

## Association of Nutritional Status with Sleep Quality among University Students in Lahore, Pakistan

### Ume-Ruman\*

Student of BS Human Nutrition And Dietetics, Department of Human Nutrition and Food Technology, Superior University Lahore  
Email: muhammadshafeeq341@gmail.com

### Ameena Qaiser Butt

Lecturer, Department of Human Nutrition and Food Technology, Faculty of Allied Health sciences, Superior University, Lahore

### Maham Saleem

Lecturer, Department of Human Nutrition and Food Technology, Faculty of Allied Health Sciences, Superior University, Lahore

### Abstract

Author Details
<b>Keywords:</b> Sleep Quality; Nutritional Status; Dietary Patterns; Micronutrients
<b>Received on</b> 10 May 2026
<b>Accepted on</b> 08 June 2026
<b>Published on</b> 15 June 2026
<b>Corresponding E-mail &amp; Author*:</b>
<b>Ume-Ruman*</b> Email: muhammadshafeeq341@gmail.com

**Background:** Sleep quality is a key determinant of physical and mental health, while nutritional status plays an important role in influencing sleep outcomes. This study examined the relationship between nutritional status and sleep quality among university students. **Methodology:** A cross-sectional design was used with 200 participants from five universities. Data were collected using a structured questionnaire assessing dietary habits, meal patterns, appetite, and body weight changes, while sleep quality was measured using a modified Pittsburgh Sleep Quality Index (PSQI). Data were analyzed using SPSS, and Chi-square tests were applied to assess associations. **Results and Discussion:** The sample included 54.0% females

and 46.0% males, mostly aged 20–21 years (54.0%). Half of the participants had a normal BMI. Low intake of fruits and vegetables was observed, along with frequent fast food and sugary beverage consumption. The mean global sleep score was  $6.62 \pm 1.35$ , with 66.0% of students classified as poor sleepers. Significant associations were found between sleep quality and breakfast consumption, fast food intake, fruit and vegetable consumption, sugary drink intake, and number of daily meals ( $p < 0.05$ ), while body weight change was not significant. The findings suggest that unhealthy dietary patterns are significantly linked with poor sleep quality among university students. Improving nutritional habits may enhance sleep health and overall well-being.

### Introduction

Sleep is a fundamental biological process essential for physical health, cognitive function, emotional regulation, and immune integrity. Adequate sleep supports memory consolidation, metabolic homeostasis, hormonal balance, and cellular repair. Chronic sleep insufficiency, increasingly prevalent worldwide, is associated with

heightened risk of obesity, type 2 diabetes, cardiovascular disease, hypertension, and psychiatric disorders. Rapid urbanization, technological overexposure, occupational stress, and sedentary lifestyles have collectively disrupted natural circadian rhythms, making sleep health a critical public health priority.

Among modifiable determinants of sleep quality, nutrition has emerged as a significant factor. Nutritional status reflecting dietary intake, nutrient absorption, and physiological adequacy directly influences sleep architecture. Both undernutrition and poor dietary quality are associated with impaired sleep, including prolonged sleep latency, nocturnal awakenings, and restorative rest. Macronutrients modulate sleep via blood glucose regulation, insulin response, and amino acid availability for neurotransmitter synthesis, while micronutrients such as magnesium, iron, zinc, folate, vitamin B6 and vitamin D regulate melatonin production and circadian alignment.

Evidence consistently demonstrates that nutritional status predicts sleep quality, particularly in vulnerable populations. Studies in community-dwelling older adults confirm that malnourished individuals or those at malnutrition risk report significantly poorer sleep quality, shorter sleep duration, and greater daytime dysfunction compared to well-nourished counterparts. Data from the Bogalusa Heart Study further indicate that higher overall diet quality, assessed via the Alternate Healthy Eating Index, is independently associated with reduced sleep apnea risk, underscoring the systemic impact of dietary quality on sleep-related pathology.

Adherence to the Mediterranean dietary pattern has been most robustly linked to favorable sleep outcomes. University-based studies report that individuals with greater Mediterranean diet adherence exhibit shorter sleep latency, fewer nocturnal disturbances, reduced daytime dysfunction, and a preference for a morning Ness chronotype itself associated with healthier behavioral profiles. Phytochemical-rich diets similarly confer sleep benefits; participants in the highest Dietary Phytochemical Index tertile demonstrated a 14% lower risk of poor sleep quality, with improvements in sleep efficiency and reduced reliance on sleep medication.

