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TRENDS IN PHYSICAL DEVELOPMENT OF STUDENTS IN NORTH: LONG-TERM DYNAMICS

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ТЕНДЕНЦИИ ИЗМЕНЕНИЯ ФИЗИЧЕСКОГО РАЗВИТИЯ СТУДЕНТОВ В УСЛОВИЯХ СЕВЕРА: МНОГОЛЕТНЯЯ ДИНАМИКА

Abstract. The aim of the study is to determine the main patterns of physical development (PD) of students of a northern university. The objectives included collecting data on somatic and physiometric parameters of first-year students of Nizhnevartovsk State University (young men and young women aged 17–18 years), retrospective analysis of the indicators obtained during annual examinations since 2003 (cumulative total: 1285 young women and 1065 young men). The study used standard methods for assessing the level of physical development and functional capabilities of the body. Statistical data processing was carried out using the Microsoft Excel, Statistica 10.0 software package. As a result of the analysis, the following features of PD were revealed: from 2003 to 2024, young men and young women showed an increase in somatometric indicators, such as body length and weight, which corresponds to the secular trend of increasing these parameters. Along with this, a decrease in muscle strength of the leading hand is noted in both young men and young women. A linear trend of decreasing vital capacity of the lungs is observed, correlating with the chest circumference indicators, which signals a negative trend in the decline in the functional capabilities of the respiratory system of the younger generation. A significant deterioration in strength capabilities among students in 2020 may be a consequence of a decrease in the level of physical activity during the COVID-19 pandemic. The results of the study emphasize the importance of continuous monitoring of the physical development of students and the use of comprehensive measures to maintain health and increase the physical activity of student youth.

Аннотация. Целью исследования является определение основных закономерностей физического развития (ФР) студентов северного вуза. Задачи включали сбор данных соматических и физиометрических параметров студентов-первокурсников Нижневартовского государственного университета (юноши и девушки в возрасте 17–18 лет), ретроспективный анализ показателей, полученных в ходе ежегодных обследований начиная с 2003 года (накопленный итог: 1285 девушек и 1065 юношей). В рамках исследования применялись стандартные методики оценки уровня физического развития и функциональных возможностей организма. Статистическая обработка данных осуществлялась с помощью пакета программ Microsoft Excel, Statistica 10.0. В результате проведенного анализа были выявлены следующие особенности ФР: с 2003 по 2024 гг. у юношей и девушек наблюдался рост соматометрических показателей, таких как длина и масса тела, что соответствует секулярному тренду увеличения данных параметров. Наряду с этим, отмечается снижение показателей мышечной силы кисти ведущей руки, как у юношей, так и у девушек. Прослеживается линейная тенденция уменьшения жизненной ёмкости лёгких, коррелирующая с показателями окружности грудной клетки, что сигнализирует о негативной динамике снижения функциональных возможностей дыхательной системы молодого поколения. Значимое ухудшение силовых возможностей у студентов в 2020 году может быть следствием уменьшения уровня физической активности в период пандемии COVID-19. Результаты исследования подчёркивают важность постоянного мониторинга физического развития обучающихся и применения комплексных мер сохранения здоровья и увеличения двигательной активности студенческой молодежи.

Keywords: students; long-term dynamics; physical development; somatic parameters; physiometric parameters.

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Ключевые слова: студенты; многолетняя динамика; физическое развитие; соматические параметры; физиометрические показатели.

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Introduction. The most important criteria for the level of health of the population are the indicators of physical development. The health of young students continues to maintain negative trends and requires attention from society [18]. Morphofunctional development, as well as the health of children and adolescents are determined not only by the gene pool, but also largely depend on various environmental factors [9], which is confirmed by long-term comprehensive studies [1; 3; 4; 10; 15; 18].

A comparative analysis of the median length and body weight of young men and women aged 17 to 21 years from different regions revealed not only regional specifics, which were characterized by accelerated PD of young people from megacities (Moscow, St. Petersburg) compared to peripheral regions, but also the influence of ethnic factors on the level of PD [11].

A study published in 2017 compared the morphofunctional parameters of the body of young people living in the North Caucasus and Khanty-Mansi Autonomous Okrug – Yugra. It was found that the functional state of the cardiorespiratory system of the subjects was due to the climatic and geophysical features of the regions of residence [12].

