Relationship between sleep quality and breakfast habits among university students: A cross-sectional study

Üniversite öğrencilerinde uyku kalitesi ve kahvaltı alışkanlıkları arasındaki ilişki: Kesitsel bir çalışma

Çiğdem BOZKIR[1] ID, Ayşegül GÜNGÖR[2] ID

1-İnönü University Faculty of Health Sciences Nutrition and Dietetics Department, Malatya, Türkiye

2-Does not work for any institution.

Sorumlu Yazar / Corresponding Author:

Asst. Prof. Çiğdem BOZKIR

e-posta / e-mail: cigdem.bozkir@inonu. edu.tr

Abstract

This study aims to evaluate the relationship between sleep quality and breakfast habits among students at the School of Health. A cross-sectional descriptive study was conducted with 291 students at Tekirdağ Namık Kemal University School of Health between January and May 2020. Data was collected through a questionnaire that included sociodemographic characteristics, anthropometric information, breakfast habits, and sleep patterns. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). Multiple linear regression was used to understand breakfast behaviour and other factors affecting the PSQI total score. The mean age of the participants was 20.78 (±2.33) years, and 75% were women. The study revealed that 68% of the participants had poor sleep quality, and 76% of those with good sleep quality had regular breakfast habits (p<0.05). Multiple linear regression analysis showed that consuming eggs less than 1-2 times a week (β=1.45) and consuming filter coffee every day (β=1.44) increased PSQI scores, indicating poorer sleep quality. Conversely, regular breakfast (β=-0.78) and lunch (β=-0.62) consumption were associated with lower PSQI scores, indicating better sleep quality (R²=0.21, p<0.01). This study found a significant bidirectional relationship between sleep quality and breakfast habits among university students. Regular breakfast consumption, adherence to meal timing, and minimizing the time interval between the last meal and bedtime are associated with better sleep quality.

Keywords: Sleep quality, breakfast habits, university students, Pittsburgh sleep quality index (PSQI)

Özet

Bu çalışmada Sağlık Yüksekokulu öğrencilerinde uyku kalitesi ile kahvaltı alışkanlıkları arasındaki ilişkinin değerlendirilmesi amaçlanmıştır. Tekirdağ Namık Kemal Üniversitesi Sağlık Yüksekokulu'nda Ocak-Mayıs 2020 tarihleri arasında 291 öğrenci ile kesitsel tanımlayıcı bir çalışma yürütülmüştür. Veriler sosyodemografik özellikler, antropometrik bilgiler, kahvaltı alışkanlıkları ve uyku düzenlerini içeren bir anket aracılığıyla toplanmıştır. Uyku kalitesi Pittsburgh Uyku Kalitesi İndeksi (PSQI) kullanılarak değerlendirilmiştir. Kahvaltı davranışı ve PSQI toplam puanını etkileyen diğer faktörleri anlamak için çoklu doğrusal regresyon kullanılmıştır. Katılımcıların yaş ortalaması 20,78 (±2,33) yıl olup %75'i kadındır. Çalışma sonucunda katılımcıların %68'inin kötü uyku kalitesine sahip olduğu, iyi uyku kalitesine sahip olanların %76'sının ise düzenli kahvaltı alışkanlığına sahip olduğu ortaya çıkmıştır (p<0,05). Çoklu doğrusal regresyon analizi, haftada 1-2 kereden az yumurta tüketmenin (β=1,45) ve her gün filtre kahve tüketmenin (β=1,44) PSQI puanlarını artırdığını ve daha kötü uyku kalitesini gösterdiğini göstermiştir. Tersine, düzenli kahvaltı (β=-0,78) ve öğle yemeği (β=-0,62) tüketimi daha düşük PSQI puanları ile ilişkili olup daha iyi uyku kalitesini göstermektedir (R²=0,21, p<0,01). Bu çalışma, üniversite öğrencileri arasında uyku kalitesi ile kahvaltı alışkanlıkları arasında anlamlı bir çift yönlü ilişki bulmuştur. Düzenli kahvaltı tüketimi, öğün zamanlamasına uyma ve son öğün ile yatma vakti arasındaki zaman aralığını en aza indirme, daha iyi uyku kalitesi ile ilişkilidir.

Anahtar Kelimeler: Uyku kalitesi, kahvaltı alışkanlıkları, üniversite öğrencileri, Pittsburgh uyku kalitesi indeksi (PSQI)

Introduction

Nutrition, an essential aspect of human life, significantly contributing to overall well-being. Eating habits, particularly from early childhood to adulthood, are key determinants of health (1). These habits, established in childhood, tend to persist into adulthood, potentially influencing food choices and eating patterns over time (2). Recently, there has been growing attention on the dietary practices of university students, as this group is particularly vulnerable to unhealthy eating habits (3). During the transition from adolescence to young adulthood, individuals face numerous challenges in making healthy food choices as they gain independence (4). These challenges can negatively impact health, highlighting the importance of interventions that promote conscious food choices to maintain health in young adults (5). Recognizing the significant role of nutrition in student health, it is also crucial to consider the impact of another fundamental lifestyle factor: sleep quality, which has been increasingly recognized for its interconnectedness with dietary habits and overall well-being in this population (6).

