

The Condition of the Respiratory Organs in Students with Different Levels of Physical Fitness

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Introduction: We studied the functional status of the respiratory system in the first-year students with different levels of physical activity. We determined the values of the functional status of the respiratory system in the young men and young women divided into two groups: those who do sports on a regular basis and those who do not. By now, there are not enough studies dedicated to the assessment of the relationship between the level of physical activity and the functions of the respiratory system in the first-year students adapting to a new environment.

Problem, purpose: The problem of the study lies in the necessity of studying the influence of physical fitness on functional reserves of the respiratory system in the first-year students. The purpose is to assess the status of the respiratory system in the first-year students with different levels of physical activity.

Materials and methods: We studied the values of the functional status in 60 students of the Faculty of Foreign Languages and the Faculty of Physical Education, Sport, and Tourism of Mari State University. We determined the duration of deep-inspiration breath hold (Stange's test) and deep-expiration breath hold (Genche's test), as well as external respiration values such as respiratory volume, respiratory rate, respiratory minute volume, vital capacity, and project vital capacity. The values were determined in a state of rest and after controlled physical activity.

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Results: We presented the results of the comparison of the respiration values in the first-year students. The study shows that the respiratory system of most students is in good condition. Gender differences are expressed in higher values of functional tests in the young men in comparison to the young women. The study shows that the functional status of the respiratory function of lungs depends largely on doing physical exercises and sports on a regular basis.

Conclusions: The study showed the dependence of the functional status of the respiratory system on the amount of physical activities and the level of students' physical fitness.

Keywords: students, respiratory system, external respiration, respiratory rate, respiratory volume, respiratory minute volume, vital capacity, physical activity, adaptive capabilities, functional tests, Stange's test, Genche's test.

INTRODUCTION

The problem of preserving young students' health is increasingly attracting the attention of researchers, which is related to the deterioration of the status of the body's functional capabilities and identification of new risk factors for the development of various pathologies [1, 3, 7].

It is commonly known that students are a special social group united by certain age and specific labor and life conditions. An intensive and rather lengthy learning process and the change in sleep, rest, nutrition and learning process patterns demand higher standards for compensatory and adaptive mechanisms of the young people's body [1].

Among the most important values of the individual's health is its functional status. At the same time, it is characterized by the adaptability of the body to the changing conditions of the external environment and reflects their influence on a physical and mental state of the body, especially the body of young people.

One of the important tasks of modern education is to protect and promote students' health. It is known that the learning process has a number of factors having a negative impact on the physical and mental development of the person, and, as a consequence, on the health of the younger generation. These factors include considerable mental workloads and decreased physical activity. In particular, the lack of physical activity causes a decrease in functional capabilities of different systems of the body, primarily the cardiorespiratory system, which reduces adaptive capabilities and resistance to various diseases [2].

Therefore, to determine the health status it is reasonable to assess the functional status of

different systems of the body. It is known that breath hold tests are used for assessing the level of oxygen support for the body. They also characterize the general fitness level of the person [2, 9].

One of the most important values of the functional status of the body in different age periods is human breathing. At the same time, physiological parameters of breathing are extremely susceptible to the influence of negative environmental factors, which underlies a high percentage of upper respiratory tract, bronchi, and lung diseases, which reduces reserve capabilities of breathing [8].

Doing physical exercises on a regular basis leads to morphological changes in the body, which is beneficial to functional capabilities of the respiratory system. Many research papers [3, 4, 5, 8] provide the results of study of athletes' breathing.

Purpose of the study. The purpose of this study was to analyze the status of the respiratory system in the first-year students with different levels of physical activity.

Study materials and methods. The study involved the first-year students of Mari State University. To conduct a comparative study, the students were divided into two groups:

- The 1st group (23 people) included the students majoring in pedagogy at the Faculty of Foreign Languages who were physically healthy young people working out as part of the university curriculum.
- The 2nd group (20 people) included the students of the Faculty of Physical Education, Sport, and Tourism doing different sports

(volleyball, basketball, football, and track and field).

Additionally, the first-year students were divided into groups by gender.

