

Evaluating the Functional State and Physical Fitness of Men and Women in the Second Period of Adulthood at the Initial Stage of Recreational and Training Activities



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Abstract: It has been demonstrated that men and women in the second period of adulthood suffer detraining associated with low level of physical fitness and functional potential at the initial stage of recreational and training activities. **Materials.** The evaluation of the physical and functional potential of people in the second period of adulthood at the initial stage of recreational and training activities has been presented in the article. **Methods.** Analysis and generalization of scientific literature, analysis of indicators of the functional potential and physical fitness. **Results.** The study has been conducted with the purpose of assessing the state of physical and functional potential of the men and women in the second period of adulthood at the initial stage of recreational and training activities. The results of the experiment indicate that the men and women in the second period of adulthood are detrained. This is manifested in the worsening of almost all indicators reflecting the functional potential of the respiratory system. Disorders of the respiratory system are combined. Restriction (reduced stretchability of the lungs and chest), weakening of the respiratory muscles due to lower lung capacity with the growing Gaensler index, and obstruction (bronchospasm) – a significant decrease in all indicators reflecting bronchial permeability, especially the peak flow expiratory rate – are observed. **Conclusion.** The results allowed to make a conclusion about detraining associated primarily with low level of physical activity in people in the second period of adulthood, which was confirmed by the results of tests evaluating their physical performance and functional potential, low level of physical health, and weak motor potential at the initial stage of recreational and training activities.

Keywords: adulthood, physical qualities, functional state, recreational and training activities.

I. INTRODUCTION

The coaching experience reveals that it is very difficult to encourage a steady and long-term interest in recreational and training activities in people in the second period of adulthood [1, 2]. The coaching personnel of sports and fitness centers,

fitness clubs, and vocational education institutions is largely interested in arranging recreational and training activities in such a way that they contribute to maintaining health and professionally important qualities of a cohort in the second period of adulthood [3, 4].

M.I. Anokhin explored the problems of computer spirometry in adults. M.Ya. Vilensky studied the main essential characteristics of the pedagogical technique for forming the physical education. B.Kh. Landa has developed a method for the integrated evaluation of physical development and physical fitness. V.V. Chernyaev designed and built the humanitarian-focused content of the physical education. V.N. Chesnokova studied the seasonal aspects of adults' adaptation.

Doctors have ascertained the deterioration in the health of adults recently: about 45 % of adults have health disorders when starting recreational and training activities, and the rest suffer from cold at least 1 – 2 times a year.

The purpose of the study is to evaluate the state of physical and functional potential of the men and women in the second period of adulthood at the initial stage of the recreational and training activities.

Scientific and practical significance of the research is as follows: its results can be used for further scientific research of this topic and related ones. The identified parameters can be used in coaching and teaching practice because the physical fitness of students should be taken into account to design recreational and training activities for the organization of classes, and it should contribute to the preservation of health and the maintenance of professionally important qualities of the trainees. Besides, the resulting parameters can be used as a methodological material in training.

II. MATERIALS AND METHODS

25 men (aged 36 – 60) and 25 women (aged 36 – 55) who had attended Atlant and Legenda sports and fitness centers in Sergiev Posad from two months to one year participated in the experiment [5]. The sample included only the participants who received full information about the study and gave informed and voluntary consent to participate. The basic level of fitness was average.

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The testees were healthy and with no diseases of the musculoskeletal system. All the participants were informed of the possible risks and gave their written consent to participate. The study complied with all ethical standards and was approved by the local ethics committee.

According to Apanasenko, the state of physical health of the participants can be evaluated during the first or second week of the experiment by measuring the body weight, height, heart rate, blood pressure at rest, and dynamometry. Besides, all participants exercised (20 squats in 30 seconds).

The following tests were conducted to evaluate physical qualities in the third or fourth week of the experiment: running 30 meters to evaluate the speed characteristics, a long jump from a place (cm) to evaluate speed and strength qualities, flexion and extension of the body (count), pull-ups on a high bar (men) and low bar (women) to evaluate strength qualities, Cooper test (one kilometer in 12 minutes) to evaluate endurance, and leaning forward (cm) to evaluate flexibility.

