PHYSICAL ACTIVITY AND MENTAL HEALTH OF MEDICAL STUDENTS

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SUMMARY

Objective: Medical students usually do not meet the recommendations on the minimum level of physical activity, despite knowing the impact that physical activity has on the prevention and treatment of various diseases. Medical students are considered to be insufficiently physically active. The aim of this study is to determine the prevalence of physically active fifth-year medical students at five universities in Serbia, as well as to identify factors associated with insufficient physical activity of students.

Methods: A cross-sectional study was performed in the population of fifth-year medical students from five different universities in Serbia. The research instrument was a questionnaire specially designed based on similar research. Descriptive and analytical statistics methods were used in statistical analysis.

Results: The study included a total of 573 fifth-year medical students from five universities in Serbia: 311 (54.3%) Belgrade; 86 (15.0%) Kragujevac; 58 (10.1%) Nis; 66 (11.5%) Kosovska Mitrovica; 52 (9.1%) Novi Sad. Insufficient physical activity was statistically significantly associated with studying at the University of Kosovska Mitrovica (OR = 3.98, 95% CI: 1.83–8.57). There was a statistically significant difference in the frequency of anti-anxiety medications use in the last 12 months between students with sufficient and insufficient physical activity ($p = 0.040$) as well as in the average number of cigarettes smoked per day between students with sufficient and those with insufficient physical activity (2.82 ± 6.35 vs. 4.50 ± 8.29, $p = 0.043$). There was also a statistically significant difference in the average score on the Beck's depression scale between students with sufficient and students with insufficient physical activity (6.51 ± 6.59 vs. 10.03 ± 9.37, $p < 0.001$) and in the average score on Zung's anxiety scale (34.86 ± 8.18 vs. 38.07 ± 8.71, $p = 0.003$).

Conclusion: A high percentage of medical faculty students (86.6%) are physically active. Differences in the level of physical activity were observed between students of these five universities as well as between students with different levels of physical activity.

Key words: medical students, physical activity, level of physical activity, mental health

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INTRODUCTION

According to the World Health Organization (WHO) recommendations, adults aged 18–64 should perform at least 150–300 minutes of moderate-intensity aerobic physical activity or at least 75–150 minutes of high-intensity aerobic physical activity or an equivalent combination of moderate- and high-intensity activity during the week (1). Also, these recommendations state that moderate or higher intensity strength training that includes all major muscle groups two or more times per week provides additional health benefits (1).

The population failing to meet these recommendations falls in the category of insufficient physical activity, which is a risk factor for development of numerous chronic non-communicable diseases (2).

Globally, one in four adults does not meet recommended levels of physical activity. If the global population were more active, up to 3.2 million deaths per year could be prevented (2). People who are insufficiently active have a 20% to 30% higher risk of death compared to people who are sufficiently active (2).

Regular physical activity has been proven to help prevent and manage non-communicable diseases such as heart disease, stroke, diabetes, and several cancers (3). It also helps prevent hypertension, maintain a healthy body weight, and can improve mental health, quality of life, and well-being (3).

Research has shown that physical activity is effective for improving anxiety symptoms in all age groups (4). Several plausible physiological mechanisms may explain these results, including the neuroendocrine, anti-inflammatory, and antioxidant effects of physical activity (5). In addition to physiological effects, there are behavioural, social, and psychological mechanisms involved in symptom relief (4). All things considered, physical activity appears to be an effective alternative treatment for anxiety symptoms in patients with or without diagnosed anxiety disorders. In addition to improving anxiety symptoms, physical activity appears to provide protective effects on incident depression as well as symptom

reduction for people with depression (6). However, evidence for the beneficial effect of physical activity interventions on the prevention of depression varies significantly in different studies (6, 7). These differences may be explained by the heterogeneity of the study population and the type of exercise. Considering the significant individual and also the burden of depression on the whole society, there is an urgent need to identify risk factors that could be changed. It is increasingly clear that lifestyle, including physical activity, can be a useful strategy for treating depression, reducing depressive symptoms, and improving quality of life.