Sleep quality (SQ) is defined as "the individual's satisfaction with the sleep experience, encompassing sleep initiation, maintenance, duration, and refreshment upon awakening" (7). The evaluations of sleep quality are typically conducted through validated tools like the Pittsburgh Sleep Quality Index (PSQI) (8). This concept encompasses multiple dimensions, reflecting the intricate interplay of voluntary behaviours, sleep-wake regulation, and circadian rhythms (9).

Research highlights that nutritional status significantly influences sleep disorders, with dietary choices affecting various sleep-related factors, including duration and quality. Unhealthy eating patterns have been linked to a higher prevalence of mental health conditions such as depression, anxiety, and sleep disturbances (6, 10, 11). Dietary behaviours are recognised as modifiable risk factors for improving sleep outcomes (12).

Breakfast is linked to nutrient intake, weight management, cardiovascular health, and cognitive performance (13). Evidence suggests a strong relationship between eating behaviours, meal timing, and sleep quality. Individuals with poor sleep quality or insufficient sleep duration often engage in irregular eating habits, including skipping breakfast (14,15), while regular breakfast consumption has been associated with better sleep quality (16). Irregular meal timing and/or skipping meals may disrupt circadian rhythm and metabolism, reducing sleep quality (14,15). However, the mechanism through which breakfast frequency affects SQ remains unclear (17). This study aimed to evaluate the effect of sleep quality on breakfast habits among students at the School of Health.

Material and Method

Study Design

This cross-sectional descriptive study involved 291 students who were continuing their education at Tekirdağ Namık Kemal University (TNKU) School of Health between January and May 2020. Participation was voluntary, and all participants signed informed consent forms. Ethical approval was obtained from the Namık Kemal University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee (Date-Number: 20/01/2020-E.4312) and the study was conducted in accordance with the tenets of the Declaration of Helsinki.

ORCID:

Çiğdem BOZKIR:
0000-0002-1103-6290
Ayşegül GÜNGÖR:
0009-0007-7936-5115

Data Collection

Data collection was carried out using a structured questionnaire developed by the researchers based on relevant literature. The questionnaire comprised 23 items, covering sociodemographic information, anthropometric data, breakfast habits, breakfast meal content, and sleep-related patterns. Pittsburgh Sleep Quality Index (PSQI) was used to evaluate sleep quality.

The PSQI, originally developed by Buysse and colleagues in 1989 (8). It was later adapted for the Turkish population and validated by Ağargün and colleagues in 1996 (18). It consists of 24 items, with 19 designed for self-assessment and 5 aimed at gathering clinical information (the latter being completed by a roommate or partner and excluded from scoring).

The scoring process consists of 18 items that are categorised into seven components. These components include subjective sleep quality (component 1), sleep latency (component 2), sleep duration (component 3), habitual sleep efficiency (component 4), sleep disturbances (component 5), use of sleeping medication (component 6), and daytime dysfunction (component 7). Each component is scored from 0 to 3, and the total score, ranging from 0 to 21, is calculated by summing these values. A total PSQI score of ≤5 is classified as "good sleep quality," while scores >5 indicate "poor sleep quality" (8, 18).

Body Mass Index (BMI) classification

Body Mass Index (BMI) is a simple and widely used measure to classify underweight, overweight, and obesity in adults. While BMI does not reflect differences in body composition, muscle mass, or overall health, it can offer a general indication of body size. The BMI values has been calculated by dividing participants' weight in kilograms by the square of their height in meters (kg/m²). According to the World Health Organization (WHO), BMI categories include underweight (BMI<18.5), within the recommended range (BMI=18.5–24.9), individuals living with overweight (BMI≥25.0), and obesity (BMI≥30.0) (19).

Statistical Analysis

The data were analysed with IBM SPSS version 22. Frequency (n), percentage (%), mean and standard deviation (SD) were used for descriptive statistics. To assess the normality of the data distribution, the Kolmogorov-Smirnov test was applied. Pearson's chi-square test was employed to examine relationships among categorical variables, while independent sample t-tests were used to compare the means of binary groups. In order to identify the factors that influence the PSQI total score, and behaviours related to breakfast, a multiple linear regression analysis was performed. Statistical significance was accepted as $p<0.05$.

Ethics

Permission to conduct the study was obtained from the Tekirdağ Namık Kemal University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee (Date-No: 20/01/2020-E.4312).

Table 1: Comparison of sociodemographic and general characteristics across sleep quality groups

Parameters	Sleep Quality		Total	p[1]
	Good (≤5) n = 93 (32%)	Poor (>5) n= 198 (68%)		
	Mean ± SD	Mean ± SD	Mean ± SD	
Age (years)	20.83 ±2.56	20.76 ± 2.22	20.78± 2.33	0.248
BMI (kg/m²)	21.96 ±3.04	21.49 ± 2.88	21.64± 2.94	0.430
Sleep duration (hour)	7.70 ±1.02	6.15 ± 2.24	6.65± 2.06	**<0.001**
PSQI total score	4.09 ± 1.08	8.35 ± 2.21	6.99 ± 2.76	**<0.001**
Sociodemographic Characteristics				
Gender	**n (%)**	**n (%)**	**n (%)**	**p[2]**
Female	74 (80.3)	146 (74.1)	220 (75.6)	0.290
Male	19 (19.7)	52 (25.9)	71 (24.4)	

