

The Effect of Playing Chess on an Aging or Pathological Organism

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Abstract

Abstract game sports are very promising in the modern world. Chess, which is one of the adaptive sports, occupies a prominent place among them. Its great advantage is associated with the absence of the need for the athlete to perform essential motor actions and the achievement of superiority over the opponent in the course of mental efforts. It is of great interest to elucidate the dynamics of the general functional indicators of a young organism with persistent pathology and an organism that has begun to age in the course of playing chess. The process of chess sports training has a pronounced positive effect on the general psychoemotional state of people with cerebral palsy and the elderly, increasing their resistance to psychophysiological stress. Mastering the game of chess increases stress resistance and improves the general psychosomatic state of chess players with disabilities. As a result of chess lessons on all scales of psychophysical qualities, the subjects showed general positive dynamics. In all cases, there was an improvement in "Well-being", "Activity", and "Mood" with a decrease in the levels of "Loneliness", "Situational anxiety", and "Personal anxiety".

Keywords: Chess sport, Adaptive sport, Cerebral palsy, Functional capabilities, Health improvement

Introduction

Modern sport activates the body and develops various human abilities, preparing him/her for any kind of useful activity in society (Karpov *et al.*, 2020a; Vorobyeva *et al.*, 2020). Regular sports activities stimulate the musculoskeletal system, increase the functional reserves of all internal organs, and increase the protective capabilities of the body (Vorobyeva *et al.*, 2018; Galeb *et al.*, 2020; Zavalishina *et al.*, 2021a). Researchers consider sport to be a multifaceted social phenomenon aimed at physical, ethical and aesthetic education, contributing to the satisfaction of a

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person's spiritual needs (Bespalov *et al.*, 2018; Abdelbasset *et al.*, 2020; Zavalishina, 2020).

Considering sport from a competitive point of view, it can be considered as an activity in comparison with human capabilities (Skoryatina and Zavalishina, 2017). Medical science considers sports as a means of effective preparation for various physical and emotional stress during training or competitive processes (Zavalishina, 2018; Fayzullina *et al.*, 2020).

There are about 200 individual sports known in the world, each of which has its own characteristics and nature of influence on the body (Zavalishina *et al.*, 2021b; Zavalishina *et al.*, 2021c). A special place among all kinds of sports is occupied by abstract-game kinds, the result of which is not associated with the athlete's motor actions, with the achievement of abstract-logical superiority over the opponent. These sports include chess (Bozhdai and Sviridova, 2017).

In the All-Russian register of sports, chess is found in the form of six sports disciplines: "chess", "rapid chess", "blitz", "chess - team competition", "chess composition" and "correspondence chess". Now chess is considered not only as training the intellect, but also as a way to stimulate the physical capabilities of the body. At critical moments of chess games, the heart rate can reach 150 or more beats per minute. Athletes are forced to spend up to 13 hours a day at the chessboard in a state of tension in all vital systems. This proves that all components of sports training are characteristic of chess sport (Mikhaylova, 2019; Raspopova *et al.*, 2020). In this regard, it is of great interest to influence the long-term regular exercise of chess on a young organism with pathology and the organism of an elderly person that has begun to age.

Purpose

To trace the dynamics of the general functional indicators of a young organism with persistent pathology and an organism, who began to age in the conditions of regular chess training.

Materials and Methods

A survey of 211 people involved in chess was carried out of whom, 105 people suffered from cerebral palsy (19-29 years old) and were engaged in chess for recreational purposes, and 106 people (60-74 years old) were representatives of mass chess sports. The work was carried out on the basis of the territorial

centers of social services for the population "Alekseevsky" and "Yuzhnoportovy" in Moscow.

The examination of all those taken under observation was carried out at the stage preceding the experiment, directly during the experiment, and at the control stage at the end of the experimental stage. At each of the three stages of the experiment (preliminary, experimental, and control), 4 series of examinations were performed (every 3 months). These surveys made it possible to draw up a picture of the dynamics of changes in the indicators taken into account throughout the year.

