J Nutr Diet 2023;51(2):34-44 DOI: 10.33076/2023.BDD.1751

RESEARCH ▪ ARAŞTIRMA

Is There a Link Between Sleep Quality and a Tendency for Eating Disorders?

Uyku Kalitesi ile Yeme Bozuklukları Eğilimi Arasında Bir İlişki Var Mı?

Seda Çiftçi[1], Merve Kızıl[2]

Received/Geliş tarihi: 02.05.2023 • Accepted/Kabul tarihi: 22.08.2023

ABSTRACT

Aim: Poor sleep quality has been associated with an increased risk of developing eating disorders, and unhealthy eating behaviours. The aim of the study was to explore the potential link between sleep quality and eating disorders.

Subjects and Method: This descriptive, observational, and cross-sectional study was conducted with 357 (84 male; 273 female) university students between the ages of 18-25 years. Exclusion criteria included being diagnosed with chronic disease and psychiatric disorders, being pregnant and lactating, using drugs that affect sleep patterns, being shift workers, and participants who did not complete the questionnaire. The questionnaire consisted of six parts including Pittsburgh Sleep Quality Index (PSQI), Three-Factor Eating Questionnaire (TFEQ-21), SCOFF (REZZY) Eating Disorders Scale, anthropometric measurements, demographic properties, and nutritional habits.

Results: The prevalence of poor sleep quality was found to be 63% and there was no significant difference between gender in terms of sleep quality (p=0.769). There was significant relationship between total TFEQ 21 (p=0.02), SCORF (REZZY) (p<0.001) scores and sleep quality. Uncontrolled eating behaviours was found higher in students with poor sleep quality (p<0.05). Age, body mass index (kg/m^2), and smoking were not significant predictors of sleep quality. However, participants with a tendency towards eating disorders behaviour were found to have a significantly higher risk of poor sleep quality (odds ratio [OR]: 2.338, 95% confidence interval [CI]: 1.444-3.785, p=0.001), as were those with a tendency towards emotional eating behaviour (OR: 1.575, 95% CI: 1.022-2.427, p=0.040).

Conclusion: Students with poor sleep quality had higher levels of uncontrolled eating behaviour and a tendency towards unhealthy eating attitudes than those with good sleep quality.

Keywords: Sleep quality, eating disorder, emotional eating

ÖZET

Amaç: Kötü uyku kalitesi, yeme bozuklukları ve sağlıksız yeme davranışları riskinin artmasıyla ilişkilendirilmektedir. Bu çalışmanın amacı, uyku kalitesi ve yeme bozuklukları arasındaki potansiyel ilişkiyi araştırmaktır.

Bireyler ve Yöntem: Tanımlayıcı, gözlemsel ve kesitsel tipte olan bu araştırma, 18-25 yaş arası 357 (84 erkek; 273 kadın) üniversite öğrencisi ile yapılmıştır. Kronik ve psikiyatrik hastalık tanısı almış olmak, hamile ve emziren olmak, uyku düzenini etkileyen ilaçlar kullanmak, vardiyalı çalışanlar ve anketi doldurmamak dışlama kriterleri olarak belirlenmiştir. Anket, Pittsburgh Uyku Kalitesi İndeksi (PSQI), Üç faktörlü yeme anketi (TFEQ-21), Rezzy Yeme Bozuklukları Ölçeği (REZZY), antropometrik ölçümler, demografik özellikler ve beslenme alışkanlıkları olmak üzere altı bölümden oluşmaktadır.

1. **Correspondence/İletişim:** İzmir Demokrasi University, Faculty of Health Sciences, Department of Nutrition and Dietetics, İzmir, Türkiye
E-posta: dytsedaciftci@gmail.com ▪ https://orcid.org/0000-0002-4103-1618
2. İzmir Demokrasi University, Faculty of Health Sciences, Department of Nutrition and Dietetics, İzmir, Türkiye ▪ https://orcid.org/0000-0003-0223-9333

Bulgular: Kötü uyku kalitesi prevalansı %63 olarak bulunmuş ve cinsiyetler arasında uyku kalitesi açısından anlamlı fark bulunmamıştır (p=0.769). Toplam TFEQ-21 (p=0.02), REZZY (p<0.001) puanları ile uyku kalitesi arasında anlamlı ilişki belirlenmiştir. Uyku kalitesi kötü olan öğrencilerde kontrolsüz yeme davranışı daha yüksek bulunmuştur (p<0.05). Yaş, beden kütle indeksi (kg/m^2) ve sigara kullanımının uyku kalitesinin anlamlı belirleyicileri olmadığı saptanmıştır. Bununla birlikte, yeme bozukluğu davranışına eğilimi olan (olasılık oranı [OO]: 2.338, %95 güven aralığı [GA]: 1.444-3.785, p=0.001) ve duygusal yeme davranışı eğilimi olan (OO: 1.575, %95 GA: 1.022-2.427, p=0.040) bireylerde uyku kalitesinin düşük olması sonucunda yeme bozuklukları riskinin anlamlı olarak daha yüksek olduğu saptanmıştır.

