

THE IMPACT OF CLIMATOGRAPHIC CONDITIONS ON STUDENTS' MOTOR ACTIVITY

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Abstract. Aim. To determine the relationship between climatogeographic conditions and motor activity levels in students. **Materials and methods.** This study involved 186 students aged between 17 and 20 years. The research methods included a literature review, pedometer measurements, and statistical analysis (arithmetic mean, standard error of the mean, and linear correlation coefficient). **Results.** Correlation analysis revealed a strong relationship between motor activity levels and the duration of daylight hours ($r = 0.93$) and the number of clear days ($r = 0.82$). This suggests that students' motor activity is directly influenced by the amount of sunlight during the year. There is a very strong negative relationship between the duration of a blizzard and motor activity levels ($r = -0.99$) and a strong negative relationship between the duration of rain and motor activity ($r = -0.89$). **Conclusion.** Climatogeographic conditions significantly influence motor activity levels among young people.

Keywords: students, physical activity, climatogeographic conditions

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КЛИМАТОГЕОГРАФИЧЕСКИЕ УСЛОВИЯ КАК ФАКТОР ВЛИЯНИЯ НА ВЕЛИЧИНУ ДВИГАТЕЛЬНОЙ АКТИВНОСТИ СТУДЕНТОВ

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Аннотация. Цель исследования – определить взаимосвязь климатогеографических условий и величины двигательной активности студентов. **Методы исследования:** изучение и анализ научных работ; определение двигательной активности по показателям шагометрии; методы статистического

анализа (среднее арифметическое, стандартная ошибка среднего; коэффициент линейной корреляции). В исследовании приняли участие 186 студентов 17–20 лет. **Результаты.** Корреляционный анализ полученных данных выявил сильную взаимосвязь между объемом двигательной активности и продолжительностью светового дня ($r = 0,93$), а также количеством ясных дней ($r = 0,82$). Это указывает на то, что показатели двигательной активности студентов напрямую зависят от количества солнечного света в течение календарного года; очень сильная отрицательная связь между продолжительностью метели и количеством двигательной активности ($r = -0,99$) и сильная отрицательная связь между продолжительностью дождя и двигательной активностью ($r = -0,89$). **Заключение.** Климатогеографические условия оказывают существенное влияние на объем двигательной активности современной молодежи.

Ключевые слова: студенты, двигательная активность, климатогеографические условия

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Introduction. Motor activity plays a crucial role in human development, and this notion has been consistently emphasized by various scholars in their research. Despite the widespread promotion of physical education and sports, an increasing number of people find themselves in conditions of physical inactivity. Unfortunately, this issue affects students as well.

The shift towards digitalization in modern higher education has led to changes in the lifestyles of young people, resulting in increased physical inactivity and psychological stress. Consequently, the problem of insufficient motor activity has taken on a social dimension.

As a result, for the Russian system of physical education in higher education institutions, the tasks of enhancing the overall somatic health of students, optimizing their motor activity, and fostering a need for systematic physical education are highly relevant. Through theoretical analysis and the review of specialized literature, we assessed the extent of scientific exploration of this issue and formed an objective understanding of its current state [9, 13].

Domestic scientific research primarily focuses on: examining the socio-pedagogical determinants of motor activity development; investigating the influence of motor activity on improving the somatic health levels of students; addressing the issues of regulating motor activity in family education and from the perspective of teachers through sociological analysis; and studying modern strategies for regulating the motor activity of a growing person in the educational space of Russia [2, 8, 21].

At the same time, foreign experts have recog-

nized weather as an environmental factor that significantly impacts daily human activity, including physical activity [1, 18, 24]. There are studies that experimentally demonstrate the effectiveness of considering climatogeographic conditions of a specific region to increase motor activity among various segments of the population [6, 7, 23].

M. Herrador-Colmenero, F. Harrison, E. Villa-Gonzalez, C. Rodriguez-Lopez, F.B. Ortega, J.R. Ruiz et al. (2018) demonstrated the dependence of the choice of transportation method (walking, bus, or bicycle) for Spanish schoolchildren aged 7 to 18 years on weather conditions [11].

A noteworthy study conducted at the University of Michigan by A.L. Wagner, F. Keusch, T. Yan, and P.J. Clarke (2019) revealed that race, age, and education exacerbate the negative impact of adverse weather conditions on the decision to engage in outdoor sports [22].

In their research, G.A. Bulatova (2000), S.Yu. Shchetinina (2000), and others have highlighted that climatic conditions play a significant role in the qualitative characteristics of the health of the Russian Federation's population [4, 17].

It should be noted that O.L. Postol (2004) demonstrated the necessity of considering the climatic and geographical features of Primorye when planning physical education classes in secondary schools [16].