Department				
Emergency Aid and Disaster Management	12 (12.9)	31 (15.7)	43 (14.7)	0.126
Nutrition and Dietetics	38 (40.9)	64 (32.3)	102 (35.1)	
Nursing	43 (46.2)	103 (52.0)	146 (50.1)	
Accommodation Type				
With family	18 (19.4)	18 (9.1)	36 (12.4)	
With friends	14 (15.1)	42 (21.3)	56 (19.3)	
Alone	4 (4.3)	7 (3.6)	11 (3.8)	0.117
Dormitory	52 (55.9)	116 (58.9)	168 (57.9)	
Other	5 (5.3)	14 (7.1)	19 (6.6)	
BMI classification				
Underweight	10 (10.7)	21 (10.6)	31 (10.6)	
Normal	69 (74.2)	153 (77.3)	222 (76.3)	0.780
Overweight and obesity	14 (15.1)	24 (12.1)	38 (13.1)	
Effect of Sleep Pattern on Food Preference				
Affects	31 (33.3)	93 (47.0)	124 (42.6)	**<0.001**
Does not affect	62 (66.7)	105 (53.0)	167 (57.4)	
Effect of Sleep Disturbance on Food Preferences				
Processed Products (packaged)	12 (38.7)[a]	51 (54.8)[a]	63 (50.8)	
Pastries (bagels, etc.)	5 (16.1)[a]	20 (21.5)[b]	25 (20.2)	**0.046**
Sweet Snacks	14 (45.2)[a]	22 (23.7)[b]	36 (29.0)	
Effect of Sleep Disturbance on Appetite				
Increases	14 (21.5)[a]	45 (26.2)[a]	59 (24.9)	
Decreases	18 (27.7)[a]	55 (31.9)[a]	73 (30.8)	**0.004**
No change	33 (50.8)[a]	72 (41.9)[b]	105 (44.3)	

BMI: Body mass index, PSQI: Pittsburgh Sleep Quality Index, [1]t test, [2]Chi-square test, n: number, SD: Standard deviation. Each subscript letter denotes a subset of Sleep Quality categories whose column proportions do not differ significantly from each other at the 0.05 level, based on pairwise comparisons. Categories with different letters differ significantly.

Results

The mean age of the study group was 20.78 (±2.33) years, and 75% were women. Approximately 50% of the students were studying in the Nursing Department, 35% in the Nutrition and Dietetics Department, and 15% in the Emergency Aid and Disaster Management Department. While most of the students (57.9%) stated that they were living in a dormitory, a very small portion (3.8%) stated that they were staying at home alone. When the PSQI scores of the study group were evaluated, it was seen that 68% of them had poor sleep quality, and 76% of those with good sleep quality had regular breakfast (p<0.05). Among the study group with a total PSQI score average of 6.99 (±2.76), approximately 33% of those with good sleep quality

stated that their sleep patterns affected their food preferences, and this effect occurred in the form of an increase in the consumption of sweet snacks (45.2%), packaged products (38.7%), and pastries such as bagels and pastries (16.1%) (Table 1).

The distribution of variables regarding breakfast habits according to participants' sleep quality is shown in Table 2. Approximately 71% of those with good sleep quality stated that they had a regular breakfast habit, while approximately 57% of those with poor sleep quality stated that they had a regular breakfast habit (p=0.019). While 65% of those with good sleep quality stated that they consume breakfast every day, 47% of those with poor sleep quality stated that they consume breakfast every day (p=0.051) (Table 2).In our study, participants

with good sleep quality reported more regular breakfast habits compared to those with poor sleep quality. Similar trends are observed in terms of lunch and dinner consumption frequencies; participants with good sleep quality tend to consume their meals more regularly (Figure 1). In addition, it was observed that the total PSQI scores of those who consume breakfast (p=0.016), lunch (p=0.012), dinner (p=0.058), and night snacks (p=0.002) every day and every other day were lower than those who consumed main and night snacks less frequently. Table 3 compares the frequency of consumption of

Table 2: Breakfast frequency and timing in relation to sleep quality

Parameters	Sleep Quality		Total	p
	Good (≤5)	Poor (>5)		
Regular Breakfast Habit	n (%)	n (%)	n (%)	
Yes	66 (70.9)	112 (56.6)	178 (61.2)	**0.019**
No	27 (29.1)	86 (43.4)	113 (38.8)	
Time Taken to Have Breakfast After Waking Up				
Does not have breakfast	1 (0.9)	9 (4.5)	10 (3.4)	0.312
15-30 minutes	47 (50.3)	84 (42.4)	131 (45.0)	
31-60 minutes	33 (35.4)	65 (32.8)	98 (33.7)	
> 1 hour	12 (12.9)	40 (20.2)	52 (17.9)	
Duration of Breakfast				
Does not have breakfast	1 (0.9)	9 (4.5)	10 (3.4)	0.657
5-15 minutes	44 (47.4)	91 (92.9)	135 (46.4)	
16-30 minutes	45 (48.5)	88 (44.5)	133 (45.7)	
> 30 minutes	3 (3.2)	10 (5.1)	13 (4.5)	
Frequency of Breakfast Consumption				
Every day	60 (64.5)	94 (47.4)	154 (52.9)	0.051
Every other day	20 (21.5)	47 (23.8)	67 (23.0)	
1-2 times a week	10 (10.8)	40 (20.2)	50 (17.2)	
1-2 times a month or less	3 (3.2)	17 (8.6)	19 (6.9)	

