

## The dependence of the academic performance of university students on the level of their physical activity

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### Abstract:

The study of the question of the interdependence of different levels of motor activity of students and their performance seems to be relevant for the professional development of future specialists. *Research aim.* Reveal the dependence between the academic performance of university students on the volume of their weekly physical activity. *Materials and methods.* The research project was carried out in 2018 - 2022. on the basis of two universities of the Siberian Federal District (Russia). 208 students were under observation, who were divided into 2 groups depending on the level of their weekly physical activity. The first group included student-athletes, who are characterized by high motor activity. The second group included students who, due to illness, attended a special medical group and had limitations in the volume and intensity of physical activity. The level of weekly physical activity of all students was assessed using the IPAQ - SF questionnaire. The assessment of the academic performance of each student was carried out on the basis of an analysis of examination sheets for the entire period of study at the university. *Results.* It was found that among student-athletes the results of physical activity indicators were significantly higher than among students exempted from traditional physical activity. The indicator of academic progress was significantly higher among student-athletes compared with students with a low level of weekly physical activity,  $p < 0.05$ . The average score of student-athletes was 9.8% higher than that of students exempted from physical activity,  $p < 0.05$ . *Conclusions.* Going in for sports among young people contributes not only to the preservation and improvement of the level of physical and somatic health, but is important for the development of the cognitive abilities of future specialists.

**Key Words:** physical education, academic performance, university students, motor activity, cognitive abilities

### Introduction

It is generally accepted that human physical activity is any bodily movement with the help of muscle strength, which is accompanied by an increase in energy expenditure more than the basic metabolism in the body. Physical activity occurs in the daily life of a person's daily activities (Physical Activity Fact Sheet. WHO, 2018). Physical activity is especially necessary for the development of the body in children, adolescents and young people (Budzynski-Seymour et al., 2020). According to many authors, physical inactivity is a key reason for the formation of severe non-communicable diseases and functional disorders in people of different ages and gender. Among the population with low physical activity, pathology of the cardiorespiratory, nervous, immune and endocrine systems, the development of obesity, and metabolic disorders in the body are most often recorded (Jordan et al., 2020; Sunda et al., 2021).

Scientific papers provide data on a decrease in motor qualities in students due to a low level of weekly motor activity (Setiarnawijaya et al., 2021; Chekhovska et al., 2020). Physical inactivity in student youth can cause manifestations of not only an insufficient level of physical fitness (Kolokoltsev et al., 2018), but also a serious deterioration in cognitive abilities (Korkin, & Krysyuk, 2017). When performing optimal physical activity,

the risk of diseases decreases and mental performance, purposefulness, endurance, self-discipline and endurance increase (Zhang et al., 2019; Zurita-Ortega et al., 2019; Savko, & Hojempo, 2018).

The first signs of deterioration in the health of children begin even before they enter a university (Krasnozhan, 2017). According to the author, one of the reasons for this is the low physical activity of schoolchildren. This leads to a decrease in the reserve capabilities of the child's body and a deterioration in the indicators of their physical development, physical fitness and cognitive abilities. However, students who exercise for at least 60 minutes a day achieve high levels of health and mental performance (Pavanello et al., 2019).

The World Health Organization recommends a minimum weekly activity requirement for adults of 150 minutes (daily 30 minutes  $\times$  5 days per week) if moderate aerobic activity is used or at least 75 minutes (daily 25 minutes  $\times$  3 days) for high-intensity exercise (Global recommendations on physical activity for health, WHO, 2010). With an increase in the volume and intensity of physical activity above 150 minutes per week, this leads to a significantly greater increase in the reserve capacity of the body and the level of health of the person involved (Billinger et al., 2014).

Students who combine their studies at the university with sports can be classified as a group with a high level of daily physical activity and a level of health. The rest of the students for physical education are divided into medical groups for health reasons. The main medical group includes completely healthy students. Such students are not contraindicated in various types of load, participation in competitions in various sports. Students with diseases are allocated to special medical groups (Mozolev, 2020), where the volume and intensity of physical activity is limited. The number of students in special groups can reach 50% of the total number of students (Gerber et al., 2017; Hollis et al., 2017). About 20% of students are in very poor health. They perform only minimal health-improving physical activity in therapeutic physical education classes and on their own at home (Glazkova et al., 2020).

It is known that the performance of educational activities requires not only a high mental potential, but also a well-developed muscular system and endurance, which help the student's body to effectively cope with intellectual loads in the learning process (Yıldız, 2018; Grajek, & Sobczyk, 2021; De la Camara et al., 2021). The question of the relationship between different levels of weekly physical activity of students and their academic success in studies seems to be relevant. We believe that the material we have received can be used to popularize sports among young people.