We determined the duration of the students' deep-inspiration breath hold (Stange's test) and deep-expiration breath hold (Genche's test), as well as some values of external respiration such as respiratory volume, respiratory rate, respiratory minute volume (RMV), vital capacity (VC), and project vital capacity (PVC) [7, 8]. The values were determined in a state of rest and after controlled physical activity in the form of 20 squats and 3-minute running.

Study results. The state of the human body directly depends on the amount of oxygen that enters cells and tissues. These processes are

supported by the performance of respiratory organs and the cardiovascular system. When examining the respiratory system, we can determine not only external respiration values but also the organ endurance level. One such method of studying the lung function is Stange's test and Genche's test. They help the researcher identify deviations in the body functions, which cannot always be determined in the usual way. Stange's and Genche's tests are defined as the study helping assess the capabilities of the body, its sensitivity to oxygen, and its fitness level.

When conducting Stange's test, students were asked to hold their breath at deep inspiration after two or three resting inspirations and expirations. Breath-hold time was documented using a stopwatch. The results of the study are shown in Figure 1.

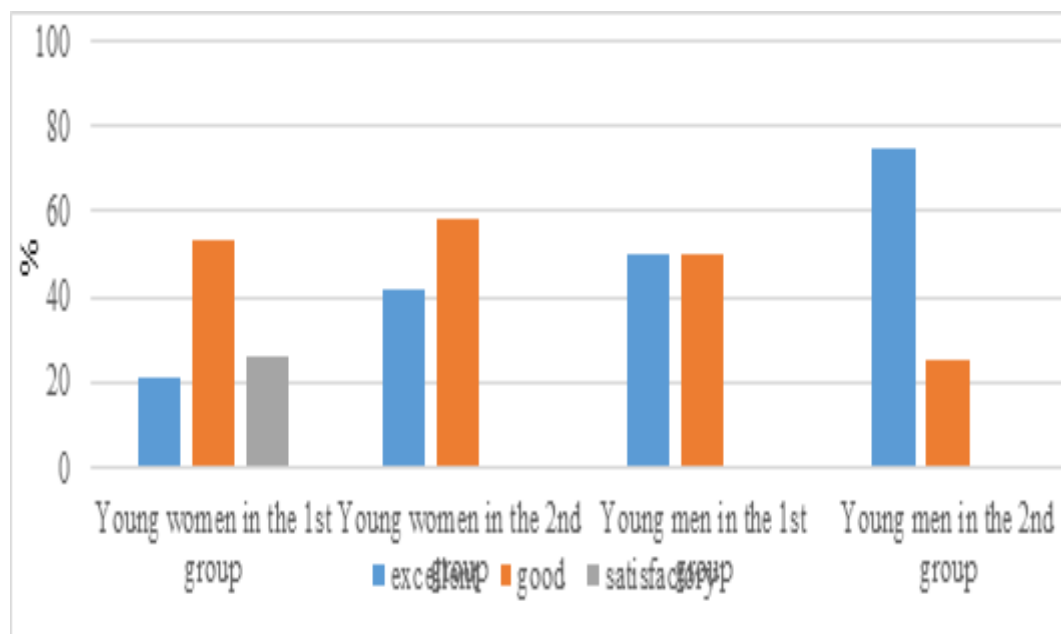


Figure 1. Functional status of the respiratory system in the first-year students %, (Stange's test)

Thus, in most young women majoring in pedagogy at the Faculty of Foreign Languages (1st group) and female students of the Faculty of Physical Education, Sport, and Tourism (2nd group), the status of the respiratory system is estimated as good (53 and 58% respectively). However, 42% of young women who do sports on a regular basis have excellent values of the respiratory system status, which is almost two times higher than in the representatives of the first group. Unfortunately, satisfactory values

were registered in 26% of female students in the same group.

Genche's functional test is performed when students hold their breath. Such a test helps understand how well the body is supported by oxygen. This test also determines the level of fitness of the human body (the body of students in our case). The results of the assessment of the functional status of the respiratory system

according to Genche's test values are shown in Figure 2.

