



# The Effect of Nutrition, Physical Activity, and Sleep Pattern on Success in Medical Students

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## Abstract

This study investigates the effects of nutrition, physical activity, and sleep patterns on the academic performance of medical students, with a focus on how these lifestyle factors can be incorporated into medical education. A questionnaire-based survey involving 330 medical students from two universities was conducted to collect data on demographic characteristics, nutrition, sleep patterns, and physical activity. Academic performance was assessed by obtaining students' grade point averages (GPAs) from the respective faculties' deanships. The relationship between lifestyle factors and academic success was examined using advanced statistical analysis methods: cluster analysis and biplot method. The correlation of the lifestyle factors and GPAs was visualized in a low-dimensional space with a biplot. The findings revealed that students residing with their families, without outside work commitments, engaging in daily walking, and maintaining regular sleep patterns achieved significantly higher GPAs. Students were divided into two distinct clusters based on lifestyle factors and differences in GPA to determine the factors with the greatest impact on academic performance including the impact of studying on physical activity, self-perception of nutritional quality, engagement in daily walking, and self-perception of physical activity. There was a significant statistical difference in GPA values between the clusters. This study highlights the importance of integrating lifestyle medicine into the medical curriculum emphasizing the importance of a stable family life, regular sleep routines, and engagement in physical activity for better academic performance. By promoting healthy behaviors within the medical education, educators can support the well-being and academic success of students. Further research is needed to establish causal relationships and explore potential interventions to support medical students in achieving optimal lifestyle habits for academic success.

**Keywords** Medical students · Medical education · Nutrition · Physical activity · Sleep patterns · Academic performance

## Introduction

The attainment of success in the medical field is dependent on a plethora of factors, including physical exercise, sleeping habits, and nutrition. It is imperative that medical students maintain healthy behavioral patterns to achieve high levels of performance during their education and practice [1]. Failure to do so may lead to “burnout,” characterized by extreme fatigue caused by high levels of stress [2]. While previous studies have examined these factors independently, there has been limited investigation into the impact of nutrition, physical activity, and sleep patterns on success in medical students. This study addresses the combined influence of lifestyle factors on medical student's academic performance, offering medical educators insights into how lifestyle medicine principles might be integrated into medical education. The incorporation of healthy routines into their lifestyle may

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enhance motivation, productivity, and effectivity, and create better caregivers [3].

Previous research has shown that sleep problems negatively affect academic performance, as evidenced by lower GPAs and higher dropout rates among college students, regardless of a formal diagnosis of any sleep disorder [4].

Similarly, another research made by Asigbee et al. indicates that healthy eating habits and regular exercise have a significant impact on academic performance [5]. These studies collectively demonstrate the importance of physical activity, better sleep, and healthier eating habits in enhancing academic performance and overall quality of life for medical students. Thus, it is essential for medical schools to educate students while establishing settings that encourage healthy lifestyle choices for them. In this study, it is acknowledged that ensuring a balanced lifestyle requires sacrifices and active effort, but results in better academic performance in the long run.

For medical students, nutrition plays a vital role in their overall health and academic success [6]. Protein, vitamins, minerals, and omega-3 fatty acids contribute to energy, metabolism, muscle health, and brain function [7]. A well-balanced diet consisting of these nutrients will nourish students with the energy and mental clarity necessary to excel in medical school. Furthermore, a proper diet reduces the risk of health problems that could interfere with academic achievement.

Along with healthy eating habits, any successful medical student's lifestyle must also include physical activity, which has numerous advantages and can have a significant impact on academic performance [6]. Physical activity improves blood and oxygen circulation, enhancing motor control and neuromuscular coordination, both of which are necessary for academic achievement. Among the benefits of physical activity for adolescents are improved cognitive functioning in the form of better information recall and increased concentration due to the release of endorphins from the physical activity [8]. Fricke et al. have shown that physical activity has a positive effect on academic performance in college, as it encourages improved focus and better academic performance [9]. Emphasizing the importance of physical exercise in medical education can help students build the right exercise routine and a balanced lifestyle; as a result, medical students can develop the skills necessary to succeed in their field.

Sleep is likewise vital for the success of medical students, as it replenishes the body and boosts energy, resulting in alertness and improved mood upon awakening [10]. The body and brain repair themselves while sleeping by enhancing the stress response and recharging the systems that promote improved functioning, which has a direct impact on students' academic achievement [11]. Medical students must recognize that when it comes to physical and

mental health, good sleep is paramount [12]. Lack of quality sleep can lead to reduced energy, physical and cognitive impairments, weak immune systems, and a greater risk of distraction [13]. Adequate sleep also boosts mental alertness and mood and helps consolidate memories, allowing for better retention of learned material [14]. Given its importance to students' well-being, healthy sleeping habits should be advised in medical education, helping students balance academic demands with their need for proper rest.

