Physical activity and supplement use among medical students

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KEYWORDS

physical activity, food supplements, medical students, academic performance, average grade.

ABSTRACT:

Background: Continuous physical activity among students boosts the immune system, which keeps them healthy, reduces students' stress and improves their concentration and academic success. Food supplements help maintain students` health and boosts academic performance by filling nutritional gaps, particularly when eating habits are poor.

Objective: The aim of this study is to evaluate physical activity levels, the prevalence of food supplement use among medical students, in order to further analyze the impact on their academic performance.

Methods: This descriptive cross-sectional study was carried out between October to November 2024 with a random sample of 215 undergraduate medical students at the University of Prishtina. A self-administered questionnaire was completed with the sociodemographic and anthropometric data, items regarding their physical activity, food supplement use and the average grade achieved so far.

Results: Two hundred and fifteen medical students participated in this study. Mean age was 21 years old, 69% were female and 31% male. The average grade of students was 8.31. Most of them were non-smokers (86%), with an average BMI of 22.80. One hundred and sixteen participants reported using food supplements and 99 did not use. One hundred and seventy-two participants reported that they practice physical activity and 43 did not practice.

Conclusion: Physical activity was positively associated with food supplements and student grades. This indicates that students who practice physical activity are more likely to use food supplements and have better grades. There is a relationship between physical activity and students` grades, but not between food supplements and students` grades.

INTRODUCTION

Physical activity is thought to have a very positive impact on preventing chronic diseases, and even plays a very protective and improving role in the overall quality of life. It strengthens the heart and increases blood circulation, thereby reducing the risk of cardiovascular diseases; regulates body weight by burning calories and keeping the metabolism healthy; improves muscles and increase bone density, which reduces the chances of osteoporosis in later years (Ignarro et al., 2007).

Continuous physical activity among students boosts the immune system, which keeps them healthy. This would also be relevant in improving sleep quality, which affects their energy level and, therefore, affects academic performance. Regular exercise reduces students' stress and anxiety and improves their mood and self-confidence, reducing symptoms of depression, by increasing serotonin and dopamine levels, while decreasing cortisol levels. Regular physical activity increases blood flow to the brain and reduces mental fatigue, which improves memory and concentration, thus improving academic success (Rebar et al., 2015).

While physical inactivity can lead to poor health, with the potential for developing chronic diseases in the future, where weight gain and obesity are also a result of lack of physical activity (Booth et al., 2008).

Food supplements can help maintain student health and boost academic performance by filling nutritional gaps, improving cognitive function, and supporting overall well-being, particularly when eating habits are poor or dietary restrictions are in place (Ames, 2001).

These products typically include vital vitamins and minerals that boost immunity, lowering the chances of illnesses that can disrupt studies. Nutritional support from food supplements helps maintain energy production and metabolic functions, enabling students to remain active and focused. Additionally, they help alleviate stress and anxiety, enhancing emotional well-being. Furthermore, they assist with memory, concentration, and cognitive performance, promote better sleep, and enhance mental alertness, all of which are crucial for effective cognitive functioning and academic success. They also support bone strength, especially important for students who have a sedentary lifestyle. Furthermore, they can protect against long-term oxidative stress and chronic diseases (Burrows et al., 2017; Sundgot-Borgen et al., 2022).

However, supplements should enhance, not substitute, a whole foods diet. They should be used with caution and as part of a balanced lifestyle that includes a healthy diet, regular exercise, and adequate sleep. The benefits of supplements may vary depending on individual needs and health issues, so before using it's best to seek advice from a professional (Hathcock et al., 2007).

The aim of this study is to evaluate physical activity levels, the prevalence of food supplement use among medical students, in order to further analyze the impact on their academic performance.

MATERIALS AND METHODS

Study design

This descriptive cross-sectional study was carried out over a four-week period from October to November 2024 at the University of Prishtina, a public university situated in Prishtina, Kosova.

Participants

The study included undergraduate students from the Faculty of Medicine at the University of Prishtina. They were informed about the study's purpose and their right to refuse or withdraw without any consequences. Those who agreed to participate completed a self-administered questionnaire about physical activity and food supplement use.

The questions about physical activity and fitness were adapted from the PAQ questionnaire. At the same time, the response options were also adapted as in the questionnaire mentioned above (PAQ, 2009). Meanwhile, the questions and response options regarding the use of food supplements were adapted from the EFNEP-20Q questionnaire (EFNEP, 2017).