Beyond macronutrient distribution and dietary patterns, targeted nutritional supplementation offers additional sleep-regulatory potential. Probiotics and 5-hydroxytryptophan (5-HTP), acting through the gut-brain axis, have demonstrated measurable improvements in sleep quality by modulating serotonin and melatonin biosynthesis. Micronutrient adequacy further supports circadian biology: folate status is linked to morningness chronotype, while vitamin B6 and vitamin D influence sleep timing preferences. An anti-inflammatory dietary profile reduces the oxidative burden associated with sleep disruption, with higher dietary inflammatory index scores independently predicting increased daytime dysfunction reinforcing diet as a holistic lever for sleep health promotion.

Nutritional status is a significant, modifiable determinant of sleep quality across populations. Malnourishment and poor dietary quality are consistently associated with impaired sleep architecture, while nutrient-dense patterns particularly the Mediterranean diet and adequate micronutrient intake correlate with better sleep parameters. These findings support the integration of nutritional assessment and dietary counseling into sleep health interventions. Future research should focus on longitudinal designs and standardized dietary measurement tools to establish causality and inform evidence-based clinical guidelines.

## **METHODOLOGY:**

This cross-sectional study was conducted among 200 university students aged 18–25 years to examine the relationship between nutritional status and sleep quality. Participants were recruited through convenience purposive sampling and included both male and female students who met the eligibility criteria. Data were collected over a four-month period using socio-demographic questionnaires, a Modified Pittsburgh Sleep Quality Index (PSQI), a 24-hour dietary recall, and a Food

Frequency Questionnaire (FFQ). Anthropometric measurements, including height, weight, BMI, and waist circumference, were also recorded. Ethical approval was obtained from the Institutional Review Board, and informed consent was secured from all participants. The collected data were analyzed using SPSS, where descriptive statistics such as frequencies, percentages, means, and standard deviations were applied to evaluate demographic characteristics, dietary intake, and sleep patterns, enabling assessment of the association between nutritional status and sleep quality.

## RESULTS

### Interpretation of Descriptive Statistics

The study included 200 university students, with females comprising 54.0% and males 46.0% of the sample. Participants were equally recruited from five universities (USA, SU, UMT, GI, and NUR), with 40 students (20.0%) from each institution, ensuring balanced representation. Most respondents (54.0%) were aged 20–21 years, followed by 22–23 years (26.0%) and 18–19 years (20.0%). BMI assessment revealed that 50.0% of participants had a normal BMI (18.5–24.9 kg/m<sup>2</sup>), while 31.5% were underweight, 15.5% overweight, and 3.0% obese. Overall, the majority of students demonstrated a healthy nutritional status, providing a suitable foundation for examining the relationship between nutritional status and sleep quality among university students.

**Table 1.1 Descriptive Statistics**

Variable	Category	Frequency	Percentage (%)
<b>Gender</b>	Male	92	46.0
<b>Gender</b>	Female	108	54.0
<b>University</b>	USA	40	20.0
<b>University</b>	SU	40	20.0
<b>University</b>	UMT	40	20.0
<b>University</b>	GI	40	20.0
<b>University</b>	NUR	40	20.0
<b>Age Distribution</b>	18–19	40	20.0
<b>Age Distribution</b>	20–21	108	54.0
<b>Age Distribution</b>	22–23	52	26.0
<b>BMI Classification</b>	<18.49 (Underweight)	63	31.5
<b>BMI Classification</b>	18.5–24.9 (Normal)	100	50.0
<b>BMI Classification</b>	25.0–29.9 (Overweight)	31	15.5.0
<b>BMI Classification</b>	≥30.0 (Obese)	6	3.0

**Table 1.2 Nutritional Status (Dietary Habits, Meal Patterns, Weight Changes, and Appetite)**

#### Section A: Nutritional Status

Question	Daily	Occasionally	Rarely	Never
----------	-------	--------------	--------	-------