In conclusion, the old Latin proverb "Mens sana in corpore sano" rings true: a healthy mind can only be achieved through a healthy body, which means planning meals, getting enough sleep, and engaging in regular exercise. Medical students can better manage their time, build productive study habits, and enhance their academic achievement by making sure they abide by these three fundamental components. Physical activity, nutrition, and sleep are interlinked and have a direct impact on academic achievement [15]. Prioritizing physical and mental health over academic performance may result in better time management, productive study habits, and enhanced academic achievement in the long term [16]. Balancing physical and mental health with academic performance may be challenging, but with sacrifices and active effort, overall academic success can be achieved. Enlightening the importance of lifestyle choices in medical education can help students achieve long-term success by balancing physical and mental health with academic responsibilities.

Despite the extensive research conducted, it is challenging to establish a clear, direct correlation between medical students' GPAs and their diet, physical activity, and sleep patterns. This study aims to investigate the potential effects of students' dietary habits, exercise routines, and sleep quality in relation to their academic performance in medical school.

## Methods

For a confidence level of 95% and a margin of error of 5%, a minimum of 245 participants needs to be included in the study, considering a response rate of 20%. This study was conducted among a sample of 330 students aged between 18 and 33 who were studying medicine. The data was collected between February 1 and April 6, 2023, through an online questionnaire administered to medical students in their 2nd, 3rd, 4th, 5th, and 6th grades, excluding first-year students. It is important to note that this study does not include a control group.

In order to evaluate academic performance, students' GPAs were acquired from the deanships of their respective faculties. The research was approved by the Ethics

Committee of Bezmialem University in Istanbul (Approval Number: 31.01.2023–95111).

This research utilized a questionnaire as the primary method of data collection. The survey was designed to be completed within 15 min, and participation was voluntary. The data was used exclusively for research purposes, and the anonymity of participants was observed. The questionnaire commenced with demographic inquiries, including height, weight, age, and other relevant characteristics of students. Subsequently, the survey explored general health and habits. The questionnaire consisted of three sections focused on nutrition, sleep patterns, and exercise. The nutrition section aimed to examine the students' daily consumption of meals and snacks, as well as the composition of food groups included in their diet. Additionally, it inquired into the presence and frequency of tobacco or alcohol consumption among the students. The sleep patterns section included questions that assessed the overall quality of students' sleep. These questions included the timing of their sleep cycle, as well as the time it took for them to fall asleep. Furthermore, the survey asked about sleep interruptions, including the frequency and reasons behind it. Lastly, the physical activity section investigated the students' daily activity levels and whether they engaged in any form of sports. For students involved in professional sports, this section also explored the challenges they encountered while balancing their academic and athletic commitments.

The questionnaire incorporated a combination of multiple choice and open-ended questions designed to match the qualifications and characteristics of the respondents ensuring every question pertained to the topic, was expressed clearly and comprehensibly, and covered broader and more specific aspects.

Descriptive statistics in terms of count and percentage were provided for categorical variables, while mean, standard deviation, median, minimum, and maximum values were provided for numerical variables. The conformity to normal distribution of the numerical variables was assessed using the Kolmogorov–Smirnov test. The Mann–Whitney  $U$  test was used for a comparison between the mean values of two independent groups, and the Kruskal–Wallis test was used for comparison between more than two independent groups. For multiple comparisons, the Dunn test was used as the post hoc method. The relationship between lifestyle factors and academic success was examined using advanced statistical analysis methods: cluster analysis and biplot method. The students were divided into two groups using the two-step cluster method, and the statistical significance of the differences in GPAs between the obtained clusters was assessed by evaluating the responses. The key factors that influenced the grouping of students were determined using cluster analysis.

The relationships between the lifestyle factors and GPAs were visualized in a low-dimensional space using multiple correspondence analysis (MCA) which is a widely accepted explanatory statistical method utilized to uncover the underlying structures of more than two qualitative variables as well as to explore the relationships between them. One of the most important properties of this method is that it does not require meeting the several assumptions that other methods of categorical data analysis do. In MCA, the structural relationships of rows and columns are assessed using points, and the purpose is to transform the information in tables into scatterplots. As such, biplots serve as useful visual representations of the categorical variables in MCA that depict the relation of the qualitative variables in a low-dimensional space, reducing the dimensions to simplify comprehensive datasets as well as to facilitate their interpretation [17]. Statistical significance level was adopted as 0.05, and calculations were conducted using SPSS (Version 26.0, Armonk, NY: IBM Corp.).

## Results

The mean age of participants was calculated to be  $21.9 \pm 1.7$ , while the mean GPAs were determined to be  $77.2 \pm 10.6$ . Among the participants, 46.5% were in the pre-clinical grade (II–III), while 53.5% were in the clinical grade (IV–V) of their studies. Most of the participants (83.9%) were staying in a home, 61.7% with their family, 13.4% with their friends, 8.8% alone, and 16.1% resided in the dormitory. The definition of family in our survey includes students' parents and/or siblings, and the definition of friends in our survey includes students' partners or spouses. The students who participated in our survey do not have any children that they are responsible for, meaning there are no parents within our demographics. Regarding health status, most students (86.9%) did not have any chronic diseases. However, it was found that 76.6% of the students had been diagnosed with a psychological disorder, with depression being the most prevalent with 16.1%. The basic characteristics of the participants are given in Table 1.

