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ORIGINAL ARTICLE

The mental well-being of medical students: do lifestyles and physical activity make any difference?

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Summary

Introduction: Lifestyle—including dietary habits, physical activity, smoking, and alcohol consumption—plays a crucial role in shaping both individual and population health. Medical students often have a suboptimal activity level and unhealthy lifestyle habits, which affect their well-being and future medical practice. The aim of this research was to examine the frequency of insufficient physical activity and lifestyle factors associated with it among fifth-year medical students at the Faculty of Medicine, University of Belgrade, as well as their association with the physical and mental health of students.

Methods: A cross-sectional study was conducted among fifth-year medical students at the Faculty of Medicine, University of Belgrade, during the social medicine course in November 2023. An anonymous questionnaire was used to assess physical activity, lifestyle characteristics, and symptoms of depression and anxiety. The study included 432 students, achieving a 90.4% participation rate. Based on energy expenditure, participants were categorized into groups with sufficient and insufficient physical activity levels.

Results: A total of 379 students (92%) belonged to the sufficient physical activity group, while 33 students (8%) were classified as having insufficient physical activity. Multivariate logistic regression exhibited a significant association between physical inactivity and lower BMI (OR: 0.81, 95% CI: 0.69-0.95), more pronounced depression symptoms (OR: 1.07, 95% CI: 1.01-1.15) and poorer financial status (OR: 0.51, 95% CI: 0.27-0.96).

Conclusion: Most of the surveyed students are sufficiently physically active. Physical inactivity was significantly associated with female gender, lower BMI, and more pronounced symptoms of depression.

Keywords: physical activity, lifestyle, obesity, mental health, medical students

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INTRODUCTION

Lifestyle refers to the way of living and social practices adopted by individuals, which reflect personal, group, and socio-economic identities and significantly impact overall physical and mental health (1). The key components of lifestyle include: dietary habits, body weight and composition, physical activity, adequate sleep, and habits related to smoking and alcohol consumption (2, 3). The World Health Organization (WHO) defines physical activity as "any bodily movement produced by skeletal muscles that requires energy expenditure" (4). Physical activity encompasses all movement, including work-related, transport, or leisure-time activities, and can involve walking, cycling, sports, active recreation, and play (5, 6). According to WHO guidelines, individuals aged 18–64 are advised to engage in 150–300 minutes of moderate-intensity aerobic physical activity or 75–150 minutes of vigorous-intensity aerobic physical activity per week. Additional health benefits could be achieved by doing more than 300 or more than 150 minutes of moderate-intensity aerobic or high-intensity activity, respectively. Additionally, engaging in muscle-strengthening activities targeting all major muscle groups at least twice weekly provides further health benefits (7).

Adopting a healthy lifestyle and habits, along with regular physical activity, has significant health benefits, reduces the risk of chronic non-communicable diseases, which are currently the leading cause of morbidity and mortality worldwide, and alleviates economic costs related to both individual healthcare and the healthcare system (8, 9). Regular physical activity facilitates healthy growth and development, especially in young people, and also reduces symptoms of depression and anxiety, and improves mood, cognitive processes, learning, judgment, and sleep quality (5, 10, 11). A healthy lifestyle is fundamental for overall health and well-being and appropriate cognitive and social development in young adults. Many factors have been identified as potential predictors of a healthy lifestyle and sufficient physical activity, including male gender, higher socio-economic status, living in an urban environment, higher education level, and higher academic performance (12, 13).

In the context of lifestyle and physical activity research, medical students are a distinct group of interest (12). Firstly, they are considered particularly vulnerable due to their new responsibilities, challenges, lack of free time, and academic stress, all associated with enrolling and studying at the University. Upon entering medical school, there is a tendency for changes in personal dietary and other lifestyle habits, and students often face the challenge of balancing academic, personal, and social lives (10-12). Secondly, lifestyle habits are typically established early in life and, once formed, can be challenging to change, often persisting over time. These habits influence personal health and can impact future careers and patient well-being (3, 14). Thirdly, medical students are future physicians and healthcare providers who will be a significant part of the healthcare system (15). Physicians with healthy habits, regular physical activity, and an overall healthy lifestyle serve as role models and provide ongoing health education and promotion of healthy lifestyles to patients and the general population (10). Previous research suggests that physicians with healthy habits are more likely to counsel patients on diet, physical activity, and lifestyle. Unfortunately, there is a lack of sufficient data and research concerning medical students' lifestyles and physical activity (10, 16).