To ensure clarity for the participants, all modified items and the questionnaire were translated into Albanian. Finally, before its distribution, the questionnaire was thoroughly reviewed and validated by all the authors of this study.

A random sample of 215 medical students (male and female), mean age 21 (age range 18-30), completed the questionnaire and participated in the survey. The survey included questions about types of physical activity, intensity, and frequency per week, use of food supplements, types and reasons for use, and academic performance based on their average grade.

Selection criteria

Only full-time undergraduate students from the Faculty of Medicine at the University of Prishtina were eligible to participate in this study, regardless their year of study.

Data collection

The questionnaire was shared online and completed by medical students voluntarily over a four-week period from October to November 2024. All data remained anonymous and confidential. Researchers explained the purpose of the survey and how the responses would be handled to students from each year, ensuring the confidentiality of their information.

Research instruments

The questionnaire contains 28 questions, which are related to physical activity and fitness, as well as the use of food supplements of medical students. The questionnaire consists of three parts. In the first part, questions are presented for data related to gender, age, weight, height, place of residence, the year of study and the average grade achieved so far. In the second part, questions are presented regarding physical activity. While in the third part, there are questions regarding the use or not of food supplements and their types.

Sociodemographic Data

The following sociodemographic data collected included age, sex (female/male), place of residence (urban/rural), and income class, which was based on three levels: low (200-449 Euro), middle (450-699 Euro), and high (>700 Euro). Further the year of study (1-5) and general grade average (6-10) were recorded.

Anthropometric and Medical Data

Anthropometric and medical data included smoking status, hours of sleep, weight, height, and body mass index (BMI), which were then compared to World Health Organization (WHO) standards for the European population (Weir & Jan, 2023). Regarding the sleep data, they were compared according to the prescriptions of the American Academy of Sleep Medicine and prescriptions from the Sleep Research Society (Watson et al., 2015).

Physical activity Data

The questionnaire included 6 questions regarding physical activity that students were required to complete. Through the answers to these questions, we tried to find out the level of physical activity that they practice. For the first four questions, which required knowing the intensity and frequency of physical activity, the answer options were from 0-7 days, which means that the more days, the more physical activity. While the last two questions allow us to understand whether students walk or cycle and how much time they spend walking or cycling, where the answer options for these two questions were from 0 - over 5 hours, which means that the more hours, the more physical activity.

Food supplements Data

Data on the use of food supplements included information about the type and reason for consuming these products. Responses of the question about the type of food supplement use, were vitamins, minerals, fish oil, probiotics, multivitamin and multimineral, proteins, other and none. Regarding the reasons for using food supplements responses were to strengthen immunity, to improve athletic performance, against fatigue, to lose weight, to build/strengthen muscles, and other. The responses were varied, but allowed us to have a clearer picture about these consumptions and about students' point of view for these products.

Statistical analysis

For the descriptive analysis, we calculated *percentages* as well as *mean* results and *standard deviation* (SD) for the distribution of variables (see Tables 1, 2, and 3). To assess the relationship between physical activity, food supplements, and students' grades, we used Pearson's *r* correlation coefficient (see Table 4 for the correlation coefficients). Finally, we employed multivariate

regression to determine the links between physical activity, food supplements, and students' grades. The significance level for the different analyses was established as $p < 0.05$. The data analysis was performed using SPSS Statistics for Windows, version 24.

Ethical Clearance

The Ethics Committee at the Faculty of Medicine, University of Pristina "Hasan Prishtina" has approved the protocol for this study and has affirmed that the research fully complies with the principles stated in the Declaration of Helsinki regarding research on human subjects.

RESULTS

Two hundred and fifteen medical students participated in our study (see Table 1). Mean age of students was 21 years old (age range 18-30), most of them were female 69%, and male 31%, reflecting the gender structure of the students in medical faculty. Twenty-one participants or 10% were first year students, 24 or 11% were second year students, 67 or 31% were third year students, 43 or 20% fourth year students, and 60 or 28% fifth year students. 163 or 76% of students were from urban and 52 or 24% were from rural areas. The average grade of students was 8.31 in a scale of 5-10, mean weight 67.32 kg, and mean height 171.34 cm, with an average BMI of 22.80. Most of the participants were non-smokers (185 or 86%) and on average slept about 7 hours per day. Among the smokers, about 2% reported to smoke less than 5 cigarettes per day, about 5% 5-10 cigarettes per day and with similar percentage 10-20 cigarettes per day, and 3% above 20 cigarettes per day. One hundred and sixteen participants or 59% reported using food supplements and 99 or 41% did not use food supplements. One hundred and seventy-two participants or 80% reported that they regularly practiced physical activity and 43 or 20% did not practice physical activity. Next, we asked students about food supplements that they consume and the main reasons for consuming it (see Graphs 1a and 2a for their reports).