According to group comparison findings, there were statistically significant differences between the places they reside in terms of their GPAs ( $p < 0.001$ ). The result of multiple comparison suggests that students residing with their families in a home had significantly higher mean GPAs compared to students living alone in a home ( $p = 0.010$ ), and specifically the GPAs of students residing with their families in a home were significantly higher than those living with their friends in a home ( $p = 0.031$ ). Furthermore, students who did not have outside work commitments achieved higher GPAs than students who had outside work commitments ( $p = 0.043$ ). Additionally, it was observed that

**Table 1** Baseline characteristics

Variable	Mean $\pm$ SD	Median [Min–Max]
GPA (out of 100)	77.2 $\pm$ 10.6	77.5 [24–98.8]
BMI	22.5 $\pm$ 2.9	22.1 [16–37.9]
Grade	Category	<i>n</i> (%)
	II	76 (23.1)
	III	77 (23.4)
	IV	79 (24)
	V	91 (27.7)
	VI	6 (1.8)
Who do you reside with?	Alone	63 (19.1)
Where do you reside?	Family or friends	266 (80.9)
	Home (with family)	203 (61.7)
	Home (with friends)	44 (13.4)
	Dormitory	53 (16.1)
	Home (alone)	29 (8.8)
Do you have any chronic disease(s)?	Yes	43 (13.1)
	No	286 (86.9)
Have you ever had a diagnosed psychological disorder?	No	77 (23.4)
	Yes	252 (76.6)
Depression	No	276 (83.9)
	Yes	53 (16.1)
Are there any supplements or medications you regularly use?	Yes	177 (53.8)
	No	152 (46.2)
Do you have outside work commitments?	Yes	17 (5.2)
	No	312 (94.8)
If you have outside work commitments, how much does your job reduce your daily academic performance?	None	8 (2.4)
	Rarely	7 (2.1)
	Moderate	2 (0.6)
	Frequently	1 (0.3)
	Very much	2 (0.6)
Which food group do your meals usually consist of?	Fast food	92 (28)
	Vegetables	151 (45.9)
	Meat	69 (21)
	Balanced	17 (5.2)
Do you think your meals and snacks are healthy?	Very unhealthy	14 (4.3)
	Unhealthy	106 (32.2)
	Moderate	68 (20.7)
	Healthy	112 (34)
	Very healthy	29 (8.8)
How much does academic stress affect your diet?	Never	33 (10)
	Rarely	69 (21)
	Moderate	31 (9.4)
	Frequently	115 (35)
	Very much	81 (24.6)
Alcohol consumption	None	248 (75.4)
	2 or 3 times a week	81 (24.6)
Smoking	No	239 (72.6)
	Less than 1 pack a day	81 (24.6)
	More than 1 pack a day	9 (2.7)
What time do you usually sleep?	21.00–00.00	131 (39.8)
	After 00.00	198 (60.2)

**Table 1** (continued)

Variable	Mean ± SD	Median [Min–Max]
What time do you usually wake up?	Before 06.00	22 (6.7)
	06.00–09.00	229 (69.6)
	After 09.00	78 (23.7)
How many minutes does it take you to fall asleep?	Less than 10 min	92 (28)
	10–30 min	176 (53.5)
	30–60 min	41 (12.5)
	More than 60 min	20 (6.1)
How many hours do you sleep at night?	Less than 5 h	20 (6.1)
	5–8 h	271 (82.4)
	More than 8 h	38 (11.6)
How many times a night do you experience sleep interruptions for any reason?	0	224 (68.1)
	2 or 3 times	101 (30.7)
	More than 3 times	4 (1.2)
If you experience sleep interruptions, what is the reason?	Toilet	30 (9.1)
	Drinking water	32 (9.7)
	Bad dreams	40 (12.2)
	Voice	3 (0.9)
	Spontaneously	6 (1.8)
	How would you assess your sleep quality in general?	Very bad
	Bad	118 (35.9)
	Moderate	62 (18.8)
	Good	109 (33.1)
	Very good	25 (7.6)
How physically active do you perceive yourself?	None	24 (7.3)
	Rarely	144 (43.8)
	Moderate	54 (16.4)
	Frequently	84 (25.5)
	Very much	23 (7)
	How often do you walk in your daily life?	None
Rarely		102 (31)
Moderate		77 (23.4)
Frequently		110 (33.4)
Very much		15 (4.6)
How much does your academic performance affect your physical activity?		None
	Rarely	79 (24)
	Moderate	26 (7.9)
	Frequently	99 (30.1)
	Very much	70 (21.3)
	How much does physical activity increase your academic performance efficiency?	None
Rarely		80 (24.3)
Moderate		64 (19.5)
Frequently		89 (27.1)
Very much		36 (10.9)

students who consumed alcohol two or three times a week had higher GPAs compared to those who did not drink alcohol ( $p = 0.034$ ). However, no statistically significant relationship was found between smoking and GPA ( $p = 0.878$ ) (Table 2).