The change in the state of the subjects during the observation was assessed using three standard tests: a test for well-being, activity, and mood; a test for loneliness using the method of subjective feelings of loneliness by Russell and Ferguson; and a test for identifying personal and situational anxiety using the Spielberger method modified by Yu.L. Khanin.

To check the significance of the samples, the parametric Student's t-test was applied. The composition of the groups observed at different time slices remained unchanged, and the sample size of both groups was homogeneous throughout the study. In accordance with the size of the sample and the equality of groups, the number of its degrees of freedom (f) was calculated using the formula:

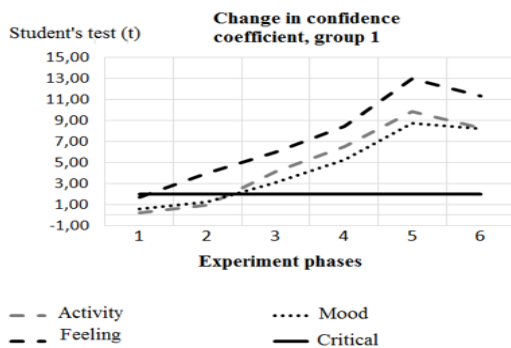
$$f = 2n - 2 \tag{1}$$

The Student's coefficient was calculated using the formula for testing the null hypothesis:

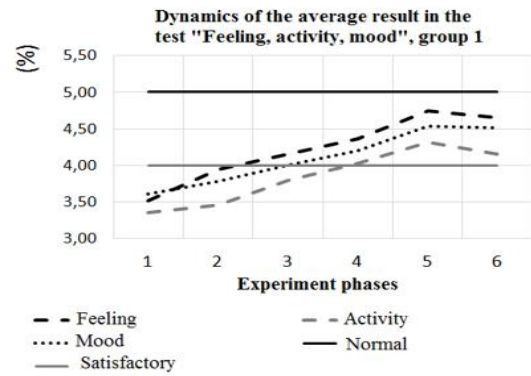
$$T = \frac{x_1 - x_2}{\sqrt{(m_1^2 + m_2^2)}} \tag{2}$$

Results and Discussion

From the graph "Confidence coefficient change" (Figure 1) starting from the second "slice", it can be seen that the Student's t-test exceeds its critical value ($t_{critical} = 1.98$) in accordance with the calculated number of degrees of freedom f and the required significance level of p (at $f_1 = 208$; $f_2 = 210$; $p \leq 0.05$ in both groups).

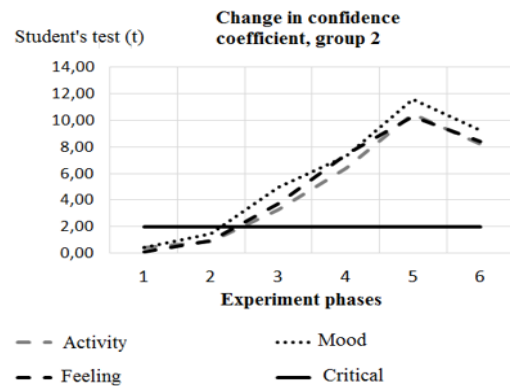


a)

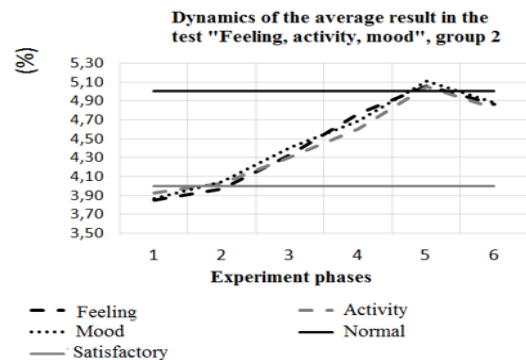


b)

Figure 1. Change in the confidence coefficient/Dynamics of the average result of the first group in the test "Well-being, activity and mood"



a)



b)

Figure 2. Change in the confidence coefficient/Dynamics of the average result of the second group in the test "Well-being, activity and mood"