Next, we asked participants about the physical activity and majority of them reported to have practice physical activity. Specifically, 20% reported to have never practice physical activity, 24% once per week, 30% 2-3 times per week, 20% 4-5 times per week, and 6% every day. For more in depth understanding of the physical activities, we asked a series of questions about different forms of physical activities during the last week (see Table 2 for details).

We also asked respondents about the amount of time they spend walking, and cycling each day. The majority of the participants spend between 30-60 minutes walking followed by 1-3 hours, whereas about cycling, most of participants cycle between 30-60min (see Table 3).

We applied t-test to analyze differences in consumption of food supplements compared to those who practice physical activity. The results showed that those who practice physical activity consume fewer food supplements than those who do not practice physical activity (8% vs. 46%, $p = 0.025$) and those who practice physical activity reported comparably lower consumption. (12% vs. 34%, $p = .024$), (see Graph 3a).

To decide whether questions related to physical activity can be merged as one variable, we applied factor analysis. The results showed that all five items loaded on one factor with values ranging from .70 to .77. These results suggest that they can be merged as one variable, therefore, we proceeded and labeled as physical activity in further analysis. Cronbach alfa for physical activity was .77, which is at acceptable level.

We applied correlation analysis between physical activity, food supplements, and students' grades. We found that physical activity was positively correlated with food supplements and with students' grades. This result indicates that participants practice physical activity are more likely to use food supplements, and more likely to have better grades (see Table 4)

Next, we applied multilinear regression analysis to test the link between physical activity practice and food supplements on students' grades. In line with the correlation coefficients, the results

indicate that there is an association between physical activity and students' grades, $B = .18$, $SE = .04$, $p = .036$, but not between food supplements and students' grades, $B = .01$, $SE = .10$, $p = .956$.

DISCUSSIONS

In this study, our goal was to investigate and determine the prevalence of physical activity and food supplement consumption among medical students, as well as to analyze their impact on academic performance.

Medical students are very busy with classes, laboratory work, medical practice and theoretical self-learning. All this load can lead them to have an unhealthy lifestyle. Lack of consumption of healthy foods with nutrients due to limited time and sedentary lifestyle can have consequences for the emergence of chronic diseases in the future (Younis, 2014).

Physical activity and the use of food supplements are two subjects that can affect students' learning and their wellbeing (Sundgot-Borgen et al., 2022). Based on this we have tried to analyze their impact on medical students' academic performance, where as an indicator of academic success we have taken the average grade so far of each student. The average grade of the students participating in our study was not low (8.31), and even if we take into account that grades range from 6 to 10, this grade is above average.

Most of the participants (80%) in our study were quite physically active, ranging from once a week to every day. Male students practiced more physical activity compared to females, but because our sample consists of a larger number of female students, we cannot say that we have a significant difference. Like us, some studies showed that most of their participants were physically active (Wang et al., 2024; Morris et al., 2012).

In contrast to our results, some other studies reported that the majority of their medical student participants practiced less physical activity, and they even added that the very fact of being a medical student was a potential risk factor to being physically inactive (NJ et al., 2014).

From this study we can understand that walking as a physical activity is more preferred among medical students compared to cycling. Although, most of our participants reported that they practiced physical activity several times a week, even at a moderate to vigorous intensity for at least 10 minutes. Similar results have been found in several studies (Morris et al., 2012; Clemente et al., 2016).

In our research, we found that physical activity has a positive correlation with average grade, indicating that students who practiced physical activity had higher grades in their studies. Our findings are consistent with the findings of other researches (Wang et al., 2024; Al-Drees et al., 2016; Edwards et al., 2011).

Also, in our study we found that those students who practiced physical activity more frequently, such as 3, 4 or 5 times a week, had higher GPAs compared to students who were passive and did not practice physical activity at all. In coordination with our study were several other studies (Wang et al., 2024; Coe et al., 2006).