The general belief is that medical students, compared to other students, have greater interest and knowledge about various aspects of health, healthy living habits, and their benefits. However, the use of this theoretical knowledge in personal life is not actively encouraged, and in some cases, it is even discouraged due to the large amount of time medical students invest in their studies (3, 14). The level of physical activity among students is generally suboptimal, which is prominent among medical students. Results from a global study across 23 countries indicate that physical inactivity among students ranges from 21.9% to 80.6% (7). Other studies have shown that over 70% of students do not meet the recommended daily step count of 10,000 steps (17). Furthermore, a recent study in Poland found that about 40% of medical students are physically inactive (7).

Qualitative studies have provided insight into factors contributing to reduced physical activity among students and they include individual factors (personal discipline, time), social factors (lack of parental control and social support), environmental factors (availability of exercise facilities, cost), and academic factors (exams, obligations) (17).

The aim of this research is to examine the frequency of insufficient physical activity and lifestyle factors associated with physical activity among fifth-year medical students at the Faculty of Medicine, University of Belgrade, as well as the association between physical activity and physical and mental health of medical students.

MATERIAL AND METHODS

The study was conducted as a cross-sectional study among fifth-year students at the Faculty of Medicine, University of Belgrade, during one week of classes in the Social Medicine course in November 2023. All participating students were informed about the purpose of the study and the research methodology and were asked to complete an anonymous questionnaire. Completion and submission of the questionnaire were considered as implied consent to participate in the study. The study was approved by the Ethics Committee of the Faculty of Medicine, University of Belgrade (17/X-15). Among the 478 fifth-year students at the Faculty of Medicine, 432

participated in the study, resulting in a response rate of 90.4%. Complete physical activity questionnaires were submitted by 412 students.

The research instrument was a questionnaire developed based on questionnaires used in similar studies, addressing socio-demographic and socio-economic characteristics of the respondents; lifestyle (including physical activity, smoking, cannabis consumption and anxiolytic use); and symptoms of depression and anxiety.

The respondents' physical activity was assessed using the International Physical Activity Questionnaire (IPAQ), which calculates total weekly energy expenditure and classifies individuals into three categories: high, moderate, or low physical activity (18). Based on this, physical activity levels were compared to the WHO recommendations for minimal physical activity.

Energy expenditure = energy expenditure in vigorous physical activity + energy expenditure in moderate physical activity + energy expenditure during walking

*Energy expenditure in vigorous physical activity = 8 * number of days spent in vigorous physical activity * minutes in vigorous physical activity*

*Energy expenditure in moderate physical activity = 4 * number of days spent in moderate physical activity * minutes in moderate physical activity*

*Energy expenditure during walking = 3.3 * number of days spent walking * minutes walking*

Students were categorized into two groups based on energy expenditure according to WHO recommendations for minimal physical activity: the group with insufficient physical activity (energy expenditure below 600 MET-minutes/week) and the group with sufficient physical activity (energy expenditure above 600 MET-minutes/week).

Depressive symptoms were assessed using the PHQ-9 Patient Depression Questionnaire. The Patient Health Questionnaire (PHQ) is a self-administered version of the PRIME-MD diagnostic tool for common mental disorders, while the PHQ-9 is its depression module. Each of the 9 DSM-IV depression criteria is scored as '0' (not at all) to '3' (nearly every day) (19). Anxiety was assessed using the Zung Self-Rating Anxiety Scale. The Zung Self-Rating Anxiety Scale (SAS) is a psychological assessment tool designed to measure the severity of anxiety symptoms in individuals, thus enabling the quantification of a person's anxiety level. It consists of 20 items, which are scored as '1' (none or a little of the time) to '4' (most or all of the time) (20).

