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Evaluation of lifestyle factors including diet, physical activity, sleep, and stress among students at Umm Al-Qura University (UQU) in Makkah city, Kingdom of Saudi Arabia

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ABSTRACT: Increasing academic demands and rapidly changing lifestyle patterns, health-related behaviours among university students have become an important research focus due to their impact on physical and psychological well-being. This study designed to investigate the relationships between dietary habits, physical activity, sleep quality, and perceived stress among students in Umm Alqura University (UQU) in Mecca, Saudi Arabia. A quantitative cross-sectional study was conducted on 400 undergraduate students at Umm Al-Qura University from February to July 2025 using validated Arabic versions of the Rapid Eating Assessment for Participants (REAP-S), the International Physical Activity Questionnaire (IPAQ-SF), the Pittsburgh Sleep Quality Index (PSQI), and the Perceived Stress Scale (PSS-10). The data were analysed using descriptive statistics, ANOVA, and Pearson correlation, with significance set at $p < 0.05$. A total of 322 participants (mean age = 20.95 ± 2.241 years; 81 % female) were included. The findings showed that most participants had poor sleep quality (78.6%) and moderate stress levels (78.9%), while diet quality was generally moderate. A significant positive association was found between diet quality and sleep quality ($p < 0.001$), as well as between diet quality and physical activity ($p = 0.017$). However, no significant association was observed between diet quality and perceived stress. These findings highlight the interconnected nature of health behaviours among university students. Sleep quality and physical activity appear to play important roles in shaping diet quality, while perceived stress showed no direct association in this sample. The results emphasize the need for multi-target lifestyle interventions addressing several behaviours simultaneously.

1. INTRODUCTION

University students often experience high academic pressure, irregular routines, and psychological stress throughout the academic year. These factors can negatively influence their eating behaviors, physical activity, and sleep patterns, contributing to poor physical and mental health outcomes. Previous studies among medical students in Saudi Arabia and other regions have demonstrated that poor diet quality, insufficient sleep, and low physical activity are common issues among this population (Mahfouz et al., 2024), (Yadav, 2022).

Diet quality represents the overall adequacy and balance of a person's dietary intake and how well it aligns with recommended nutritional guidelines while minimizing unhealthy and processed foods (Khandalavala et al., 2024). Physical activity is defined as any bodily movement that requires energy expenditure and contributes to maintaining overall health and fitness (Srirangaramasamy et al., 2024). Sleep quality reflects the duration, efficiency, and restfulness of sleep, which are essential for

cognitive function, recovery, and well-being (Masaad et al., n.d.). Stress is a psychological and physiological response to challenging situations that can directly affect diet, sleep, and activity patterns (Cruz et al., 2024), (Dodin et al., 2024).

Research has shown that high stress levels are frequently linked to unhealthy eating habits, reduced exercise, and poor sleep among students (Hammoudi Halat et al., 2023), (Deisz et al., 2024). Lifestyle imbalances, particularly during intense academic periods, can impair academic performance, concentration, and overall wellness (Masaad et al., n.d.) Validated instruments such as the Rapid Eating Assessment for Participants (REAPS-S), the International Physical Activity Questionnaire (IPAQ), the Perceived Stress Scale (PSS-10), and the Pittsburgh Sleep Quality Index (PSQI) are commonly used to assess these interrelated health behaviours among university students.

However, few studies have examined the combined relationships among diet quality, physical activity, stress, and sleep quality among both medical and non-medical students within the same academic setting. Understanding how these lifestyle factors interact can provide valuable insights into student health and help universities develop effective health promotion strategies.

2. MATERIALS AND METHODS

2.1 Study Design

This study used a quantitative cross-sectional design to examine the relationship between dietary habits, physical activity level, sleep quality, and perceived stress among undergraduate students at Umm Al-Qura University in Mecca, Saudi Arabia. A convenience sampling method was used in this study. Data were collected using an online self-administered questionnaire.

Electronic informed consent was obtained from all study participants at the beginning of the online questionnaire, where they were required to indicate their agreement before proceeding. Participation was voluntary, and data confidentiality and anonymity were strictly maintained. The data were kept and only used for scientific purposes. Ethical approval was obtained from the Biomedical Research Ethics Committee at Umm Al-Qura University, Mecca, Saudi Arabia (Approval No. HAPO-02-K-012-2025-11-3017).

2.2 Sample Collection

A post hoc sample size analysis was conducted using G*Power (version 3.1.9.7; Universität Düsseldorf, Düsseldorf, Germany) to investigate whether the final sample size was sufficient to the statistical analyses performed in the study. The calculation designed based on a medium effect size ($f^2 = 0.15$), a significance level of 0.05, and power of 0.95. According to these parameters, the required minimum sample size should be at 150 participants. The study population included undergraduate students aged 18–25 years enrolled at Umm Al-Qura University, from both health-related and non-health-related colleges. Data were collected using an online self-administered questionnaire.

Eligibility Criteria

Eligible participants were healthy students at Umm Al-Qura University aged 18–25 years, both males and females, from health and non-health majors. The exclusion criteria were as follows: (1) pregnant or breastfeeding women; (2) the presence of any self-reported chronic diseases; (3) those using medications that affect sleep, mental health, or appetite; (4) participants with incomplete responses.

2.3 Data Collection Tools

Data for this study were collected through a self-administered online survey created on the Google Forms. An online questionnaire were distributed among students via online platforms such as WhatsApp and X. The questionnaire were consisting of five sections as following:

1. Sociodemographic characteristics: age, gender, weight, height (used to calculate BMI), marital status, academic level, major, chronic disease status, and smoking status.
2. Dietary habits: assessed by using the REAPS-S, which evaluates healthy and unhealthy dietary behaviors through approximately 15 items scored from 0 to 1.
3. Physical activity: assessed by using the IPAQ-SF, measuring vigorous, moderate, and walking activities as well as sitting time, with results converted into MET-minutes per week.

