ASSESSMENT OF PHYSICAL DEVELOPMENT AND LIFESTYLE IN JUNIOR MEDICAL STUDENTS

Shestera AA ✉, Trankovskaya LV, Kaerova EV, Nagirnaya LN

Pacific State Medical University, Vladivostok, Russia

Preserving the health of student youth is one of the state's priority tasks. The relevance of the issue results from the students' health deterioration. The study was aimed to assess physical development in students of the medical higher educational instutution considering their lifestyle. We performed comparative assessment of physical development in 940 first-year students of the Pacific State Medical University. The source of information was primary medical documentation (form No. 025-CZ/u). Polling was used to assess the students' lifestyle. The CHAID algorithm for decision trees was used in 2021 to estimate the effects of lifestyle on the indicators of physical development in students. It was found that the students' body length decreased over 20 years. The chest circumference of students increased ($p = 0.001$). The right and left hand grip strength decreased ($p < 0.001$). A significant increase in the vital capacity was reported in males only ($p = 0.007$). We revealed the increase in the number of students with disharmonious physical development (by 9.4% in males and 15.3% in females) due to overweight, along with reduction of body weight by 12.5% in males. The risk factors of disharmonious physical development with the highest impact factor in males were as follows: the lack of vegetables in the diet and the use of social media and computer games during free time. In females, the risk factors were as follows: daily consumption of cereals, pasta, and bread and living apart from parents. The findings make it possible to estimate the risk factors of disharmonious physical development and determine the priority directions for the development of preventive measures for preservation of students' health.

Keywords: students, health, physical development, lifestyle, risk factors

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Compliance with ethical standards the study was performed in accordance with the Declaration of Helsinki of the World Medical Association and approved by the interdisciplinary Ethics Committee of the Pacific State Medical University (protocol № 7 dated 27 March 2023). All subject submitted the informed consent to participation in the study.

✉ **Correspondence should be addressed:** Albina A. Shestera
pr. Ostryakova, 2a, Vladivostok, 690002, Russia; shestera81@mail.ru

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ОЦЕНКА ФИЗИЧЕСКОГО РАЗВИТИЯ И ОБРАЗА ЖИЗНИ СТУДЕНТОВ МЛАДШИХ КУРСОВ МЕДИЦИНСКОГО ВУЗА

А. А. Шестера ✉, Л. В.Транковская, Е. В. Каерова, Л. Н. Нагирная

Тихоокеанский государственный медицинский университет, Владивосток, Россия

Сохранение здоровья студенческой молодежи является одной из приоритетных задач государства. Актуальность этой проблемы обусловлена ухудшением состояния здоровья студентов. Целью исследования было оценить физическое развитие обучающихся в образовательной организации высшего образования медицинской направленности с учетом их образа жизни. Проведена сравнительная оценка физического развития 940 студентов 1-го курса ФГБОУ ВО ТГМУ Минздрава России. Источником информации послужила первичная медицинская документация (форма № 025-ЦЗ/у). Методом опроса был изучен образ жизни учащихся. Для исследования влияния образа жизни на показатели физического развития студентов в 2021 г. использовали метод построения деревьев классификации (CHAID). Установлено, что за 20 лет произошло уменьшение длины тела студентов. Размеры окружности грудной клетки учащихся увеличились ($p = 0{,}001$). Сила правой и левой кистей уменьшилась ($p < 0{,}001$). Жизненная емкость легких значимо увеличилась лишь у юношей ($p = 0{,}007$). Выявлены увеличение числа студентов с дисгармоничным физическим развитием (у юношей на 9,4%, у девушек на 15,3%) за счет избыточной массы тела и снижение массы тела у юношей на 12,5%. Факторами риска дисгармоничного физического развития с наибольшим индексом влияния у юношей стали недостаток овощей в рационе и использование социальных сетей и компьютерных игр в свободное от учебы время. У девушек такими факторами стали ежедневное включение в рацион круп, макаронных изделий, хлеба и проживание отдельно от родителей. Полученные данные позволяют оценить факторы риска дисгармоничного физического развития и определить приоритетные направления разработки профилактических мер для сохранения здоровья учащихся.