Young people between the ages of 18 and 35 are at risk of a sedentary lifestyle. This is a transitional period during the life course, considering that rapid and significant changes occur in the lives of young people, in the sense of transitioning to university education, becoming financially independent, establishing romantic relationships, and assuming responsible roles as productive and engaged community members between other. Probably because of all those new stressors, young people in this period notice an increase in body weight (8), while physical activity is significantly reduced (9).

Studying very often implies independence from parents, which often brings new changes in the way of eating, but also a low level of physical activity during the period of study (10). The period of late adolescence and early adulthood is vital for the development of healthy lifestyle habits (11), given that the prevalence of achieving the recommended level of physical activity decreases rapidly after the age of 24, and the greatest decline is seen at the beginning of the studies (12).

For medical students in particular it could be suggested that a healthy lifestyle, including regular physical activity, is very important due to the ever-present stress, obligations and new fast-paced lifestyle, as well as the future of the patients they will be working with, where primarily future doctors will be a role model and theoretically explain all the health-related benefits of physical activity. In addition, it has been proven that physically active medical doctors give advices and recommendations on patients' physical activity more often.

The physical activity of the University of Belgrade students was examined indirectly as part of research on the quality of life, where only the frequency of engaging in physical activity was examined (13). This research showed that slightly more than a third of students do not engage in any form of physical activity at all or only occasionally, while only 28% of students regularly engage in some physical activity.

Another study, in the 2016/2017 school year with a sample of 4,019 students at the University of Belgrade, using the International Physical Activity Questionnaire short form (IPAQ-SF), showed that male students are more active than female students (14). Additionally, the most active on a weekly basis were students of the fourth year of natural and mathematical sciences (4.20 days), while on daily basis it was female students of the first year (161 min). On the other hand, the most sedentary were female students of the third year of medical sciences (475 minutes of sitting per day) (14).

The aim of this research was to examine the frequency of insufficient physical activity among students in the fifth year of medical faculties at five universities in Serbia, as well as to examine the factors associated with insufficient physical activity among students in the field of social determinants of health, lifestyle and characteristics of mental health (score on the scales depression and anxiety).

MATERIALS AND METHODS

A cross-sectional study, which included 573 fifth-year students of medical faculties at five universities in Serbia (Belgrade, Kragujevac, Niš, Novi Sad, and Kosovska Mitrovica), was conducted during the last week of December 2019. The overall response rate was 54.06% (573/1,060).

The research instrument was a questionnaire that was created based on questionnaires used in similar research (15–17). The questionnaire consisted of 75 questions, grouped into five units: social-demographic and socioeconomic characteristics, lifestyle, physical activity, Beck's Depression Inventory (15), and Zung's Anxiety Scale (16).

Among the socio-demographic and socioeconomic characteristics examined were sex, body weight, body height, age, place of residence, type of settlement, housing, means of subsistence during studies, relationship status, self-assessment of health, family relationships, financial situation, and average grades during studies. Among lifestyle characteristics, time spent studying during the day, time spent watching TV programmes, time spent on social networks, sleep time, number of meals, alcohol consumption, heavy episodic drinking, type of alcoholic beverages, use of cannabis, anti-anxiety medications, and smoking were examined.

Body mass index (BMI) was calculated as the ratio between body weight and the square of body height expressed in meters.

The level of physical activity was examined with the use of the International Physical Activity Questionnaire (IPAQ) (17), which was previously used and validated in Serbian (18). This questionnaire consists of six questions, and the total energy consumption is recalculated based on the number of days spent in vigorous physical activity, moderate physical activity and walking during the previous seven days and the average time spent in each activity (17). Total energy consumption is expressed in MET-minutes/week.

Energy consumption = energy consumption in intense physical activity + energy consumption in moderate physical activity + energy consumption during walking.

Energy consumption in intense physical activity = 8* number of days spent with intense physical activity* number of minutes in intense physical activity.

Energy consumption in moderate physical activity = 4* number of days spent with moderate physical activity* number of minutes in moderate physical activity.

Energy consumption while walking = 3.3* number of days spent walking* number of minutes walking.

Students were classified into two groups on the basis of energy consumption based on WHO recommendations on minimum physical activity: group with insufficient physical activity (energy consumption less than 600 MET-minutes/week) and a group with sufficient physical activity (energy consumption with more than 600 MET-minutes/week).