4. Sleep quality: assessed by using the Pittsburgh Sleep Quality Index (PSQI), including bedtime, sleep latency, wake-up time, hours of actual sleep, sleep disturbances, medication use, and daytime dysfunction.

5. Perceived stress: assessed using the Perceived Stress Scale (PSS-10), which consists of 10 items rated on a 0–4 scale to measure perceived stress during the past month.

Participants responses were submitted anonymously, and no personal identification information was collected. All collected data were restricted solely to the study team to maintain participant confidentiality and guarantee compliance with ethical data standards.

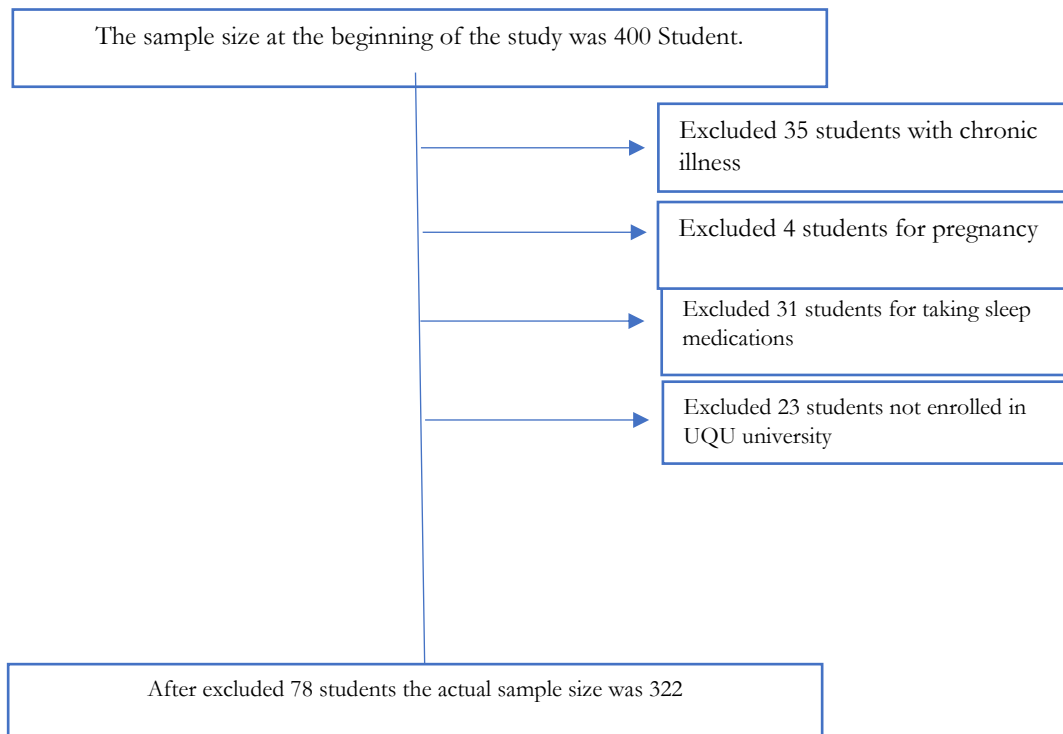
2.4 Statistical Analysis

Data were analysed using SPSS version 26. Descriptive statistics were calculated for all variables. Independent t-tests and ANOVA were used to compare group differences. Pearson correlation analysis was conducted to examine relationships between variables. A p-value of < 0.05 was considered statistically significant.

3. RESULTS

A cross-sectional study was conducted among undergraduate students at UQU in Makkah, Saudi Arabia, from February 2025 to July 2025. After applying the eligibility criteria and excluding incomplete or ineligible responses, 322 valid responses were included in the final analysis.

The present study included 322 university students with a mean age of 20.95 ± 2.241 years. Females represented the majority of the sample (81.1%), while males accounted for 18.9%. Most participants were single (94.1%), with only 5.9% married. The mean weight and height were 59.63 ± 16.261 kg and 161.46 ± 10.240 cm, respectively, with a mean BMI of 23.02 ± 9.208 kg/m². Approximately half of the participants were medical students (52.2%). Most students reported engaging in physical activity (67.4%), while 32.6% did not. Smoking was reported by 7.5% of participants



3.1 Participant Characteristics

Table 1. Sociodemographic and Academic Characteristics of the Included Participants

Variables	N=322
Age (mean $\pm$ SD; years)	20.95 $\pm$ 2.241
Gender (n, %)	
Male	61 (18.9%)
Female	261 (81.1%)
Marital status (n, %)	
Single	303 (94.1%)
Married	19 (5.9%)
Weight (mean $\pm$ SD; kg)	59.63 $\pm$ 16.261
Height (mean $\pm$ SD; cm)	161.46 $\pm$ 10.240
BMI (mean $\pm$ SD; kg/m ²)	23.02 $\pm$ 9.208
BMI (n, %)	
Underweight	67 (20.8%)
Normal weight	178 (55.3%)
Overweight	55 (17.1%)
Obese	22 (6.8%)
Medical students (n, %)	
No	154 (47.8%)
Yes	168 (52.2%)
Physical activity (n, %)	
No	105 (32.6%)
Yes	217 (67.4%)
Smoking (n, %)	
No	298 (92.5%)
Yes	24 (7.5%)

SD = Standard Deviation

N = Number of participants (sample size)

Table 1 shows that the majority of participants were females and had a normal BMI. More than half of the participants were medical students. Most students were physically active, while only a small proportion reported smoking.