Regarding sleep patterns, students who started sleeping between 21:00 and 00:00 at night had significantly higher GPAs than students who slept after 00:00 at night ( $p = 0.014$ ). A statistically significant difference was observed in terms of students' waking hours ( $p = 0.003$ ),

**Table 2** Group comparison results

Variable	Category	Mean $\pm$ SD	Median [Min–Max]	<i>p</i> -value
Where do you reside?	Home (with family)	78.95 $\pm$ 10.183	79.5 [24–98.8]	<0.001
	Home (with friends)	74.4 $\pm$ 11.3	77 [47–97]	
	Dormitory	74.9 $\pm$ 10.9	77 [38.3–95.3]	
	Home (alone)	73.3 $\pm$ 9.2	72 [51–93.3]	
Do you have outside work commitments?	Yes	72 $\pm$ 10.5	76.3 [48–96]	0.043
	No	77.5 $\pm$ 10.5	78 [24–98.8]	
Alcohol consumption	No	76.6 $\pm$ 10.7	77.1 [24–98.8]	0.034
	2 or 3 times a week	75 $\pm$ 10	81 [38.3–94]	
Smoking	No	77.1 $\pm$ 10.7	77.8 [24–97]	0.878
	Less than 1 cigarette box a day	77.7 $\pm$ 9.9	77.1 [38.3–98.8]	
	More than 1 cigarette box a day	74 $\pm$ 14.2	77.3 [48–93.3]	
What time do you usually sleep?	21.00–00.00	78.6 $\pm$ 10.9	79.5 [24–98.8]	0.014
	After 00.00	76.3 $\pm$ 10.3	77 [38.3–97]	
What time do you usually wake up?	Before 06.00	81.2 $\pm$ 8.5	81.9 [64.5–92.3]	0.003
	06.00–09.00	77.9 $\pm$ 10.1	78.5 [24–97]	
	After 09.00	73.8 $\pm$ 11.6	76 [38.3–98.8]	
How many minutes does it take you to fall asleep?	Less than 10 min	77.3 $\pm$ 9.8	77.8 [47–98.8]	0.004
	10–30 min	78.4 $\pm$ 10.2	79 [38.3–97]	
	30–60 min	75.7 $\pm$ 10.8	76.5 [52–93.8]	
	More than 60 min	68.9 $\pm$ 13.6	71 [24–86.3]	
How many times a night do you experience sleep interruptions for any reason?	0	78.2 $\pm$ 10	79 [38.3–98.8]	0.044
	2 or 3	74.9 $\pm$ 11.4	76.8 [24–96.3]	
	More than 3	79.7 $\pm$ 6.6	78.5 [73–88.8]	
How would you assess your sleep quality in general?	Very bad	72.5 $\pm$ 14.1	76.8 [38.3–86.3]	0.019
	Bad	77 $\pm$ 10.4	78 [49.3–95.3]	
	Moderate	73.9 $\pm$ 10.9	76.6 [24–93.3]	
	Good	79.4 $\pm$ 9.8	79.8 [47–98.8]	
	Very good	79 $\pm$ 9.1	77.1 [64–97]	
How often do you walk in your daily life?	Never	75.1 $\pm$ 15.9	77.5 [24–93.8]	0.023
	Rarely	76.9 $\pm$ 9.9	77.1 [49.3–97]	
	Moderate	74.8 $\pm$ 10.2	75 [47–98.8]	
	Frequently	79.4 $\pm$ 9.8	79.9 [48–97]	
	Very much	78.4 $\pm$ 9.3	79.5 [61–90.3]	
How much does your academic performance affect your physical activity?	Never	78.4 $\pm$ 11.5	78 [38.3–98.8]	0.008
	Rarely	79.5 $\pm$ 9.6	79.5 [51–96.3]	
	Moderate	73.2 $\pm$ 8.2	76.5 [55–93.3]	
	Frequently	77.4 $\pm$ 10	78 [47–97]	
	Very much	74.8 $\pm$ 11.8	77 [24–93.8]	

GPA's being notably lower for students who woke up after 09:00 in the morning compared to those who woke up before 06:00 ( $p=0.016$ ) and those who woke up between 06:00 and 09:00 ( $p=0.002$ ). There were statistically significant differences between GPA's in terms of the time it took them to fall asleep ( $p=0.004$ ). It was determined that the GPA's of students who took more than 60 min to fall asleep were significantly lower than those who took 10–30 min ( $p=0.003$ ). There were significant differences in terms of experiencing sleep interruptions ( $p=0.044$ ), GPA's being observed

to be considerably lower in those who woke up at night for any reason compared to those who did not ( $p=0.040$ ). A statistically significant difference was observed between the students' assessment of their sleep quality in terms of achievement scores ( $p=0.019$ ). Students who rated their sleep quality as "very bad" achieved significantly higher academic success than students who answered "very good" ( $p=0.012$ ) (Table 2). There could be discrepancy between their perception and reality since the GPA's of the students who took more than 60 min to fall asleep and had sleep

interruptions were significantly lower since taking longer periods of time to sleep interruptions are often associated with bad sleep quality.

In terms of the frequency of walking in daily life, a statistically significant difference was observed between students' GPAs ( $p=0.023$ ). The mean GPA of students who reported frequent walking was significantly higher than that of those who stated moderate levels of walking ( $p=0.010$ ). A statistically significant difference was observed between how much academic performance affected students' physical activity ( $p=0.008$ ). The academic success of participants who stated that studying did not affect their physical activity was significantly higher than students who reported a moderate impact ( $p=0.017$ ) (Table 2). The findings of this current study indicate that individuals who reside with their families, do not have outside work commitments, engage in a high level of physical activity, and maintain regular sleep patterns achieve significantly higher GPAs.