The Beck's Depression Inventory is one of the most commonly used instruments for self-assessment of depressive symptoms. The questionnaire consists of 21 questions referring to the last seven days. This questionnaire has shown good internal consistency,

and it takes about 10 minutes to complete (15). The score on the Beck' Depression Inventory ranges from 0 to 63.

The Zung's Anxiety Scale consists of twenty questions that measure anxiety symptoms during the previous seven days. Responses are presented on a four-point Likert scale and range from 1 – never or rarely to 4 – most of the time. The total score on the scale varies from 20 to 80, and scores above 45 indicate the presence of anxiety (16).

Students were asked to fill out an anonymous questionnaire during exercises in the course Social Medicine. All students received information about the study and its objectives. We considered that all students who filled out and returned the questionnaire gave their consent to participate in the research. The research was approved by the Ethics Committee, Faculty of Medicine, University of Belgrade (No. 1322/V-17).

A total of 17 variables were analysed: university, type of settlement, sex, body mass index, grade point average during studies, relationship status, financial situation, family relations, health status, alcohol consumption, use of anti-anxiety medications during the last 12 months, number of cigarettes per day, number of hours spent on social networks during the day, hours of sleep per day, score on the Beck's Depression Inventory, score on the Zung's Anxiety Scale, and total energy consumption measured by the International Physical Activity Questionnaire. The significance of the difference in the frequency of qualitative variables was examined with the Chi-square test. The significance of the difference between normally distributed continuous variables was tested using Student's t-test. All variables that proved to be significant (significance level $p < 0.005$) were included in a multivariate logistic regression model with insufficient physical activity as the outcome variable. Statistical analysis was performed in the statistical program SPSS for Windows 22.0.

RESULTS

A total of 573 fifth-year students of medical faculties from five universities in Serbia were included in the study: 311 (54.3%) Belgrade; 86 (15.0%) Kragujevac; 58 (10.1%) Niš; 66 (11.5%) Kosovska Mitrovica; 52 (9.1%) Novi Sad.

The average age of the participants was 23.86 ± 1.83 years, the energy consumption of all students included in the study was 2,501.88 ± 3,933.76 MET-minutes/week, the average score on the Zung's Anxiety Scale was 35.39 ± 8.41/80, the average score on the Beck's Depression Inventory was 7.10 ± 7.21/63, and the average BMI was 22.63 ± 3.20 kg/m^2.

A total of 547 students had complete data on physical activity, 73 (13.3%) students had an energy consumption of < 600 MET-minutes/week and were classified as having insufficient physical activity, while the rest of the students were in the group with sufficient physical activity: 347 (63.4%) had a moderate level of physical activity while 127 (23.2%) of them had a high level of physical activity.

A statistically significant difference was observed in the frequency of insufficient physical activity between students of different universities. The characteristics of students with sufficient and insufficient physical activity are presented in Table 1.

A statistically significant difference was observed in the frequency of anti-anxiety medications use in the last 12 months between students with sufficient and insufficient physical activity ($p = 0.040$). A statistically significant difference was observed in the average number of cigarettes smoked per day between students with sufficient and those with insufficient physical activity (2.82 ± 6.35 vs. 4.50 ± 8.29, $p = 0.043$). A statistically significant difference was observed in the average score on the Beck's Depression Inventory between students with sufficient and students with insufficient physical activity (6.51 ± 6.59 vs. 10.03 ± 9.37, $p < 0.001$). A statistically significant difference was observed in the average score on the Zung's Anxiety Scale (34.86 ± 8.18 vs. 38.07 ± 8.71, $p = 0.003$). The lifestyle characteristics of students with sufficient and insufficient physical activity are shown in Table 2.

Multivariate logistic regression analysis with insufficient physical activity as an outcome variable showed that insufficient physical activity was statistically significantly associated with studying at the University of Kosovska Mitrovica (OR = 3.98, 95% CI: 1.83–8.57), and with score on Beck's Depression Inventory (OR = 1.05, 95% CI: 1.01–1.10) (Table 3).