The territory of the Khanty-Mansiysk Autonomous Okrug – Yugra is characterized by unfavorable climatic and geographical conditions, which allows it to be equated with the regions of the Far North. The features of the local climate include cold winters, short cool summers, lack of ultraviolet radiation, significant seasonal changes in the length of daylight hours, strong fluctuations in the magnetic field, as well as sharp daily changes in atmospheric pressure, which together have a rather negative effect on the health of the population [5; 6; 16].

Over the past few decades, there has been an increase in the number of children, adolescents and young people with physical developmental disabilities and deterioration in the functional state of the body [3; 7; 8; 13; 15]. Tendencies towards changes in the physical parameters of the younger generation, as well as acceleration processes that began at the end of the 19th century and continuев until the beginning of the 21st century have been found throughout the world [10]. Health problems of the younger generation that arise during their studies can have many causes, one of which is insufficient physical activity.

According to the RF Government Resolution of December 29, 2001 N 916 "On the all-Russian system for monitoring the state of physical health of the population, physical development of children, adolescents and youth", the study of the PD of young people is significant and contributes to the improvement of work to strengthen the health of the population. In this regard, the issue of improving the physical development of the younger generation, in particular, living in the harsh climatic conditions of the North, continues to be relevant [20].

The aim of the study: to determine the main patterns of physical development of students of a northern university based on long-term observations.

Methods and organization of the study. This study was initiated in 2003 and is ongoing. By September 2024, 1,285 girls and 1,065 boys aged 17–18, who are first-year students of Nizhnevartovsk State University (NVSU), took part in the study. The study was conducted in accordance with the generally accepted scientific principles of the Helsinki Declaration of the World Medical Association (2013 edition). Standard methods for assessing physical development were used in the study. Such parameters as body weight (kg), body length (cm) and chest circumference (cm) were analyzed; muscle strength of the leading hand (kg) and vital capacity of the lungs (VC, l) were measured. A spring hand dynamometer was used to assess muscle strength, and a portable dry spirometer was used to measure the vital capacity of the lungs. Statistical data processing was performed using the Microsoft Excel, Statistica 10.0 software package. The arithmetic mean (M) and the error of the mean (m) were calculated for key somatic and functional indicators; the significance of differences was assessed using Student's t-test.

Results and discussion.

Since 2003, the length and weight of the body of young men and young women has gradually increased (Fig. 1 and 2), with slight fluctuations relative to the trend line. Such positive dynamics correspond to the secular trend of increasing somatometric indicators of the PD of the younger generation [10].

The survey revealed statistically significant differences in growth rates among young women in 2024 (165.9±5.6 cm) compared to 2003 (159.2±2.4 cm), 2004 (160.4±2.7 cm), 2005 (159.3±2.6 cm), 2006 (160.8±2.9 cm), 2007 (161.5±2.8 cm), 2008 (162.0±2.5 cm), 2012 (169.3±2.1 cm), 2013 (168.9±2.5 cm), 2016 (162.5±2.4 cm), 2017 (160.7±2.3 cm), as well as 2022 (168.2±2.3 cm). Despite the fact that according to the measurement results, in 2012, 2013 also in 2022, the weight of young women was greater than in 2024, the trend line as a whole demonstrates the growing dynamics of this indicator over the past 22 years (Fig. 1).

In young men, statistically significant differences in body length indicators are observed for 2024 compared to 2003-2008, as well as in the period from 2015 to 2017. The lowest indicator was recorded in 2003 and amounted to 169.4±2.2 cm. In general, males also show long-term dynamics in increasing height (Fig. 1).

