

HYGIENIC FACTORS SHAPING POSTURE IN UNIVERSITY STUDENTS

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The basics of student youth health all over the world are ensured by factors of the educational environment and the young adults' lifestyle. Modeling of such conditions is possible with comprehensive assessment of the quality and safety of university internal environment, update of modern educational spaces in response to the students' need for motor activity and physical exercises. Currently, it becomes increasingly necessary to pay attention to the hygienic factors affecting shaping proper posture in university students. The main focus is on such aspects, as learning conditions, workplace organization, physical activity, and other daily habits that contribute to either impairment, or maintenance of healthy posture. There is no need to emphasize the importance of proper workplace organization. The height of the desk and chair, the level of the monitor, the quality of the furniture and lighting play a key role in maintaining a comfortable and safe body position during classes. Incorrect organization can result in developing musculoskeletal disorders and postural alterations. Physical activity and regular breaks while learning are considered important prerequisites for preservation of the students' musculoskeletal system functional disorders. Students leading a sedentary lifestyle face the risk of postural alterations. It is recommended short physical exercises and active breaks in the daily routine in order to improve muscle tone and reduce tension.

Keywords: students, classroom furniture, posture, preventive measures, physical exercises, furniture size, age-related features

Author contribution: Milushkina OYu, Bashmakov OA — data acquisition, manuscript writing.

Compliance with ethical standards: the informed consent to participation in the study was submitted by all students.

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Received: 11.09.2024 **Accepted:** 22.04.2025 **Published online:** 27.06.2025

DOI: 10.24075/rbh.2025.133

ГИГИЕНИЧЕСКИЕ ФАКТОРЫ, ВЛИЯЮЩИЕ НА ФОРМИРОВАНИЕ ОСАНКИ У СТУДЕНТОВ ВУЗОВ

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Основы здоровья студенческой молодежи во всем мире обеспечивают факторы образовательной среды и образ жизни молодых людей. Моделирование этих условий возможно при полноценной оценке качества и безопасности внутренней среды университетов, актуализации современных учебных пространств с учетом потребности обучающихся в двигательной активности и физических упражнениях. В настоящее время все больше возрастает необходимость уделять внимание гигиеническим факторам, влияющим на формирование правильной осанки студентов высших учебных заведений. Основное внимание уделяют таким аспектам, как условия учебного процесса, организация рабочего пространства, физическая активность и другие ежедневные привычки, которые способствуют либо нарушению, либо поддержанию здоровой осанки. Нет необходимости подчеркивать важность правильной организации рабочего места. Высота стола и стула, уровень расположения монитора, качество мебели и освещение играют ключевую роль в поддержании комфортного и безопасного положения тела во время занятий. Неправильная организация может приводить к развитию заболеваний опорно-двигательного аппарата и изменению осанки. Физическая активность и регулярные перерывы в учебе также рассматривают как важные условия сохранения функциональной работоспособности костно-мышечной системы обучающихся. Студенты, ведущие малоподвижный образ жизни, сталкиваются с риском изменения состояния осанки. Рекомендуется включать в распорядок дня короткие физические упражнения и активные перерывы для улучшения мышечного тонуса и снижения напряжения.

Ключевые слова: студенты, учебная мебель, осанка, профилактические мероприятия, физические упражнения, размер мебели, возрастные особенности

Вклад авторов: О. Ю. Милушкина, О. А. Башмаков — сбор материала, написание статьи.

Соблюдение этических стандартов: все студенты дали добровольное информированное согласие на участие в исследовании.

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Статья получена: 11.09.2024 **Статья принята к печати:** 22.04.2025 **Опубликована онлайн:** 27.06.2025

DOI: 10.24075/rbh.2025.133

Even in the distant times of the rise of civilization, humanity began to pay attention to the need for physical activity. Thus, many of the writings of thinkers that have come down to us contain ideas and recommendations aimed at maintaining and improving health. Avicenna wrote: "Those who give up physical exercise often waste away because their body weakens as a result of their refusal to exercise". "Nothing exhausts and destroys a person more than prolonged physical inactivity", Aristotle pointed out [1].

Later Hippocrates wrote: "Gymnastics, physical exercises, walking should become a part of the daily life of everyone, who wants to maintain efficiency, health, a full and joyful life". In the 1st century BC, numerous elements of the Tibetan therapeutic gymnastics theory were shaped [2, 3].