3.2 Assessment of Diet Quality, Physical Activity, Sleep Quality, and Perceived Stress Among University Students

3.2.1 Diet Quality Assessment

Table 2. Distribution of Responses to the Rapid Eating Assessment for Participants (REAPS-S)

Variables				
	Usually/ Often	Sometimes	Rarely/ Never	Does not apply to me
REAPS-S				
In an average week, how often do you:				
Skip breakfast?	22 (6.8%)	56 (17.4%)	132 (41%)	112 (34.8%)

Eat 4 or more meals from sit-down or take out restaurants?	67 (20.8%)	93 (28.9%)	131 (40.7%)	31 (9.6%)
Eat less than 2 servings of whole grain products or high fiber starches a day?	17 (5.3%)	65 (20.2%)	166 (51.6%)	74 (23%)
Eat less than 2 servings of fruit a day?	17 (5.3%)	60 (18.6%)	119 (37%)	126 (39.1%)
Eat less than 2 servings of vegetables a day?	22 (6.8%)	53 (16.5%)	153 (47.5%)	94 (29.2%)
Eat or drink less than 2 servings of milk, yogurt, or cheese a day?	24 (7.5%)	64 (19.9%)	138 (42.9%)	96 (29.8%)
Eat more than 8 ounces (see sizes below) of meat, chicken, turkey or fish per day?	23 (7.1%)	70 (21.7%)	131 (40.7%)	98 (30.4%)
Use regular processed meats (like bologna, salami, corned beef, hotdogs, sausage or bacon) instead of low fat processed meats (like roast beef, turkey, lean ham; low-fat cold cuts/hotdogs)?	113 (35.1%)	75 (23.3%)	99 (30.7%)	35 (10.9%)
Eat fried foods such as fried chicken, fried fish, French fries, fried plantains, tostones or fried yuca?	17 (5.3%)	61 (18.9%)	156 (48.4%)	88 (27.3%)
Eat regular potato chips, nacho chips, corn chips, crackers, regular popcorn, nuts instead of pretzels, low-fat chips or low-fat crackers, air-popped popcorn?	10 (3.1%)	61 (18.9%)	147 (45.7%)	104 (32.3%)
Add butter, margarine or oil to bread, potatoes, rice or vegetables at the table?	51 (15.8%)	60 (18.6%)	135 (41.9%)	76 (23.6%)
Eat sweets like cake, cookies, pastries, donuts, muffins, chocolate and candies more than 2 times per day.	27 (8.4%)	68 (21.1%)	148 (46%)	79 (24.5%)
Drink 16 ounces or more of non-diet soda, fruit drink/punch or Kool-Aid a day?	78 (24.2%)	88 (27.3%)	104 (32.3%)	52 (16.1%)
You or a member of your family usually shops and cooks rather than eating sit-down or take-out restaurant food?	11 (3.4%)	42 (13%)	130 (40.4%)	139 (43.2%)
Usually feel well enough to shop or cook.	9 (2.8%)	46 (14.3%)	125 (38.8%)	142 (44.1%)

How willing are you to make changes in your eating habits in order to be healthier?	7 (2.2%)	30 (9.3%)	103 (32%)	182 (56.5%)
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Table 2 shows mixed dietary behaviours among the students studied. Several positive patterns were observed, as many participants reported rarely or never skipping breakfast (41.0%), eating fried foods (48.4%), or consuming regular snack chips and similar products (45.7%) In addition, more than half of the students reported rarely or never having low intake of whole grains (51.6%), Conversely, some negative dietary practices were still noticeable particularly the use of regular processed meats, which was reported as usually/often by 35.1% of the participants and the consumption of sugary beverages, which was usually/often reported by 24.2% A notable finding was that 182 participants (56.5%) responded “Does Not Apply To Me” to the question about willingness to make changes eating habits. These results may reflect issues related to question interpretation or response categorization and should therefore be interpreted with caution.

3.2.2 Physical activity Assessment

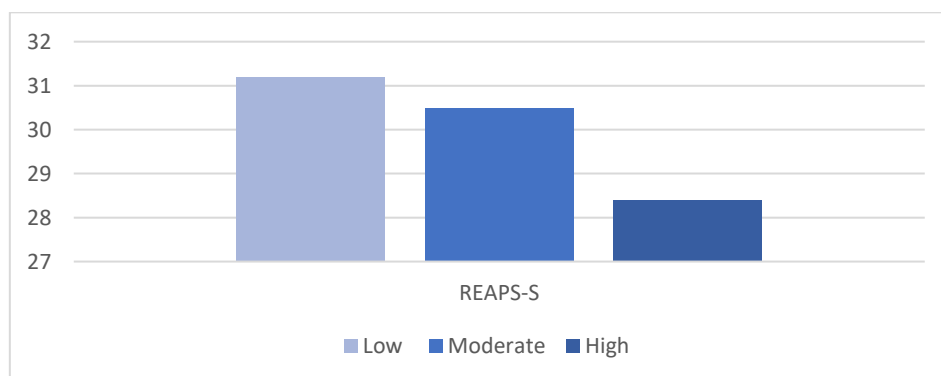
Table 3. The mean values represent the average number of days per week or the average duration in minutes spent on each type of physical activity, as reported in the IPAQ-SF.

IPAQ-SF item	Mean $\pm$ SD	Unit
Vigorous physical activity frequency	1.36 $\pm$ 1.778	days/week
Vigorous physical activity duration	28.22 $\pm$ 28.32	minutes/day
Moderate physical activity frequency	1.79 $\pm$ 1.679	days/week
Moderate physical activity duration	58.14 $\pm$ 35.252	minutes/day
Walking frequency	3.36 $\pm$ 2.137	days/week
Walking duration	60.62 $\pm$ 33.526	minutes/day
Sitting time on a weekday	2.57 $\pm$ 1.952	hours/day

Table 3 shows Mean values represent the average number of days per week, minutes per day, or hours per day reported by the participants for each physical activity domain, the average physical activity pattern of the studied students according to the IPAQ-SF, The mean values represent the average frequency or duration of each activity Walking had the highest average frequency (3.36 $\pm$ 2.14 days/week) followed by moderate physical activity (1.79 $\pm$ 1.68 days/week). In comparison, vigorous physical activity had the lowest average frequency (1.36 $\pm$ 1.78 days/week). This indicates that walking was the most reported form of physical activity among the students.