K.V. Bogdanova, S.A. Polyakova, and R.A. Malishev (2022) investigated the impact of the climate of Arctic zones on the health and physical education of higher education students. They proved that motor activity strengthens the im-

immune system, which in turn ensures the body's resistance to the harsh conditions of the Arctic [3].

This issue remains relevant, as the study of the influence of various climatic and geographical conditions on students' work capacity and motor activity is of great significance for the educational process in higher education institutions worldwide.

The purpose of this study is to determine the relationship between climatogeographic conditions and students' motor activity.

Materials and methods. The study involved 186 students aged 17–20 years from higher education institutions in Belgorod, Russia. We conducted a review of scientific literature on the topic from 2000 to 2020, including works indexed in the Scopus and Web of Science databases. These papers addressed the issues of optimizing motor activity among young people.

The study involved a comprehensive analysis of scientific papers on the subject from both domestic and foreign researchers. Motor activity was determined using pedometer indicators recorded with a fitness bracelet (Lerbyee fitness tracker K1). Statistical analysis methods, such as arithmetic mean, standard error of the mean when using sample variance, and linear correlation coefficient (Pearson correlation coefficient), were employed to obtain the values of the aforementioned indicators.

Results. Numerous studies have demonstrated the impact of sunlight and daylight hours on the productivity and efficiency of living organisms, with people being no exception. In our study, we examined the relationship between the students' motor activity and the number of clear days in each month (throughout the calendar

year) and the duration of daylight. The results of the study are presented in Fig. 1.

The spring-summer period (April–October) has the greatest number of clear days on average (13.13 days per month), while the period from November to March has an average of 8.20 clear, cloudless days. Similarly, from April to October, there is a longer daylight duration of 14.14 hours, which is significantly reduced to 9.0 hours during the autumn-winter period. Fig. 1 illustrates the dynamics of motor activity, which corresponds to changes in daylight duration and the number of clear days. The average motor activity for the period from April to October is 11.89 thousand steps per day, while in winter, it is 9.46 thousand steps per day. It is worth noting that motor activity reaches its highest indicators during the summer holidays (June – August) and significantly decreases during the academic period. The correlation analysis of the data obtained revealed a strong relationship between the amount of motor activity and the duration of daylight hours ($r = 0.93$) and the number of clear days ($r = 0.82$). This indicates that students' motor activity directly depends on the amount of sunlight during the year.

Additionally, the vital activity of living organisms, including humans, depends on weather conditions and the amount of precipitation that falls during a specific time period. Fig. 2 clearly demonstrates the impact of various precipitation types and their durations on students' motor activity during the day.

A comparison of motor activity levels and various precipitation types, considering their durations, has clearly demonstrated the negative impact of precipitation on the number of steps

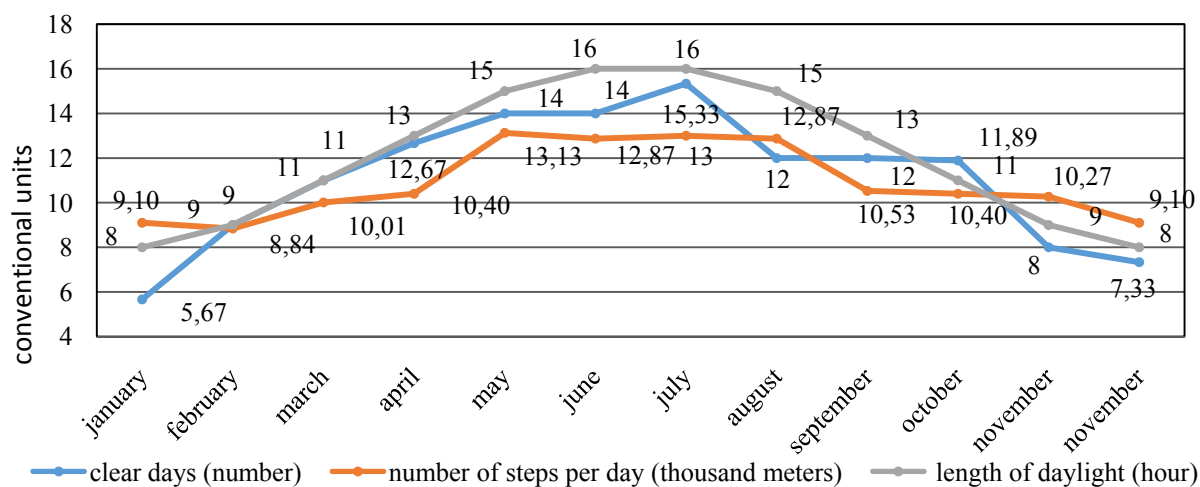


Fig. 1. The relationship between students' motor activity, daylight duration, and the number of clear days

performed by students throughout the day. Fig. 2 illustrates a general downward trend in these indicators in relation to the duration and intensity of precipitation. In other words, the longer it snows or rains, the less students move. Among the precipitation types, a blizzard and a downpour have a more substantial negative impact on motor activity, whereas calm snow only contributes to a slight decrease in these indicators.