Statistical analysis was performed using descriptive and analytical statistical methods. The significance of differences between categorical variables was examined using the chi-square (χ^2) test and Fisher's exact test. The significance of differences between normally distributed numerical variables was examined using the Student's t-test, and the significance of differences between numerical variables without normal distribution was analyzed using the Mann-Whitney U test. The normality of distribution was tested using the Kolmogorov-Smirnov test. Multivariate logistic regression analysis examined the association between insufficient physical activity (outcome variable) and independent variablessuch as gender, BMI, cannabis use, PHQ-9 score and financial status. All analyses were conducted using SPSS for Windows version 22.0.

RESULTS

The study included 412 students, most female (268, or 65%). The average age of respondents was 23.65±1.41 years, and the average academic grade was 8.68±0.89. A total of 369 (89.6%) respondents reported living in an urban area, while the rest lived in a rural area. The majority of students rated their financial status (56.8%), family relationships (79.4%), and personal health (79.6%) as good, while fewer rated them as average, and the smallest proportion rated them as poor. The average BMI (Body Mass Index) was 22.73±3.62. Based on BMI values and WHO recommendations, 288 (69.9%) students were of normal weight, 81 (19.7%) were overweight, 12 (2.9%) were obese, and 30 (7.3%) were underweight. The median energy expenditure was 2586.00 METs. A total of 379 students (92%) met the WHO recommendations for minimal physical activity and were in the sufficient physical activity group, while 33 (8%) were in the insufficient physical activity group.

In the sufficient physical activity category, 36.2% were male compared to 63.8% female, whereas in the insufficient physical activity category, 15.2% were male and 84.8% female, which is statistically significant (p=0.015) **(Table 1)**.

BMI was significantly higher among students with sufficient physical activity, 23.00±3.86, compared to students with insufficient physical activity, 20.84±2.01 (p<0.001) **(Table 1)**.

There were no statistically significant differences between the two categories of students in their average grades. Most students from both categories reported living in urban areas rather than rural ones. Among students with sufficient physical activity, the highest percentage live with their parents, followed by those residing in their apartment, a rented apartment, a student dormitory, or other housing conditions. Students from the category with insufficient physical activity predominantly reside in student dormitories, followed by living with their parents, with equal frequency in their own and rented apartments, and finally, in other conditions. Neither of these parameters was statistically significant. Students from both categories, in terms of financial support, are primarily supported individuals. Therefore, no significant difference was shown. Most students with sufficient physical activity reported having good financial status, while those with insufficient physical activity predominantly rated their financial status as average. In both groups, the fewest

Table 1. Demographic, socioeconomic, physical and mental health characteristics of the respondents and their physical activity

Characteristic	Insufficient physical activity N (%)	Sufficient physical activity N (%)	p-value
Gender			**0.015**
Male	5 (15.2)	136 (36.2)	
Female	28 (84.8)	240 (63.8)	
BMI (X ± SD)	20.84 ± 2.01	23.0 ± 3.86	**<0.001**
Age (X ± SD)	23.67 ± 1.06	23.66 ± 1.41	0.165
Grade average (X±SD)	8.57 ± 0.71	8.69 ± 0.84	0.228
Living area			0.230
Urban	32 (97.0)	337 (89.4)	
Rural	1 (3.0)	40 (10.6)	
Housing			0.385
Own apartment	7 (21.9)	100 (26.5)	
Rented apartment	7 (21.9)	88 (23.3)	
Student dorm	9 (28.1)	55 (14.6)	
Parents house	8 (25.0)	122 (32.3)	
Other	1 (3.1)	13 (3.4)	
Financial support			0.183
Scholarship	1 (3.1)	52 (13.8)	
Supported individual	31 (96.9)	310 (82.0)	
Personal income	0 (0)	15 (4.0)	
Other	0 (0)	1 (0.3)	
Financial status			**0.036**
Poor	3 (9.4)	15 (4.0)	
Average	16 (50.0)	142 (37.6)	
Good	13 (40.6)	221 (58.5)	
Median	2.00	3.00	
Family relations			0.304
Poor	3 (9.1)	20 (5.3)	
Average	6 (18.2)	56 (14.8)	
Good	24 (72.7)	303 (79.9)	
Median	3.00	3.00	
Personal health			0.255
Poor	1 (3.2)	15 (4.1)	
Average	7 (22.6)	48 (13.0)	
Good	23 (74.2)	305 (82.9)	
Median	3.00	3.00	
Cannabis use			**0.045**
Yes	2 (6.1)	75 (20.4)	
No	31 (93.9)	293 (79.6)	
Tobacco products use			0.257
Yes	10 (30.3)	153 (40.4)	
No	23 (69.7)	226 (59.6)	
Anxiolytic use in last 12 months			0.540
Yes	8 (24.2)	111 (29.3)	
No	25 (75.8)	268 (70.7)	
Zung Self-Rating Anxiety scale score ($\overline{X}$ ± SD)	37.80 ± 8.03	34.79 ± 8.83	0.060
PHQ-9 score ($\overline{X}$ ± SD)	5.00 (0 - 27)	4.00 (0 - 25)	**<0.001**