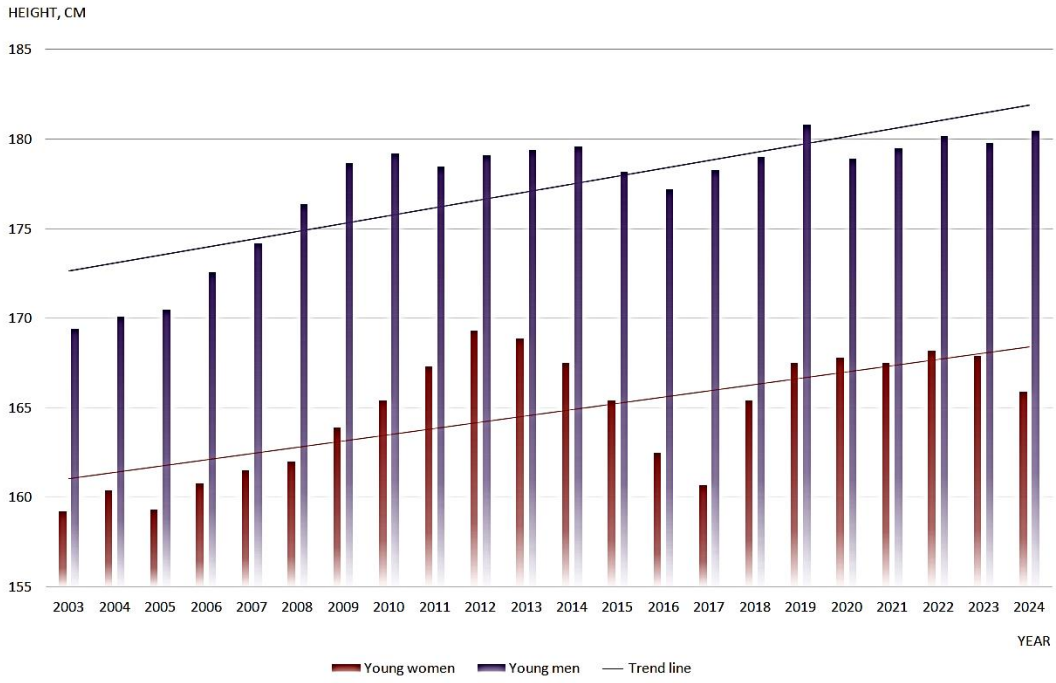

Fig. 1. Change in body length of young men and young women (cm)

When comparing the anthropometric data of students of the Voronezh State Medical University named after N.N. Burdenko for 2010 and 2020, a reflection of the general trend of growth acceleration was revealed. In 2010, above-average growth rates were observed in 6.5% of young men and 4% of young women, while in 2020 these figures increased to 38% and 22%, respectively [19].

Belarusian scientists S.A. Sidorovich and Zh.A. Shavel also identified long-term dynamics in the increase in average height, comparing the indicators of young people aged 17–25 years living in the Grodno region with data for 1978 [17].

A comparison of the average height values of Belarusian students for 1995–2002 with the height data of conscripts from Minsk 140th district for 1927, as well as with the indicators of young men of Minsk in the pre-war and post-war periods confirmed a similar trend. Data analysis demonstrated an increase in the body length of young men from Minsk from 1925 to 2002 [14].

Unlike young women, young men from NVGU show a pronounced long-term dynamics in increasing weight indicators (Fig. 2).

In the period from 2003 to 2024, the lowest value of weight indicators in young men was recorded in 2004 (65.4 ± 2.5 kg), and the maximum was 81.8 ± 2.1 kg in 2018. The second highest value is observed in 2020 (81.5 ± 2.7). The difference in body weight at the start of the study in

2003 (66.1 ± 1.9 kg) was statistically significant with the indicator obtained in 2024 (72.4 ± 16.9 kg), while the difference was 6.3 ± 15 kg (Fig. 2).