Ключевые слова: студенты, здоровье, физическое развитие, образ жизни, факторы риска

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Соблюдение этических стандартов: исследование проведено в соответствии с Хельсинской декларацией Всемирной медицинской ассоциации и одобрено междисциплинарным комитетом по этике ФГБОУ ВО ТГМУ Минздрава России (протокол № 7 от 27 марта 2023 г.). Все участники подписали добровольное информированное согласие на участие в исследовании.

✉ **Для корреспонденции:** Альбина Александровна Шестера
пр. Острякова, д. 2а, г. Владивосток, 690002, Россия; shestera81@mail.ru

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Preserving the health of student youth is one of the state's priority tasks. The relevance of the issue results from the continuing deterioration of students' health [1–3]. According to the data provided by the Ministry of Health of the Russian Federation and the Federal Service for the Oversight of Consumer Protection and Welfare, only 14% students in our country are considered to be generally healthy. Functional disorders are reported in 50%, and 40% have chronic diseases [4]. There has been a yearly increase in the number of students included in the special physical training group due to their health status. In some higher education institutions, the rate of such students is as high as 50% of the whole student body [5]. The students' health status attracts attention of both Russian and foreign scientists [6–10]. It is students who represent a specific social group at high risk due to health status that is characterized by definite age range (17–25 years), specific lifestyle, intense rhythm of learning resulting from high mental load, processing of information under time pressure, extensive use of smartphones, computers and other devices [11, 12]. At the same time, the lifestyle, the basics of intellectual and moral development, the students' health status are shaped against this specific "background" [6].

Junior students have certain biological features inherent to young adulthood (males aged 17–21 years, females aged 16–20 years), when the development of the body is not fully completed. At the same time, extreme lability of the nervous and emotional processes, tension of adaptive compensatory processes persist, some alterations occur in the CNS [13]. It is young adulthood, when many disorders typical for adults (arterial hypertension, diabetes mellitus, etc.) emerge, manifestation of mental disorders with atypical symptoms leading to diagnostic difficulties that reduce professional suitability, likelihood of military service and future parenting takes place. That is why this ontogeny period is considered to be the most significant in terms of studying certain morphological criteria for the diagnosis of norm and disorder [6, 14].

It is well known that physical development is the most important indicator of health owing to the environmental factor exposure and the internal state of the human body [15, 16]. In this regard, the aggregated data on the state of students' physical development are the object of preventive medicine allowing one to predict the development of the population, make certain managerial decisions.

The study was aimed to assess physical development in students of the medical higher education instutution considering their lifestyle.

METHODS

The source of information was primary medical documentation (form No. 025-CZ/u) of 940 first-year students of the Pacific State Medical University. Among them 277 individuals (44.0% males and 56.0% females) were first-year students in 2001 and 663 individuals (31.2% males and 68.8% females) were first-years in 2021. We assessed physical development using the regional regression scales based on the following indicators: body length (BL), body weight (BW), chest circumference (CC), right and left hand grip dynamometry (HHD), and vital capacity of the lungs (VC) [17].

In 2021, polling was used to assess the features of lifestyle formation in students.

In 2021, the CHAID algorithm for decision trees was used to assess the lifestyle factors affecting the students' physical development. Furthermore, the indices were calculated showing the extent, to which the probability of disharmonious physical development in certain group (node) was higher or lower compared to the average value for the whole sample. The index exceeding 100% suggested that the risk of disharmonious physical development in the group was higher relative to the average value for the whole sample [18].

Statistical data analysis was performed using the StatTech 3.0.7 software package ("Stattech"; Russia). When the distribution was normal, the data were described using the mean (M) and error of the mean (m). Statistical significance of differences in the quantitative parameters in the groups was assessed using the Student's *t*-test; the significance level was 0.05.