Chi-square test, p<0.05

the foods preferred by the participants for breakfast according to their sleep quality. While 41% of the participants with good sleep quality stated that they consume white bread every day, this rate is seen as 46% in the participants with poor sleep quality. When we look at the consumption of whole wheat bread, 11% of the participants with good sleep quality and 8.6% of the participants with poor sleep quality consume whole wheat bread every day. It was determined that the rate of those who consume white cheese and other fatty cheeses every day is 42% and 14% in the participants with good sleep quality and 31% and 9% in the participants with poor sleep quality, respectively.91% of participants with good sleep quality and 80% of participants with poor sleep quality consume eggs at least 1-2 times a week. In both groups, the foods that were consumed 30% or more every day were white bread and white cheese, while in individuals with good sleep quality, approximately three out of every ten people also consumed eggs every day. In the foods that were consumed rarely or never more than 30% and were less preferred; for participants with poor sleep quality, there were products such as whole wheat bread, breakfast cereals, cream/butter, and in addition to these, for those with good sleep quality, there were sucuk, salami, and sausages (Table 3). In addition, it was
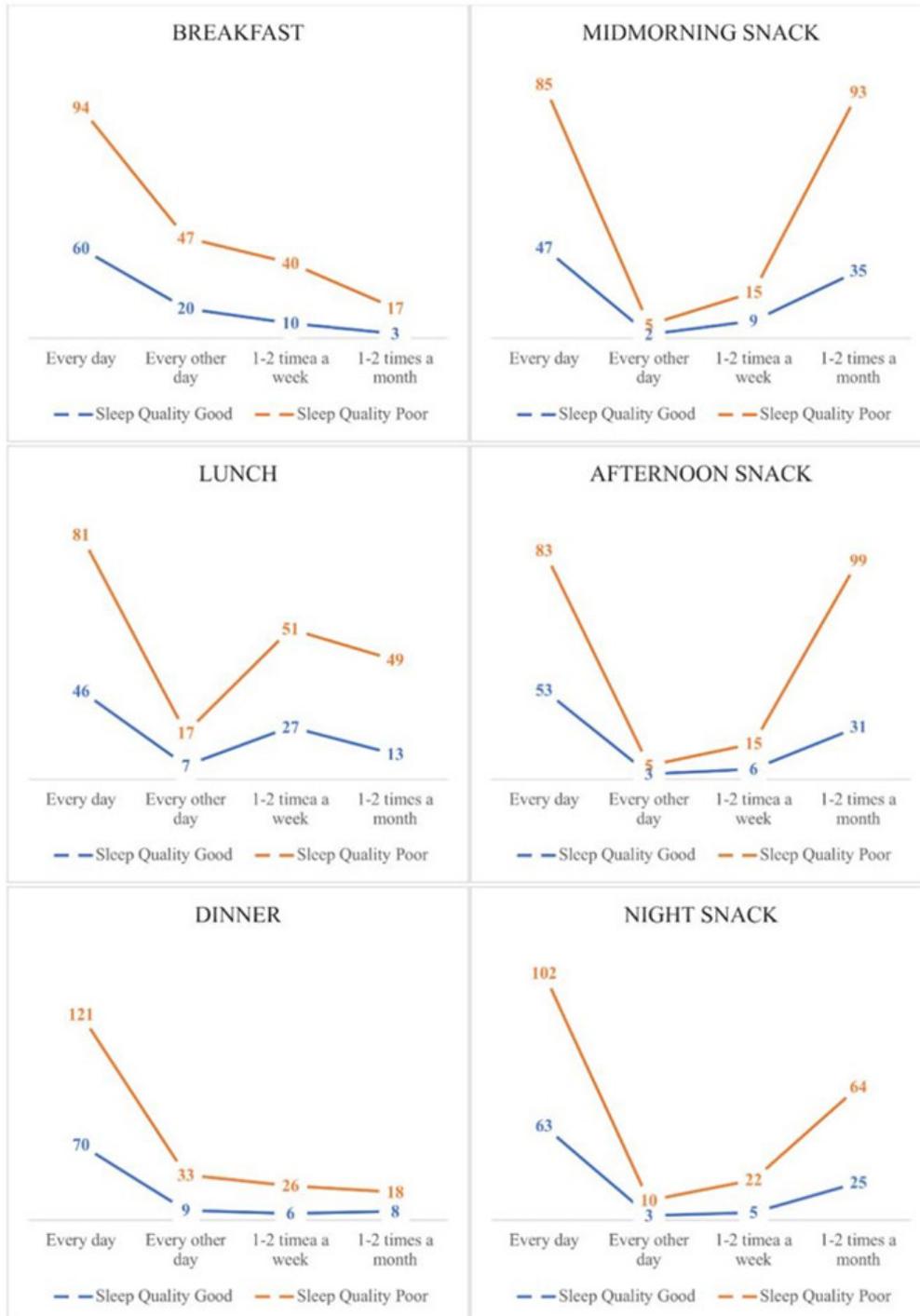
Figure 1: Comparison of daily meal and snack consumption frequencies by sleep quality

determined that the total PSQI scores of those who stated that they consumed processed products such as bagels, pastries (p=0.12), cakes, cookies, biscuits, and crackers (p=0.41) at least 1-2 times a week were higher than those who consumed less.Figure 2 shows the frequency of consumption of beverages preferred at breakfast according to the sleep quality of the research group. When the beverages consumed at breakfast at least 1-2 times a week were questioned, it was determined

that participants with good sleep quality consumed black tea (91%), ayran (82%), instant coffee (58%), and milk (57%), respectively, while participants with poor sleep quality consumed black tea (91%), ayran (74%), milk (61%), and instant coffee (58%). It is seen that 40% of individuals with poor sleep quality consumed filter coffee at least 1-2 times a week, and 58% consumed ready-mixed coffees, and these rates were similar in individuals with good sleep quality (41%, 58%). The rates of those