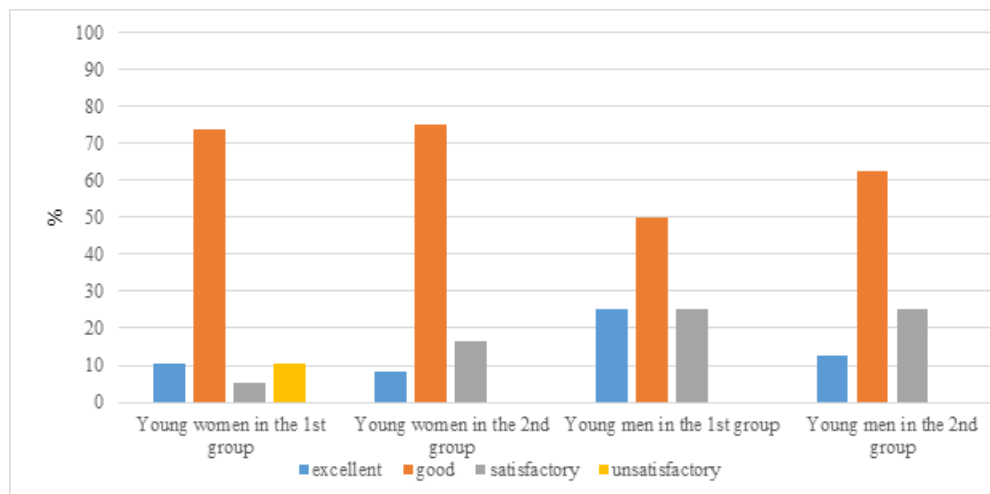


Figure 2. Functional status of the respiratory system in first-year students %, (Genche's test)

The data obtained shows that the female first-year students in both groups under study had a good level of body fitness when breath-hold time at a deep expiration was 30-50 seconds. Unfortunately, 10.5% of students in the first group had a poor status of the respiratory system according to this test. In general, the diagnosis results are at the same level. The young men's values also differ little from each other in the groups under study. Most young men have good values, but the athletes show a little higher values.

The second stage of the study was also supposed to identify the differences in the values characterizing the functional status of the respiratory system by the RR, RV, and RMV

values in the compared groups of students both in a state of rest and after completing different physical activities.

The first activity was to do 20 squats per 30 seconds. The second activity was three minutes of running in place with a rate of 180 steps/minute. The pace of steps was determined using a metronome. The rest interval between the first and the second activities was 5 minutes.

The results of the study of the functional status of the respiratory system in the young men and young women by RR values (min) in a state of relative rest and after completing two physical activities are shown in Figure 3.

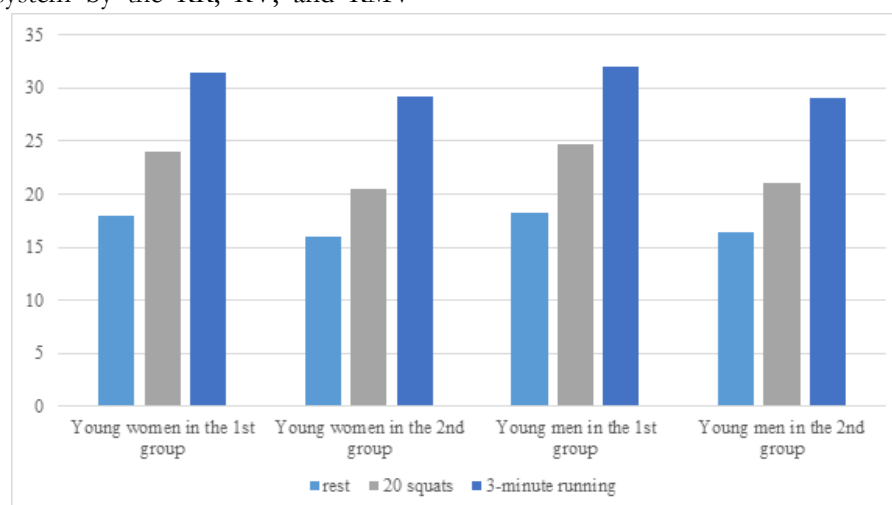


Figure 3. Respiratory rate values (min) in the first-year students before and after physical activity