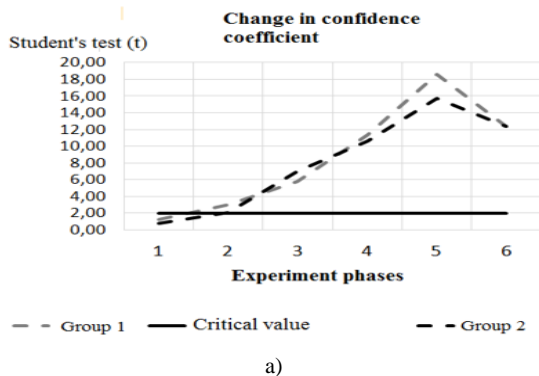
The results of the study, lying within the confidence interval, were statistically significant (Figure 2). Already from the second "slice" of the preliminary stage of testing until the end of the observation, it could be assumed with a 95% probability that a group of chess players with musculoskeletal disorders showed positive results in the group of tests for well-being, activity, and mood.

There was a general tendency towards an increase in indicators at the preliminary stage (1-2 "slice") and during the main training in the game of chess (3-4 "slice"). The prevalence of the results of the participants in the sports and recreation stage with the indicators "Satisfactory" occurred already at the 2nd "slice", while the representatives of mass chess, mainly of the elderly, crossed the required level only by the 3rd "slice" of the study. This was due to the differentiation in the cognitive abilities of athletes and in their psychosomatic indicators.

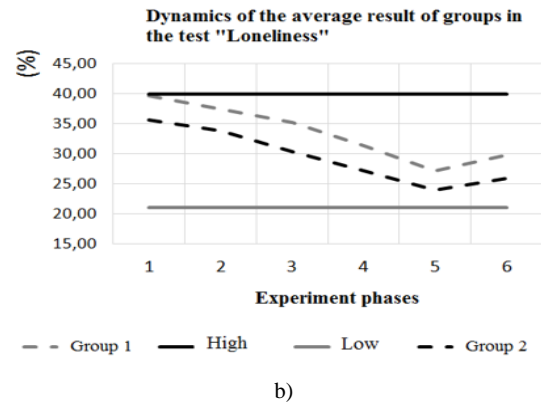
At the preliminary stage of the study, there was a slight increase in the psychological indicators of the subjects. In group 1, the results on the "Well-being" scale to the second "slice" showed an increase of 11.4%, the results on the "Activity" scale increased by 3.3%. On the "Mood" scale, the average result increased by 4.7%. In group 2, the results on the "Feelings" scale to the second "slice" showed an increase of 3.1%, the results on the "Activity" scale increased by 2.5%, and on the "Mood" scale, the average result increased by 5.2%. Moreover, this indicator for most of the subjects was below the satisfactory (less than 4 points) level.

At the next stage, following the results of the continuation of learning to play chess, there was a more pronounced increase in the level of indicators of all test scales in the results of group 2, which averaged 8.7%, while the increase in group 1 was 4.7%. In group 1, the results on the "Feelings" scale to the 4 "slice" showed an increase of 5.3%, the results on the "Activity" scale increased by 3.3%, on the "Mood" scale the average result increased by 5.8%. In group 2, the results on the "Feelings" scale to the 4 "slice" showed an increase of 9.3%, the results on the "Activity" scale increased by 7.5%, and on the "Mood" scale the average result increased by 10.1%.

The control stage of the study, carried out after the subjects completed the course of improving chess mastery, showed that the level of general well-being achieved in the course of training worsened starting from the end of the experimental stage. In group 1, to the final 6th "slice" the decrease was 2.1% on the "Feelings" scale, 4.7% on the "Activity" scale, and 0.9% on the "Mood" scale. In group 2, to the final 6th "slice", the decrease was 4% on the "Well-being" scale, 4.1% on the "Activity" scale, and 4.1% on the "Mood" scale. Apparently, this is due to the termination of group chess lessons and a decrease in the degree of involvement of the subjects in the process of sports training.



a)



b)

Figure 3. Change in the confidence coefficient/Dynamics of the average group results in the test "Level of loneliness"

