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## **SECTION 2. HUMAN HEALTH, FITNESS AND RECREATION, PHYSICAL EDUCATION OF DIFFERENT GROUPS OF POPULATION, PHYSICAL REHABILITATION**

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### **STATE OF RESPIRATORY SYSTEMS OF STUDENTS AGED 12–14**

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Children's health is the foundation of a country's future economic, employment and intellectual potential. The physical condition of students influences their ability to learn, their working capacity and their quality of life.

The modern educational process causes significant stress due to high intellectual and prolonged static loads. The low level of physical activity of students is exacerbated by the consequences of the COVID-19 pandemic

and military operations in our country, which has led to an increase in physical inactivity and a steady trend towards deterioration in the health of children and adolescents [1, 4, 6, 7]. Among the main health problems of children and adolescents, respiratory system diseases are the most common [8].

Teenage years are critical for the formation of habits that affect health, as growth and development are accompanied by an increase in the functioning of the neuroendocrine system [5]. Adolescent students are characterised by pronounced vegetative changes under the influence of various stressors, high fatigue and unbalanced mental processes [3, 4, 6]. All this negatively affects the state of the body's functional systems and the respiratory system in particular. Age-related changes in the external respiratory system, along with the cardiovascular system, shape the functional capabilities and physical performance of children and adolescents [1]. Therefore, monitoring the functional state of the respiratory system is necessary to control and timely detect health deviations in students.

The **purpose** of the study is to define the state of the respiratory system of adolescents aged 12-14 years.

**Organisation and methods** of the study. The study involved 74 7th and 8th grade girls aged 12-14 years. To assess the state of the respiratory system, we measured the vital capacity of the lungs (VC, l) and tests with breath holding after inhalation (test of Stange, s) and exhalation (test of Gench, s) [2]. Mathematical processing of the results was performed using Excel for Microsoft.

**Results and discussion.** As noted by scientists, VC depends on anthropometric data, age, gender, and level of physical condition [1, 3]. Our results showed an increase in VC with age (Tab. 1). This can be attributed to anatomical changes in the body and respiratory system, such as an increase in the number of alveoli and their diameter [5].

The average group values of breath tests (Table 1) were less than the age norms [2] and decreased in each age group. In girls aged 14 years, the time of breath holding after inhalation was significantly shorter compared to 12 years ( $p \leq 0.05$ ). Low results in the test of Gench in each age group and a tendency to decrease with age ( $p \geq 0.05$ ) may indicate decreased resistance to hypoxia [5].

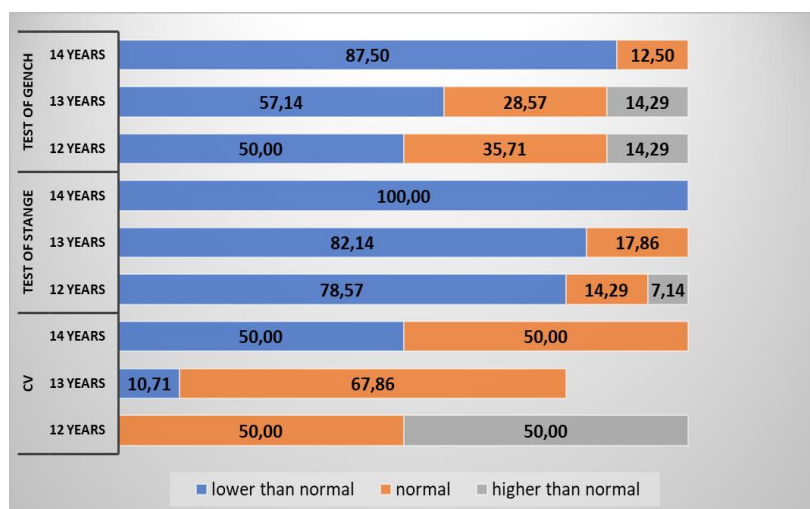
As can be seen from the diagram in Fig. 1, 12-year-old girls had the greatest indicators of the external respiratory apparatus. Among 13-year-olds, the majority had VC within the normal range (67.86%), and among 14-year-olds, an equal number of subjects had an indicator within the normal range and lower than normal.

Table 1

**Indicators of the respiratory system of adolescent girls**

| Indicators       | Age        |           |            |
|------------------|------------|-----------|------------|
|                  | 12 (n=14)  | 13 (n=28) | 14 (n=32)  |
| VC, l            | 2,55±0,17  | 2,75±0,11 | 2,69±0,09  |
| test of Stange,s | 32,5±2,54* | 30,5±1,51 | 29,3±1,30* |
| test of Gench, s | 19,5±1,74  | 18,5±1,80 | 16,0±0,75  |

Note: \* – significant differences at  $p \leq 0.05$  (Student's t-test).



**Fig. 1. Distribution of results of measurement of respiratory system indicators in girls aged 12–14 years by criteria of norms, %.**

The results of the Stange test decreased in each age group (Fig. 1). Only 7.14% of 12-year-olds had high results in this test, and very few of all girls examined had normal values. Among 14-year-olds, all girls had a low rate of inspiratory breath holding. The data obtained from the Stange test indicate an unsatisfactory state of the respiratory system and aerobic reserves of the body in the vast majority of the girls surveyed.

The results of the Gench test – breath holding after exhalation – were somewhat better (Fig. 1). Among girls aged 12 and 13 years, the distribution of the results of the Hench test was almost the same: 14.29% had a breath-holding time above the norm; half/slightly more than half had a breath-holding time lower than the norm. The overwhelming majority of 14-year-olds showed

an expiratory breath-hold time below the normal range, and only 12.5% were within the age range.

During puberty, changes of respiratory regulation occur, which makes the adolescent's body very sensitive to hypoxia [8]. This explains why the percentage of subjects with good and above normal levels in the Stange and Hench tests is decreasing.

Kotz S.M. and co-authors found that among different age groups of children, 14-year-old adolescents with low levels in breath-holding tests were the least likely to have a low level [4]. Other researchers have noted that more than half of the 12-year-old girls examined had low and below average respiratory system capacity reserves [3]. The measurements we obtained on the decline in respiratory system indicators in the group of 14-year-old girls compared to 12- and 13-year-olds are consistent with the data of subjective assessment of the health status of children and adolescents. The results of the survey showed that over the years, the proportion of adolescents who assess their own health as good or satisfactory has decreased and the proportion of children who assess their own health as poor has increased [7].

**Conclusions.** Higher values of respiratory system indicators in the group of 13-year-old girls compared to 12-year-old girls indicate the natural development of the respiratory system, which is associated with age-related changes in the body. The low results in the group of 14-year-olds are probably due to a decrease in physical activity or a slight decrease in the development of lung reserves and the sensitivity of the girls' body to hypoxia.

The identified differences indicate that the development of the respiratory system in adolescent girls aged 12–14 years is influenced by both internal (morphological and physiological changes, hormonal changes) and external factors (reduced physical activity, educational load and stressful environment).

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