Previous studies have shown that the impact of physical activity on academic performance is attributed to improvement in cognitive functioning and memory recall. It is hypothesized that physical activities increase oxygen levels and stimulate the growth of new blood vessels in the parts of the brain that are responsible for performing the task. Moreover, physical activity induces the production of nerve growth factors that are directly involved in the maintenance of neuronal tissue in the brain, this allows for an overt improvement in academic performance and success (Van Praag, 2009; McMorris et al., 2008).

Regarding the use of food supplements, more than half (59%) of our student participants in this research reported that they use food supplements regularly, while the type they use most was vitamins, followed by multivitamins and multiminerals. Numerous other studies have shown that vitamins are the most frequently used supplements among students and other age groups in the

general population, and our results are in line with these findings (Martinovic et al., 2021; Allen et al., 2000).

The third most commonly used type of food supplement by our participants was protein, especially by male students and those who exercised to build and strengthen muscles, and to improve athletic performance (Lentjes, 2019).

The main reason for using food supplements by the most of our students was to strengthen immunity, followed by against fatigue. This is in agreement with previous studies which reported approximately the same reasons (Martinovic et al., 2021; Allen et al., 2000; Froiland et al., 2004). Medical students use of food supplements by may also be related to their knowledge of the importance of healthy eating, where skipping meals can result in harmful health effects. However, the use of food supplements should be based on a doctor's prescription, because these products should be part of our diet and not a substitute for healthy daily food. It is extremely important for students, and even the entire population, to be aware of this. These products do not provide us with the energy we get from food, without which it is impossible for us to function (Hathcock et al., 2007). Therefore, advice and recommendations for a healthy diet from health professionals are helpful and necessary.

We analyzed the number of students who practice physical activity and use food supplements to see if there is a difference compared to those who do not practice physical activity. The results showed that those who practice physical activity reported relatively consumption of food supplements, but the difference was not significant. While, in few studies, in opposition to our results, a significantly higher consumption of food supplements was observed in participants who practiced physical activity compared to those who did not (Joseph et al., 2018; Ficarra et al., 2022).

In our study, we have found that there is no positive correlation between food supplement consumption and students` average grade. This result shows that the use of food supplements does not have any impact on students' grades. Meanwhile, several studies have investigated the association between educational achievement and the consumption of food supplements, concluding that individuals with higher levels of education tend to utilize these products more frequently (Pouchieu et al., 2013; Alfawaz et al., 2017).

Food supplements can correct some deficiencies in nutrition and maintain health, however their effect on grades may not be as significant or might only be indirect when more vital factors are taken into consideration. It is unlikely that food supplements alone could be directly responsible for improving students' average grades, because the latter are determined by various factors, such as lifestyle, environment, and personal circumstances (El Ansari et al., 2012).

Strength and Limitations of the Study

This study stands out as the first of its kind in our country, offering valuable data that addresses a significant gap in the existing literature. However, it does have limitations, including a small sample size, reliance on self-reported data, and a disproportionate number of female students compared to male students, which could potentially skew the results.

CONCLUSIONS

From our results, we found that most participants were physically active, practicing from once a week to daily. Over half of participants used food supplements, with vitamins being the most frequently mentioned type. Physical activity was positively associated with food supplements and student grades. This result indicates that students who practice physical activity are more likely to use food supplements and have better grades. There is a relationship between physical activity and student grades, but not between food supplements and student grades.

To increase students' well-being and academic achievement, future studies would be necessary considering a more comprehensive research investigation on the relationship between physical

activity, food supplements, and their academic performance, also comparing the benefits of different types of exercise and the effects of commonly used supplements.

AUTHORS` CONTRIBUTION

AM and DS were closely monitoring this research project and had complete access to the study's data. In the meantime, they took on the responsibility of ensuring the integrity of the data.
Study Design: AM, DS, ZI
Instruction on the use of instruments for the outcome measures used in this study: SRM, DS
Analysis and interpretation of data: AM, ZI, VM
Manuscript preparation: AM, DS
Statistical Analysis: VM, ZI

DISCLOSURE STATEMENT

No competing financial interests exist for all authors.

AVAILABILITY OF DATA

The data supporting the findings of this study can be obtained from the corresponding author upon reasonable request.