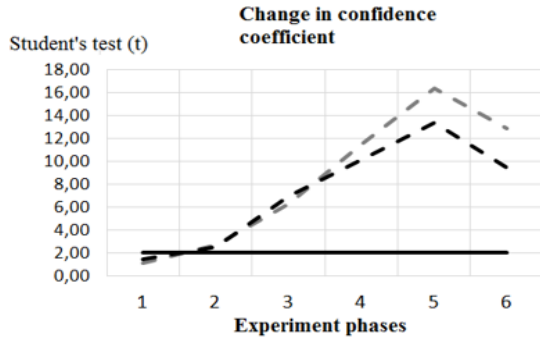
On the graph "Change in the confidence coefficient" (Figure 3), starting from the second "slice", it can be seen that the Student's t-test exceeds its critical value ($t_{critical} = 1.98$) in accordance with the calculated number of degrees of freedom f and the required level of significance p (at $f_1 = 208$; $f_2 = 210$; $p \leq 0.05$ in both subgroups).

Analyzing the dynamics of the average results of the subjects in the test for loneliness, one can note a tendency towards a decrease in indicators at the preliminary stage (1-2 "slice") and during learning to play chess (3-4 "slice"). At the preliminary stage of testing, there was a slight decrease in the level of loneliness and an increase in the psychophysiological indicators of the subjects. In the 1st group to the 2nd "slice", the decrease was 5.1%. In group 2, to "slice" 2, the decrease was 6.2%.

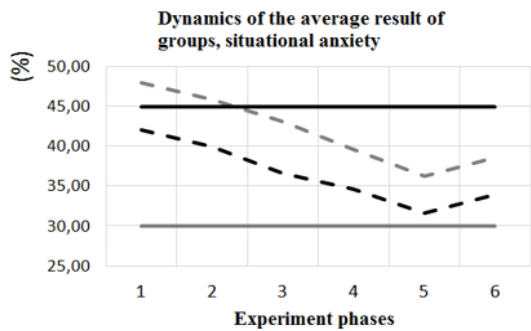
At the next stage, during the main stage of training, there was a pronounced decrease in the average level of loneliness of the subjects in comparison with preliminary measurements. In the 1st group to the 4th "slice", the decrease was 11.4%. In the 2nd group to the 2nd "slice", the decrease was 10.2%. Already on the 3rd measurement of the experimental series, the number of subjects with a high level of loneliness decreased by one and a half times from 29 (on the 2nd measurement of the preliminary series of tests) to 19. By the final 4th measurement, the number of subjects with a high level of loneliness decreased to 5. At the same time, a pronounced increase in the number of subjects was observed with an average level of loneliness up to 99 people by the 4th measurement (more than 90% of the total number of subjects). This indicates, in general, an improvement in the psychoemotional state of the surveyed. By the final 4th measurement, the decrease in the average level of loneliness in the first group was 20.5%, and in the second - 22.8%. One can think about the positive influence of participation in the process of chess sports training on the psychological state and the level of socialization of a person with a lesion of the musculoskeletal system.

The control stage of the study, carried out after the subjects completed the training course, revealed that the decrease in the level of loneliness of the tested, achieved during the main stage of

the training, was replaced by a slight increase of 7.5% on the 6th "slice". The final recorded increase in the parameters of the subjects in relation to the preliminary stage for group 1 was 25.6% and in the second - 28.7%. This confirms the importance of chess lessons as a means of maintaining a stable positive background of the psychoemotional state of a person, especially with the pathology of the musculoskeletal system.

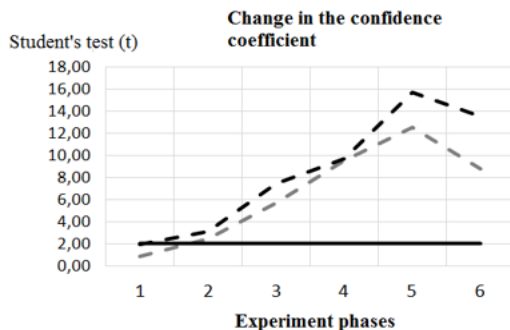


a)