Table 3: Breakfast food preferences and their consumption frequency by sleep quality group

Foods	Good (n=93)						Poor (n=198)					
	Every day n (%)	Every other day n (%)	1-2 times a week n (%)	1 time in 15 days n (%)	Once a month n (%)	Rarely/ never n (%)	Every day n (%)	Every other day n (%)	1-2 times a week n (%)	1 time in 15 days n (%)	Once a month n (%)	Rarely/ never n (%)
White bread	38 (**40.9**)	17 (18.3)	11 (11.8)	4 (4.3)	8 (8.6)	15 (16.1)	92 (**46.4**)	41 (20.7)	18 (9.1)	10 (5.1)	12 (6.1)	25 (12.6)
Wholewheat bread	10 (10.8)	15 (16.1)	12 (12.9)	4 (4.3)	3 (3.2)	49 (**52.7**)	17 (8.6)	32 (16.2)	17 (8.6)	20 (10.1)	18 (9.1)	94 (**47.5**)
Wholegrain bread	14 (15.0)	20 (21.5)	10 (10.8)	3 (3.2)	8 (8.6)	38 (**40.9**)	41 (20.7)	29 (14.7)	18 (9.1)	10 (5.1)	19 (9.6)	81 (**40.9**)
Egg	28 (**30.1**)	33 (**35.5**)	24 (25.8)	5 (5.4)	0 (0)	3 (3.2)	76 (**38.4**)	76 (**38.4**)	34 (17.2)	10 (5.1)	17 (8.6)	17 (8.6)
White cheese	39 (**42.0**)	34 (**36.5**)	9 (9.7)	5 (5.4)	1 (1.1)	5 (5.4)	62 (**31.3**)	74 (**37.4**)	30 (15.2)	5 (2.5)	10 (5.1)	17 (8.6)
Other cheese	13 (14.0)	25 (26.9)	24 (25.8)	8 (8.6)	9 (9.7)	15 (16.1)	49 (24.7)	53 (26.8)	54 (27.3)	24 (12.1)	24 (12.1)	26 (13.1)
Olives	23 (24.7)	25 (26.9)	13 (13.9)	9 (9.7)	6 (6.5)	17 (18.3)	43 (21.7)	52 (26.3)	27 (13.6)	19 (9.6)	16 (8.1)	40 (20.2)
Green vegetables	27 (29.1)	37 (**39.8**)	18 (19.4)	7 (7.5)	1 (1.1)	3 (3.2)	50 (25.3)	76 (**38.4**)	40 (20.2)	16 (8.1)	9 (4.5)	7 (3.5)
Tomato and cucumber	24 (25.8)	37 (**39.7**)	18 (19.4)	10 (10.8)	3 (3.2)	1 (1.1)	46 (23.2)	75 (**37.9**)	40 (20.2)	19 (9.6)	10 (5.0)	8 (4.1)
Fresh fruits	18 (19.4)	37 (**39.8**)	21 (22.6)	10 (10.8)	3 (3.2)	1 (1.1)	29 (14.6)	80 (**40.4**)	43 (21.7)	25 (12.6)	11 (5.6)	10 (5.1)
Dry fruits	6 (6.5)	17 (18.3)	16 (17.2)	16 (17.2)	18 (19.4)	4 (4.3)	14 (7.1)	38 (19.1)	45 (22.7)	30 (15.2)	25 (12.6)	46 (23.2)
Nuts	9 (9.7)	25 (26.9)	22 (23.7)	19 (20.4)	11 (11.8)	7 (4.5)	27 (13.6)	55 (27.8)	42 (21.2)	35 (17.7)	22 (11.1)	17 (8.6)
Honey/jam/molasses	15 (16.1)	23 (24.8)	24 (25.8)	10 (10.8)	7 (7.5)	14 (15.1)	29 (14.6)	58 (29.3)	40 (20.2)	16 (8.1)	16 (8.1)	39 (19.7)
Cream/butter	5 (5.4)	16 (17.2)	23 (24.7)	10 (10.8)	8 (8.6)	31 (**33.3**)	14 (7.1)	33 (16.7)	49 (24.7)	17 (8.6)	24 (12.1)	61 (**30.8**)
Sucuk, salami, sausage	4 (4.3)	13 (14)	14 (15.1)	16 (17.2)	12 (12.9)	34 (**36.6**)	9 (4.5)	44 (22.3)	34 (17.2)	30 (15.2)	30 (15.1)	51 (25.8)
Breakfast cereals	1 (1.1)	12 (13)	9 (9.7)	10 (10.8)	18 (19.3)	43 (**46.2**)	12 (6.1)	18 (9.1)	21 (10.6)	26 (13.1)	28 (14.1)	93 (**47.0**)
Turkish bagel/pogaca	8 (8.6)	18 (19.3)	22 (23.7)	17 (18.3)	21 (22.6)	7 (7.5)	18 (9.1)	55 (27.8)	55 (27.8)	31 (15.7)	28 (14.1)	11 (5.6)
Toast/sandwich/borek	2 (5.4)	13 (17.2)	15 (21.5)	26 (18.3)	22 (18.3)	15 (19.3)	3 (2.0)	27 (17.2)	42 (25.8)	47 (19.7)	41 (16.7)	38 (19.2)
Cakes/ cookies/ biscuits/crackers	1 (1.1)	18 (19.3)	23 (24.8)	22 (23.7)	18 (19.3)	11 (11.8)	6 (3.0)	48 (24.2)	50 (25.4)	46 (23.2)	24 (12.1)	24 (12.1)