The results presented indicate that the respiratory rate value in a state of rest in the young women studying at the Faculty of Foreign Languages was higher than in the young women from the 2nd group. In the young men attending sports clubs, this value turned out to be lower than in the students from the 1st group under study. It is worth mentioning that there are very small gender differences in respiratory rates in each group, and we can observe slightly smaller values

The values of respiratory volume in a state of rest and after physical activities are shown in Figure 4.

of this parameter in the young women. According to the data provided, the respiratory rate is 17 respiratory motions per minute on average, which corresponds to the normal values [2]. After the students complete different physical activities, the respiratory rate expectedly increases, but the increase is less pronounced in the students who do sports on a regular basis than in the students of the Faculty of Foreign Languages.

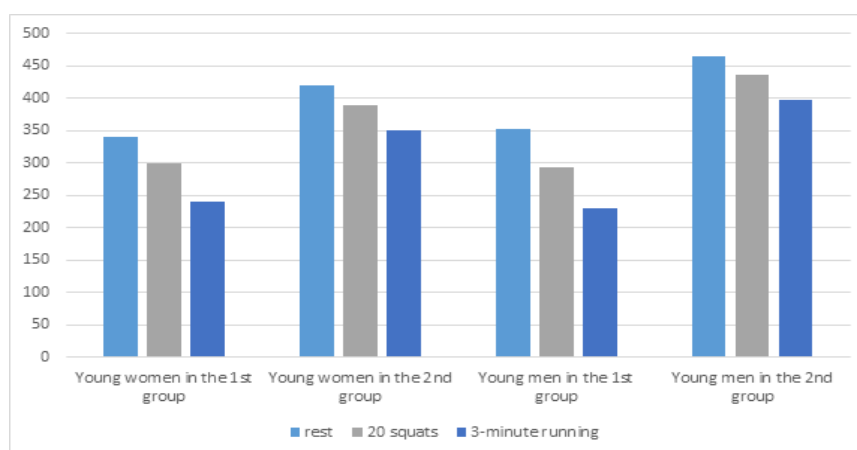


Figure 4. The values of respiratory volume (ml) in the first-year students before and after physical activity

The study shows that the respiratory rate value in a state of rest in the students from the second group was lower than in the students from the first group, whereas the respiratory volume values (Figure 4), on the contrary, were higher in the students of the Faculty of Physical Education, which is most likely to be related to great strength

of respiratory muscles and higher values of vital capacity. After the students completed the physical activity, the respiratory volume value decreased in both groups, but more pronounced changes were observed in the representatives of the first group, both in young men and young women.

The study of the value of respiratory minute volume yielded the results shown in Figure 5.

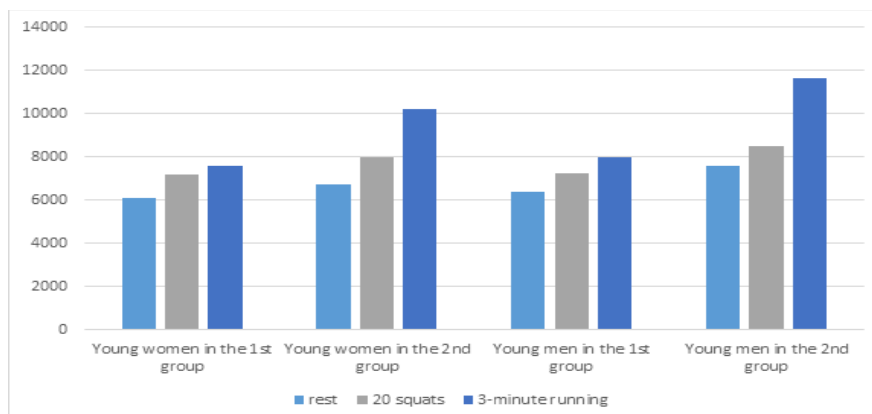


Figure 5. The values of respiratory minute volume (ml) in the first-year students before and after physical activity

The RMV value in the young men who work out and do sports on a regular basis considerably exceeded the corresponding values in the students from the first group. In both young men and young women, RMV increased, to a greater extent, due to respiratory rate and, to a lesser extent, due to respiratory volume.