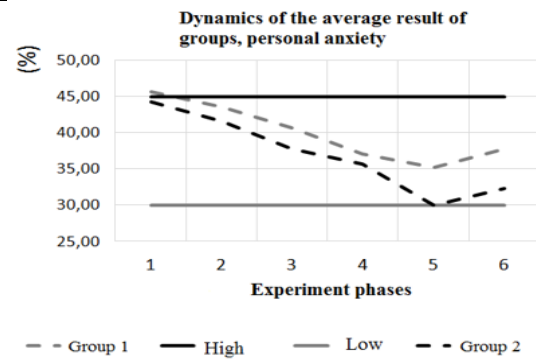


b)

Figure 4. Change in the confidence coefficient/Dynamics of the average result of the group in the test "Situational anxiety"



a)



b)

Figure 5. Change in the confidence coefficient/Dynamics of the average result of the group in the test "Personal Anxiety"

From the graph "Change in the confidence coefficient", starting from the second "slice", it can be seen that the Student's t-test exceeds its critical value ($t_{critical} = 1.98$) (Figures 4 and 5) in accordance with the calculated number of degrees of freedom f and the required level of significance p (at $f_1 = 208$; $f_2 = 210$; $p \leq 0.05$ in both subgroups).

Analyzing the dynamics of the average results of the subjects in the test for identifying personal and situational anxiety, we can note a general tendency towards an increase in indicators at the preliminary stage (1-2 "slice") and during the main stage of learning to play chess (3-4 "slice").

At the preliminary stage of testing, there was a slight decrease in the level of the group's indicators on the scale of situational and on the scale of personal anxiety in group 1 by an average of 4.4%, and in the second - by 5.9%. In group 1, according to the scale "Situational anxiety" on the second "slice" there was a decrease by 4.3%, according to the scale "Personal anxiety" by 4.4%. In group 2 on the scale "Situational anxiety" on the second "slice", there was a decrease by 5%, on the scale "Personal anxiety" by 6.8%.

In the case of the "Situational anxiety" scale in group 1, the subjects with a high level of anxiety (from 57 to 72 people) were the most numerous throughout the entire stage of preliminary measurements. Individuals with a low level of anxiety were absent at all. In the second group, the overwhelming majority were persons with an average level of anxiety (77 people), low anxiety was found in isolated cases.

In the case of the scale "Personal anxiety" in group 1, students with high and medium levels of anxiety were divided equally (52/52 persons), persons with a low level of anxiety were also absent. In the second group, a similar picture was observed, however, students with an average level of anxiety prevailed (from 62 to 76 people), low anxiety was rare.

At the next stage, a stable decrease in the average level of the subjects' situational and personal anxiety was observed. It averaged 8.1% in group 1, and 7.8% in group 2. In group 1, on the scale "Situational anxiety" on the fourth "slice", there was a

decrease by 9.3%, on the scale "Personal anxiety" by 6.8%. In group 2, on the scale "Situational anxiety" on the fourth "slice", there was a decrease by 7.2%, and on the scale "Personal anxiety" by 8.3%.

In the case of the "Situational anxiety" scale in group 1, starting from the second measurement, the most numerous group (92 out of 105 people) consisted of subjects with a moderate level of anxiety and their number increased until the final measurement. The group of the surveyed with a high level of anxiety gradually lost in size and decreased to 11 people by the 4th measurement. In the second group, starting from the second measurement, the most numerous group (up to 90 people out of 106) consisted of subjects with a moderate level of anxiety, and their number gradually increased until the final measurement. At the same time, the group with a high level of anxiety decreased and disappeared completely by the 4th measurement.

In the case of the scale "Personal anxiety" in group 1, starting from the second measurement, the most numerous group consisted of subjects with a moderate level of anxiety, and their number gradually increased until the final measurement. The group of chess players with a high level of anxiety was losing its size and was reduced to 16 people by the 4th measurement. In the second group, a similar picture was observed, however, the number of subjects with a low level of anxiety became the maximum by the 5th measurement and amounted to 55 people, and a high level of anxiety almost ceased to occur.

The control stage of the study, carried out after the subjects completed the training course, revealed that the decrease in the level of situational and personal anxiety achieved in the course of learning to play chess is fixed at a moderate (and low in the case of the second group) level of anxiety with small fluctuations at the 6th "slice".