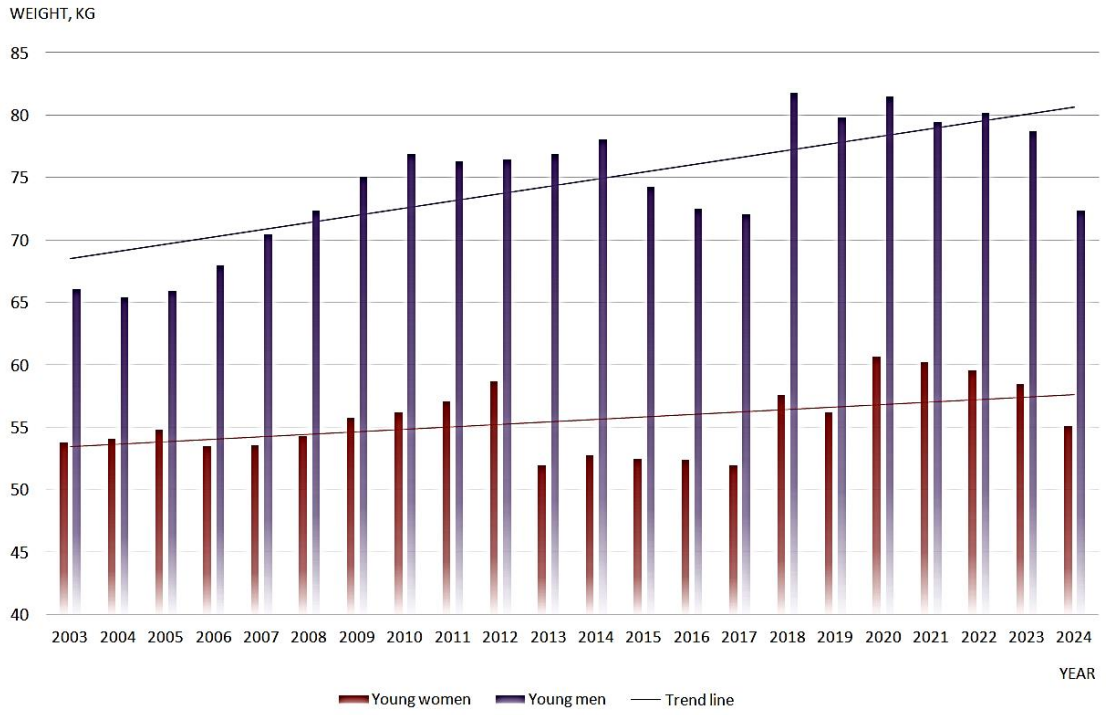

Fig. 2. Change in body weight of young men and young women (kg)

In females, the dynamics of body weight indicators over a 22-year period is not very pronounced. Statistically significant differences in weight indicators are noted only in the period from 2018 to 2022 compared to the data for 2024. The range of indicators from 2003 to 2024 is 8.7 ± 0.4 kg, with the lowest value observed in 2017 (52.0 ± 2.0 kg), and the highest in 2020 (60.7 ± 2.4 kg) (Fig. 2).

Presumably, the peak body weight of young men and young women in 2020 may be due to a decrease in physical activity during self-isolation and distance learning, which caused weight gain (Fig. 2).

Throughout the study period, chest circumference (CC) has been statistically decreasing annually in both young men and their peers significantly. This trend is clearly concerning, since the chest circumference indirectly characterizes respiratory function, and therefore, this trend may signal a deterioration in the respiratory system of modern youth (Fig. 3).

The dynamics of somatometric indicators of young men (17–21 years old) and young women (17–20 years old) of the Nizhny Novgorod region for the period from 1987 to 2018 has regional characteristics and reflects gender differences. Young women show an increase in body length and weight, as well as chest circumference, compared to their peers of the 20th century. At the same time, young men show a decrease in height against the background of an increase in body weight [2].

The linear trend of decreasing VC in NVSU students of both sexes reflects a deterioration in the function of external respiration and demonstrates a significant decrease in the indicators recorded in 2024, compared to the results of 2003 (Fig. 4).