3.2.2 Diet Quality and Physical Activity Assessment

Figure 1. Mean REAPS-S Scores Across Physical Activity Levels (MET Categories)



This figure illustrates the relationship between physical activity levels and diet quality among participants. Mean REAPS-S scores decreased slightly with increasing MET levels, with participants in the high-MET category showing the lowest mean score compared to the low- and moderate-MET groups.

3.2.3 Sleep Quality Assessment

Table 4. Sleep Characteristics and Pittsburgh Sleep Quality Index (PSQI) Components Among the Studied Students

A. Sleep timing and duration				
Variable			Mean ± SD	
Usual bedtime during the past month			10.38 ± 10.509	
Sleep latency (minutes)			55.8 ± 108.182	
Usual wake-up time during the past month			9.52 ± 1.577	
Actual sleep duration (hours/night)			7.52 ± 2.188	
B. Sleep disturbances				
Variable	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
Cannot get to sleep within 30 minutes	96 (29.8%)	84 (26.1%)	73 (22.7%)	69 (21.4%)
Wake up in the middle of the night or early morning	66 (20.5%)	94 (29.2%)	76 (23.6%)	86 (26.7%)
Have to get up to use the bathroom	112 (34.8%)	111 (34.5%)	64 (19.9%)	35 (10.9%)
Cannot breathe comfortably	194 (60.2%)	70 (21.7%)	39 (12.1%)	19 (5.9%)
Cough or snore loudly	233 (72.4%)	50 (15.5%)	29 (9.0%)	10 (3.1%)
Feel too cold	109 (33.9%)	103 (32.0%)	65 (20.2%)	45 (14.0%)
Feel too hot	120 (37.3%)	116 (36.0%)	66 (20.5%)	20 (6.2%)
Had bad dreams	131 (40.7%)	104 (32.3%)	66 (20.5%)	21 (6.5%)
Have pain	178 (55.3%)	78 (24.2%)	42 (13.0%)	24 (7.5%)
Trouble sleeping because of other reasons	187 (58.1%)	67 (20.8%)	42 (13.0%)	26 (8.1%)
C. Subjective sleep quality and related factors				
Variable	Response category		N = 322	
Overall sleep quality	Very good		58 (18.0%)	
	Fairly good		154 (47.8%)	
	Fairly bad		86 (26.7%)	
	Very bad		24 (7.5%)	
Sleep medication use	Not during the past month		264 (82.0%)	
	Less than once a week		39 (12.1%)	
	Once or twice a week		11 (3.4%)	
	Three or more times a week		8 (2.5%)	
Trouble staying awake during daily activities	Not during the past month		135 (41.9%)	
	Less than once a week		108 (33.5%)	

	Once or twice a week	54 (16.8%)		
	Three or more times a week	25 (7.8%)		
Problem keeping up enough enthusiasm to get things done	No problem at all	46 (14.3%)		
	Only a very slight problem	216 (67.1%)		
	Somewhat of a problem	0 (0.0%)		
	A very big problem	60 (18.6%)		
Bed partner or roommate	No bed partner or roommate	138 (42.9%)		
	Partner/roommate in other room	34 (10.6%)		
	Partner in same room, but not same bed	131 (40.7%)		
	Partner in same bed	19 (5.9%)		
If the participant has a roommate or bed partner, ask him/her how often in the past month the participant had:				
Variable	Not during the past month	Less than once a week	Once or twice a week	Three or more times a week
Loud snoring	267 (82.9%)	30 (9.3%)	20 (6.2%)	5 (1.6%)
Long pauses between breaths while asleep	247 (76.7%)	55 (17.1%)	18 (5.6%)	2 (0.6%)
Legs twitching or jerking while asleep	185 (57.5%)	66 (20.5%)	47 (14.6%)	24 (7.5%)
Episodes of disorientation or confusion during sleep	238 (73.9%)	44 (13.7%)	32 (9.9%)	8 (2.5%)

Table 4 demonstrates that participants experienced moderate sleep quality, with several reported sleep disturbances, including delayed sleep onset and frequent awakenings. However, the use of sleep medication remained relatively uncommon.

3.2.4 Diet Quality and Sleep quality Assessment

Figure 2. Mean REAPS-S Scores Across according to Sleep Quality

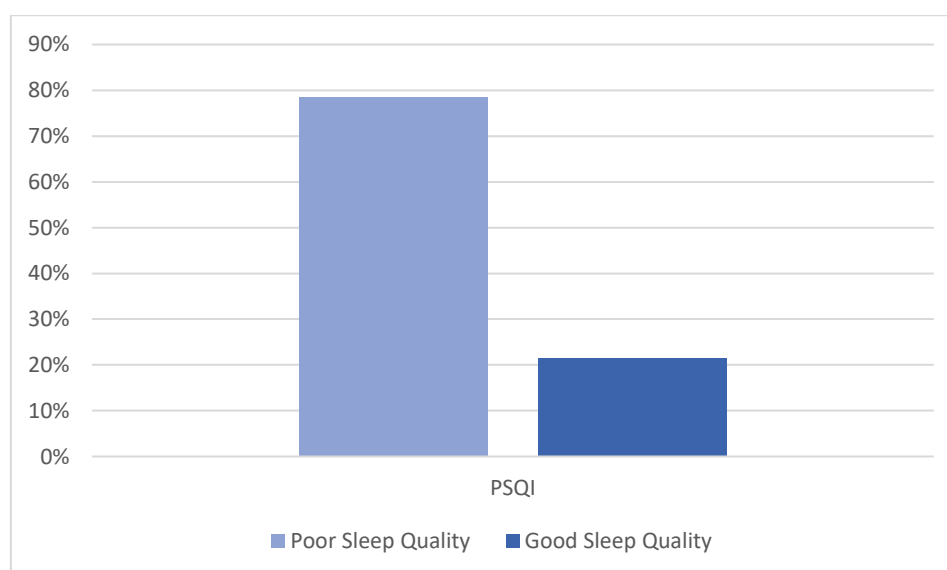


Figure 2 shows that students with good sleep quality had higher REAP-S mean scores compared to those with poor sleep quality, suggesting a positive association between sleep quality and diet quality.