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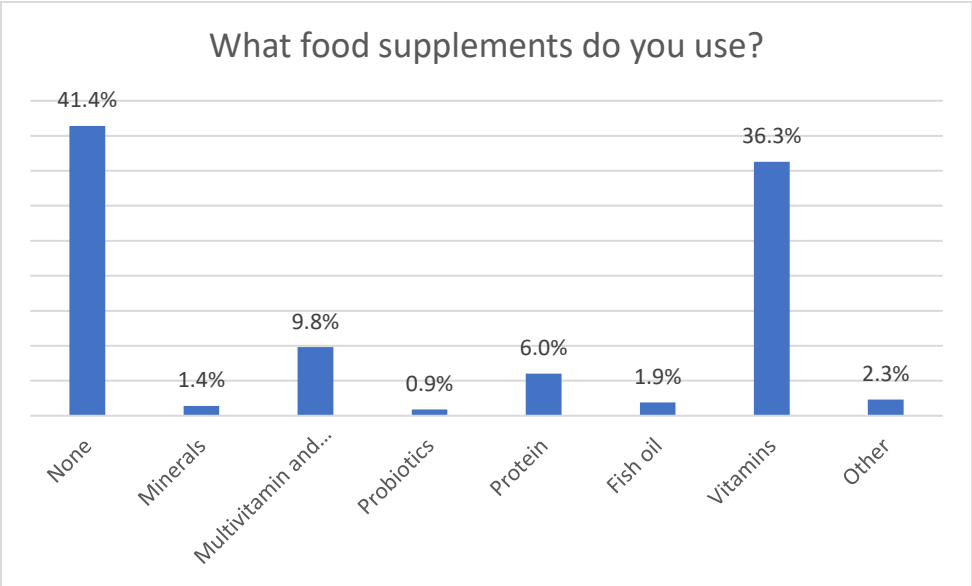
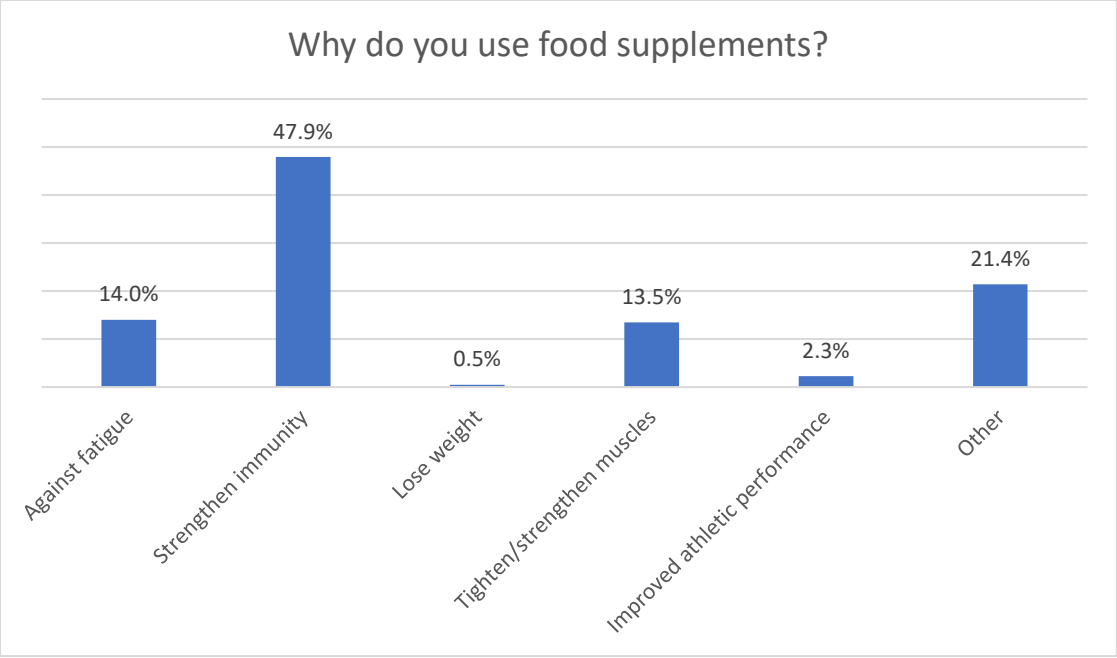
Table 1. Characteristics of the study participants by the number of totals

	Total		**Male**		**Female**	
Characteristics	**No**	**(%)**	**No**	**(%)**	**No**	**(%)**
	215	100%	67	31%	148	69%
Education						
First year of studies	21	10%	3	14%	18	86%
Second year of studies	24	11%	3	13%	21	87%
Third year of studies	67	31%	27	40%	40	60%
Fourth year of studies	43	20%	6	14%	37	86%
Firth year of studies	60	28%	27	45%	33	55%
Living place						
Urban	163	76%	40	25%	123	75%
Rural	52	24%	29	56%	23	44%
Smoker						
Yes	36	17%	18	50%	18	50%
No	179	83%	48	27%	131	73%
Mean age of students						
	21.29	N/A	21.61	N/A	21.15	N/A
Average hours of sleep per day						
	6.79	N/A	6.86	N/A	6.76	N/A
Mean grade of students						
	8.31	N/A	8.24	N/A	8.47	N/A
Mean BMI						
	22.80	N/A	21.69	N/A	25.36	N/A

(Source: Authors)



(Source: Authors)
Graph 1a. Types of food supplements consumed by student participants.



