

# Physiological effects of the introducing of the program of personalized support for adolescent chess players

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## Abstract

**Objective of the study** was to evaluate the physiological effects of introducing a program of personalized support into the educational and training process of 15-16 year old chess players.

**Methods and structure of the study.** The experiment involved 15 teenage chess players (15-16 years old) with 1-2 sports categories. The functional assessment of the respiratory and cardiovascular systems was carried out using the Stange and Genchi tests, the calculation of the endurance coefficient, and the fatigue state index. The quantitative assessment of the health of chess players was studied according to the method developed by N.N. Mityukov on the basis of changes in the level of adaptive potential. A comparative five-segment analysis of body composition indicators was carried out using professional Tanita BC-418MA analyzer scales (Japan).

**Research results and conclusions.** A personalized program of physical training of a chess player is proposed. A feature of the personalized support program for a chess player is that it includes the creation of a training system taking into account individual indicators of physical endurance with entry into the database and the implementation of professional consultations in the pre-competitive and post-competitive period. After the application of the personalized physical training program, the reserve capacity, the efficiency of the functioning of the respiratory and cardiovascular systems of chess players increased.

**Keywords:** chess, training process, physical training, personalized program, body composition, cardiovascular system, respiratory system.

**Introduction.** The popularity of the game of chess is steadily increasing. The reasons for the increased interest in chess are varied, they are determined by the intellectualization of modern society and the importance of the problems of human creative development [1, 4, 5]. Educational, training and competitive loads of chess players are accompanied by increased emotional stress against the background of low motor activity, leading to dysfunction of many body systems. In this regard, it is relevant to introduce a personalized physical training program into the educational and training process of chess players, which will reduce psycho-emotional stress and prevent destabilization of the physiological functions of the body.

**Objective of the study** was to evaluate the physiological effects of introducing a program of personalized support into the educational and training process of 15-16 year old chess players.

**Methods and structure of the study.** Scientific work was carried out at the municipal educational institution of additional education for children, specialized children's and youth sports school of the Olympic reserve in chess and checkers in Chelyabinsk, it was attended by 15 teenage chess athletes (15-16 years old), with 1-2nd sports categories. The functional assessment of the respiratory and cardiovascular systems was carried out using the Stange and Genchi tests, as well as by calculating the endurance coefficient. With the help of a test



with physical activity (15 squats in 30 s), the index of the state of fatigue was calculated (according to the method of L.L. Varnas, I.I. Yashchaninas). The quantitative assessment of the health of chess players was studied according to the method developed by N.N. Mityukov (1993).

Comparative analysis of indicators of the component composition of the body was carried out using professional scales-analyzers Tanita BC-418MA (Japan). Changes in the ratio of labile components of body weight - adipose tissue and lean mass were analyzed. Bioimpedance analysis of body composition in a sample of chess players was carried out in the morning on an empty stomach in a five-segment mode. The assessment of the general physical fitness of chess players was carried out using standard tests.

The organization of the survey was regulated by compliance with the requirements of the Council of Europe Convention on Human Rights and Biomedicine. To compare the indicators measured in two different periods on the same sample of moderate athletes, statistical analysis of the results was carried out using MS Excel 2016 programs with the calculation of the Wilcoxon T-test, changes in indicators were considered statistically significant at  $p < 0.05$ .

Due to the fact that the duration of a chess game can last from 1.5 to 6 hours, with the development of a state of fatigue, far from specific chess factors come to the fore, but such as physical endurance, the state of the cardiovascular and respiratory systems. We have proposed a personalized program of physical training for a chess player, which includes a set of exercises and a plan for their use during a six-month training cycle.

A feature of the program of personalized support for chess players is that it includes the creation of a training system taking into account individual indicators of physical endurance with entry into the database and the implementation of professional consultations in the pre-competitive and post-competitive period. The program includes both exercises of general impact and for strengthening various muscle groups of the body (back, abdominals, cervical spine, shoulder girdle and limbs), relieving fatigue; as well as individually selected exercises for playing the game in conditions of lack of time for the development of physical and mental endurance.