who consumed carbonated drinks and packaged fruit juice at breakfast at least 1-2 times a week were determined to be 42%; 48% in those with poor sleep quality and 33%; 45% in those with good sleep quality, respectively.In the regression model conducted to evaluate the factors affecting the PSQI score, it was observed that consumption of eggs, filter coffee, and fresh fruit juice at breakfast and lunch was statistically effective. The model explained 21% of the variance in PSQI scores (R^2=0.21,

p<0.01). The analysis revealed that several factors were statistically significant predictors of sleep quality. Specifically, consuming eggs less than 1-2 times a week (β=1.45, p=0.002) and consuming filter coffee every day (β=1.44, p=0.017) were associated with statistically significant increases in PSQI scores, indicating poorer sleep quality. Conversely, having a regular breakfast habit (β=−0.78, p=0.016), consuming fresh fruit juice 1-2 times a week (β=−1.10, p=0.032), and having
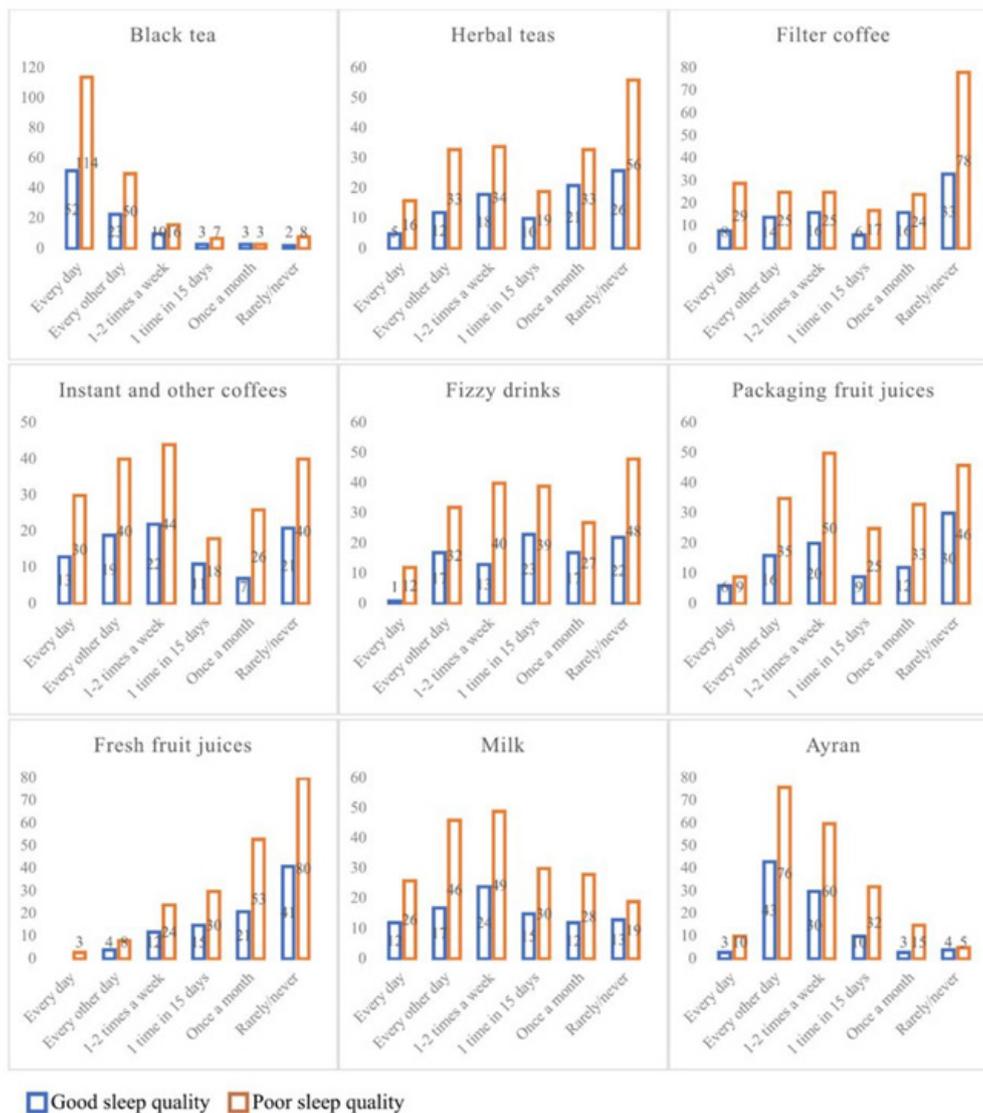

Figure 2: Breakfast beverage preferences and their consumption frequency by sleep quality group

regular lunch consumption (β=−0.62, p=0.046) were associated with statistically significant decreases in PSQI scores, indicating better sleep quality. Other variables included in the model, ayran consumption (p=0.065), and fizzy drinks consumption (p=0.146), were not found to be statistically significantly associated with PSQI scores.