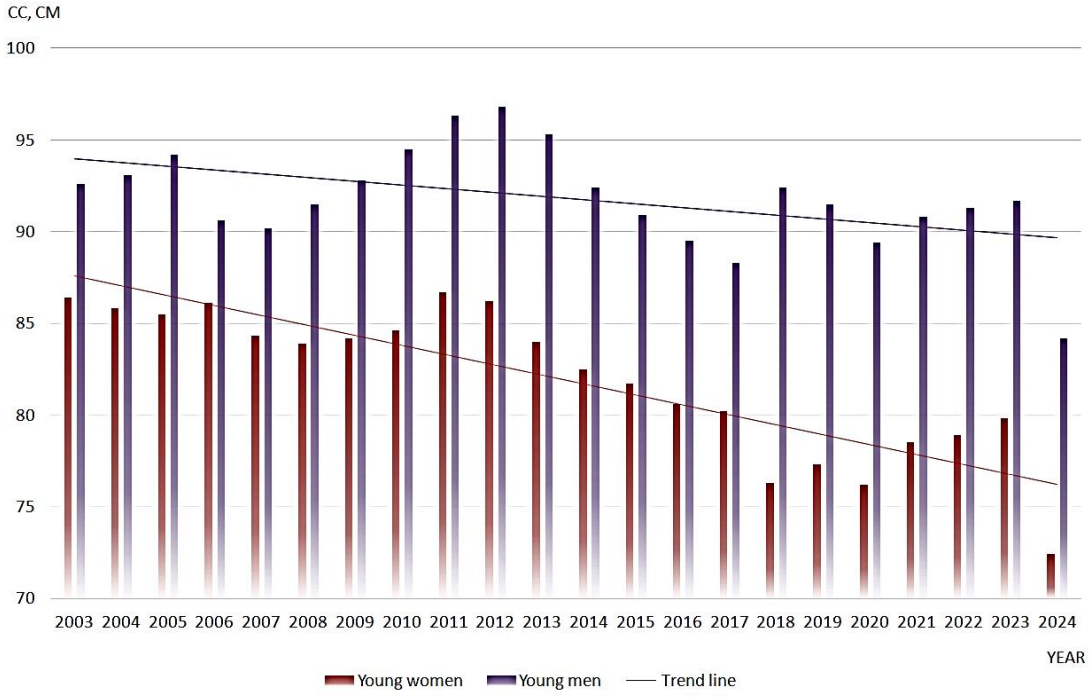

Fig. 3. Changes in CC of young men and young women (cm)

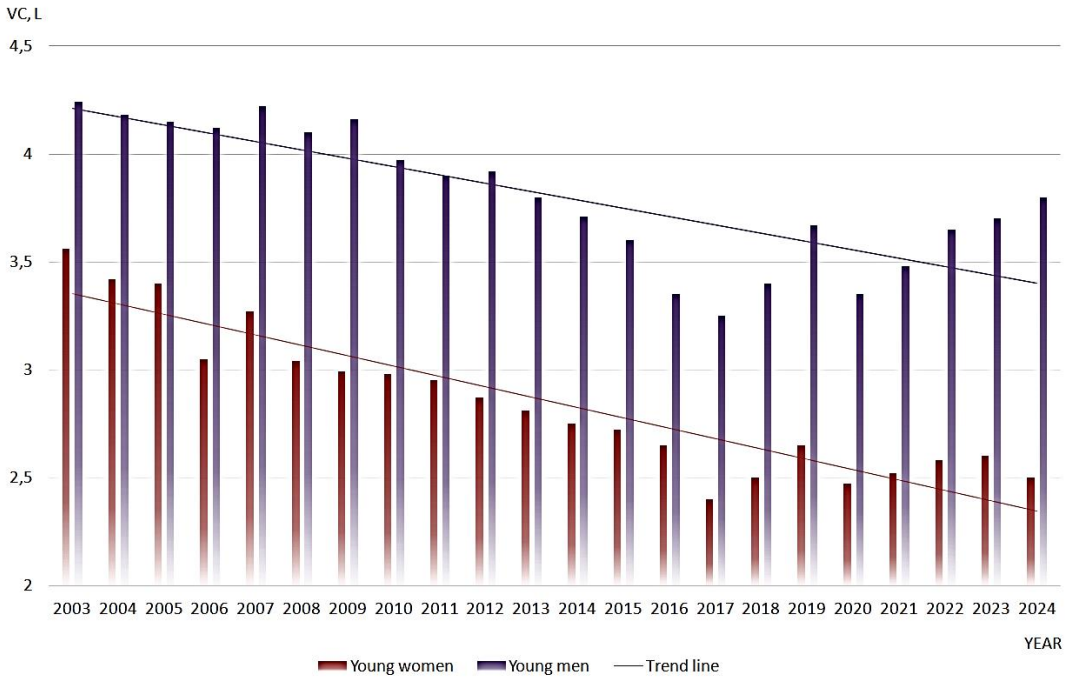

Fig. 4. Changes in vital capacity indicators of young men and young women (l)

Throughout the study period, two declines in indicators were noted, which occurred in 2017 and 2020. The second negative peak can be explained by a decrease in the level of physical activity during self-isolation (Fig. 4).

Somatic parameters of PD are associated with functional indicators, including the strength capabilities of the body. The dynamics of the values of muscle strength of the leading hand from 2003 to 2024 has a descending character (Fig. 5).