Since the times of the Russian Empire, special attention has been paid to the health of students, as reflected in the works

of contemporaries. Sources for those years indicate that masters forced students to sit correctly so that the apprentices would not develop back pain.

The unique methodological manual "Handbook on Physical Education Issues" was written by a group of authors as early as in the 19th century. It states that physical education can correct hereditary physical disabilities or those acquired under exposure to environmental factors. The authors paid attention to posture and the conditions leading to postural alterations. Even then, the first preventive measures aimed at developing proper posture were defined. The purpose of the exercises proposed was to strengthen muscles of the back, upper and lower extremities, as well as to improve posture [4, 5].

In Soviet times, the attitude towards the issues of developing proper posture in the younger generation was most positive. The necessary requirements for the schoolchildren's positioning

at their desks, requirements for the design and size of classroom furniture and other types of learning conditions aimed at preventing various diseases of the musculoskeletal system, primarily the spine, were developed.

In the mid-20th century, in the heyday of modern hygiene, it was proposed to introduce physical education in kindergartens, secondary and higher educational institutions. Morning exercises, exercises before the start of classes, physical education breaks during theoretical classes were introduced everywhere; groups of therapeutic physical education and "introductory gymnastics" were created to strengthen the back muscles, which contributed to posture improvement. It was proposed to play various outdoor games during breaks.

In the 21st century, during the period of developing the technological options to provide large information flows, it is reported that the planet inhabitants experience severe emotional overload. Numerous "bloggers" appear on the Internet offering "health-improving" technologies, often referring to ancient texts and unconventional types of gymnastics and psychological techniques, some of which are based on "cleansing" the body, etc. Prevention of the use of irrational health preservation methods represents one of the tasks of preventive medicine.

At the current stage of Russia's strategic development, the issue of preserving and improving the health of the younger generation is becoming especially acute. This is mostly due to the persistent trend towards children's health deterioration, changes in their physical development indicators, and the increase in the rate of functional disorders [6, 7]. Given this context, arrangement of physical education in children and adolescents assigned to the preparatory medical group for physical education becomes relevant. The main criteria for inclusion in this group are functional impairment and low physical fitness. These manifestations pose the risk of developing various abnormalities in the future.

Posture is the body's habitual position in space while standing, sitting and walking. Healthy posture is based primarily on the properly shaped spine with all physiological curves (lordosis, kyphosis), tendons and muscles attached to the vertebrae. The axial skeleton becomes fully mature by the age of 20–21 years, i.e. during the period, when the student is senior at the higher educational institution. The current situation (COVID-19 pandemic and other) and lifestyle adversely affect the musculoskeletal system health [6]. The group at risk consists of students attending high school, secondary vocational education institutions, university students, whose childhood and adolescence coincided with the implementation of restrictive measures during the pandemic, i.e. distance learning in unsuitable premises. The core maturation is completed in adolescence and early adulthood, when the students spend most of their time at a desk, not always maintaining proper body position in space. Learning at home has made it impossible to comply with the necessary rules for prevention of various musculoskeletal system abnormalities. In particular, it has been noted that students listen to lectures, write notes, and prepare for seminars while lying down or half-sitting.

Thus, the issues of prevention of the musculoskeletal system abnormalities and the core functional state impairment during undergraduate studies are relevant and timely when organizing training of students. The study aimed to assess the major hygienic factors shaping posture in university students.

METHODS

The study was conducted at the Moscow Pedagogical State University (MPGU) and the Pirogov Russian National Research

Medical University (Pirogov University). It involved 276 first-year medical students and 108 first-year students-teachers. Gender distribution: 82% females and 18% males in the medical university, 59% females and 41% males in the pedagogical university. The research methods were as follows: sociological (questionnaire survey), hygienic (monitoring, natural hygiene experiment), statistical methods, literature review. The standard (GOST) Sutyagin's school stadiometer was used to assess the furniture match to the student sizes (Fig.).

The line is marked with six growth groups in accordance with GOST 22046—2016 "Furniture for Educational Institutions. General Specifications". Assessment was conducted in the morning, afternoon and evening hours; the students' height was measured with their shoes on (in accordance with the measurement procedure). Statistical processing of the data obtained involving calculation of relative values was performed using the StatTech software package (StatTech; Russia).