Discussion

This study evaluated the effect of sleep quality on breakfast habits among students at the School of Health, revealing a significant relationship between sleep quality and regular breakfast consumption. The findings are consistent with the existing literature, which also reports associations

between sleep quality and dietary behaviours. Several studies have shown that poor sleep quality is associated with less frequent breakfast consumption. For instance, a study on adolescents found that those with poor sleep quality were less likely to eat breakfast regularly (20). Another study reported that regular breakfast consumption is linked to improved sleep quality (21). These findings suggest a bidirectional relationship where sleep quality influences breakfast habits, and regular breakfast consumption can positively affect sleep quality. Therefore, dietary interventions that promote consistent breakfast consumption may enhance sleep quality.

Skipping breakfast and irregular meal consumption are strongly associated with poor sleep quality (22). A study evaluating meal patterns and sleep quality found that individuals with poor sleep quality had more irregular meal consumption compared to those with good sleep quality (23). These results indicate that a consistent and balanced dietary regimen could help regulate circadian rhythms and improve sleep quality.

A study evaluating the sleep quality and dietary intake of 2446 adults in Turkey observed that those with good sleep quality consumed more milk and dairy products, eggs, cereals, legumes, vegetables, and fruits, while those with poor sleep quality consumed fewer nuts and meat products (24). This aligns with our findings, where participants with good sleep quality reported more regular consumption of nutrient-dense foods.

In a systematic review, consumption of healthy foods was associated with better sleep quality, while higher consumption of processed foods and foods high in simple sugars was associated with worse sleep quality (6). In a study on adolescents, higher consumption of fatty or sugary foods and red meat or processed foods was associated with poorer sleep quality (25). Our study supports these findings, showing that participants with poor sleep quality consumed high amounts of processed products such as white bread, bagels, pastries, cakes, cookies, biscuits, and crackers at least 1-2 times a week for breakfast.

The transition from the adolescent years to young adulthood involves biological, cognitive and physiological changes, as well as increased academic demands and psychosocial stress. It is commonly accepted that caffeine-containing stimulants help university students focus and stay awake, improving academic performance, socialization, and mental alertness (26). However, a meta-analysis has reported that high levels of caffeine consumption are strongly associated with poor quality of sleep (27). In our study, frequent consumption of ready-mixed coffee, fizzy drinks, ayran, and milk at breakfast was observed, aligning with literature suggesting these beverages can negatively impact sleep quality.

Caffeine's disruptive effects on sleep are mainly due to its influence on the homeostatic component of the sleep-wake cycle (27). Higher caffeine intake can inhibit the buildup of sleep pressure, delay the onset of sleep, and lead to lighter, less restorative sleep (28, 29). Our results suggest that frequent consumption of black tea, instant coffee, and filter coffee among participants may contribute to diminished sleep quality.

This study has several limitations. First, its cross-sectional design prevents the establishment of causal relationships between sleep quality and breakfast habits. Second, the data were based on self-reported questionnaires, which may be subject to recall bias and social desirability bias. Lastly, the study sample consisted of students from a single university, which may limit the generalizability of the findings to other populations.

Conclusions

The connection between diet and sleep has gained increasing attention, as diet is widely recognised as an important factor influencing sleep health. Although the exact mechanisms are not yet fully understood, dietary habits have a significant impact on sleep quality. This study shows that regular breakfast consumption, following consistent meal timings, and reducing the gap between the final meal of the day and bedtime are associated with better sleep quality among university students. These findings suggest that improvements in dietary strategies may have the potential to improve sleep quality and prevent sleep disorders. Therefore, providing comprehensive nutrition education and reinforcing it regularly can likely contribute to better sleep quality among university students.

Addressing dietary habits is a practical intervention to improve sleep health.

References

1. Mediratta S, Mathur P. Determinants of Food Choices among Adults (20–40 Years Old) Residing in Delhi, India. Curr Dev Nutr. 2023;7(2). doi:10.1016/J.CDNUT.2023.100029.

2. Montaño Z, Smith JD, Dishion TJ, Shaw DS, Wilson MN. Longitudinal relations between observed parenting behaviors and dietary quality of meals from ages 2 to 5. Appetite. 2015;87:324-9. doi:10.1016/J.APPET.2014.12.219.

3. Suárez-Reyes M, Muñoz Serrano M, Van Den Broucke S. How do universities implement the Health Promoting University concept? Health Promot Int. 2019;34(5):1014-24. doi:10.1093/HEAPRO/DAY055.

4. Stok FM, Renner B, Clarys P, Lien N, Lakerveld J, Deliens T. Understanding Eating Behavior during the Transition from Adolescence to Young Adulthood: A Literature Review and Perspective on Future Research Directions. Nutrients. 2018;10(6):667. doi:10.3390/NU10060667.

5. Sogari G, Velez-Argumedo C, Gómez MI, Mora C. College Students and Eating Habits: A Study Using An Ecological Model for Healthy Behavior. Nutrients. 2018;10(12):1823. doi:10.3390/NU10121823.

6. Godos J, Grosso G, Castellano S, Galvano F, Caraci F, Ferri R. Association between diet and sleep quality: A systematic review. Sleep Med Rev. 2021;57:101430. doi:10.1016/J.SMRV.2021.101430.

7. Kline, C. Sleep Quality. In: Gellman, M.D., Turner, J.R. (eds) Encyclopedia of Behavioral Medicine. Springer, New York, NY; 2013:1811-3. https://doi.org/10.1007/978-1-4419-1005-9_849

8. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res. 1989;28(2):193-213. doi:10.1016/0165-1781(89)90047-4.