Two distinct clusters were formed by conducting a cluster analysis based on the responses provided by the students to the relevant questions. The clusters were differentiated in terms of similar characteristics and lifestyle parameters.

The most influential questions in dividing students into clusters included the impact of studying on physical activity, self- perception of nutritional quality, engagement in daily walking, self-perception of physical activity, monthly income status, place of residence, the influence of academic stress on dietary habits, bedtime, sleep quality, and changes in meal patterns (Fig. 1).

Furthermore, a comparison was made between the clusters based on their GPAs. The students in cluster 1 had significantly higher GPAs compared to those in cluster 2 ( $p < 0.001$ ). The fundamental characteristics of students in cluster 1 were found to be unaffected by the impact of physical activity of studying, self-perception of nutritional quality, engaging in daily walking, self-perception of physical activity, having moderate monthly income, living with family, experiencing reduced impact of academic stress on dietary habits, going to bed before midnight, and experiencing changes in their daily nutritional patterns (Table 3).

Multiple correspondence analysis was utilized to describe the key dimensions that represent the underlying structure of the influence of eating habits, sleeping patterns, and physical activity levels on academic success in medical students. The

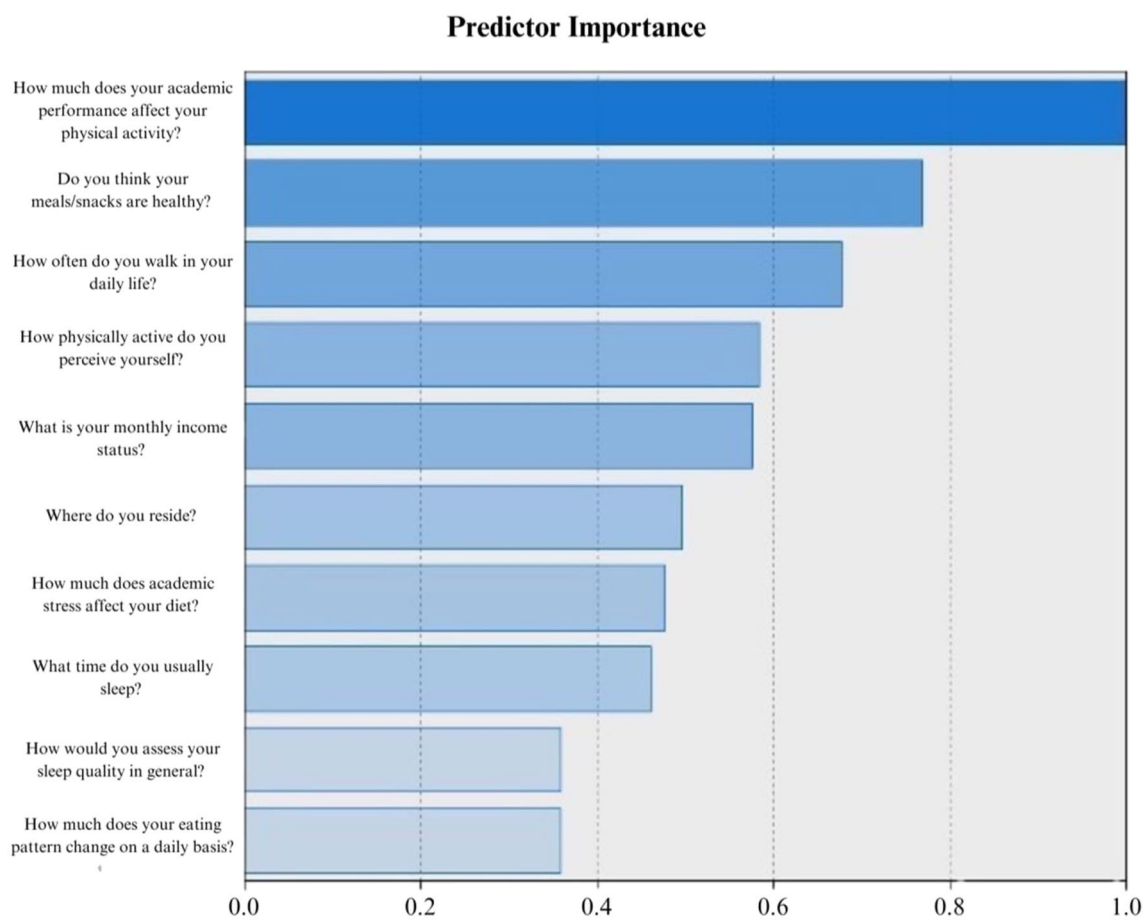


Fig. 1 Predictor importance of variables according to cluster analysis results

**Table 3** Comparison of the means of GPA between cluster groups

Two-step cluster number	Mean	Median	Std. deviation	Minimum	Maximum	<i>p</i>
Cluster 1	78.9186	79.8750	10.47318	38.25	98.75	<0.001
Cluster 2	74.6704	77.0000	10.25034	24.00	93.75	

first dimension of the biplot for eating habits of the students reflected the “healthy lifestyle” as their nutritional habits depicted that students with high academic success consume less than one pack of cigarettes a day, drink alcohol two or three times a week, usually consume meat in their meals, have a slow or very slow eating speed, and consume fruit 1–2 days a week. On the other hand, the second dimension of this plot mainly pointed out the “psychological impact” of eating habits of the students as they are with GPA > 60 stated that the stress caused by academic life greatly affected their nutritional levels and they are undecided whether their meals or snacks are healthy (Fig. 2).