Do you take breakfast regularly?	84 (42.0%)	45 (22.5%)	48 (24.0%)	23 (11.5%)
How frequently do you consume fruits per week?	14 (7.0%)	42 (21.0%)	92 (46.0%)	52 (26.0%)
How frequently do you consume vegetables per week?	38 (19.0%)	39 (19.5%)	81 (41.5%)	42 (21.0%)
How often do you eat fast food?	28 (14.0%)	75 (37.5%)	58 (29.0%)	38 (19.0%)
How often do you consume sugary beverages?	49 (24.5%)	60 (30.0%)	50 (25.0%)	41 (20.5%)
How often do you consume dairy products?	45 (22.5%)	115 (57.5%)	26 (13.0%)	14 (7.0%)
Do you use vitamins or supplements?	16 (8.0%)	11 (5.5%)	54 (27.0%)	119 (59.5%)

**Table 1.5 Descriptive Statistics for Global Sleep Scores and Component Buckets (N = 200)**

Variable	Min	Max	Mean	Std. Deviation
<b>Global Sleep Score</b>	2.15	9.50	6.62	1.35
<b>Bucket 1</b> (Quality & Bedtime)	0.00	3.00	1.95	0.55
<b>Bucket 4</b> (Fatigue & Daily Stress)	0.00	3.00	1.88	0.58
<b>Bucket 3</b> (Duration & Disturbances)	0.00	3.00	1.55	0.60
<b>Bucket 2</b> (Delays & Mobile Phone)	0.00	3.00	1.25	0.69

Logically the individual component scores were examined in terms of average scores (range 0-3), to find out the main causes of sleep loss. The severity mean was highest with 1.95 (SD = 0.55) in Bucket 1 (Sleep Quality & Bedtime), and was tied for second place with mean = 1.88 (SD = 0.58) in Bucket 4 (Daytime Fatigue & Daily Stress). This suggests that inconsistent bedtimes are the most important issue for undermining student wellness, as is self-reported poor sleep quality and high levels of daytime stress all relate to students. On the other hand, there were also some students with a relative severity lower in the cohort in Bucket 3 (Sleep Duration & Disturbances) (M = 1.55, SD = 0.60) and Bucket 2 (Sleep Latency & Mobile phone delays) (M = 1.25, SD = 0.69).

**Table 1.6 Categorical Distribution of Diagnostic Sleep Profiles (N = 200)**

Sleep Classification	Frequency (n)	Percentage (%)
Good Sleepers (Score < 5.00)	68	34.0%
Poor Sleepers (Score $\geq$ 5.00)	132	66.0%
<b>Total</b>	<b>200</b>	<b>100.0%</b>

**Table 1.7 Comprehensive Item-Level Response Scaling across the Four Component Buckets**

Component / Bucket	Underlying Questionnaire Items	Score 0	Score 1	Score 2	Score 3
<b>Bucket 1: Quality &amp; Bedtime</b>	<ul style="list-style-type: none"> <li>• <i>Gotobed (Q11: Bedtime regularity)</i></li> <li>• <i>Sleep quality (Q18: Subjective quality)</i></li> </ul>	Very Good	Fairly Good	Fairly Bad	Very Bad
<b>Bucket 2: Latency &amp; Screen Time</b>	<ul style="list-style-type: none"> <li>• <i>fall asleep (Q12: Time to fall asleep)</i></li> <li>• <i>mobile phone (Q20: Night phone delay)</i></li> </ul>	None	Mild Delay	Moderate Delay	Severe Delay
<b>Bucket 3: Duration &amp; Disturbances</b>	<ul style="list-style-type: none"> <li>• <i>sleep hours (Q13: Total hours of sleep)</i></li> <li>• <i>sleep disturbed (Q14: Night waking)</i></li> <li>• <i>returning sleep (Q15: Trouble returning to sleep)</i></li> </ul>	None	Minimal	Noticeable	Severe / Frequent

**Bucket 4: Fatigue & Daytime Stress** • Daytime sleep (Q16: Staying awake daytime) •sleep

None Minimal Noticeable Severe / Constant

medication (Q17: Use of medicine)

• stress daily (Q19: Perceived daily stress)

**Statistical Interpretation**

This is because the data is spread out and there are various trends that can be observed in this study. Responses to the 10 individual items were not uniformly distributed but did offer a good range of responses across all levels of evaluation. A significant portion of the population were found to have between no or only slight difficulties (with a score across the globe ranging from no to a maximum of 5.00) and labelled as Good Sleepers (34.0% n = 68). Tricky these folks were able to strike a balance with sleep indoors regardless of the school work. Late-night use of mobile phone (4), irregular use of mobile phone (5), Gotobed and, in particular, high daily stress (6), however, were constantly rated higher severity ratings (i.e., scores of 2 and/or 3) by a larger portion of the participants. The Global Sleep Scores of the total cohort successfully exceeded the critical score of 5.00 in 66.0% (n = 132) cases due to all of these problematic behaviors. The difficulties had collectively pushed the Global Sleep Scores over the critical score of 5.00 in 66.0% (n = 132) cases making them Poor Sleepers. This dual-distribution offers solid mathematical and logical evidence of a general problem with sleep hygiene adopted by the student sample and an ability to harness the differential power of the diagnostic index between different sleep hygiene challenges.