3.2.5 Perceived Stress Assessment

Table 5. Distribution of Responses to the Perceived Stress Scale (PSS)

	Never	Almost never	Sometimes	Fairly often	Very often
PSS					
1. In the last month, how often have you been upset because of something that happened unexpectedly?	44 (13.7%)	76 (23.6%)	111 (34.5%)	59 (18.3%)	32 (9.9%)
2. In the last month, how often have you felt that you were unable to control the important things in your life?	41 (12.7%)	81 (25.2%)	134 (41.6%)	43 (13.4%)	23 (7.1%)
3. In the last month, how often have you felt nervous and stressed?	30 (9.3%)	38 (11.8%)	118 (36.6%)	93 (28.9%)	43 (13.4%)
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	67 (20.8%)	79 (24.5%)	103 (32%)	49 (15.2%)	24 (7.5%)
5. In the last month, how often have you felt that things were going your way?	31 (9.6%)	91 (28.3%)	136 (42.2%)	41 (12.7%)	23 (7.1%)
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	37 (11.5%)	72 (22.4%)	124 (38.5%)	68 (21.1%)	21 (6.5%)
7. In the last month, how often have you been able to control irritations in your life?	40 (12.4%)	90 (28%)	129 (40.1%)	41 (12.7%)	22 (6.8%)
8. In the last month, how often have you felt that you were on top of things?	42 (13%)	81 (25.2%)	121 (37.6%)	57 (17.7%)	21 (6.5%)
9. In the last month, how often have you been angered because of things that happened that were outside of your control?	20 (6.2%)	52 (16.1%)	106 (32.9%)	88 (27.3%)	56 (17.4%)
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	75 (23.3%)	61 (18.9%)	62 (19.3%)	57 (17.7%)	67 (20.8%)

Table 5 demonstrates variable levels of perceived stress among participants, with a notable proportion reporting moderate to high stress. Despite some positive coping responses, the findings indicate that stress is relatively common among university students.

Figure 3. Distribution of Responses to the Perceived Stress Scale (PSS) among students

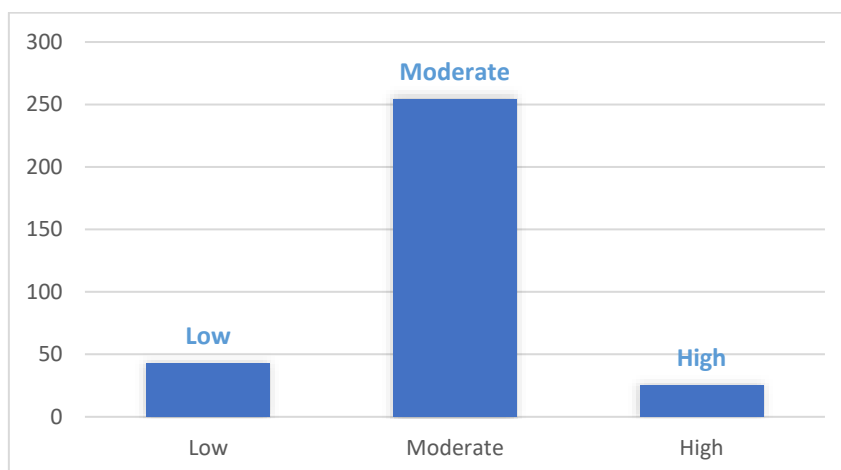


Figure 3 shows that most students have moderate stress levels, making it the most common category. Fewer students have low stress, and only a small number experience high stress.

Table 6. Distribution of Diet Quality, Physical Activity, Sleep Quality, and Perceived Stress Among the Studied Students

Variables	N=322
REAPS-S	
Mean $\pm$ SD*	30.47 $\pm$ 6.285
Median (IQR)**	31 (8)
IPAQ-TM	
Low MET	81 (25.2%)
Moderate MET	194 (60.2%)
High MET	47 (14.6%)
PSQI	
Poor Sleep Quality	253 (78.6%)
Good Sleep Quality	69 (21.4%)
PSS	
Low	43 (13.4%)
Moderate	254 (78.9%)
High	25 (7.8%)

Table 6 shows that the mean REAPS-S score was 30.47 ± 6.29 , indicating the average overall diet quality of the studied students. Regarding physical activity, most participants were classified as having moderate MET levels (60.2%), while 25.2% had low MET levels and only 14.6% had high MET levels. In terms of sleep quality, most students (78.6%) had poor sleep quality. Involving perceived stress, most participants (78.9%) had moderate stress levels, whereas only 7.8% had high stress. The

findings indicate that moderate physical activity and moderate stress were the most common patterns, while poor sleep quality was highly prevalent among the studied students.

3. Comparison Between Medical and Non-Medical Students

Table 7. Comparison of Diet Quality, Physical Activity, Sleep Quality, and Perceived Stress Between Medical and Non-Medical Students

Variables	Non-Medical Student N=154	Medical Student N=168	Test Value	P Value
Physical activity				
No	55 (35.7%)	50 (29.8%)	1.295	0.255 ^b
Yes	99 (64.3%)	118 (70.2%)		
REAPS-S				
mean $\pm$ SD	31.02 $\pm$ 5.996	29.96 $\pm$ 6.515	5.027	0.256 ^a
IPAQ-TM				
Low MET	33 (21.4%)	48 (28.6%)		
Moderate MET	99 (64.3%)	95 (56.5%)	2.448	0.294 ^b
High MET	22 (14.3%)	25 (14.9%)		
PSQI				
Poor Sleep Quality	122 (79.2%)	131 (78%)	0.074	0.786 ^b
Good Sleep Quality	32 (20.8%)	37 (22%)		
PSS				
Low	14 (9.1%)	29 (17.3%)		
Moderate	129 (83.8%)	125 (74.4%)	5.056	0.080 ^b
High	11 (7.1%)	14 (8.3%)		
^a p-values are based on Chi Square test. Statistical significance at $P < 0.05$				
^b p-values are based on Student test. Statistical significance at $P < 0.05$				