students reported poor financial status. These parameters were statistically significantly different (p=0.360). Perception of personal health status and family relations did not statistically significantly differ between students with sufficient and insufficient physical activity. The most students in both categories rated their family relations and personal health status as good. In contrast, the smallest number described them as poor **(Table 1)**.

Students with sufficient physical activity reported significantly higher cannabis use over the past 12 months, with 20.4% compared to 6.1% in the group with insufficient physical activity (p=0.045). They also had a statistically significantly lower score on the PHQ-9 depression scale, with the median 4.00 compared to 5.00 (p<0.001). Although students with sufficient physical activity reported somewhat more frequent use of tobacco products and anxiolytics in the past 12 months, this difference was not statistically significant. The Zung Self-Rating Anxiety Scale score for students with insufficient physical activity was 37.80±8.03, while for students with sufficient physical activity, it was 34.79±8.83. The difference was not statistically significant **(Table 1)**.

Multivariate logistic regression analysis showed an association between the PHQ-9 depression scale score (OR: 1.07, 95% CI: 1.01-1.15), body mass index (OR: 0.81, 95% CI: 0.69-0.95) and financial status (OR 0.51, 95% CI: 0.27-0.96) with insufficient physical activity **(Table 2)**.

Table 2. Multivariate logistic regression analysis with insufficient physical activity as outcome variable

Characteristic	OR (95% CI)
Gender	
Male	0.73 (0.35 – 2.18)
Female	1.0 reference category
BMI	**0.81 (0.69 – 0.95)**
Cannabis	
Yes	0.36 (0.08 – 1.64)
No	1.0 reference category
PHQ-9 score	**1.07 (1.01 – 1.15)**
Financial status	**0.51 (0.27 - 0.96)**

DISCUSSION

The aim of this study was to examine the frequency of insufficient physical activity, as well as lifestyle and mental health factors associated with it among medical students. The findings revealed that 92% of fifth-year students at the Faculty of Medicine, University of Belgrade, met the WHO recommendations for sufficient physical activity. Although, as univariate models, female gender, poorer financial status, greater use of cannabis, as well as higher BMI and PHQ-9 score were significantly associated with physical inactivity, as multivariate models, only poorer financial status, higher BMI and PHQ-9 score showed significant association.