The biplot for physical activity level suggested the identification of the dimensions as “inactive lifestyle” and “exercising effect,” respectively since the students with a high academic success stated that they were not interested in any professional sport, studying had little effect on their physical activity, and they do not see themselves as physically active or see themselves as very little active. On the other hand, students with lower GPA seem to be moderately affected by their activity levels into their academic

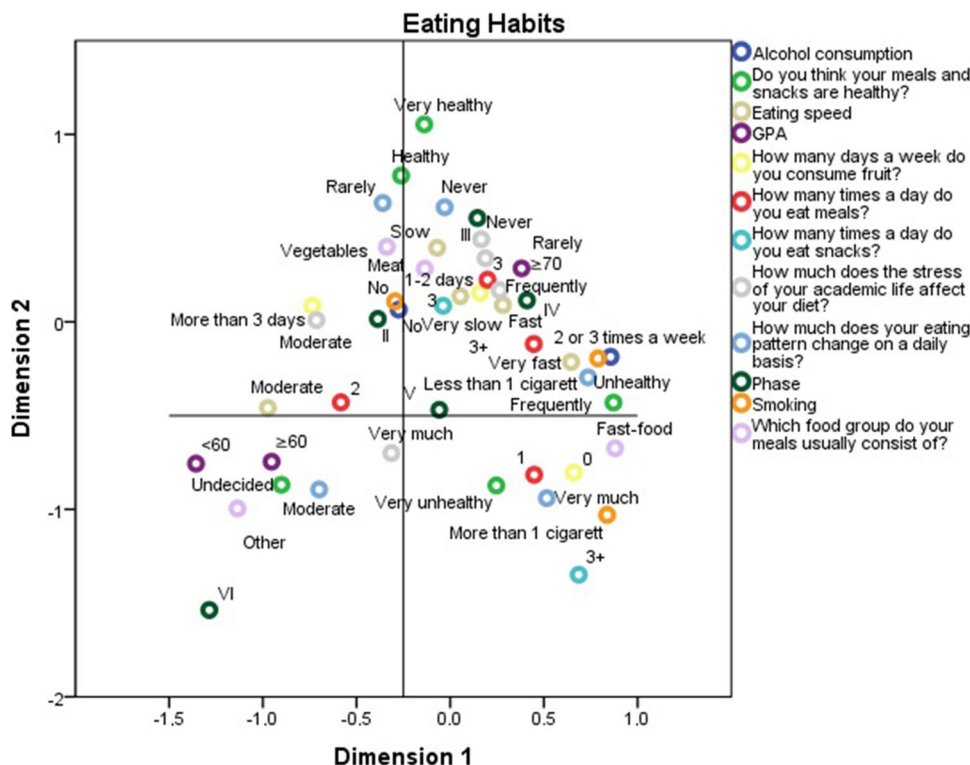
success as their responses were clustered with a moderate level of increment of academic performance efficiency (Fig. 3).

Similar to the dimensions of the eating habits, the first and second dimensions for the sleeping patterns biplot could be termed as “organized lifestyle” and “mental status,” respectively as the biplot demonstrates students with high academic success sleep before 6 am, go to bed before 9 pm, fall asleep within 10 min, and sleep between 5 and 8 h. On the other hand, students with lower GPA stated that they woke up two to three times at night, that the reasons for waking up were spontaneous or bad dreams, and that they slept less than 5 h, and described their sleep quality as moderate (Fig. 4).