RESULTS

Distribution of medical students by height showed that three height groups were the most common: 4, 5, and 6 (Table 1).

Distribution of students-teachers by height showed a similar pattern. Sizes 4, 5, and 6 also were the most common (Table 2). Furthermore, the share of students of the 4th size group is higher in the pedagogical university, than in the medical one among both females and males.

The data obtained suggest that classrooms must have furniture of at least three sizes. Furthermore, assessment of classroom furniture in both Pirogov University and MPGU showed that there was only group 5 furniture.

The findings have shown that among MPGU students only 68.7% of the female group have the height corresponding to group 5, while among males only 30.3% correspond to this group. Furthermore, 63.6% of males have the height corresponding to the height group 6, and 6.1% have that corresponding to the height group 4. It is clear that the classroom furniture does not correspond to the height of 2/3 of males and 1/3 females.



Fig. Sutyagin's school stadiometer

Таблица 1. Distribution of medical students by height sizes

Females		Males	
Height group	Share of students (%)	Height group	Share of students (%)
4	5.3	4	3.2
5	77.2	5	30.4
6	17.5	6	76.4

A similar pattern is reported for the Pirogov University, where 77.2% of females correspond to the height group 5 and the majority of surveyed males correspond to group 6. Given the results, the classroom furniture at the Pirogov University is more in line with the students' height. Thus, in 77.2% of females in the medical university and 68.7% of females in the pedagogical university, the classroom furniture will have no negative effect on the posture. However, there are tall girls and short girls studying at the universities (about 30%), in whom the furniture does not correspond to the body length parameters. This will negatively affect the posture, which can result in exacerbation of a number of musculoskeletal system disorders and the development of spinal deformities.

Based on the findings, recommendations for universities on the selection and order of furniture are provided, along with individual recommendations for students.

When organizing the educational process, one should follow the basic recommendations for universities. Classrooms should have furniture that is appropriate for different height groups, so that students can choose the most suitable options. Tables and chairs of the height groups 4, 5, and 6 must be available. A prerequisite should be that educational institutions switch to the maximum use of adjustable furniture ensuring maximum adaptation to the students' individual characteristics.

Temporary solutions for individual selection of furniture include footrests (help maintain the correct angle at the knees and reduce the load on the lower back), using seat cushions (this measure increases the height of the seat and provides a comfortable posture while working), using book or laptop stands (allow one to raise the work surface, reducing the need to slouch).

Each person has individual body type features, legs and arms of different length, different proportions, which also need to be taken into account when choosing furniture. The ideal solution is to use adjustable furniture, which allows one to adjust the height of the table and chair to the student's individual parameters. Furthermore, it is also important to organize the workplace properly: ensure adequate lighting, proper positioning of the computer monitor, and foot support.

One of the individual recommendations may be to conduct an ergonomics consultation. Ergonomics specialists can provide consultations to students, teaching them how to choose the furniture properly and organize their workspace wisely.

DISCUSSION

The properly selected furniture plays a key role in shaping the proper posture and prevention of health problems. Furniture

sizes that are not appropriate for the student's height can lead to muscle tension (incorrect sitting posture causes tension in the muscles of the neck, back, and shoulders), to the emergence of pain (constant tension leads to back pain, neck pain, headache), postural alterations (sitting for a long time on unsuitable furniture can contribute to the development of stoop, scoliosis, and other spinal deformities), to poor concentration (feeling uncomfortable and pain distract students from studying, reducing their performance).

It should be noted that the learning space ergonomics and the students' physical characteristics must be properly matched.

Students with the body length of 160–175 cm and above are the most common, for whom furniture of the height groups 5 and 6 is suitable. Appropriate classroom furniture is available for these height groups.

Medical students, as the majority of young adults, usually fall in the height range that corresponds to the height groups 5 and 6. Female students usually have the height corresponding to the height group 5, although some exceptions are possible. Male students are usually higher; many of them fall into the height group 6. The study has shown that furniture for the height group 5 only is available in the universities.