**Table 1.8 Chi-Square Analysis of Dietary Habits by Sleep Quality Classification (N = 200)**

Dietary Variable	Good Sleeper (n=68) Count (%)	Poor Sleeper (n=132) Count (%)	Total (N=200) Count (%)	p-value
<b>Breakfast Consumption</b>				<b>0.010</b>
- Daily	37 (44.0%)	47 (56.0%)	84 (100%)	
- Occasionally	14 (31.1%)	31 (68.9%)	45 (100%)	
- Rarely	13 (27.1%)	35 (72.9%)	48 (100%)	
- Never	4 (17.4%)	19 (82.6%)	23 (100%)	
<b>Fast Food Consumption</b>				<b>0.020</b>
- Daily	4 (14.3%)	24 (85.7%)	28 (100%)	
- Occasionally	24 (32.0%)	51 (68.0%)	75 (100%)	
- Rarely	22 (37.9%)	36 (62.1%)	58 (100%)	

- Never	18 (47.4%)	20 (52.6%)	38 (100%)
<b>Fruit Consumption</b>			<b>0.043</b>
- Daily	8 (57.1%)	6 (42.9%)	14 (100%)
- Occasionally	18 (42.9%)	24 (57.1%)	42 (100%)
- Rarely	31 (33.7%)	61 (66.3%)	92 (100%)
- Never	11 (21.2%)	41 (78.8%)	52 (100%)
<b>Vegetable Consumption</b>			<b>0.047</b>
- Daily	18 (47.4%)	20 (52.6%)	38 (100%)
- Occasionally	16 (41.0%)	23 (59.0%)	39 (100%)
- Rarely	25 (30.9%)	56 (69.1%)	81 (100%)
- Never	9 (21.4%)	33 (78.6%)	42 (100%)
<b>Sugary Beverages</b>			<b>0.015</b>
- Daily	10 (20.4%)	39 (79.6%)	49 (100%)
- Occasionally	19 (31.7%)	41 (68.3%)	60 (100%)
- Rarely	20 (40.0%)	30 (60.0%)	50 (100%)
- Never	19 (46.3%)	22 (53.7%)	41 (100%)
<b>Meals Per Day</b>			<b>0.006</b>
- 1 Meal	2 (12.5%)	14 (87.5%)	16 (100%)
- 2 Meals	20 (26.3%)	56 (73.7%)	76 (100%)
- 3 Meals	38 (45.2%)	46 (54.8%)	84 (100%)
- >3 Meals	8 (33.3%)	16 (66.7%)	24 (100%)
<b>Body Weight Changes</b>			<b>0.479</b>

### **Dietary Habits and Sleep Quality:**

A Chi-square test of independence was conducted to assess the association between dietary habits and sleep quality among 200 university students. Sleep quality was categorized as good sleepers (n = 68) and poor sleepers (n = 132). Significant associations were observed between sleep quality and several dietary factors, including breakfast consumption, fast-food intake, fruit and vegetable consumption, sugary beverage intake, and meal frequency ( $p < 0.05$ ). However, no significant association was found between body weight changes and sleep quality ( $p = 0.479$ ). Students who consumed breakfast regularly demonstrated better sleep quality, whereas those who skipped breakfast were more likely to be poor sleepers. Similarly, frequent consumption of fast food and sugary beverages was associated with poorer sleep quality. Daily intake of fruits and vegetables was linked with better sleep

outcomes, while regular meal patterns, particularly consuming three meals per day, were associated with a higher proportion of good sleepers. Overall, the findings suggest that healthier dietary habits are positively associated with better sleep quality among university students.

## **DISCUSSION**

The present cross-sectional study investigated the relationship between nutritional status and sleep quality among 200 university students. Sleep quality was assessed using the Modified Pittsburgh Sleep Quality Index (PSQI), while nutritional status was evaluated through dietary habits, meal frequency, fruit and vegetable intake, fast-food consumption, sugary beverage intake, appetite, and short-term body weight changes. The findings demonstrated a significant association between dietary behaviors and sleep quality among university students.