Vital capacity is one of the most important values of the functional status of the external respiration organs. Vital capacity is usually expressed in volume units (l and ml). It allows us to indirectly assess the area of respiratory surface of lungs where gas exchange takes place between alveolar air and blood of pulmonary capillaries. The greater the vital capacity of the lungs, the larger the respiratory surface and the greater the depth of breathing can be, and the easier it is to achieve an increase in ventilation volume.

The vital capacity values in the young women who do not do sports on a regular basis are within 3 liters and lower than the PVC value by 23%, which is statistically reliable, whereas VC in the female athletes is 3.36 liters (Figure 6). Moreover, these values in the female athletes are virtually identical to the PVC values (3.52 l). The young men are in the following situation: the PVC and VC values in the athletes are almost at the same

level (a little over 5 liters), the values are somewhat lower in pedagogy students, and there is a difference between the PVC and VC values, which is around 0.2 liters. This difference is insignificant, which can be explained by the fact that most young men attended sports clubs during their school time, and they maintain a certain level of functional capabilities of lungs even with a low current activity. After the students complete the suggested physical activity, their VC values expectedly reduce. The most pronounced reduction in VC was observed in the students from the first group: the VC values decreased by 17% in the young women and by 3.0% in the young men after the first activity and by 29% and 10%, respectively, after the second activity. In the students from the group doing sports, the VC values decreased insignificantly: by 2 and 5% in the young women and by 1.5 and 4.7% in young men, respectively, after each activity (Figure 6). The results obtained indicate a physiological response of the body to the activity, which can be ascribed to the increase in blood refill of pulmonary circulation vessels. However, a more noticeable reduction in the VC value in the young women from the first group is related, in our opinion, to low functional capabilities of the cardiovascular and respiratory systems.

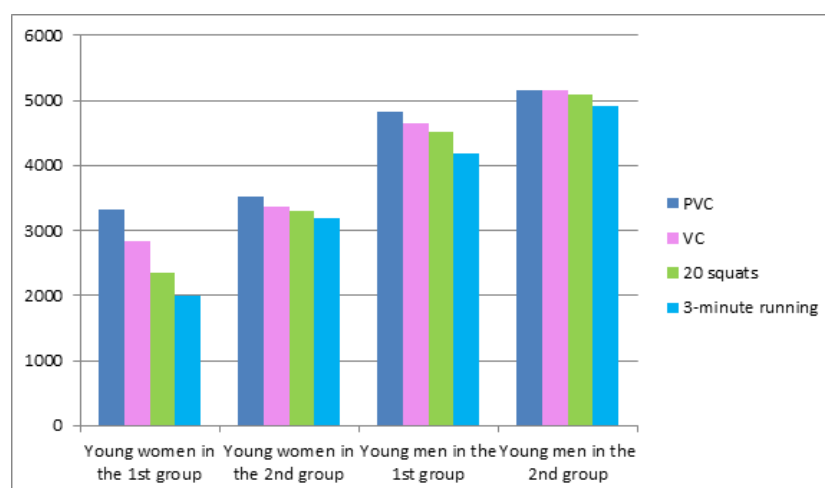


Figure 6. The vital capacity values and project vital capacity values in the first-year students, (ml)

Thus, both students majoring in pedagogy at the Faculty of Foreign Languages (1st group) and students of the Faculty of Physical Education, Sport, and Tourism (2nd group) had a good status of the respiratory system in general.

However, the observed decrease in breath hold values can result from overstrain and overfatigue when the general functional status of the body worsens. It is worth mentioning that we can judge the capabilities and level of aerobic support based

on the shifts of functional indicators. Moreover, the smaller these shifts after a standard physical activity, the more economically it is performed and the higher the aerobic support indicator [4].

In general, improvements in the functional status of the respiratory function of lungs depend largely on young people's physical activity and, in particular, on doing physical exercises and sports on a regular basis. The study clearly shows the dependence of the functional status of the

respiratory system on the amount of physical activities and the level of students' physical fitness. Breath hold and vital capacity values turned out to depend mostly on the level of physical fitness, and these differences were more significant in the young women. In this respect, it is necessary to adjust health and fitness programs for students with a low level of physical activity and develop preventive measures to improve their health and adaptation to study loads.

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