The Ruffier's test was used to evaluate the physical performance at the fourth week of the experiment [5-8]. The functional potential at the 4th week of the experiment was studied using the spirometry method (SpiroC 100). The following indicators were determined at third or fourth week of the experiment: lung capacity (LC), inspiratory and expiratory reserve volume (iRV and eRV), respiratory capacity (RC), respiratory frequency (RF), maximum breathing capacity (MaxBC), minute breathing capacity (MinBC), maximum respiratory capacity (MRC), and maximum respiration frequency (MRF). The respiratory reserve was found as $RR = MaxBC - MinBC$, and relative RF was found as $\%RF = RF \times 100 / MaxBC$.

The statistical data were processed in software SPSS 15.0. The Shapiro-Wilk criterion was used to check for the normal distribution of the measured variables. The parametric methods (Student's t-test) were used for dependent samples in the case of a normal distribution of variables, and nonparametric methods (Wilcoxon test) were used in the case of nonnormal distribution. The indicators that obey the law of normal distribution are presented as arithmetic mean (M), and standard deviation errors (m), which do not obey the law of normal distribution, are presented as arithmetic mean (Md) and 25th and 75th percentiles. Differences were considered statistically significant at $p < 0.05$.

III. RESULTS AND DISCUSSION

Determining the level of physical health of people in the second period of adulthood at the initial stage of recreational and training activities (according to the method developed by G.L. Apanasenko) reveals that the average score for the group is 8 points, which corresponds to the functional level of health – "average". According to this method, a safe level of health begins from 7 – 11 points. This is the lowest score, which guarantees no clinical signs of the disease. Its decrease is accompanied by an increase in morbidity and the worsening functional state of the body [5, 9, 10].

Table 1: Table of scores corresponding to health levels

	Health level				
	low	below	average	above	high

		average		average	
General health assessment	3 and less points	4 – 6 points	7 – 11 points	12 – 15 points	16 – 18 points

The physical fitness of the men and women in the second period of adulthood at the initial stage of recreational and training activities was evaluated using a set of standard tests that determined the degree of development of basic physical qualities. It has been found that the development of physical speed and endurance qualities corresponds to the "average" level, and the development of strength, dexterity and flexibility corresponds to the "low" level.

There is an insufficient development of the muscles of the back and abdominal muscles, as well as insufficient stretching of muscles and ligaments. Strength training is required to improve blood circulation, has a strengthening effect on the cardiovascular and respiratory systems, and increases metabolism. The high level of flexibility contributes to better recovery of physical performance in the case of severe fatigue and the restoration of mobility in the joints resulting from the shortening of muscles, ligaments, and tendons through static stresses during labor and physical sports activities. The results of the study of the respiratory system were compared with the corresponding indicators for the age group in order to find the functional potential of the men and women in the second period of adulthood at the initial stage of recreational and training activities. The comparison algorithm is related to the fact that the transfer of intense muscular loads on the body must have a certain level of adaptive capacity to overcome extreme environmental factors affecting a human. The basis for adaptive rearrangements is the physiological reserves of the body, a lack of which can lead to pathological conditions and diseases. In the case of respiratory failure, maladaptation response occurs three times more often than without it [6, 7, 10]. The results of the study have revealed that LC in adults is reduced by 23 % ($p < 0.001$), which indicates a decrease in the functional reserves of the body (Table 2). The fractional analysis indicates a significant excess of the iRV ($p < 0.001$) and a decrease in the eRV ($p < 0.001$), while the RF increases by 15 % ($p < 0.05$) relative to proper values. An increase in the iRV, RF, and RC indicates an increase in the intensity of metabolic processes and energy release, which may cause an increased need of the body for oxygen aimed at ensuring tissue metabolism (Badmaev, 2004; Chesnokova, 2010).

A significant reduction in the ability of the respiratory system to use a functional reserve has been found in the testees. The MaxBC estimation reveals that its actual values lie within 59 % ($p < 0.001$) from the proper values. However, the magnitude of the MinBC is higher than the normalized values for this age by 18 % ($p < 0.001$). A decrease in the RR by 13 % ($p < 0.001$) and relative RR (% RR) by 29 % ($p < 0.001$) was also recorded for this cohort. Perhaps, a decrease in the functional potential is associated with weakness of the respiratory muscles and low stretchability of the lungs and chest, which suggests a low physical potential, which can be influenced by properly chosen exercises.