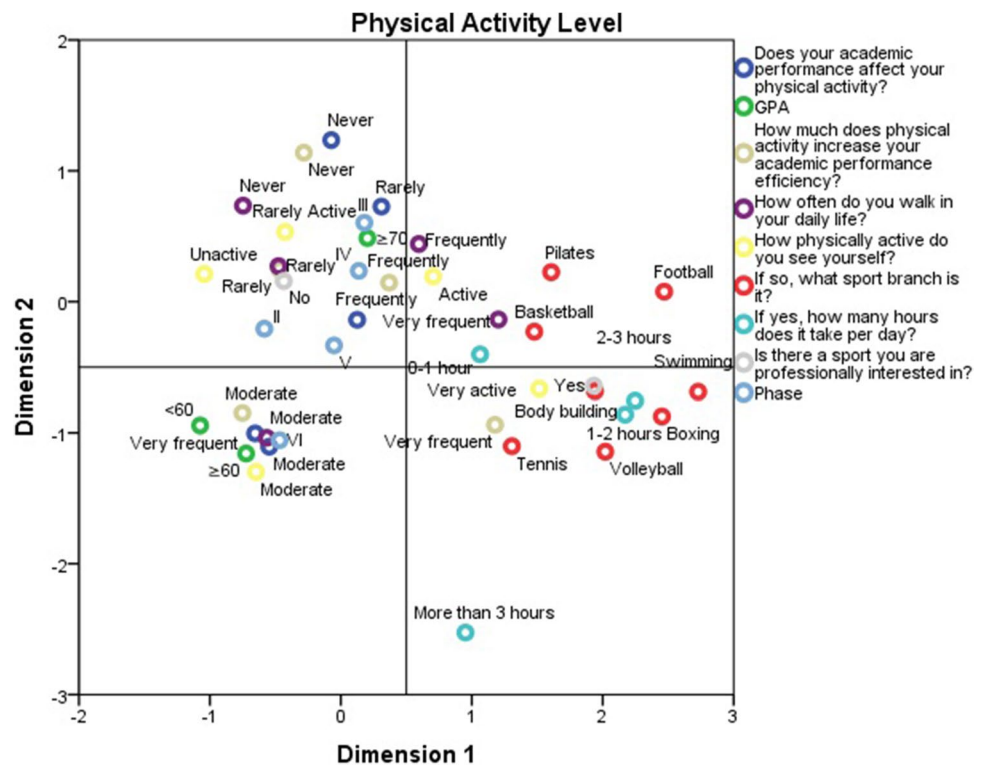
### Discussion

Upon conducting a literature review, it appears that although studies exist wherein individual factors are investigated, there is a lack of comprehensive research addressing the

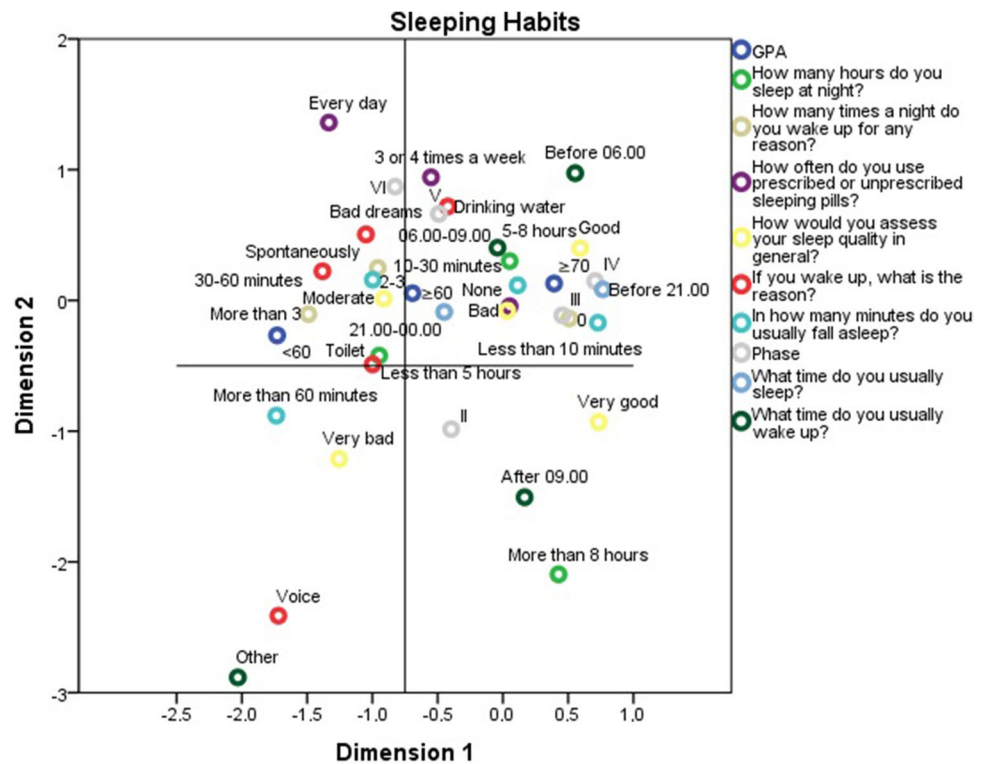
**Fig. 2** Biplot of the relationship between eating habits and academic success



**Fig. 3** Biplot of the relationship between physical activity level and academic success



**Fig. 4** Biplot of the relationship between sleep habits and academic success



combined effects of these factors on university students. In this study, a detailed evaluation of medical students' nutrition, physical activity, and sleep patterns was conducted to

investigate their cumulative impact on academic success. Additionally, the study adds novelty to the literature using advanced statistical methods.

Based on the results of the study with the cluster analysis, it was observed that nutrition did not have a significant effect on academic success overall. However, several factors were found to have remarkable impact on academic success, including students residing with their families, not having outside work commitments, maintaining regular sleep patterns such as sleeping before midnight, waking up early, not experiencing sleep interruptions, and engaging in daily walking. For example, students in cluster 1 reported consistent characteristics such as frequent physical activity, higher self-perceived nutrition, and constant daily walking, all of which have been associated with improved cognitive performance and mental health in past studies [12]. They went to bed before midnight, which may have contributed to better sleep quality. Furthermore, living with family can give a supportive atmosphere and financial stability, reducing anxiety and distractions from economic issues and enabling more time to focus on education. Interestingly, these students had fewer food pattern disruptions due to academic stress, indicating a stronger resilience in continuing good routines during stressful times. In contrast, students in cluster 2 may have faced more stress with keeping these behaviors, resulting in lower academic achievement. This contrast emphasizes the need to have a balanced lifestyle, which includes regular physical exercise, sleep, and a secure home, for better academic performance. Students living with their families are less exposed to financial stress than students living alone or with friends. The lower academic success of students who do not live with their families may be associated with the financial stress they experience. Students living alone or with friends had lower achievement rates because they experience financial stress while supporting their own households. There were no correlations that the students who are living alone are also working or have poorer diets. Consequently, it is evident that students who have a stable family life, regular sleep routines, and engage in regular physical activity experience an increase in academic success.