The results revealed several unhealthy dietary patterns among participants. Although 42.0% of students reported regular breakfast consumption, a considerable proportion skipped breakfast or consumed it irregularly. Fruit and vegetable intake was also inadequate, with many students reporting infrequent consumption. Such dietary patterns may contribute to insufficient intake of essential nutrients, including magnesium, potassium, folate, and B-complex vitamins, which play important roles in neurotransmitter function and melatonin synthesis, both of which are involved in sleep regulation.

The study also found moderate consumption of fast food and sugar-sweetened beverages, reflecting common dietary behaviors among university students. These eating habits are often influenced by academic stress, busy schedules, and lifestyle factors. High intake of processed foods and sugary drinks may negatively affect metabolic regulation and contribute to poorer sleep quality. Meal frequency analysis further showed that students consuming three regular meals per day generally demonstrated healthier dietary patterns than those with irregular meal schedules.

Sleep assessment indicated that 66.0% of participants were classified as poor sleepers, with a mean PSQI score of  $6.62 \pm 1.35$ . The most affected domains were sleep quality and bedtime regularity, followed by daytime fatigue and stress. These findings suggest that academic pressures, irregular routines, and lifestyle behaviors may substantially influence sleep quality among university students.

Chi-square analysis demonstrated significant associations between sleep quality and several dietary factors, including breakfast consumption, fruit intake, vegetable intake, fast-food consumption, sugary beverage intake, and meal frequency ( $p < 0.05$ ). Students who consumed breakfast regularly, ate fruits and vegetables frequently, and maintained regular meal patterns were more likely to report good sleep quality. In contrast, higher consumption of fast food and sugary beverages was associated with poor sleep quality. However, short-term body weight changes were not significantly associated with sleep quality ( $p = 0.479$ ).

Overall, the findings indicate that healthier dietary habits are positively associated with better sleep quality among university students. The study highlights the importance of promoting balanced nutrition and regular eating patterns as potential strategies for improving sleep quality and overall well-being in this population.

## **CONCLUSION**

This study investigated the relationship between nutritional status and sleep quality among 200 university students and found a significant association between dietary habits and sleep quality. Many participants reported unhealthy dietary behaviors, including irregular breakfast consumption, low fruit and vegetable intake, and frequent consumption of fast food and sugary beverages. Sleep assessment revealed that 66.0% of students were poor sleepers, with sleep quality, bedtime irregularity, daytime fatigue, and stress being the most affected domains. Statistical analysis

showed that breakfast consumption, fruit and vegetable intake, fast-food consumption, sugary beverage intake, and meal frequency were significantly associated with sleep quality ( $p < 0.05$ ), whereas body weight changes were not. Overall, students with healthier and more regular dietary patterns were more likely to experience better sleep quality, highlighting the importance of balanced nutrition and healthy eating habits in promoting sleep health and overall well-being among university students.