There were also two significant peaks in the decline in strength capabilities in both young men and young women during the study period. The first occurred in 2017, and the second decline was observed in 2020. In the second case, the reason is probably the reduction in usual physical activity due to the self-isolation regime introduced during that period (Fig. 5).

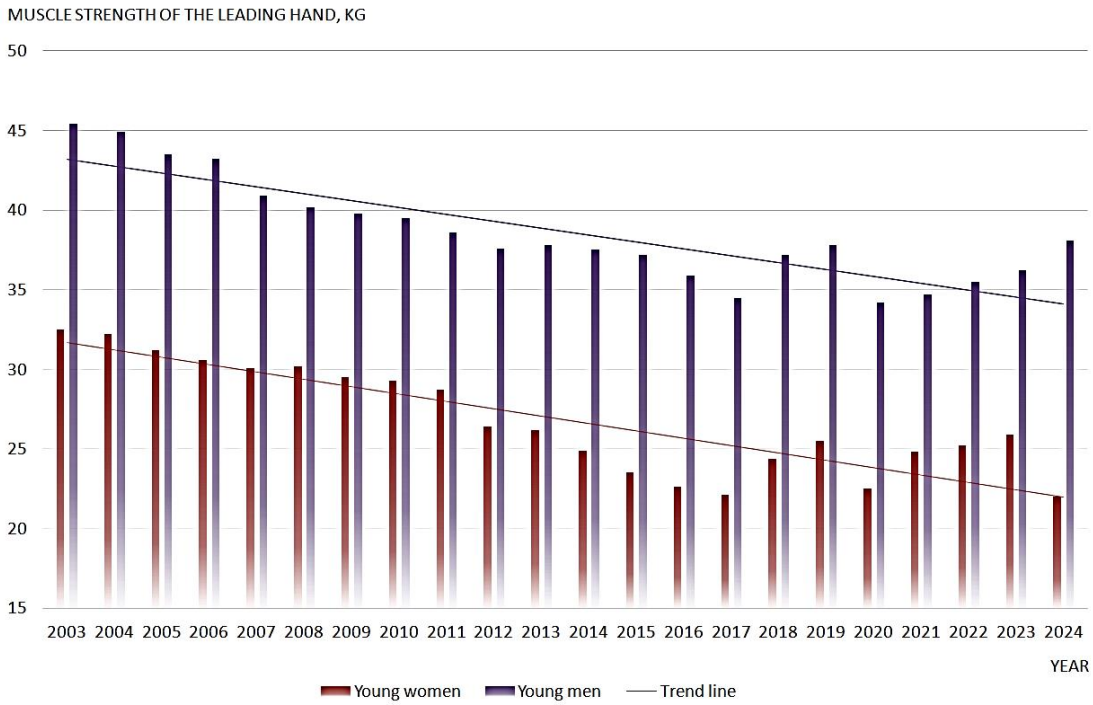

Fig. 5. Changes in muscle strength of the leading hand indicators of young men and young women (kg)

A similar trend in decreasing indicators was revealed as a result of a comparative analysis of the right hand dynamometry (RHD) in young men (17–21 years old) and young women (17–20 years old) of the Nizhny Novgorod region. A significant decrease in indicators was noted over the period from 1987 to 2018. Thus, in young men, the RHD values reliably decreased by 27.6%, while in young women – by 25.4% compared to measurements taken in 1987–1988 [2].

The results of hand dynamometry obtained during the examination of 569 students aged 20-22 years from Voronezh also show a noticeable decrease in functional indicators in 2020 compared to students who studied in 2010 [19].

Conclusion. The long-term dynamics of physical development of students at the northern university has been studied. Since 2003, young men and women have shown an increase in

somatometric indicators, which is consistent with the secular trend. The study revealed an aggravation of negative trends in the physical development of students. Along with an increase in body length and weight, there is a deterioration in the function of external respiration and a decrease in strength capabilities that indicates a reduction in body functional reserves. The indicated functional deviations have multiple causes, and one of the major risk factors is lack of physical activity. In the conditions of the North, this is especially important, where young people are often forced to spend a significant amount of time indoors due to adverse climatic conditions. The results obtained identified the need for the development and implementation of exercise complexes, including those suitable for independent performance aimed at maintaining the optimal functional state of students' respiratory system in the the northern region, given the decrease in daily spontaneous motor activity due to extreme natural and climatic conditions and periodic distance learning.

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