**Results of the study** and their discussion. In order to more objectively assess the effectiveness

of introducing a personalized physical training program to the activities of the main energy supply systems of the chess players' body, we studied the reaction of the respiratory and cardiovascular systems to a dosed physical load. In the dynamics of the study, the duration of breath holding on inspiration (Stange's test) increased from  $72.5 \pm 4.9$  (s) to  $85.5 \pm 5.1$  (s) ( $p < 0.05$ ); on exhalation (Genci test) - from  $43.5 \pm 3.9$  (s) to  $51.4 \pm 4.2$  (s) ( $p < 0.05$ ); VC increased from  $2.8 \pm 0.4$  (l) to  $3.2 \pm 0.5$  (l) ( $p < 0.05$ ); vital index from  $60.2 \pm 4.8$  (ml/kg) to  $63.7 \pm 4.9$  (ml/kg) ( $p < 0.05$ ); endurance coefficient and fatigue state index decreased from  $16.8 \pm 1.1$  and  $1.30 \pm 0.30$  to  $16.3 \pm 0.9$  and  $0.90 \pm 0.02$ , respectively ( $p < 0.05$ ), which indicates on improving the efficiency of the functioning of the cardiovascular and respiratory systems in chess players aged 15-16.

In the dynamics of the training process, there was a significant decrease in heart rate and systolic blood pressure at rest, after exercise, after 1 minute of recovery. In addition, after systematic physical training sessions in athletes, recovery of heart rate after a dosed load was observed at 2-3 minutes; the values of the double product after the load, compared with the beginning of the training process, decreased from  $17013.21 \pm 657.89$  to  $14945.76 \pm 567.43$  ( $p < 0.05$ ), after a minute of recovery - by 20.7% against the background of a decrease in efficiency ratio from  $279.92 \pm 25.31$  to  $236.86 \pm 21.45$  ( $p < 0.05$ ).

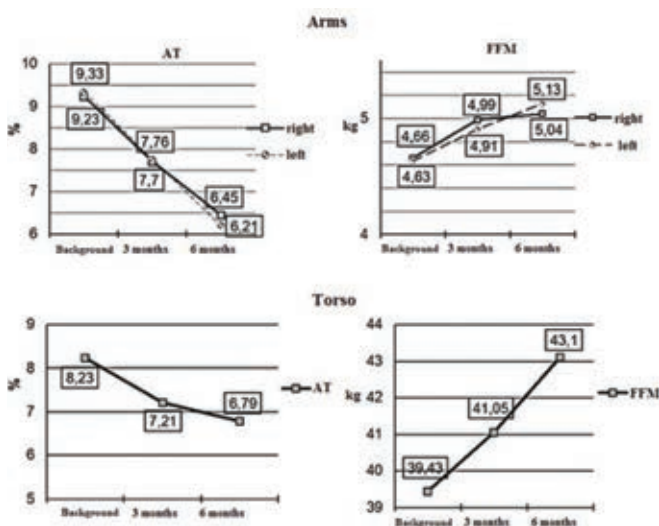
An indicator reflecting the effectiveness of physiological adaptation is the recovery rate after a load within one minute [7], which in chess players increased from  $72.05 \pm 5.11$  to  $81.31 \pm 6.35$  ( $p < 0.05$ ) under the influence of personalized physical training. The values of the health index among chess players at the beginning of the training process indicate a decrease in adaptation; after six months of training, this indicator decreased, corresponding to a satisfactory level of adaptation (from  $3.89 \pm 0.22$  to  $2.91 \pm 0.14$  at  $p < 0.05$ ).