**Research aim.** To reveal the dependence between the academic performance of students of technical and natural science areas of study at the university on the volume of their weekly physical activity.

## Material & methods

The research project was carried out in 2018 - 2022 on the basis of two universities in the Siberian Federal District (Russia). Using a randomized method, 208 students aged 17 to 22 years ( $18.3 \pm 0.4$  years) were included in the project. Among the observed students, 98 studied at institutes and faculties of the natural science profile of education and 110 - in technical specialties education. According to the level of volume and intensity of physical activity, students were divided into 2 groups. The first group ( $n=112$ ) included student-athletes, who are distinguished by the combination of studying at a university and playing sports (High group). Their life activity was characterized by high daily physical activity. All of them were part of the sports teams of universities or administrative districts in playing sports popular with young people, martial arts, athletics and weightlifting, powerlifting, sports dancing, sports tourism, archery, etc. The second group of the project ( $n=96$ ) included students assigned to a special medical group. Due to their somatic disease, this group of students had restrictions on physical activity in physical education classes and did not participate in sports competitions and pass sports standards (Low group). In addition, an individual complex of physical exercises was provided for them for independent physical culture and health-improving classes. All students signed a voluntary written consent to participate in a research project that does not violate the moral and ethical standards of the Declaration of Helsinki 2008.

Analysis of the results of assessing the level and volume of weekly physical activity of students in both observation groups was carried out using the international questionnaire IPAQ-SF - International Questionnaire on Physical Activity, IPAQ-Short Form (Craib et al., 2003), which showed high validity, reliability and ease of study. To assess the academic performance of students in both groups of observation, an analysis of the examination sheets of each student was carried out with the calculation of the average score of learning success for the entire period of educational activity at the university.

In statistical processing, parametric methods were used, which included the calculation of the arithmetic mean value, its error and the reliability of the difference in indicators according to Student's t-test ( $p < 0.05$  was considered a significant difference in indicators). To assess a significant difference in qualitative parameters, a chi-square calculation ( $\chi^2$ ) was used (at  $p < 0.05$ , the critical value  $\chi^2 = 3.841459$ ; statistically significant differences were considered when  $\chi^2 > \chi^2$  was critical).

## Results

Description of the results of the analysis of weekly physical activity of students in both observation groups using the IPAQ-SF questionnaire is presented in Table 1.

**Table 1. Values of indicators of physical activity of students of both groups, (M±m)**

A group of students	Questions in the IPAQ-SF						
	1 Days per week with intense* physical activity (number)	2 Time of intense* physical activity per day (min)	3 Days per week with non-intense** physical activity (number)	4 Time of non-intense physical activity per day (min)	5 Walking days per week (quantity)	6 Walking time per day (min)	7 Sitting time per day (hour)
High group (n=112)	4.24±0.12	92.45±1.26	3.54±0.15	73.4±2.45	6.94±0.1	76.9±2.35	7.4±0.12
Low group (n=96)	0.24±0.09	12.24±1.32	1.38±0.12	13.6±1.45	6.19±0.1	62.3±3.45	11.5±0.24
p	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

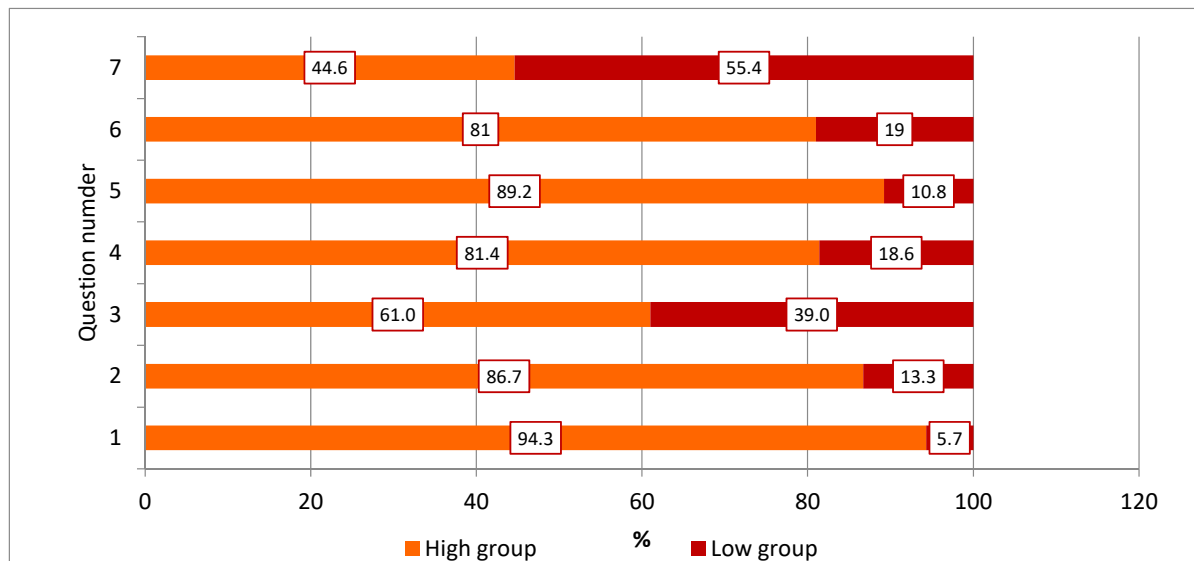
Note:

\*-intense physical activity leads to a strong increase in breathing, an increase in heart rate by more than 20% and lasting 10 minutes or more.

\*\* - non-intense physical activity includes motor actions, leading to a slight increase in breathing and lasting at least 10 minutes.

The results of a survey of students from both groups of observation indicate significant differences in the values of indicators in the answers to questions about weekly physical activity.

Figure 1 shows the ratio of the results of the answers of students of both groups about their weekly physical activity.

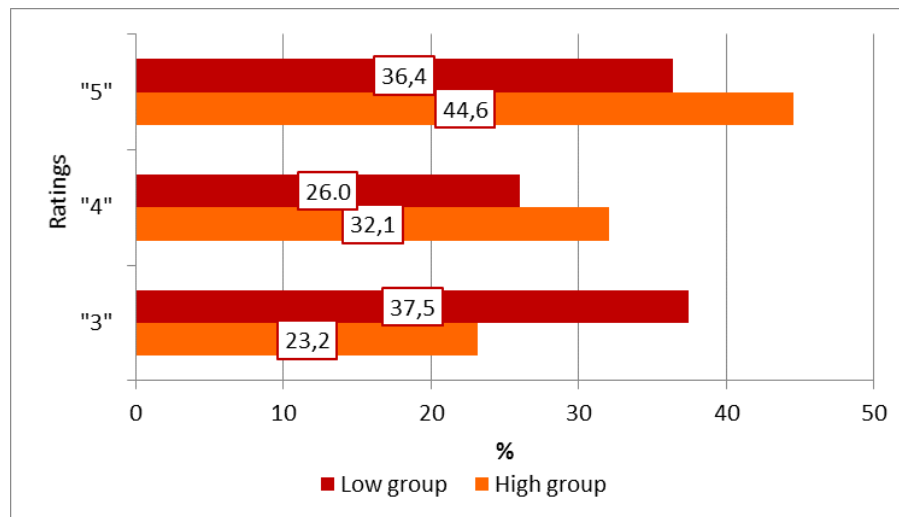


**Fig. 1. The results of students' answers about physical activity according to questionnaire IPAQ-SF**

For High group students (Fig. 1), the results of weekly physical activity indicators for all questions of the questionnaire were significantly higher, the time spent in the "sitting" position (question No.7) was less than for Low group students,  $p < 0.05$ . The highest share of value indicators in responses to physical activity in the High group was found in questions No.1 (94.3%), No.2 (86.7%), No.4 (81.4%) and No.5 (89.2%).

The results of our research project have established a significant difference in the quality of mastering the educational material at the university between the students of the observed groups.

The data in fig. 2 show that the value of the indicator of academic progress of students with different weekly physical activity was significantly higher in High group students compared to High group students,  $p < 0.05$ .



**Fig. 2. The number of students with appropriate grades for the entire period of study**

Figure 2 shows that the number of students who received the mark "satisfactory" in the High group turned out to be 38.1% less, the number of students with the mark "excellent" 22.5% more than the number of students in the Low group (23.2 and 37.5% and 44.6 and 36.4%, respectively),  $p < 0.05$ . The number of students with a "good" rating was 23.4% more in the High group of students compared to the number of Low group students (32.1 and 26.0%, respectively),  $p < 0.05$ .

The average score of academic performance in High group students was  $4.48 \pm 0.12$  points, in Low group students, the value of this indicator was 9.8% less -  $4.04 \pm 0.10$  points,  $p < 0.05$ . The average score of academic performance of students of technical and natural science profiles of training in universities and different levels of weekly physical activity is presented in Table 2.