Table 1. Assessment of the average values of physical development indicators in males (M ± *m*)

Indicators of physical development	Year of observation/number of individuals		*p*
	2001/122	2021/207	
Body length, cm	179.8 ± 0.7	178.0 ± 0.5	0.05*
Body weight, kg	68.6 ± 1.2	70.8 ± 1.0	0.07
Chest circumference, cm	91.0 ± 0.6	95.1 ± 0.7	0.001*
Right hand grip dynamometry, kg	44.8 ± 0.6	40.9 ± 0.5	0.001*
Left hand grip dynamometry, kg	30.7 ± 0.5	28.3 ± 0.5	0.001*
Vital capacity, mL	2458.2 ± 44.5	2738.8 ± 35.0	0.007*

Note: * — significant differences ($p < 0.05$).

Table 2. Assessment of the average values of physical development indicators in females (M ± *m*)

Indicators of physical development	Year of observation/number of individuals		*p*
	2001/155	2021/456	
Body length, cm	166.7 ± 0.5	164.8 ± 0.3	0.01*
Body weight, kg	58.6 ± 0.7	58.5 ± 0.5	0.23
Chest circumference, cm	83.9 ± 0.5	89.0 ± 0.4	0.001*
Right hand grip dynamometry, kg	29.1 ± 0.3	26.5 ± 0.2	0.01*
Left hand grip dynamometry, kg	28.2 ± 0.4	24.9 ± 0.2	< 0.001*
Vital capacity, mL	2794.2 ± 39.5	2828.9 ± 25.0	0.16

Note: * — significant differences ($p < 0.05$).

Table 3. Assessment of the harmony of physical development in males

Physical development assessment	Assessment criterion	Year of observation/number of individuals			
		2001/122		2021/207	
		Abs.	%	Abs.	%
Harmonious	M ± 1σR	88	72.1	104	50.2
Disharmonious due to		34	27.9	103	49.8
underweight	body weight below M – 1,1σR	13	10.7	48	23.2
overweight	body weight over M + 1,1σR	21	17.2	55	26.6

Table 4. Assessment of the harmony of physical development in females

Physical development assessment	Assessment criterion	Year of observation/number of individuals			
		2001/155		2021/456	
		Abs.	%	Abs.	%
Harmonious	M ± 1σR	118	76.1	273	59.9
Disharmonious due to		37	23.9	183	40.1
underweight	body weight below M –1,1σR	16	43.2	51	27.9
overweight	body weight over M + 1,1σR	21	56.8	132	72.1

RESULTS

It was found that multidirectional changes in the indicators of medical students' physical development took place in 20 years. In males, BL, right and left hand grip strength decreased significantly, while CC and VC significantly increased. Furthermore, BW increased, but the differences were non-significant (Table1).

Infemales, BL, right and left hand grip strength decreased significantly, CC significantly increased, BW remained almost the same, VC showed non-significant changes (Table 2).

Assessment of the harmony of physical development using the regional regression scales showed that the number of young males with harmonious physical development decreased by 21.9% over 20 years. The rate of underweight increased 2.2-fold and the rate of overweight increased 1.5-fold (Table 3).