DISCUSSION

The total percentage of sufficiently physically active fifth-year medical school students from five universities in Serbia (Belgrade, Kragujevac, Niš, Kosovska Mitrovica, Novi Sad) was 86.6%. Regular physical activity during the transition period from youth to adulthood represents the essential basis of the life model of adults (19). In this regard, it is encouraging that in our study the level of physical activity was high among all groups of students. This result is not in accordance with a study conducted by Marques et al., which indicates that a large percentage of students from all over Europe do not meet the minimal recommendations for physical activity for their age group (20). Potential reasons for such differences in results are because the mentioned study included a much larger number of respondents from different countries and different universities, while only medical students were included in ours.

Insufficient physical activity was statistically associated with studying at the University of Kosovska Mitrovica. This result can be explained by the specificities of situation in Kosovska Mitrovica. It is important to note that physical activity can actually be successfully incorporated in the populations living in post-conflict areas and is commonly considered as an effective intervention for improving mental health, although there is not enough evidence to support this (21). When it comes to other characteristics of the students, such as type of settlement, sex, relationship status, financial situation, family relationships, and health status, the differences were not statistically significant, although it is worth mentioning that students with a good health status had a higher frequency of sufficient physical activity of those who stated that they have a poor or average health condition. Although, as previously mentioned, the difference is not statistically significant, the interesting fact is that students with bad family relationships were percentage-wise more active than students with average or good financial conditions. Few studies have considered the influence of family factors on the level of physical activity of adolescents. For example, it can be observed that children from wealthier families from almost all countries are more satisfied

Table 1. *Characteristics of students with sufficient and insufficient physical activity*

Characteristics	Sufficient physical activity n (%)	Insufficient physical activity n (%)	p-value
University			
Belgrade	266 (56.1)	33 (45.2)	**0.009**
Kragujevac	74 (15.4)	12 (16.4)	
Nis	52 (11.0)	4 (5.5)	
Kosovska Mitrovica	43 (9.1)	16 (21.9)	
Novi Sad	39 (8.2)	8 (11.0)	
Type of settlement			
Urban	426 (90.6)	65 (89.0)	0.666
Rural	44 (9.4)	8 (11.0)	
Sex			
Male	156 (33.3)	28 (38.4)	0.393
Female	313 (66.7)	45 (61.6)	
BMI, mean (SD)	22.53 (3.16)	23.18 (3.49)	0.109
Average grade, mean (SD)	8.69 (0.75)	8.50 (0.79)	0.051
Relationship status			
In relationship	229 (48.3)	32 (43.8)	0.476
Single	245 (51.7)	41 (56.2)	
Material condition			
Bad	27 (5.7)	2 (2.7)	0.572
Average	205 (43.2)	32 (43.8)	
Good	242 (51.1)	39 (53.4)	
Family relationships			
Good	25 (5.3)	1 (1.4)	0.261
Average	66 (14.0)	13 (17.8)	
Bad	382 (80.8)	59 (80.8)	
Health condition			
Bad	14 (3.0)	3 (4.2)	0.156
Average	77 (16.3)	18 (25.0)	
Good	380 (80.7)	51 (70.8)	

Numbers in bold indicate statistically significant values.

Table 2. *Lifestyle and mental health of students with sufficient and insufficient physical activity*

Characteristics	Sufficient physical activity n (%)	Insufficient physical activity n (%)	p-value
Alcohol consumption			
Yes	412 (87.1)	59 (80.8)	0.147
No	61 (12.9)	14 (19.2)	
Anti-anxiety medications in the last 12 months			
Yes	381 (80.4)	51 (69.9)	**0.040**
No	93 (19.6)	22 (30.1)	
Number of cigarettes per day, mean (SD)	2.82 (6.35)	4.50 (8.29)	**0.043**
Hours per day on social networks, mean (SD)	2.48 (2.01)	3.02 (4.24)	0.077
Hours of sleep per day, mean (SD)	7.11 (1.39)	6.76 (2.01)	0.063
Score on Beck's inventory, mean (SD)	6.51 (6.59)	10.03 (9.37)	**0.001**
Score on Zung's scale, mean (SD)	34.86 (8.18)	38.07 (8.71)	**0.003**

Numbers in bold indicate statistically significant values.