## REFERENCES:

- Jiang H, Ye L, Zhang S, Jin M, Wang J, Tang M, Chen K. The association between nutritional status and sleep quality of Chinese community-dwelling older adults. *Aging Clin Exp Res.* 2023;35(9):pp. 1- 9
- Potts KS, Wallace ME, Gustat J, Ley SH, Qi L, Bazzano LA. Diet quality and sleep characteristics in midlife: The Bogalusa Heart Study. *Nutrients.* 2023; 15(9), pp. 1- 8
- Naja F, Hasan H, Khadem SH, Buanq MA, Al-Mulla HK, Aljassmi AK, Faris ME. Adherence to the Mediterranean diet and its association with sleep quality and chronotype among youth: a cross-sectional study. *Front Nutr.* 2022; 8, pp. 1- 12
- Nouripour F, Mazloom Z, Fararouei M, Zamani A. Effect of protein and carbohydrate distribution among meals on quality of life, sleep quality, inflammation, and oxidative stress in patients with type 2 diabetes: a single-blinded randomized controlled trial. *Food Sci Nutr.* 2021; 9(11), pp. 1- 9
- Zhang R, Luo L, Zhang L, Lin X, Wu C, Jiang F, Wang J. Genetically supported causality between micronutrients and sleep behaviors: a two-sample Mendelian randomization study. *Brain Behav.* 2025; 15(2), pp. 1- 10
- İnan CM, Özçelik AÖ. Dietary phytochemical index and sleep quality: a cross-sectional study from Turkey. *J Health Popul Nutr.* 2025; 44(1), pp. 1- 10
- Masaad AA, Yusuf AM, Shakir AZ, Khan MS, Khaleel S, Cheikh Ismail L, et al. Sleep quality and dietary inflammatory index among university students: a cross-sectional study. *Sleep Breath.* 2021; 25(4), pp. 1- 8
- Alghamdi NA, Almasaudi AS. Evaluating dietary habits of adults and their relationship with sleep quality in the Kingdom of Saudi Arabia. *Front Nutr.* 2025; 12, pp. 1- 11.
- Lee E, Lim ST. Associations among sleep duration, physical activity, and nutrient intake in Korean adults. *Nutrients.* 2025; 17(14), pp. 1- 10
- Verkaar AJCF, Winkels M, Kampman E, Luik AI, Voortman T. Associations of dietary patterns with objective and subjective sleep duration and sleep quality in a population-based cohort study. *Sleep Med.* 2024; 119, pp. 1- 7
- Sandri E, Broccolo A, Piredda M, Micheluzzi V, Sandri E. Socio-demographic, nutritional, and lifestyle factors influencing perceived sleep quality in Spain, with a particular focus on women and young people. *Nutrients* 2025; 17(6), pp. 1- 10
- Descarpentrie A, Calas L, Cornet M, Heude B, Charles MA, Avraam D, et al. Lifestyle patterns in European preschoolers: associations with socio-demographic factors and body mass index. *Pediatr Obes.* 2023; 18(12), pp. 1- 9
- Marín Ferrandis AV, Broccolo A, Piredda M, Micheluzzi V, Sandri E. Nutritional and lifestyle behaviors and their influence on sleep quality among Spanish adult women. *Nutrients.* 2025; 17(13), pp. 1- 11
- Sutanto CN, Xia X, Heng CW, Tan YS, Lee DPS, Fam J, et al. The impact of 5-hydroxytryptophan supplementation on sleep quality and gut microbiota composition in older adults: a randomized controlled trial. *Clin Nutr.* 2024:

- 43(3), pp. 1- 9
- Ho YT, Tsai YC, Kuo TBJ, Yang CCH. Effects of *Lactobacillus plantarum* PS128 on depressive symptoms and sleep quality in self-reported insomniacs: a randomized, double-blind, placebo-controlled pilot trial. *Nutrients*. 2021; 13(8), pp. 1- 10
- Li J, Zhao J, Ze X, Li L, Li Y, Zhou Z, et al. *Lacticaseibacillus paracasei* 207-27 alters the microbiota-gut-brain axis to improve wearable device-measured sleep duration in healthy adults: a randomized, double-blind, placebo-controlled trial. *Food Funct*. 2024; 15(21), pp. 1-13
- Golmohammadi M, Attari VE, Salimi Y, Saed L, Nachvak SM, Samadi M. The effect of MIND diet on sleep status, mental health, and serum level of BDNF in overweight/obese diabetic women with insomnia: a randomized controlled trial. *Sci Rep*. 2025; 15(1), pp. 1- 9
- Poursalehi D, Shahdadian F, Hajhashemy Z, Lotfi K, Moradmand Z, Rouhani P, et al. Diet in relation to metabolic, sleep and psychological health status (DiMetS): protocol for a cross-sectional study. *BMJ Open*. 2023; 13(12), pp. 1- 10
- Coxon C, Hepsomali P, Brandt K, Vauzour D, Costabile A. Personality, dietary identity, mental and sleep health in vegans and vegetarians: a preliminary cross-sectional study. *Health Sci Rep*. 2023; 6(8), pp. 1- 9
- Famodu OA, Barr ML, Holásková I, Zhou W, Morrell JS, Colby SE, Olfert MD, Mathews AE, Byrd-Bredbenner C, Greene GW, Kidd T. Shortening the Pittsburgh Sleep Quality Index (PSQI) for use among college students. *J Am Coll Health*. 2018;66(8):pp. 749–756.
- Al-Jawarneh Y, Chauhan C, Csölle A, Lohner S. Association between unhealthy eating behaviors and sleep quality among university students. *Nutrients*. 2023;15(11):pp. 1–9.