Correlation analysis revealed a very strong negative relationship between the duration of a blizzard and the amount of motor activity ($r = -0.99$), and a strong negative relationship between the duration of rain and motor activity ($r = -0.89$). Similarly, the correlation analysis showed a very strong negative relationship between motor activity levels and the duration of the blizzard ($r = -0.99$), as well as the duration of rain ($r = -0.89$). The correlation between calm snow and the amount of motor activity is closer to the average negative ($r = -0.78$).

Ambient temperature is undoubtedly a significant factor influencing the vital activity of living organisms. In our study, we compared indicators of motor activity and average daily temperature throughout the annual cycle (Fig. 3). We found that students achieved the highest mo-

tor activity levels in temperature ranges from $+5\text{ }^{\circ}\text{C}$ to $+25\text{ }^{\circ}\text{C}$. As temperature increases or decreases beyond this range, there is a general trend toward decreased motor activity.

Correlation analysis revealed that a decrease in temperature from $0\text{ }^{\circ}\text{C}$ to $-30\text{ }^{\circ}\text{C}$ has a substantial effect on the number of steps performed by students per day ($r = 0.89$), while an increase in temperature from $0\text{ }^{\circ}\text{C}$ to $+35\text{ }^{\circ}\text{C}$ has a lesser effect on motor activity ($r = -0.67$). It is important to note that both extremely low and extremely high ambient temperatures negatively impact the motor activity of young people.

In the second half of the 20th century, researchers such as A.P. Golikov and P.P. Golikov (1973), N.K. Trapeznikova (1974) observed that seasonal meteorological fluctuations significantly impact a person's physical condition [10, 20]. G.I. Myzan (1996) and V.A. Nesterov (1999) further demonstrated that incorporating natural and climatic factors judiciously can increase the effectiveness of physical education by 15–20% [14, 15].

However, O.O. Shumskaya (2008) highlighted the negative impact of the climatic and geographical conditions of Primorsky Krai on the motor activity of children aged 4–7 years old [19].

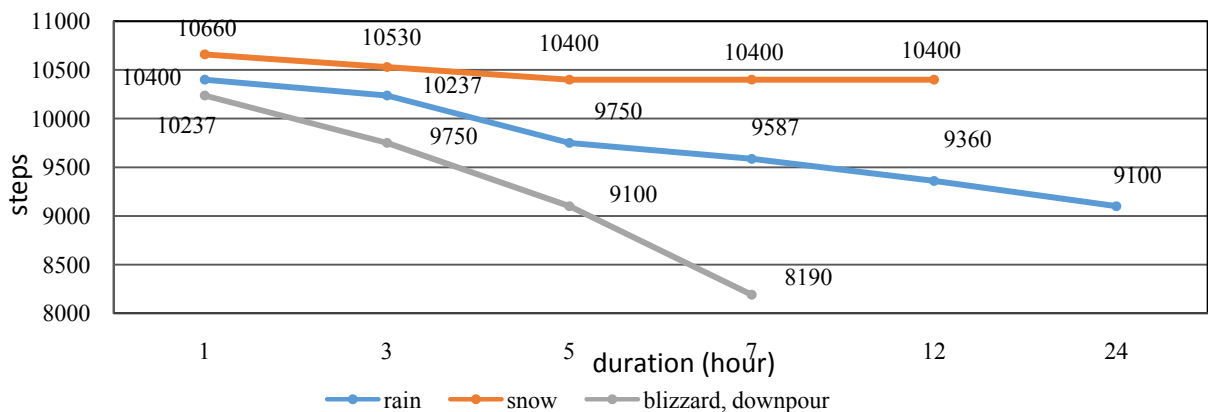


Fig. 2. The relationship between students' motor activity and the type and duration of precipitation