Table 3. *Multivariate logistic regression analysis with insufficient physical activity as outcome variable*

Characteristics	OR (95% CI)
University	
Belgrade (reference category)	1.0
Kragujevac	1.31 (0.61–2.79)
Nis	0.71 (0.23–2.16)
Kosovska Mitrovica	**3.98 (1.83–8.57)**
Novi Sad	1.47 (0.58–3.65)
Anti-anxiety medications in the last 12 months	
Yes	1.88 (0.97–3.59)
No (reference category)	1.0
Number of cigarettes per day	1.01 (0.98–1.05)
Score on Beck's inventory	**1.05 (1.01–1.10)**
Score on Zung's scale	0.99 (0.95–1.04)

Numbers in bold indicate statistically significant values.

with their lives and are also more physically active (22). In addition, a Chinese study involving high school students found that families who are actively involved in children's physical activity exert the most significant influence on children's attitudes toward physical activity (23).

In our study, the difference in the average value of BMI and the average grade was not statistically significant. The results of our research are not consistent with the results of previous studies that suggest that increased physical activity and physical fitness can improve academic performance (24) and help reduce body weight (8). According to our research, sufficiently physically active students did not have a significantly higher average study grade, nor a lower BMI than their peers who were insufficiently physically active. Potential reasons why there are no significant differences in BMI between sufficiently physically active and insufficiently physically active students may be genetic factors, dietary habits, hydration, and sleep (25). When it comes to the average study grade, genetic factors as well as certain personality traits play a very big role.

When it comes to lifestyle and mental health, physical activity levels play a crucial role. Students with insufficient physical activity had a lower frequency of anti-anxiety medications use in the last 12 months and a higher average number of cigarettes smoked, however, the difference was not significant in multivariate logistic regression.

Anti-anxiety medications could be a great danger because it has been shown that a high percentage of doctors in the USA and Europe abuse these medications (26). Medical students are a very sensitive population when it comes to the development of addiction, due to relative social isolation during their studies, but also due to high demands and a large number of obligations at the faculty of medicine (26).

For every point increase of the score on the Beck's Depression Inventory, there was a 5% higher likelihood that the participants will be insufficiently active. Medical students are exposed to high levels of stress that can have a negative impact on mental health. Physically active people are 45% less likely to have symptoms of depression (27). People who report being inactive over a four-year period have a 22% higher risk of developing depression (27). Taking everything into account, we can say that the results obtained in this research are in line with other studies, which indicate that more physically active students are less likely to suffer from symptoms of depression (27). Public health interventions to increase physical activity among medical student are crucial in order to sustain and maintain a good mental and physical health. The interventions should be based on cognitive-behavioural strategies for behaviour change (26). These strategies aim to change the way an individual thinks about himself, his behaviour, the environment, as well as ideas on how to change behaviour patterns (26). Since the burden of mental illnesses is among ten highest causes of disability-adjusted life-years worldwide in 2019, accounting for 16% of all DALYs, all interventions with the possibility for reducing this burden hold an important public health role (28). One of the strengths of this research is that it represents a study that evaluated the level of physical activity of students of the same faculty, at all universities in Serbia as well as how the various characteristics of those students, their lifestyle and mental health are associated to their studies. This research also has several limitations. The first of these is that the results cannot be generalized to the entire student population, given the low response rate in addition to the fact that only medical faculty students participated. Second, since it is a cross-sectional study, it is not possible to establish a causal relationship between the variables. Third, although the questionnaire is anonymous, it is possible that the respondents did not want to share some information with the researchers. Finally, it is important to note that due to the nature of the questionnaire, recall bias is possible.

CONCLUSION

A high percentage of Medical Faculty students from five universities in Serbia (Belgrade, Kragujevac, Niš, Kosovska Mitrovica, Novi Sad) are physically active. This result is not in accordance with the majority of the studies on the subject. Differences in the level of physical activity were observed between students of these five different universities as well as between students with different levels of physical activity. Students from the university of Kosovska Mitrovica were more likely to have insufficient levels of physical activity.

When it comes to other characteristics of the students, such as the type of settlement, sex, relationship status, financial situation, family relations, and health status, the differences were not statistically significant.

Students with sufficient physical activity had a lower likelihood for higher score on the Beck's Depression Inventory. The high possibility of physical activity to work as an intervention for improvement of mental health in this population, should be more thoroughly investigated.

Conflicts of Interest

None declared

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