Complex statistical processing of the test results was carried out using longitudinal psychography (Karpov *et al.*, 2020b; Karpov *et al.*, 2021a). Based on the results of the content analysis, a standardized visual step-by-step interpretation of the increase in the psychophysical readiness of chess players up to the end of the experiment was given in the form of a standard built-up general beam psychogram (Karpov *et al.*, 2021b).

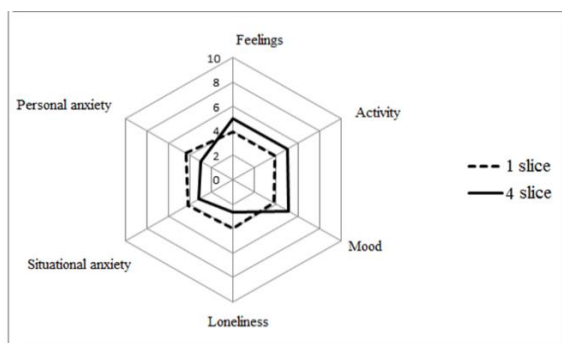


Figure 6. Psychogram of a group of chess players with musculoskeletal disorders

The presented psychogram (**Figure 6**) reflects the dynamics of the development of psychological functions and the psychoemotional state of the personality of athletes in the first and final (fourth) sections of the experiment. For the convenience of a comprehensive analysis, the values of all parameters were converted into a ten-point assessment scale.

Analyzing the scales of psychophysical qualities of the subjects, we can note a generally positive trend (an increase from 10 to 14%) for all indicators. This indicates a comprehensive improvement in the mental state in the process of mastering the techniques of playing chess by persons with disabilities. So, the scales "Feelings", "Activity", and "Mood" showed their fixed growth from 1.1 to 1.3 points for each indicator. The scales "Loneliness", "Situational anxiety" and "Personal anxiety" recorded a drop from 1 to 1.4 points for each considered criterion.

Conclusion

The process of chess sports training has a pronounced positive effect on the general psychoemotional state of persons with cerebral palsy and the elderly, increasing their resistance to psychophysiological stress. According to the results of the study, it can be said that mastering the game of chess increases stress resistance and improves the general psychosomatic state of chess players with disabilities. As a result of chess lessons on all scales of psychophysical qualities, the subjects showed general positive dynamics. In all cases, there was an improvement in "Well-being", "Activity", "Mood" with a decrease in the levels of "Loneliness", "Situational anxiety", and "Personal anxiety".

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Ethics statement: The study was approved by the local ethics committee of the Russian State Social University on September 15, 2018 (protocol №11).

References

- Abdelbasset, W. K., Nambi, G., Moawd, S. A., Alrawaili, S. M., Elnegamy, T. E., Elshehawy, A. A., & Eltrawy, A. H. (2020). Evaluating the depression status following backward walking exercise in diabetic neuropathy patients. *Archives of Pharmacy Practice*, 11(1), 105-109.
- Bespalov, D. V., Kharitonov, E. L., Zavalishina, S. Y., Mal, G. S., & Makurina, O. N. (2018). Physiological basis for the distribution of functions in the cerebral cortex. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, 9(5), 605-612.
- Bozhdaï, A. S., & Sviridova, V. V. (2017). Modeling and information support of the process of preparing chess