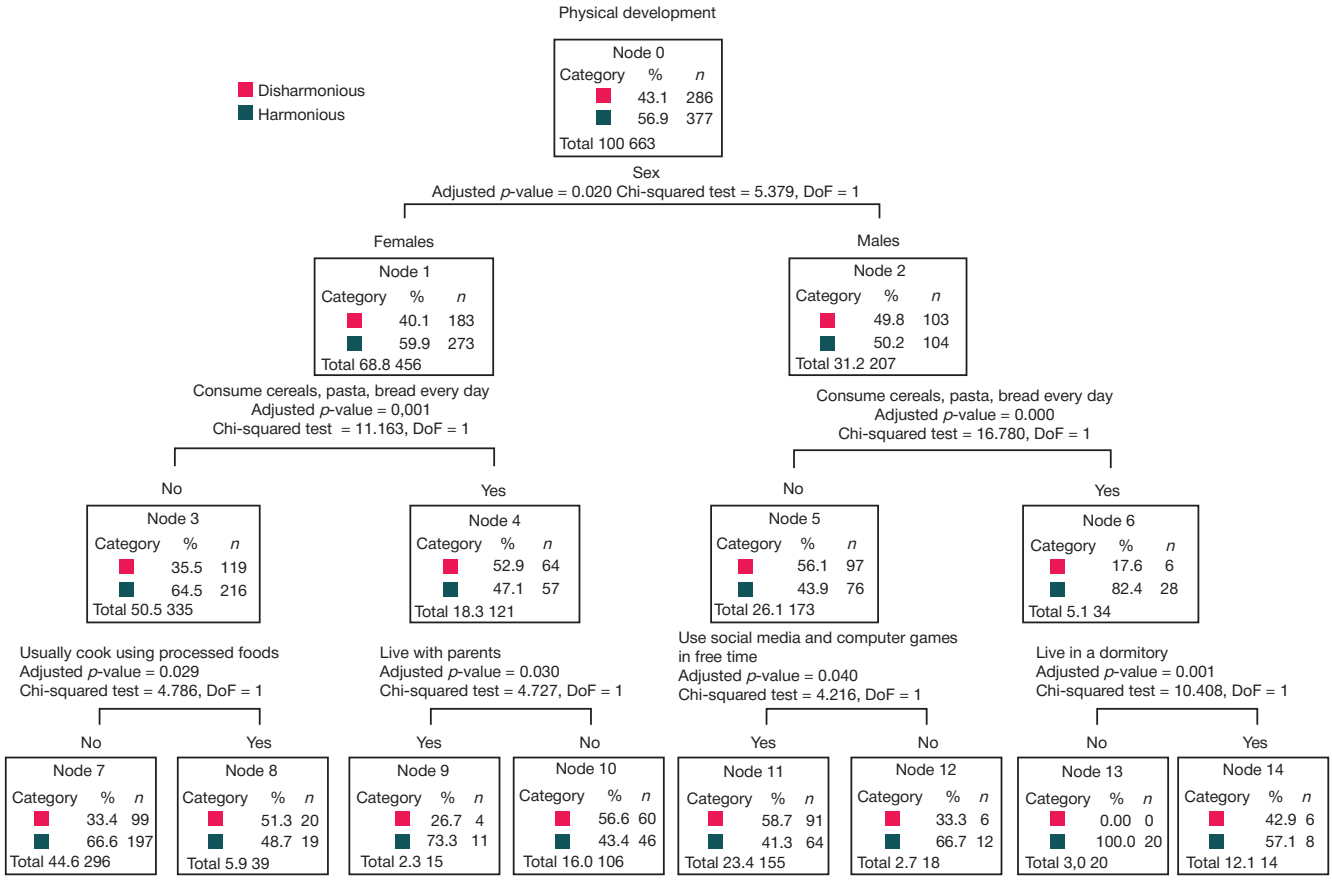

Fig. The most significant risk factors in students with different physical development scores depending on their lifestyle

Table 5. Characteristics of the classification tree terminal nodes

Number of the node	Risk factor values	Total number of students in the overall structure of the node		Share of students with the outcome relative to the total number for the node	Response (share of observations in the target category for the node in the overall number of observations for the node)	Impact factor of the node
		Abs.	%	Abs.	%	%
11	Sex (males) Consume vegetables every day (no) Use social media and computer games in free time (yes)	155	23.4	91	58.7	136.1
10	Sex (females) onsume cereals, pasta, bread every day (yes) Live with parents (no)	106	16	60	56.6	131.2
8	Sex (females) Consume cereals, pasta, bread every day (no) Usually cook using processed foods (yes)	39	5.9	20	51.3	118.9
14	Sex (males) Consume vegetables every day (yes) Live in a dormitory (yes)	14	2.1	6	42.9	99.4
7	Sex (females) Consume cereals, pasta, bread every day (no) Usually cook using processed foods (no)	296	44.6	99	33.4	77.5
12	Sex (males) Consume vegetables every day (no) Use social media and computer games in free time (no)	18	2.7	6	33.3	77.3
9	Sex (females) Consume cereals, pasta, bread every day (no) Live with parents (yes)	15	2.3	4	26.7	61.8
13	Sex (males) Consume vegetables every day (yes) Live in a dormitory (no)	20	3	0	0	0

The number of females, whose physical development was considered harmonious, decreased by 16.2%. Excess body weigh was the main cause of disharmony. The number of overweight female students reported in 2021 was 1.3 times higher than that reported in 2001 (Table 4).