Given the numerous benefits of physical activity, the finding that only 8% of medical students engage in insufficient physical activity is highly encouraging. Results from other studies on this topic vary. Studies with similar results (7, 8, 13) offer a potential explanation that medical students have better knowledge regarding health, healthy lifestyle, and physical activity and their importance, which leads them to be more focused on their own health (21). Martinović et al. (22) report that more than half of biomedical science students in Split, Croatia have a satisfactory level of physical activity, which can partly be attributed to their desire to achieve a popular physical appearance and aesthetics. In contrast, some studies (23-26) highlight a significantly higher prevalence of physical inactivity and unhealthy eating among medical students, primarily due to lack of time, stress, and demanding schedules (3). Such differences may be attributed to variations in study methodology as well as differences between participants and university environments (10). When evaluating the methodology, it is essential to consider whether physical activity levels were self-reported—an approach that can be subjective and somewhat inaccurate—or measured using a more objective tool. While a large number of studies which used the self-reporting method showed a fairly high percentage of students with sufficient physical activity (7, 8, 13, 21, 22), a study from Nigeria (26) which monitored physical activity levels of each participant using the actigraph accelerometer activity monitor showed fewer promising results, i.e., a lower percentage of students with sufficient physical activity. Another possible explanation for these differences is highlighted in a study from Bahrain (24), which suggests that limited access to exercise facilities at universities may contribute to student inactivity. Additionally, socio-cultural factors, including restrictions imposed by some families on female students' participation in physical activity, further exacerbate inactivity among women. Moreover, a Saudi Arabian study argues that even college location and the nature of studies can contribute to different results. This study found that students who attended College for Emergency Medical Services situated off the main campus were more physically active than their peers who attended the College of Applied Medical Studies of the same University located within the main campus (10).

A statistically significant difference in physical activity was observed between genders, with males being more physically active. In contrast to varying results among studies on physical activity levels among medical students, research on this topic shows consistency with our results. Through a study conducted in Poland (7) it has been shown that female students (77.97%) have higher frequencies of sedentary activities, as well as lower levels of physical activity compared to their male companions. Similarly, another study from India displayed that male students (39.8%) were significantly more active than female students (20.6%) (27). Romero-Blanco et al. (28) suggest that this difference arises from different motivational factors between genders, as well as greater environmental influence on males (social pressure, competition). Generally, men show significantly higher intrinsic motivation based on a desire to achieve mastery, social recognition, strength, and endurance. They are also more motivated by competition and challenge than women are (29). In addition, society's views and expectations regarding traditional male and masculine attributes could also have an impact. One research revealed that, the majority of young Western adult males wish to increase their muscularity levels to attain the perceived social, sexual, and personal benefits associated with the physique (30). On the other hand, in some studies, women expressed that they feel intimidated while exercising in front of others, especially men, as well as that the exercise facilities are often more tailored towards the needs of men, thus making them feel unwelcome (31).

Among students with sufficient physical activity, the average BMI was statistically significantly higher. However, other studies did not show a statistically significant difference or that individuals with lower BMI have higher levels of physical activity (32, 33). Our results could be explained by the assumption that students with higher

BMI may engage in more physical activity in an effort to reduce body weight and achieve their desired physical appearance and optimal health. Additionally, BMI does not account for body composition, so a higher index could also be related to increased muscle mass in physically active students. Therefore, a more precise analysis should include body composition.

Students with sufficient physical activity significantly more often reported good financial status, whereas students with insufficient physical activity more often reported average or poor financial status. These results are consistent with the ones shown in a study conducted by Grujičić et al. (5). A potential explanation for these results is the fact that people with poorer financial status do not possess resources for gyms, adequate sports equipment and sport activities which require financial investments. Moreover, some universities, including the ones of the Western Balkans often do not provide programmes that would enable free sports centers for all students, thus preventing adequate participation of students with poorer financial status in physical activities (5).

In our study, there was no statistically significant difference in terms of type of settlement, housing, financial status, family relations, and average grades between students with sufficient and insufficient physical activity. However, some studies have shown a positive correlation between above-average financial status, urban area, good family relations, support, higher grades, and higher levels of physical activity (11, 34).

Consistent with the well-documented positive effects of physical activity on mental health and depression (35–38), our study found that students with sufficient physical activity had lower PHQ-9 scores, indicating fewer symptoms of depression compared to those with insufficient activity. Sloan et al. (39) consider physical activity a significant protective factor against depression, poor sleep quality, and psychopathological symptoms. This claim is also supported by population-based observational studies, which have shown that physically active people were nearly 45% less likely to suffer from depressive symptoms than inactive people (40). Given these results, it is clear how important an active lifestyle is throughout life, especially during the vulnerable period of college education (11). Although there is evidence that physical inactivity increases the likelihood of anxiety by 1.75-2 times, anxiety did not show a statistically significant difference in our study (40).