**Table 2. The average score of academic performance of students of different areas of training and the level of weekly physical activity ( $M \pm m$ )**

Direction of higher education	High group	Low group	p
Technical education	$4.34 \pm 0.10$	$3.72 \pm 0.09$	$< 0.05$
Natural Science education	$4.65 \pm 0.13$	$4.36 \pm 0.11$	$< 0.05$
Average score	$4.48 \pm 0.12$	$4.04 \pm 0.10$	$< 0.05$

The average score of academic performance of the students of the High group of the technical direction of education was 16.7% higher than that of the students of the Low group ( $4.34 \pm 0.10$  and  $3.72 \pm 0.09$  points, respectively),  $p < 0.05$ . Among the students of the natural science direction of education, the average score of students from the High group turned out to be 6.6% higher than among students from the Low group ( $4.65 \pm 0.13$  and  $4.36 \pm 0.11$  points, respectively),  $p < 0.05$ . Attention is drawn to a significant difference in the values of the average score of students of technical and natural science areas of study in both groups of observation. Thus, among the students of the High group of the technical direction of study, the average score was  $4.34 \pm 0.10$ , and among the students of natural sciences, this indicator was higher by 7.1% and amounted to  $4.65 \pm 0.13$  points,  $p < 0.05$ . Among the students of the Low group, this difference was even greater: among the students of the technical direction, the average score was  $3.72 \pm 0.09$ ; among the students of the natural sciences, this indicator was higher by 17.2% and amounted to  $4.36 \pm 0.11$  points,  $p < 0.05$ . We believe this is due to the presence in the curricula of the technical direction of teaching complex disciplines, in comparison with the natural science direction of education, which requires further study of this issue.

## Discussion

It is known from the scientific literature that physical inactivity is not only one of the causes of somatic and mental diseases in humans (Jordan et al., 2020; Sunda et al., 2021), a decrease in the level of physical fitness and physical development (Kolokoltsev et al., 2018), but also a factor that impairs the cognitive abilities of young people (Korkin, & Krysyuk, 2017).

In a person who is in long-term conditions of lack of motor actions, there is a decrease in metabolic processes, irreversible breakdown of muscle protein. In addition, in hypodynamia, there was a deficit in the supply of nerve impulses to the cerebral cortex from working skeletal muscles (Nobari et al., 2021). The result of this is

the development of violations of the coordinating function of the central nervous system, which negatively affects the functioning of all organs and systems of the body and the psycho-emotional sphere of a person. Physical inactivity, which lasts for a long time, lies in the genesis of the development of a stressful state, the appearance of apathy, loss of concentration, the development of depression and other factors that negatively affect the student's educational process and reduce his academic performance. With regular physical activity, physical and mental performance increases, resistance to stress factors increases, purposefulness, endurance, self-discipline and endurance develop (Savko, Hojempo, 2018; Zhang et al., 2019; Zurita-Ortega et al., 2019). Therefore, the regular motor activity of a student can positively affect the development of academic disciplines at the university. The data obtained by us in the framework of the research project are consistent with similar results of other authors. According to our data, student-athletes have not only significantly greater weekly physical activity, but also higher academic performance in universities compared to students with low physical activity. Higher performance of student-athletes is established both in technical and natural science areas of study.

Our data do not contradict the results of studies by other authors. According to Pavanello et al., (2019), students who have a sufficient level of physical activity had a significantly higher level of health and mental performance compared to students with low physical activity. The results of our study are consistent with the data of other authors (Yıldız, 2018; Grajek, & Sobczyk, 2021; De la Cámara et al., 2021) that higher performance of student-athletes is associated with a positive effect of physical activity on cognitive abilities. Higher endurance and strength abilities also play a role, providing resistance to the educational process, psycho-emotional stress and the formation of positive psychological qualities in athletes, in particular, determination, perseverance and willpower in overcoming difficulties. These qualities allow student-athletes to more easily cope with intellectual stress during training.

### Conclusions

As a result of the research project, the relationship between the academic performance of students and the level of their physical activity was established. It was found that the value of the indicator of academic progress in student-athletes was significantly higher by 9.8% compared with students with a low level of motor activity ( $4.48 \pm 0.12$  and  $4.04 \pm 0.10$  points, respectively),  $p < 0.05$ . The students of the technical profile of education with a high level of physical activity had an average score of 16.7%, the natural science direction of training was 6.6% higher than among students of these profiles of education, who have low physical activity,  $p < 0.05$ .

Among student-athletes in the technical field of study, the average score was 7.1% lower than among students of natural sciences ( $4.34 \pm 0.10$  and  $4.65 \pm 0.13$  points),  $p < 0.05$ . Among students with low physical activity, this difference was 17.2%,  $p < 0.05$ .

Our research shows that sports activities increase mental and physical performance and contribute to more effective professional development of students and labor activity in society.

**Conflicts of interest.** The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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