Table 7. There were no statistically significant differences observed between medical and non-medical students across all measured variables ($p > 0.05$). Regarding physical activity, 64.3% of non-medical students and 70.2% of medical students reported engaging in physical activity ($\chi^2 = 1.295$, $p = 0.255$). The REAPS-S scores showed no significant difference between groups (mean $\pm$ SD: 31.02 $\pm$ 5.996 vs. 29.96 $\pm$ 6.515; $t = 5.027$, $p = 0.256$). Similarly, the distribution of physical activity levels based on IPAQ was comparable between groups ($\chi^2 = 2.448$, $p = 0.294$). Sleep quality assessed using PSQI also showed no significant difference ($\chi^2 = 0.074$, $p = 0.786$). Although perceived stress levels measured by PSS did not differ significantly ($\chi^2 = 5.056$, $p = 0.080$), the result approached statistical significance. Overall, these findings suggest similar lifestyle patterns between medical and non-medical students.

4. Association Between Diet Quality and Selected Variables

Table 8. Association Between REAPS-S Score and Selected Variables Among the Studied Students

Variables	N	REAPS-S score (mean $\pm$ SD)	Test value	P value
Gender				
Male	61	29.57 $\pm$ 6.510	0.714	0.219
Female	261	30.67 $\pm$ 6.226		
Marital status				
Single	303	30.41 $\pm$ 6.140	2.822	0.520
Married	19	29.96 $\pm$ 8.428		
Medical student				
No	154	31.02 $\pm$ 5.996	1.259	0.130
Yes	168	29.96 $\pm$ 6.515		
Physical activity				
No	105	31.64 $\pm$ 6.070	0.063	0.020
Yes	217	29.90 $\pm$ 6.322		
Smoking				
No	298	30.34 $\pm$ 6.281	0.054	0.190
Yes	24	32.08 $\pm$ 6.234		
IPAQ-TM				
Low MET	81	31.59 $\pm$ 6.111	4.128	0.017
Moderate MET	194	30.52 $\pm$ 6.219		
High MET	47	28.32 $\pm$ 6.441		
PSQI				
Poor sleep quality	253	29.81 $\pm$ 6.064	0.382	<0.001
Good sleep quality	69	32.86 $\pm$ 6.545		
PSS				
Low	43	28.95 $\pm$ 5.563	1.492	0.227
Moderate	254	30.66 $\pm$ 6.285		
High	25	31.08 $\pm$ 7.274		

*Note: P values were calculated using Student's t-test for variables with two categories and one-way ANOVA for variables with more than two categories. Statistical significance was considered at $p < 0.05$.

Table 8 shows that the mean REAPS-S score differed significantly according to physical activity status ($p = 0.020$), IPAQ-TM categories ($p = 0.017$), and sleep quality ($p < 0.001$). Physically inactive students had a higher mean REAPS-S score than

physically active students (31.64 ± 6.07 vs 29.90 ± 6.32). In addition, students with good sleep quality had a higher mean REAPS-S score (32.86 ± 6.55) than those with poor sleep quality (29.81 ± 6.06). No statistically significant differences were observed according to gender, marital status, medical student status, smoking, or perceived stress level.

5. Relationship Between Diet Quality, Physical Activity, Sleep Quality, and Perceived Stress

5.1 Physical Activity Association

Table 9. Association Between Physical Activity Level (IPAQ-TM) and Diet Quality, Sleep Quality, and Stress Among the Studied Students

Variables	IPAQ			Test Value	P Value
	Low MET N=81	Moderate MET N=191	High MET N=47		
Age, mean±SD	20.54±1.525	20.93±1.768	20.89±1.772	1.510	0.223
Gender (n, %)					
Male	8 (9.9%)	31 (16%)	22 (46.8%)	129.213	0.000
Female	73 (90.1%)	163 (84%)	25 (53.2%)		
Marital status (n, %)					
Single	77 (95.1%)	182 (93.8%)	44 (93.6%)	0.183	0.912
Married	4 (4.9%)	12 (6.2%)	2 (6.4%)		
Weight, mean±SD	55.4±11.779	58.4±16.020	65.9±15.762	7.592	0.001
Height, mean±SD	160.9±6.651	160.1±11.296	165.7±10.116	5.811	0.003
BMI, mean±SD	21.4±3.951	23.2±12.257	23.9±4.934	1.208	0.300
Medical student (n, %)					
No	33 (40.7%)	99 (51%)	22 (46.8%)	2.448	0.294
Yes	48 (59.3%)	95 (49%)	25 (53.2%)		
Physical activity (n, %)					
No	49 (60.5%)	53 (27.3%)	3 (6.4%)	45.841	0.000
Yes	32 (39.5%)	141 (72.7%)	44 (93.6%)		
Smoking (n, %)					
No	77 (95.1%)	181 (93.3%)	40 (85.1%)	4.674	0.097
Yes	4 (4.9%)	13 (6.7%)	7 (14.9%)		
REAPS-S, mean±SD	31.2±6.111	30.5±6.249	28.3±6.441	4.128	0.017
PSQI					
Poor Sleep Quality	62 (76.5%)	153 (78.9%)	38 (80.9%)	0.353	0.838
Good Sleep Quality	19 (23.5%)	41 (21.1%)	9 (19.1%)		
PSS					

Low	6 (7.4%)	27 (13.9%)	10 (21.3%)	6.091	0.192
Moderate	69 (85.2%)	153 (78.9%)	32 (68.1%)		
High	6 (7.4%)	14 (7.2%)	5 (10.6%)		
p-values are based on Chi Square test. Statistical significance at P < 0.05					
p-values are based on ANOVA test. Statistical significance at P < 0.05					

Table 9 Analysis of physical activity levels revealed significant associations between IPAQ-TM categories and several variables. Gender was strongly associated with MET category, with males representing a higher proportion in the high MET group (46.8%) compared to females (53.2%) ($p < 0.001$). Weight and height were significantly higher among students in the high MET group (65.9 ± 15.76 kg and 165.7 ± 10.12 cm) compared to low and moderate MET groups ($p = 0.001$ and $p = 0.003$, respectively). Physical activity status was, by definition, significantly associated with MET classification, as the majority of physically active students were in the moderate and high MET groups. In contrast, most inactive students were in the low MET group ($p < 0.001$).