- players for competitions using an automated system. *Models, Systems, Networks in Economics, Technology, Nature and Society*, 2, 140-148.
- Fayzullina, I. I., Savchenko, D. V., Makurina, O. N., Mal, G. S., Kachenkova, E. S., & Lazurina, L. P. (2020). Improving the level of socio-psychological adaptation in first-year students of a Russian university Moscow, Russia. *Bioscience Biotechnology Research Communications*, 13(3), 1231-1235.
- Galeb, H. A. M., Ezzeldin, H. M., Ismail, S. M., Elfadl, S. A. F. A., & Elkady, H. M. (2020). Impact of exercise training program on markers of atherosclerosis in hypertensive patients with blood group A. *Journal of Advanced Pharmacy Education & Research*, 10(2), 21-26.
- Karpov, V. Y., Zavalishina, S. Y., Bakulina, E. D., Dorontsev, A. V., Gusev, A. V., Fedorova, T. Y., & Okolelova, V. A. (2021b). The physiological response of the body to low temperatures. *Journal of Biochemical Technology*, 12(1), 27-31. doi: 10.51847/m1aah69aPr
- Karpov, V. Y., Zavalishina, S. Y., Komarov, M. N., & Koziakov, R. V. (2020a). The potential of health tourism regarding stimulation of functional capabilities of the cardiovascular system. *Bioscience Biotechnology Research Communications*, 13(1), 156-159. doi: 10.21786/bbrc/13.1/28
- Karpov, V. Y., Zavalishina, S. Y., Komarov, M. N., & Koziakov, R. V. (2020b). The potential of health tourism regarding stimulation of functional capabilities of the cardiovascular system. *Bioscience Biotechnology Research Communications*, 13(1), 156-159. doi: 10.21786/bbrc/13.1/28
- Karpov, V. Y., Zavalishina, S. Y., Marinina, N. N., Skorosov, K. K., Kumantsova, E. S., & Belyakova, E. V. (2021a). Possibilities of regular physical culture lessons in restoring the functional status of students. *Journal of Biochemical Technology*, 12(2), 62-66. <https://jbiochemtech.com/wDCYQLtIhx>
- Mikhaylova, I. V. (2019). Pedagogical concept of technical and tactical training of persons with disabilities in chess sport. *Person Sport Medicine*, 19(4), 111-116. doi: 10.14529/hsm190413
- Raspopova, E. A., Shmeleva, S. V., Mikhaylova, I. V., & Rysakova, O. G. (2020). The problem of prevention and correction of posture disorders with the help of orderly muscle activity: A literature review. *Bali Medical Journal*, 9(3), 619-623. doi: 10.15562/bmj.v9i3.1434
- Skoryatina, I. A., & Zavalishina, S. Y. (2017). Ability to aggregation of basic regular blood elements of patients with hypertension and dyslipidemia receiving non-medication and simvastatin. *Bali Medical Journal*, 6(3), 521-528. doi:10.15562/bmj.v6i3.553
- Vorobyeva, N. V., Mal, G. S., Tkacheva, E. S., Fayzullina, I. I., & Lazurina, L. P. (2020). Endothelial functions in people with high normal blood pressure experiencing regular exercise. *Bioscience Biotechnology Research Communications*, 13(2), 451-455.
- Vorobyeva, N. V., Mal, G. S., Zavalishina, S. Y., Glagoleva, T. I., & Fayzullina, I. I. (2018). Influence of physical exercise on the activity of brain processes. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, 9(6), 240-244.
- Zavalishina, S. Y. (2018). Functional activity of primary hemostasis in calves during the first year of life. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*, 9(6), 1575-1581.
- Zavalishina, S. Y. (2020). Functional activity of the cardiorespiratory system and the general level of physical capabilities against the background of regular physical exertion. *Bioscience Biotechnology Research Communications*, 13(4), 2327-2331. doi: 10.21786/bbrc/13.4/105
- Zavalishina, S. Y., Bakulina, E. D., Eremin, M. V., Kumantsova, E. S., Dorontsev, A. V., & Petina, E. S. (2021b). Functional changes in the human body in the model of aslicee respiratory infection. *Journal of Biochemical Technology*, 12(1), 22-26. doi: 10.51847/F8mofsugnZ
- Zavalishina, S. Y., Karpov, V. Y., Rysakova, O. G., Rodionov, I. A., Pryanikova, N. G., & Shulgin, A. M. (2021a). Physiological reaction of the body of students to regular physical activity. *Journal of Biochemical Technology*, 12(2), 44-47. doi: 10.51847/ERJ8YmdKPC
- Zavalishina, S. Y., Karpov, V. Y., Zagorodnikova, A. Y., Ryazantsev, A. A., Alikhojin, R. R., & Voronova, N. N. (2021c). Functional mechanisms for maintaining posture in humans during ontogenesis. *Journal of Biochemical Technology*, 12(1), 36-39. doi: 10.51847/5LNdyTcdH