.V., Rysakova, O.G., Dorontsev, A.V. Strengthening the General Functional Capabilities of the Body in the Conditions of a Feasible Increase in Muscle Activity after Intervention on the Heart. *Biomedical & Pharmacology Journal*, **13**(2): 597-602 (2020).
32. Zavalishina, S.Y. Physiological characteristics of cattle of different ages. IOP Conference Series: Earth and Environmental Science. *Biological Technologies in Agriculture: from Molecules to Ecosystems,* **548**(4): 042066 (2020)
33. Kachenkova, E.S., Zavalishina, S.Yu., Zbrueva, Yu.V., Kosukhina, O.I. The dynamics of the functional state of the body of men 50-59 years old against the backdrop of health training. *International Journal of Pharmaceutical Research*, Supplementary Issue 1 : 1378-1385 (2020).

34. Zhou, S., Zhang, X., Yang, F., Zhou, Z., Zheng, L., Fu, W. Characteristics of quadriceps fatigue induced by continuous maximal knee extension among young and elderly adult men with different levels of physical activity. *Isokinetics and Exercise Science*, **29**(2): 193-197 (2021).
35. Zakhem, E., Sabbagh, P., Ghanem-Zakhem, A., El Khoury, C., El Khoury, G., Zunquin, G., Baquet, G., El Hage, R. Influence of Physical Activity Level on Composite Indices of Femoral Neck Strength in a Group of Young Overweight Men. *Journal of Clinical Densitometry*, **23**(4): 596-603 (2020).
36. Zavalishina, S.Yu., Vinichenko, M.A., Makurina, O.N., Mal, G.S. Optimization of the Functional State of the Cardiovascular System in Women with a Complex of Dosage Physical Exertion. *Biomedical & Pharmacology Journal*, **14**(2): 549-555 (2021).
37. Makurina, O.N., Vorobyeva, N.V., Mal, G.S., Skripleva, E.V., Skoblikova, T.V. Functional Features of Hemocoagulation in Rats with Experimentally Formed Arterial Hypertension in Conditions of Increased Motor Activity. *Prensa Medica Argentina*, **105**(8): 469-476 (2019).
38. Kachenkova, E.S., Zavalishina, S.Y, Makurina, O.N., Kulkova, I.V., Tkacheva, E.S. Physiological Reaction of the Cardiovascular System of Men 50-59 Years to Feasible Regular Physical Activity. *Biomedical & Pharmacology Journal*, **13**(4): 1719-1727 (2020).
39. Wojciak, G., Szymura, J., Szygula, Z., Gradek, J., Wiecek, M. The effect of repeated whole-body cryotherapy on SIRT1 and SIRT3 concentrations and oxidative status in older and young men performing different levels of physical activity. *Antioxidants*, **10**(1), art. no. 37: 1-16. (2021).
40. Zavalishina, S.Y., Karpov, V.Y., Eremin, M.V., Bakulina, E.D., Boldov, A.S., Dorontsev, A.V. Optimization of Physiological Processes in Conditions Staged Activation of Motor Activity in Cardiac Patients. *Biomedical & Pharmacology Journal*, **13**(4): 1653-1658 (2020).
41. Zavalishina, S.Yu., Karpov, V.Yu., Eremin, M.V., Pryanikova, N.G., Tatarova, S., Kozjakov, R.V. The functional state of the body of older men experiencing regular recreational stress. *International Journal of Pharmaceutical Research*, **13**(1): 292-298 (2020).
42. Pavlov, S.E., Kuznetsova, T.N. Some physiological aspects of sports training. Moscow, 55p. (1998).
43. Tkacheva, E.S., Zavalishina, S.Yu. Functional Features of Platelet Secretion in Piglets During Early Ontogenesis. *Biomedical & Pharmacology Journal*. **12**(1): 485-489. http://dx.doi.org/10.13005/bpj/1665 (2019).
44. Komarov, M.N., Zavalishina, S.Yu., Karpushkin, A.A., Malyshev, A.V., Kumantsova, E.S. Rehabilitation Potential of Physical Activity Complex with Elements of Sports and Health Tourism in Case of Dysfunction of the Cardiovascular System in Adolescence. *Indian Journal of Public Health Research & Development*, **10**(10): 1814-1818 (2019).
45. Appelqvist-Schmidlechner, K., Vaara, J.P., Vasankari, T., Häkkinen, A., Mäntysaari, M., Kyröläinen, H. Relationship between different domains of physical activity and positive mental health among young adult men. *BMC Public Health*, **20**(1): art. no. 1116 (2020).
46. Zavalishina, S. Physiological Characteristics of Dairy-Plant Calves Receiving Katozal. *Lecture Notes in Networks and Systems*, **354**: 485-491. (2022).
47. Zavalishina, S.Yu., Kachenkova, E.S. Physiological changes in cardiovascular system with vestibular irritation among representatives of team sports. *Teoriya i Praktika Fizicheskoy Kultury*, **8**: 24-26. (2021).