9. Latta F, Van Cauter. Chapter 13: Sleep and biological clocks. In: I.B. Weiner, eds. Handbook of psychology. John Wiley & Sons, Inc.; 2003:355-77.

10. Faris MAE, Jahrami H, Al-Hilali MM, et al. Energy drink consumption is associated with reduced sleep quality among college students: a cross-sectional study. Nutr Diet. 2017;74(3):268-74. doi:10.1111/1747-0080.12289.

11. Castellucci B, Barrea L, Laudisio D, et al. Improving sleep disturbances in obesity by nutritional strategies: review of current evidence and practical guide. Int J Food Sci Nutr. 2021;72(5):579-91. doi:10.1080/09637486.2020.1851659.

12. Jahrami H, Al-Mutarid M, Penson PE, Al-Islam Faris M, Saif Z, Hammad L. Intake of Caffeine and Its Association with Physical and Mental Health Status among University Students in Bahrain. Foods. 2020;9(4):473. doi:10.3390/FOODS9040473.

13. Gibney MJ, Barr SI, Bellisle F, et al. Breakfast in Human Nutrition: The International Breakfast Research Initiative. Nutrients. 2018;10(5):559. doi:10.3390/NU10050559.

14. Lebacq T, Holmberg E, Pedroni C, Dujeu M, Castetbon K. Weekday sleep duration and morning tiredness are independent covariates of breakfast skipping in adolescents. Eur J Clin Nutr. 2022;76(10):1403-8. doi: 10.1038/S41430-022-01117-2.

15. Faris MAIE, Vitiello M V., Abdelrahim DN, et al. Eating habits are associated with subjective sleep quality outcomes among university students: findings of a cross-sectional study. Sleep Breath. 2022;26(3):1365-76. doi: 10.1007/S11325-021-02506-W.

16. Zhang Y, Wang J, Lu X, Che B, Yu J. Sleep Status and the Associated Factors: A Large Cross-Sectional Study in Shaanxi Province, China. Int J Environ Res Public Health. 2021;18(3):1-13. doi: 10.3390/IJERPH18031250.

17. Xian X, Wang C, Yu R, Ye M. Breakfast Frequency and Sleep Quality in College Students: The Multiple Mediating Effects of Sleep Chronotypes and Depressive Symptoms. Nutrients. 2023;15(12). doi:10.3390/NU15122678.

18. Ağargün MY, Kara H, Anlar O. The Validity and Reliability of the Pittsburgh Sleep Quality Index. Turkish J of Psychiatry. 1996;7(2):107-15.

19. World Health Organization. Obesity: preventing and managing the global epidemic. Report of a WHO consultation. Geneva: World Health Organization; 2000. (WHO Technical Report Series, No. 894). Available from: https://iris.who.int/handle/10665/42330

20. Agostini A, Lushington K, Kohler M, Dorrian J. Associations between self-reported sleep measures

and dietary behaviours in a large sample of Australian school students. J Sleep Res. 2018;27(5):e12682. doi:10.1111/JSR.12682.

21. Gwin JA, Leidy HJ. Breakfast Consumption Augments Appetite, Eating Behavior, and Exploratory Markers of Sleep Quality Compared with Skipping Breakfast in Healthy Young Adults. Curr Dev Nutr. 2018;28;2(11):nzy074. doi: 10.1093/cdn/nzy074.

22. St-Onge MP, Mikic A, Pietrolungo CE. Effects of Diet on Sleep Quality. Adv in Nutr. 2016;7(5):938. doi:10.3945/AN.116.012336.

23. Theorell-Haglöw J, Lemming EW, Michaëlsson K, Elmståhl S, Lind L, Lindberg E. Sleep duration is associated with healthy diet scores and meal patterns: Results from the population-based EpiHealth study. J of Clin Sleep Med. 2020;16(1):9-18. doi:10.5664/jcsm.8112.

24. Çakir B, Nişancı Kılınç F, Özata Uyar G, Özenir Ç, Ekici EM, Karaismailoğlu E. The relationship between sleep duration, sleep quality and dietary intake in adults. Sleep Biol Rhythms. 2020;18(1):49-57. doi:10.1007/s41105-019-00244-x.

25. Zhong L, Han X, Li M, Gao S. Modifiable dietary factors in adolescent sleep: A systematic review and meta-analysis. Sleep Med. 2024;115:100-8. doi:10.1016/J.SLEEP.2024.02.009.

26. Yang CK, Kim JK, Patel SR, Lee JH. Age-related changes in sleep/wake patterns among Korean teenagers. Pediatrics. 2005;115(1 Suppl):250-6. doi:10.1542/PEDS.2004-0815G.

27. Borbély AA. Refining sleep homeostasis in the two-process model: Editorial. J Sleep Res. 2009;18(1):1-2. doi:10.1111/j.1365-2869.2009.00750.x.

28. Landolt HP. Sleep homeostasis: a role for adenosine in humans? Biochem Pharmacol. 2008;75(11):2070-9. doi:10.1016/J.BCP.2008.02.024.

29. Clark I, Landolt HP. Coffee, caffeine, and sleep: A systematic review of epidemiological studies and randomized controlled trials. Sleep Med Rev. 2017;31:70-8. doi:10.1016/J.SMRV.2016.01.006.