It is important to take into account individual differences between students [8]. There are tall males among the students. Their body length exceeds 185 cm, so the use of size 5 furniture can cause serious problems. The major abnormalities developed by such students are as follows: increased kyphosis, leading to the rounded back development (stoop); head protraction manifested by pulling the head forward, overloading the neck muscles and causing headache; muscle tension in the back and neck resulting in chronic pain; position of the knees above the pelvis causing blood circulation disturbances and leading to discomfort in the legs (paresthesia, etc.). The general discomfort caused by the low desk and chair often leads to fatigue, decreased concentration and reduced learning performance. Tall young males are the most vulnerable group. During the study, when timing their working posture, they were noted to be in a semi-recumbent position with tilts to different sides.

Shaping proper posture since childhood makes it possible to maintain the core, allowing one to properly hold his/her body throughout the working day, in old age. The time spent at the workplace, and for the student this is primarily classroom furniture, consisting of a desk and a chair, increases from school to the initial years of higher education. The first years of study at the university are probably the most time-consuming in terms of the time spent at a desk and studying textbooks. New learning environment, fundamental disciplines force one

Table 2. Distribution of students-teachers by height sizes

Females		Males	
Height group	Share of students (%)	Height group	Share of students (%)
4	20.3	4	6.1
5	68.7	5	30.3
6	11.0	6	63.6

to spend a lot of time mastering the curriculum. Therefore, the student, being either in the library or in classrooms, overloads his/her musculoskeletal system with static loads, and also strains his visual organ. The data of a number of studies showed that students spent on average 10–11 h learning during the period of distance learning [8, 9]. When conducting the questionnaire survey, it was also noted that 10–13% of students showed higher rate of back pain during learning at home, which they associated with being in a sitting position. The distance learning at home allowed students to move away from the basic rules of hygiene of body positioning at the desk, which immediately affected the condition of the skeletal and muscular systems [9, 10]. The surveyed individuals admitted that they often watched lectures and seminars while lying down or reclining, which resulted in exacerbation of some chronic conditions. Adynamia, prolonged time spent at the computer, incorrect posture — all this led to poor posture, and subsequently to deterioration of health. Furthermore, some students complained of sleep alteration and deterioration due to the problems emerging.

According to the research data obtained by E.N. Vavilova, physical exercises that force active work of the back extensor muscles and abdominal flexor muscles represent the main means to prevent postural abnormalities in primary-school-age children [11]. Professor S.N. Popova points out that physical exercises should be selected in accordance with the postural disorder type [11, 12]. It is important to proceed from the fact that disease prevention is a complex of medical and non-medical measures of preventive and health-improving nature. Hippocrates also said that "...the patient, those around him, and all external circumstances should assist the doctor in his work" [6]. In medicine, prevention is a set of measures aimed at preventing various diseases and injuries, as well as eliminating risk factors [13]. Preventive measures represent an important part of the healthcare system, which is aimed at developing medical and social activity and motivation for a healthy lifestyle in the population.

The main objectives of prevention are as follows:

- prevention of various postural disorders;
- minimization of the effect of various risk factors;
- reduction of the risk of various postural disorder complications;
- slowing down the postural disorder progression;
- prevention of chronicity and secondary disorders;
- reduction of various negative effects associated with postural disorders;
- general posture improvement [1, 5].

Implementation of preventive measures and following recommendations will help students maintain proper posture and high mental performance at all stages of training.

CONCLUSIONS

The properly selected furniture that suits the height and individual characteristics of students plays an important role in maintaining their health and performance. Educational institutions must pay attention to ergonomic issues, providing students with the opportunity to study in comfortable and safe environment. The use of furniture corresponding to the height groups 5 and 6, as well as adjustable furniture, is an important step in this direction.

The use of size 5 furniture by tall students (over 185 cm) is unacceptable; it can result in serious postural and health problems. Educational institutions must consider this and apply measures to provide students with furniture that is appropriate for their height. Using adjustable furniture is the most effective solution to ensure comfortable and healthy learning for all students.

Comprehensive and well-organized physical activity can reduce the likelihood of developing the disease, as well as reduce the disease duration and accelerate restoration of performance. However, both in educational institutions and at home, an effective way to prevent postural disorders is properly selected furniture. It is necessary to comply with the requirements and recommendations aimed at shaping proper posture. Short breaks for performing a set of physical exercises should be used during long-term loads and prolonged sessions.

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