These findings imply that lifestyle medicine should be included in medical education which teaches students about the benefits of a healthy lifestyle. Integrating lifestyle medicine concepts into medical education encourages educators to better empower students with capabilities for managing their health, reducing stress, and improving academic achievement. In this regard, lifestyle coaching classes might be considered to teach students how to include physical exercise, diet, and quality sleep into their packed lives.

Coaching programs that focus on time management, stress reduction, and physical well-being might be particularly helpful in improving academic achievement. Educators might utilize the study's findings to inform such programs, helping medical students realize the need for proper sleep, exercise, and a healthy living environment. Encourage

students to reflect on their lifestyles and embrace healthier practices, which will not only improve their academic achievement but also prepare them for the challenges of their future healthcare employment.

Similar to our findings, Macilwraith and Bennet reported an increase in professional efficiency among medical students due to physical activity [2]. In a study conducted by Faught et al. involving students aged 13–18, sleep behaviors and physical activity were not found to influence academic success, while the impact of nutrition patterns on success was significant [11]. However, it is important to note that our study focused on medical students, whereas the above-mentioned study included a younger age group that had not yet reached the developmental stage of forming eating habits and typically had normal sleep patterns for their age.

Maniaci et al. evaluated the effects of a healthy lifestyle on academic success in 373 tourism students [18]. This research revealed that academic performance had a positive correlation with dietary quality, but no significant relationship was observed between sleep and success. Similar to the abovementioned study, Sigfúsdóttir et al. found that dietary habits had an impact on academic performance [19].

Previous research has reported findings both corroborating and disputing ours. Okano et al. found that longer sleep duration, better sleep quality, and greater sleep consistency were related to better academic performance [4]. Gallego-Gómez et al. reported a weak association between high levels of academic performance and a short sleep pattern, bad sleep habits, and younger age in a sample of nursing students [20]. Although their sample did not consist of medical students, a similar relationship between sleep behavior and academic performance in a different sample showed its general effect on academic success. Consistent with our results, BaHammam et al. reported a negative association between irregular sleep patterns, specifically decreased sleep time, late bedtimes during weekdays and weekends, increased daytime sleepiness, and high academic success among medical students [21].

In the current study, physical activity was found to be an important contributor to academic success. Similarly, Karakılıç et al. revealed that students with a moderate level of physical activity have more success compared to inactive students [22]. Al-Drees et al. also identified a positive association between physical activity and academic performance [23].

No distinct link between the eating habits of students and academic success was established within the course of our research process. Consistent with the findings in this paper, some earlier studies reported no relationship between academic success and lifestyle habits [24]. In contrast, Karakılıç et al. identified a negative association between smoking, consumption of coffee and/or sugary beverages, and academic success [22]. Moreover, Arasegowda et al. found that

students who had almost never consumed fast food had the highest odds of academic performance [25].

This study demonstrates the importance of specific lifestyle factors on academic performance among medical students. Regular sleeping patterns, physical exercise, and living with family were all connected with improved academic achievement. In contrast, no significant association was observed between nutrition and academic performance, which is consistent with some earlier research but differs from others that highlighted eating behaviors. The findings underscore the significance of leading a healthy lifestyle for academic performance. Medical educators need to consider how lifestyle medicine concepts might be included in student coaching programs to help students develop routines that will assist them academically and in their future medical practice. Medical schools may assist students in establishing a basis of health and well-being that will serve them throughout their careers by providing coaching and lifestyle education.

## Limitations

There are some limitations in this current study that should be considered. The main limitation is the questionnaire-based self-reporting design used in this research, which introduces significant personal bias. Another limitation is the relatively small and imbalanced sample sizes from two different medical faculties. Additionally, since the methodology was designed in a cross-sectional manner, casual associations cannot be evaluated.

## Conclusion

This study assessed the nutritional quality, physical activity, and sleep patterns of university students and performed advanced statistical analysis, the results of which point to sleep and physical activity having significant effects on academic success. It also underscores the importance of family support, absence of outside work commitments, regular sleep patterns, and daily walking in contributing to academic success. While further research is needed to establish a clear and direct correlation, this study provides valuable insight into the relationship between lifestyle and academic achievement for medical students.

Here is a list of the lifestyle factors that were found to enhance academic performance in medical students:

- Regular sleep patterns
- Regular physical activity
- Family support
- Lack of outside work commitments

These findings indicate that encouraging these behaviors through coaching may be important in encouraging medical students to succeed academically and professionally. As medical education evolves, including lifestyle medicine coaching in the student support system might play a critical role in improving the results for students.

## Declarations

**Conflict of Interest** The authors declare no competing interests.

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