The most significant risk factors of the lifestyle of today's students associated with disharmonious physical development were determined using the CHAID algorithm for decision trees (Fig.).

As a result of the analysis, the three-level classification tree that included 14 nodes was constructed. The impact factors of the nodes with the risk factors triggering disharmonious physical development were determined.

The detailed description of the classification tree terminal nodes is provided in Table 5. Nodes 11 and 10 are considered to have the most adverse effect. The 11th node includes such characteristics, as male sex, lack of daily consumption of vegetables and excess use of gadgets (impact factor 136.1%). The 10th node includes such factors, as female sex, excess consumption of carbohydrate foods, and living apart from the family (131.2%). The table also contains nodes with the risk factors having a less significant effect on physical development.

The findings showed that the longitudinal growth acceleration in students of the Pacific State Medical University slowed down in the early 21st century. In 2021, a significant

decrease in BL of young males ($p = 0.05$) and females ($p = 0.01$) relative to the indicators reported in 2001 was observed. Changes in the students' BW were non-significant. The students' CC increased on average by 4 cm ($p = 0.001$). The changes in physiometric indicators predictably lead to the changes in functional capabilities. There was a significant decrease in the students' right and left hand grip strength ($p < 0.001$). VC increased significantly in males ($p = 0.007$).

Assessment of the individual physical development level has shown that more than a half of subjects have harmonious physical development. Despite this fact, the number of students with disharmonious physical development due to overweight increased by 9.4% in males and 15.3% in females over 20 years.

The classification tree construction method has made it possible to identify the risk factors affecting the students' physical development indicators. The risk factors of disharmonious physical development in males with the highest impact factor were the lack of vegetables in the diet and the use of social media and computer games in free time (136.1%). In females, the risk factors included daily consumption of cereals, pasta, bread and living apart from parents (131.2%).

DISCUSSION

The earlier research results indicate multidirectional dynamics of the modern students' physical development indicators. If in some regions of the country a decrease in anthropometric indicators is reported, then in other territories their increase is recorded [19, 20]. The majority of students have harmonious physical development. However, there is still a rather large share of students with disharmonious and sharply disharmonious physical development [21]. Thus, disharmonious physical development has been reported in 17% and sharply disharmonious physical development has been reported in 9% of students of the Pirogov Russian National Research Medical University [22]. The same results were obtained for medical students from Kyrgyzstan: disharmonious and sharply disharmonious physical development was reported in 18.8% and 1.6% of males, 15.7% and 7.3% of females [23]. At the same time, our study has shown that 43.1% of subjects have deviations. The findings have made it possible to identify the major risk factors affecting physical development of students of the Pacific State Medical University.

It is well-known that nutrition is an important factor of shaping the students' physical development and one of the characteristics of their lifestyle [24]. A number of studies have shown that the medical students' nutrition is usually non-compliant with the physiological standards and unbalanced. Furthermore, the eating pattern is disturbed [11, 25]. Similar results were obtained in our study. It was found that the lack of vegetables in the diet and daily consumption of carbohydrate foods were the risk factors of disharmonious physical development in students.

Excess computerization of the modern students' life poses a significant health risk [26]. Scientific research has proven the adverse effects of the use of electronic devices on the emergence of deviations in physical development [10, 11]. This fact was also confirmed by our study. For example, it was found that 41.3% of young males with disharmonious physical development spent most of their time in social media and played computer games. Furthermore, it was shown that the students' place of residence and sex had a significant impact on their health.

The study conducted suggests that is is necessary to further monitor the indicators of physical development. The need for development and timely update of the modern standards for physical development assessment is still relevant for both schoolchildren and student youth.

CONCLUSIONS

Thus, regular monitoring of the students' physical development makes it possible to determine the priority directions of the development of complex and targeted preventive measures for health preservation and improvement, as has been implemented based on the study results.

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