Although cannabis use was higher among students with sufficient physical activity, there was no statistically significant association in multivariate logistic regression. Additionally, there was no statistically significant difference in tobacco use and anxiolytic use.

This study had several limitations. Primarily, it was a cross-sectional study, and therefore causal relationships between parameters cannot be inferred. The research instrument was a self-reported questionnaire, which introduces potential subjectivity and varying interpretations of certain questions. Also, participants were students from one year at one faculty, and there was a large difference in the size of the physically active and inactive groups, so the results cannot be generalized. Given these considerations, future studies should incorporate more objective measures of physical activity, such as sports watches, step counters, and physical fitness tests. Additionally, including students from different years of study and various universities could help identify factors that promote or hinder physical activity. Longitudinal research following a cohort of students from their first to final year of study would also provide valuable insights into changes in physical activity over time.

CONCLUSION

The majority of fifth-year students at the Faculty of Medicine in Belgrade have a sufficient level of physical activity. In this sample, physical inactivity was significantly associated with lower BMI, more pronounced symptoms of depression and poorer financial status. Therefore, it is important to emphasize the role of physical activity as a protective factor against depression. Bearing in mind the positive impact of physical activity on physical, mental and social well-being, we should strive to create an environment which will further enable and encourage physical activity and healthy lifestyle habits among students, especially medical students, as they represent one of the key pillars of our healthcare system.

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MENTALNO BLAGOSTANJE STUDENATA MEDICINE: ČINE LI STILOVI ŽIVOTA I FIZIČKA AKTIVNOST RAZLIKU?

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Sažetak

Uvod: Životni stil, koji obuhvata navike u ishrani, fizičku aktivnost, spavanje, pušenje i konzumiranje alkohola između ostalih faktora utiče na zdravlje pojedinca, ali i populacije u celini. Studenti medicine često imaju suboptimalan nivo fizičke aktivnosti i nezdrave životne navike, što može uticati na njihovo blagostanje i buduću medicinsku praksu. Cilj ovog istraživanja bilo je ispitivanje učestalosti nedovoljne fizičke aktivnosti i faktora stila života povezanih sa njom među studentima pete godine Medicinskog fakulteta Univerziteta u Beogradu, kao i njihovog međusobnog uticaja na fizičko i mentalno zdravlje studenata. **Metode:** Studija preseka je sprovedena među studentima pete godine Medicinskog fakulteta Univerziteta u Beogradu tokom jedne nedelje na vežbama iz Socijalne medicine u novembru 2023. godine. Instrument istraživanja bio je upitnik koji su studenti anonimno popunili. Studija je uključila 432 učesnika, sa obuhvatom od 90,4%. Ispitivani su: fizička aktivnost, karakteristike stila života, simptomi depresivnosti i anksioznosti. Na osnovu energetske potrošnje studenti su bili podeljeni u kategorije sa dovoljnom i nedovoljnom fizičkom aktivnošću.

Rezultati: Ukupno 379 studenata (92%) bilo je u grupi sa dovoljnom fizičkom aktivnošću, dok je njih 33 (8%) bilo u grupi sa nedovoljnom fizičkom aktivnošću. Multivarijantnom logističkom regresijom pokazana je značajna povezanost fizičke neaktivnosti sa manjim BMI (OR: 0,81, 95% CI: 0,69-0,95) i izraženijim simptomima depresije (OR: 1,07, 95% CI: 1,01-1,15) i lošijim finansijskim statusom (OR: 0,51, 95% CI: 0,27-0,96).

Zaključak: Većina ispitivanih studenata je dovoljno fizički aktivna. Fizička neaktivnost bila je značajno povezana sa manjim BMI, izraženijim simptomima depresije i lošijim finansijskim statusom.

Ključne reči: fizička aktivnost, stilovi života, gojaznost, mentalno zdravlje, studenti medicine

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