Diet quality, as assessed by REAPS-S, differed significantly across IPAQ-TM categories, with the highest mean REAPS-S score in the low MET group (31.2 ± 6.11) and the lowest in the high MET group (28.3 ± 6.44) ($p = 0.017$), indicating a tendency for lower diet quality among students with higher physical activity. No significant associations were observed for age ($p = 0.223$), marital status ($p = 0.912$), BMI ($p = 0.300$), medical specialty ($p = 0.294$), smoking status ($p = 0.097$), sleep quality ($p = 0.838$), or perceived stress levels ($p = 0.192$).

5.2 Sleep Quality Association

Table 10. Association Between Sleep Quality (PSQI) and Diet Quality, Physical Activity, and Stress Among the Studied Students

Variables	PSQI		Test Value	P Value
	Poor Quality Sleep N=253	Good Quality Sleep N=69		
Age, mean±SD	20.73±1.718	21.17±1.662	0.071	0.058
Gender (n, %)				
Male	51 (20.2%)	10 (14.5%)	1.133	0.287
Female	202 (79.8%)	59 (85.5%)		
Weight, mean±SD	59.2±15.865	57.3±13.178	0.835	0.383
Height, mean±SD	161.3±10.984	160±7.243	2.631	0.346
BMI, mean±SD	23.1±10.948	22.2±4.331	0.431	0.552
Medical student (n, %)				
No	122 (48.2%)	32 (46.4%)	0.074	0.786
Yes	131 (51.8%)	37 (53.6%)		
Physical activity (n, %)				
No	80 (31.6%)	25 (36.2%)	0.525	0.469
Yes	173 (68.4%)	44 (63.8%)		

Smoking (n, %)				
No	232 (91.7%)	66 (95.7%)	1.228	0.268
Yes	21 (8.3%)	3 (4.3%)		
REAPS-S, mean±SD	29.8±6.088	32.9±6.545	0.382	0.000
IPAQ				
Low MET	62 (24.5%)	19 (27.5)	0.353	0.838
Moderate MET	153 (60.5%)	41 (59.4%)		
High MET	38 (15%)	9 (13%)		
PSS				
Low	30 (11.9%)	13 (18.8%)	3.347	0.188
Moderate	201 (79.4%)	53 (76.8%)		
High	22 (8.7%)	3 (4.3%)		
p-values are based on Chi Square test. Statistical significance at P < 0.05				
p-values are based on Student test. Statistical significance at P < 0.05				

Table 10 shows that, for students with poor and good sleep quality, most variables were not significantly associated with PSQI classification. There were no statistically significant differences regarding age ($p = 0.058$), gender ($p = 0.287$), marital status ($p = 0.593$), weight ($p = 0.383$), height ($p = 0.346$), BMI ($p = 0.552$), medical specialty ($p = 0.786$), physical activity status ($p = 0.469$), smoking status ($p = 0.268$), IPAQ MET categories ($p = 0.838$), or perceived stress levels ($p = 0.188$).

However, a highly statistically significant difference in REAPS-S scores was observed according to sleep quality. Students with good sleep quality had a significantly higher mean REAPS-S score (32.9 ± 6.55) compared to those with poor sleep quality (29.8 ± 6.09) ($p < 0.001$), indicating a strong association between better diet quality and good sleep status.

Table 11. Association Between Perceived Stress (PSS) and Diet Quality, Sleep Quality, and Physical Activity Among the Studied Students

Variables	PSS			Test Value	P Value
	Low N=43	Moderate N=252	High N=25		
Age, mean $\pm$ SD	20.1 $\pm$ 1.536	20.8 $\pm$ 1.763	20.5 $\pm$ 1.474	0.738	0.479
Gender (n, %)					
Male	11 (25.6%)	48 (18.9%)	2 (8%)	3.184	0.204
Female	32 (74.4%)	206 (81.1%)	23 (92%)		
Marital status (n, %)					
Single	41 (95.3%)	238 (93.7%)	24 (96%)	0.356	0.837
Married	2 (4.7%)	16 (6.3%)	1 (4%)		
Weight, mean $\pm$ SD	60 $\pm$ 18.084	58.7 $\pm$ 15.102	57.8 $\pm$ 12.728	0.296	0.744

Height, mean±SD	162.1±8.850	161.1±10.721	158.4±7.661	1.265	0.284
BMI, mean±SD	22.7±5.641	23±10.835	22.6±3.993	0.035	0.966
Medical student (n, %)					
No	14 (32.6%)	129 (50.8%)	11 (44%)	5.056	0.077
Yes	29 (67.4%)	125 (49.2%)	14 (56%)		
Physical activity (n, %)					
No	9 (20.9%)	89 (35%)	7 (28%)	3.593	0.166
Yes	34 (79.1%)	165 (65%)	18 (72%)		
Smoking (n, %)					
No	40 (93%)	235 (92.5%)	23 (92%)	0.025	0.987
Yes	3 (7%)	19 (7.5%)	2 (8%)		
REAPS-S, mean±SD	29±5.631	31±6.296	31.1±7.274	1.492	0.227
PSQI					
Poor Sleep Quality	30 (69.8%)	201 (79.1%)	22 (88%)	3.347	0.188
Good Sleep Quality	13 (30.2%)	53 (20.9%)	3 (12%)		
IPAQ					
Low MET	6 (14%)	69 (27.2%)	6 (24%)	6.091	0.192
Moderate MET	27 (62.8%)	153 (60.2%)	14 (56%)		
High MET	10 (23.3%)	32 (12.6%)	5 (20%)		
p-values are based on Chi Square test. Statistical significance at P < 0.05					
p-values are based on ANOVA test. Statistical significance at P < 0.05					