Table 2: Indicators of respiratory volumes and capacities of the men and women in the second period of adulthood (M ± m; Md (25th, 75th percentiles))

Indicators	Values	
	Actual	Proper
LC, l	3.52 ± 0.88	4.55 ± 0.85***
RF, count/min	21.1 ± 1.6	18.0 ± 1.5*
iRV, l	1.73 (1.21; 2.95)	1.31 ± 0.05***
eRV, l	0.57 (0.13; 1.39)	0.82 ± 0.05***
RC, l	0.81 (0.14; 1.58)	0.55 ± 0.05***
MinBC, l/min	7.27 (1.72; 16.24)	6.14 (5.79; 6.47)***
MaxBC, l/min	80.0 ± 4.2	135.5 ± 1.5***
MRC, l	1.53 (0.72; 2.35)	1.05 ± 0.08***
MRF, count/min	45.9 (30.3; 100.9)	-
RR, l/min	65.8 ± 2.99	75.5 ± 6.5***
%RR,	67.3 ± 2.81	94.1 ± 2.3***

Note: differences are significant at * -p < 0.05; *** -p < 0.001

The limiting abilities of the respiratory system also depend on the resistance to the air flow. As such, the study of respiratory volumes and capacities should be supplemented by a study of the airways condition. Analysis of the forced LC, which is one of the main tests reflecting the airways condition and mechanical properties of the respiratory system, has revealed that all the parameters are recorded at a level below the proper values (Table 3).

There is a decrease in the forced LC relative to proper values by 23 % (p < 0.001), which confirms the low reserve capacity of the respiratory system. There is a decrease in permeability of the large bronchi system, as indicated by low forced expiratory volume (FEV) values (24 % less than proper) (p < 0.001) and maximum flow rate (MFR) (31 % decrease in MFR25).

Table 3: Airways permeability in the men and women in the second period of adulthood (M ± m), (M (25th, 75th percentiles))

Indicators	Values	
	Actual	Proper
FLC, l	2.99 ± 0.55	3.88 ± 0.05***
FEV 1, l	2.75 ± 0.08	3.58 ± 0.88***
IG, %	92.4 ± 1.5	89.90 ± 0.30
AFR 25 – 75, l/sec	3.40 ± 0.10	4.50 ± 0.01***
PRF, l/sec	4.88 ± 0.29	6.95 ± 0.55***
MFR25, l/sec	4.55 ± 0.53	6.55 ± 0.19***
MFR50, l/sec	3.91 ± 0.25	4.50 ± 0.15***

Similar results have been obtained as a result of the study of the small bronchi system – a decrease in the MFR50 (p < 0.001) and an average flow rate (AFR 25 – 75 by 14 % (p < 0.01)) was recorded. Besides, the peak flow rate (PFR) indicator was also almost 30 % below the due age values, which might indicate a decrease in the physical condition of the testees: the state of the respiratory muscles, their strength and speed were not at the proper level.

As such, the results of the experiment indicate that the men and women in the second period of adulthood are detrained.

This is manifested in the worsening of almost all indicators reflecting the functional potential of the respiratory system. Disorders of the respiratory system are combined. Restriction (reduced stretchability of the lungs and chest), weakening of the respiratory muscles due to lower LC with the growing Gaensler index, and obstruction (bronchospasm) – a significant decrease in all indicators reflecting bronchial permeability, especially the peak flow rate, – are observed [2, 4, 8]. It seems probable that these disorders are caused by a decrease in the muscular strength of the respiratory muscles and general detraining, rather than by diseases of the respiratory system.

Besides, the physical performance and resistance to hypoxia were studied. Analysis of the results of physical performance has revealed that its ratio was assessed as "satisfactory" (Table 4).

Evaluation of individual health indicators has revealed that 58.5 % of the testees experienced a result rated as "good", 35.1 % - as "average", and 6.4 % - as "satisfactory".

The study of the body's resistance to hypoxia also indicates the reduced functional reserves of the body. The result of the breath-holding inspiration test was "low" in 58.3 %, and breath-holding expiration test was "low" in 78.9 % of the participants.

Table 4: Indicators of the physical performance and hypoxic stability in men and women in the second period of adulthood, (M ± m)

Indicators	Values	
	Actual	Proper
Physical performance, c.u.	11.8 ± 0.8	satisfactory
Breath-holding inspiration test (sec)	45.5 ± 2.5	low
Breath-holding expiration test (sec)	23.1 ± 0.35	low

IV. CONCLUSION

The above assumption about the physical condition of people in the second period of adulthood, primarily due to the low level of motor activity, is proven by the results of the tests assessing their physical performance and functional potential, average level of physical health, and insufficiently realized motor potential at the initial stage of fitness and training activities.

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Evaluating the Functional State and Physical Fitness of Men and Women in the Second Period of Adulthood at the Initial Stage of Recreational and Training Activities

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