(Source: Authors)
Graph 2a. Reasons for consuming food supplements by student participants.

Table 2. Participants physical activity practice.

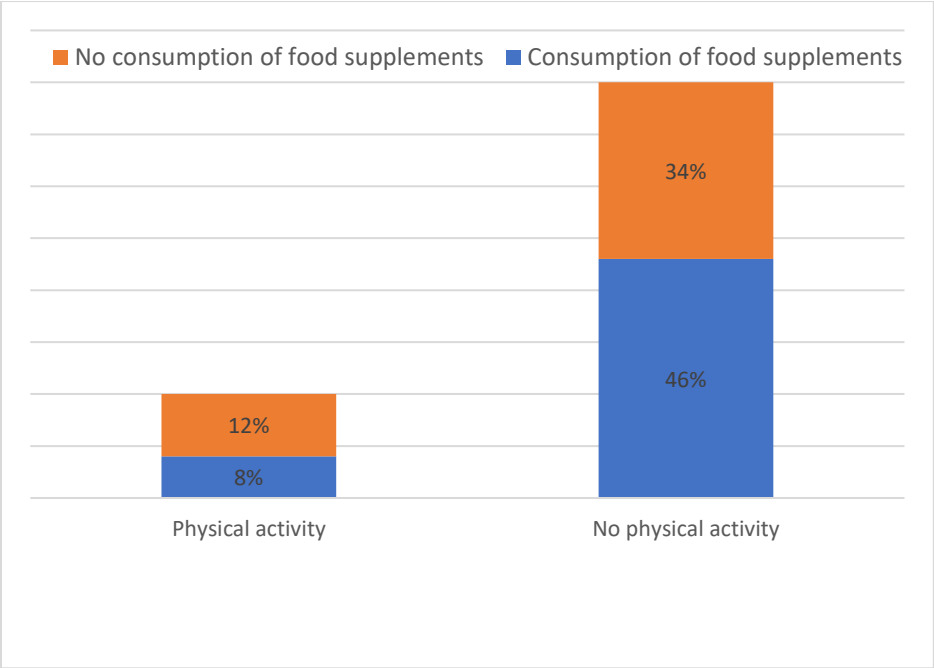
During the past week, how many days did you:	**0 days**	**1 day**	**2 days**	**3 days**	**4 days**	**5 days**	**6 days**	**7 days**
Have been physically active (any type of physical activity) for at least 60 minutes?	18.1%	14.9%	12.6%	11.6%	19.5%	14.9%	2.3%	6%
Have been physically active at a moderate intensity (any type of physical activity) for at least 10 minutes	14.9%	11.6%	10.7%	12.1%	14%	16.3%	3.3%	17.2%
Have been physically active at a vigorous intensity (any type of physical activity) for at least 10 minutes	35.8%	15.8%	16.3%	10.2%	10.7%	5.6%	1.9%	3.7%
Have you exercised to build and strengthen muscles for at least 30 minutes?	57.2%	11.6%	8.8%	7%	10.2%	3.7%	0.9%	0.5%

(Source: Authors)

Table 3. Time spent walking and cycling each day

	None	**30-60 min**	**1-3h**	**3-5h**	**Over 5h**
How much time do you spend walking every day?	0	52.6%	40%	6%	1.4%
How much time do you spend cycling every day?	91.1%	7.9%	0.5%	0	0.5%

(Source: Authors)



(Source: Authors)

Graph 3a. Differences between consumption of food supplements compared to physical activity

Table 4. Correlations between the main variables in the study

	1	**2**	**3**
1. Physical activity	-		
2. Food supplements	.28**	-	
3. Grades	.24*	.09	-
M	3.21	1.47	8.31
SD	1.36	.50	.74
Note. *$p < .05$, **$p < .001$			

(Source: Authors)