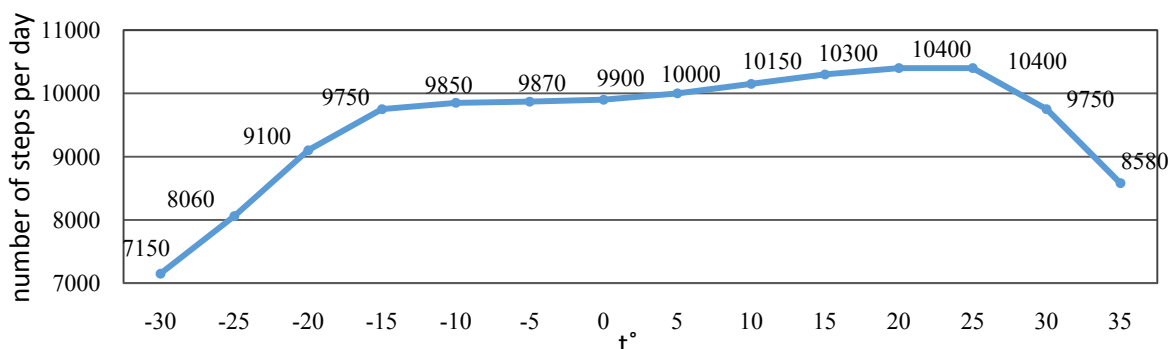


Fig. 3. The relationship between students' motor activity levels and temperature

Zh.I. Busheva and A.V. Auster (2016) conducted studies on the influence of motor activity on the morphological and functional indicators of 10-year-old children living in Siberian conditions. They concluded that optimal motor activity significantly optimizes a child's vital activity and adaptive capabilities in unfavorable climatic and geographical conditions [5].

Research conducted by O.N. Moskovchenko, L.A. Sanina, and A.K. Dashkova (2009) enabled the authors to assess the impact of climatic conditions on the adaptive capabilities and physical activity of students living in the Siberian region. They emphasized the need to differentiate physical activity in physical education of university students, considering the adaptive capabilities of the body and the influence of environmental, climatic, and geographical factors of Siberia [13].

Although the influence of climatic and geographic conditions, as well as natural factors, on the adaptive capabilities of the human body has been studied relatively well, the problem remains relevant. This is due to the fact that climatic conditions and an individual's social status are subject to continuous change.

Since the beginning of the 21st century, numerous experts have observed significant climate changes on our planet. Some countries experience abnormally hot temperatures, while others face excessively harsh and snowy winters, which are unusual for their regions. Environmentalists have noted the imbalance of all-natural systems, leading to changes in precipitation regimes, temperature anomalies, and an increase in the frequency of extreme events such as hurricanes, floods, and droughts.

Our research supports the conclusions of I. Kharlova, W.H. Deng, J. Mamen, A. Mamen, M.V. Fredriksen, and P.M. Fredriksen (2020) that weather conditions and daylight duration affect physical activity. They discovered that high temperatures and dry weather contribute to an increase in motor activity levels [12].

C. Zheng, W.Y. Huang, and S.H.S. Wong (2019) investigated the relationship between weather conditions and physical activity, sedentary lifestyle, and sleep duration among Hong Kong adolescents. They found that adverse weather conditions (a combination of high temperature and humidity) correlate with a decrease in motor activity [25]. As we previously men-

tioned, the findings of C. Zheng, W.Y. Huang, and S.H.S. Wong (2019) align with our research results.

The scientific research we have analyzed primarily focuses on the impact of climatic and geographical conditions in the Arctic, subarctic, temperate (marine, monsoon, continental, and sharply continental), subtropical (Mediterranean and monsoon), subequatorial, and equatorial zones. Our research aims to investigate the influence of climatic and geographical conditions in the temperate continental zone on the motor activity of students living in the middle zone of Russia. A search in the Scopus and Web of Science databases revealed no research similar to ours.

Conclusions

The correlation analysis of the obtained data revealed several key findings:

1. A strong relationship exists between the amount of motor activity and the duration of daylight ($r = 0.93$) and the number of clear days ($r = 0.82$). This suggests that students' motor activity is directly influenced by the amount of sunlight during the year.

2. A very strong negative relationship was found between the duration of a blizzard and the amount of motor activity ($r = -0.99$), and a strong negative relationship between the duration of rain and motor activity ($r = -0.89$). The relationship between calm snow and motor activity is closer to the average negative ($r = -0.78$).

3. A strong relationship ($r = 0.89$) was observed between a decrease in temperature from $0\text{ }^{\circ}\text{C}$ to $-30\text{ }^{\circ}\text{C}$ and the number of steps performed by students per day. Meanwhile, a negative relationship of average strength ($r = -0.67$) was found between an increase in temperature from $0\text{ }^{\circ}\text{C}$ to $+35\text{ }^{\circ}\text{C}$ and motor activity.

These findings indicate that climatogeographic conditions have a significant impact on the amount of motor activity among modern youth. Based on our research, we recommend that the sports event programs in educational institutions be adjusted to accommodate local climatogeographic conditions.

Our study does not claim to be an exhaustive solution to the problem. Further research with a larger sample size in various climatogeographic zones across the country is necessary to expand upon these findings.

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