Under the influence of the program of personalized support in the dynamics of the training process, there was an improvement in all indicators of the general physical fitness of chess players: the effectiveness of 30m and 2000m runs decreased from  $5.7 \pm 0.5$  (s) and  $600.6 \pm 34.4$  (s) to  $4.4 \pm 0.4$  and  $513.4 \pm 31.5$  (s); the number of flexion-extension of the arms while hanging on the crossbar and in support increased from  $7.5 \pm 0.4$  and  $25.1 \pm 3.9$  to  $9.6 \pm 0.5$

and  $31.3 \pm 4.8$ ; the number of body lifts in 1 minute from the "lying on the back" position increased from  $41.9 \pm 4.1$  to  $47.1 \pm 4.9$ ; stuffed ball throws – from  $8.3 \pm 1.5$  to  $9.2 \pm 2.1$ .

Focusing on the results of bioimpedance analysis of the body composition of chess players, it can be revealed that after three months of using the personalized support program, chess players have a statistically significant decrease in the content of adipose tissue in all parts of the body. This trend was also observed after six months - a decrease in adipose tissue in the extremities by an average of 31.4%, and in the trunk - by 17.5%. Fat-free mass in the studied regions of the body in chess players increased (in relation to the background values, at  $p < 0.05$ ): after three and six months of using the program in the upper shoulder girdle - by 5.9% and 9.5%; in the bottom - by 7.4% and 7.9%; in the trunk - by 4.1% and 9.3%, respectively.

Asymmetry was revealed in the content of adipose tissue in the hands of chess players after six months of the physical training program ( $p < 0.05$ ). The figure shows a decrease in adipose tissue and an increase in lean mass in the studied regions of the body in chess players in the dynamics of using a personalized program. When calculating the Wilcoxon T-test, which is equal to the sum of the ranks corresponding to an atypical shift of the indicator,



*Dynamics of regional changes in the parameters of the component body composition of chess players during the application of the physical training program.*

Note: Note: AT - adipose tissue; FFM - fat-free mass; difference of paired indicators  $|d|$  within  $[0.1; 0.5]$

with the revealed difference in paired indicators  $|d|$  within  $[0.1; 0.5]$ ,  $T=4.5$  was obtained. Comparing Temp. with Tcr., which at a significance level of  $p=0.05$  and  $n=15$  is equal to 14, we can consider changes in bioimpedance study parameters to be statistically significant.

A systematic increase in lean mass and a decrease in adipose tissue in the regions of the body corresponds to an increase in working capacity in the conditions of a decrease in energy costs per unit of work [1], and also confirms the adequacy of the applied training effects to the functional capabilities of the athletes' body and the formation of long-term adaptation of the phosphate, oxygen and lactate energy systems [6].

The program of personalized support for chess players should be developed in compliance with the principle of ensuring a sufficient volume of compensatory work against the background of a decrease in the total volume of motor work when an individual limit is reached in terms of lean mass and low levels of adipose tissue.

Indirectly, the issues of personalized training of chess players were considered by A.G. Korovyansky, who argues that a good level of chess form can be achieved only with attention to physical exercises, adherence to a sports regime, and control over one's health [5]. E.V. Kondratieva points out the need to include general physical training classes in the training process of chess players in order to reduce the negative impact of emotional stress on the body, minimize the negative consequences of high tournament loads, which is consistent with our findings [4]. E.V. Bykov notes that a sedentary lifestyle negatively affects the health of chess players, it is necessary to develop technologies that ensure the preservation of the health of athletes [2]. V.S. Grinchenko proposed a daily routine aimed at building an effective process of training chess players, mobilizing body systems without negative health consequences [3].

**Conclusions.** The introduction of a personalized training program into the educational and training process of teenage chess players contributed to functional changes, which manifested themselves in the following physiological effects: an increase in the reserve capacity of the cardiovascular and respiratory systems; reduction in the degree of fatigue after exercise; increasing the endurance and working capacity of the organism of chess players aged



15-16 under conditions of competitive loads against the background of improving their sportsmanship.

In addition, the optimal combination of mental and physical loads in the system of personalized training of teenage chess players contributes to the activation of thought processes, concentration of attention, increase in noise immunity, improvement of technical and tactical training and increase in the effectiveness of game actions.

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