Table 11 Analysis of perceived stress levels revealed no statistically significant associations with any of the examined variables. Age ($p = 0.479$), gender ($p = 0.204$), marital status ($p = 0.837$), weight ($p = 0.744$), height ($p = 0.284$), BMI ($p = 0.966$), medical specialty ($p = 0.077$), physical activity status ($p = 0.166$), smoking ($p = 0.987$), diet quality assessed by REAPS-S ($p = 0.227$), sleep quality assessed by PSQI ($p = 0.188$), and IPAQ MET categories ($p = 0.192$) all showed no significant differences across low, moderate, and high stress groups. These findings indicate that, within this population, perceived stress levels were not significantly influenced by sociodemographic factors, lifestyle behaviours, diet quality, sleep quality, or physical activity level.

4. DISCUSSION

This research aimed to explore how diet, physical activity, sleep, and stress are related among students, and whether having a medical background has any effect on these lifestyle factors. The findings showed that most students were generally in the moderate range for their lifestyle habits. However, poor sleep quality was a common issue among participants and appeared to be the most noticeable problem in both groups (Srirangaramasamy et al., 2024), (Deisz et al., 2024). Interestingly, medical students did not show better results than non-medical students, as both groups had very similar lifestyle patterns (Khandalavala

et al., 2024), (Dodin et al., 2024). This may suggest that having health-related knowledge alone is not enough to overcome the academic stress and daily challenges students experience.

Regarding diet quality, the results showed a gap between students' nutritional knowledge and their actual eating habits (Mahfouz et al., 2024), (Khandalavala et al., 2024). Many students may understand the importance of healthy eating, but busy schedules and academic demands often lead them to choose quick and convenient meals instead of more nutritious options, especially during exams. A similar pattern was seen in physical activity. Although many students reported some level of daily movement, fewer students engaged in vigorous exercise, which may be due to lack of time and increased academic responsibilities (Srirangaramasamy et al., 2024), (Deisz et al., 2024). During periods of heavy coursework, exercise is often one of the first habits to be reduced as students prioritize studying.

The widespread struggle with sleep is perhaps the most significant issue of the modern students experience, likely stemming from the cumulative burden of irregular study hours and constant deadlines (Srirangaramasamy et al., 2024), (Masaad et al., n.d.). Interestingly, we anticipated that stress would be the primary driver of poor habits, yet the data did not show a direct statistical link. This might suggest a degree of resilience or perhaps that students have developed coping mechanisms that decouple their mental stress from their physical choices (Hammoudi Halat et al., 2023).

A paradoxical finding emerged where students who were more physically active actually reported lower diet quality scores. This "active but poorly fueled" trend likely reflects a lifestyle of constant mobility, where high energy expenditure is met with quick, processed snacks to keep up with a busy schedule. Ultimately, these results challenge the assumption that medical education guarantees a healthier lifestyle (Cruz et al., 2024), (Yadav, 2022). The "daily grind" of the university environment—deadlines, social shifts, and the campus itself—simply carries more weight than any theoretical knowledge found in a textbook.

The strength of this research lies in its use of multiple validated scales (REAPS-S, IPAQ-SF, PSQI, and PSS-10) to build a reliable picture of student life. However, certain limitations warrant caution include the following; a the study is cross-sectional design that can identify patterns but cannot prove that one factor caused another. Also, the research relying on self-reported data which may carries the risk of recall bias.

6. CONCLUSION

This study's findings can inform the development of several practical recommendations and future research directions. Since poor sleep quality was highly prevalent among the studied students, universities are encouraged to implement programs that raise awareness about the impact of sleep on health. Students should be aware of some factors that negatively affect sleep quality such as excessive screen time and irregular sleep schedules.

In addition, as a significant positive association was found between better diet quality and good sleep quality, integrated health promotion campaigns that combine nutrition education with sleep awareness may help students adopt healthier lifestyle behaviors.

Furthermore, the finding that students with higher levels of physical activity reported poorer diet quality highlights the importance of targeted nutritional education programs for physically active students, assisting them in making healthier food choices to support their activity levels and overall well-being.

Since there were no significant differences between medical and non-medical students, future health promotion interventions should target university students across all academic disciplines. For future research, large studies including students from different colleges within Umm Al-Qura University and other universities are recommended to improve the generalizability of the findings. The use of face-to-face interviews or mixed data collection methods may also provide more accurate responses and reduce the self-report bias associated with online questionnaires.

AUTHOR CONTRIBUTIONS

Conceptualization, **Amal F Alqurashi**; methodology, **Rahaf Alqurashi, Raghad Alqurashi, Ruqayah Almatrafi and Dana Salawaty**; validation, **Amal F Alqurashi**; data analysis, **Amal F Alqurashim and Dana Salawaty**; writing—original draft preparation, **Raghad Alqurashi, Ruqayah Almatrafi**; writing—review and editing **Amal F Alqurashi**, visualization, **Ruqayah Almatrafi and Dana Salawaty**; supervision, **Amal F Alqurashi**; project administration, **Amal F Alqurashi**.

All authors have read and agreed to the published version of the manuscript.

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DATA AVAILABILITY STATEMENT

Responses collected from the participants are available upon request. Questionnaire items are also available.

CONFLICT OF INTEREST

The authors declares no conflicts of interest.

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