Sonuç: Uyku kalitesi kötü olan öğrencilerin, uyku kalitesi iyi olanlara göre daha yüksek düzeyde kontrolsüz yeme davranışı ve sağlıksız yeme tutumlarına sahip oldukları görülmüştür.

Anahtar kelimeler: Uyku kalitesi, yeme bozuklukları, duygusal yeme

INTRODUCTION

Sleep duration and quality are factors that state a noteworthy impact on human health plus overall life quality. Sleep quality (SQ) has been closely related to an individual's sense of well-being and their ability to function effectively throughout the day (1). Sleep deprivation can affect dietary intake and food choices by increasing hunger, cravings for high-fat and high-carbohydrate foods, and overeating. Hormonal changes, such as alterations in ghrelin and leptin, and changes in brain activity and reward processing, may contribute to this effect. Sleep deprivation is also associated with a preference for energy-dense, palatable foods and a reduced desire for healthy foods, indicating the importance of improving SQ for promoting healthy eating behaviors (EBs) and preventing eating disorders (EDs) (2-4). Indeed, eating habits play a significant role in maintaining a healthy lifestyle. However, numerous factors, including individual and environmental factors, can affect one's eating habits and lead to the development of eating disorders. Genetic predisposition, environmental factors such as societal pressure to achieve a certain body type, biological factors such as hormonal imbalances, and psychosocial factors such as anxiety and depression, are all known to contribute to the etiology of EDs. Thus, promoting healthy eating habits and raising awareness about the risk factors associated with EDs is essential for maintaining optimal physical and mental health (5). American Psychiatric Association defines EDs as a group of conditions portrayed by permanent disturbance of eating patterns or behaviour associated to eating, which damages physical health or psychosocial working (6). There is a bidirectional relationship between sleep and EBs. Sleep disturbances, such as insomnia and sleep apnea, can increase risk of developing disordered EBs, including binge eating, emotional eating, and food addiction. On the other hand, disordered EBs, such as restrictive eating and binge eating, can negatively affect SQ and quantity. Additionally, both sleep and EBs are regulated by similar neurobiological pathways, including the hypothalamus and the reward system, which may contribute to the co-occurrence of these disorders. Hence, it is critical to investigate the link between sleep and EBs to better recognize and treat these conditions. (7). The university period is recognized as a critical phase of development that can have a lasting impact on individuals. Research suggests that university students are particularly susceptible to poor nutrition habits because of changing living conditions, which may increase risk of both sleep disorders and EDs (8).

In the present study, we formulated a hypothesis that individuals with poor sleep quality (PSQ) would have a higher prevalence of EDs compared to those with good sleep quality (GSQ). To investigate this hypothesis, a cross-sectional observational study was conducted among university students. The aim of the study was to explore potential association between SQ and EDs in this population.

SUBJECTS AND METHODS

Study type and sample size

This observational study aimed to investigate link between SQ and EDs among university students aged 18-25 years. Before beginning the study, the primary aim was to achieve a minimum sample size of 365 participants, considering a 95% confidence interval and a margin of error of 0.05. This determination was made using G Power software. Additionally, information from verbal interviews with the student affairs department wrote down an estimated population size of approximately 8000 students. The data collection method employed snowball randomization to gather the necessary information for the study. A total of 384 students participated in the study, they were informed of study's objectives, plan, and potential benefits and were allowed to withdraw from study at any time. Informed consent was obtained from those who volunteered to participate. However, 27 individuals were excluded due to not meeting the inclusion criteria, resulting in the final sample size of 357 participants. The exclusion criteria included chronic disease, pregnancy or lactation, psychiatric disorders, unwillingness to participate, use of chronic drugs affecting sleep patterns, or unreliable completion of the questionnaire. The Ethics Committee Permission-2022/02-27 was obtained from the Ethics Committee of Non-Interventional Clinical Research of İzmir Democracy University on 27.02.2022.

Data Collection Tools

The data for this study was collected through a questionnaire consisting of queries on general information, health, anthropometric measurements, and eating habits. The questionnaire was administered through face-to-face interviews.

Eating behaviour of the participants was evaluated using the Three-Factor Eating Questionnaire (TFEQ-21), Rezzy Eating Disorders Scale (REZZY/SCOFF) was used to assess the risk of EDs, and the Pittsburgh Sleep Quality Index (PSQI) was used to determine the SQ. Subjects self-reported their anthropometric measurements' data and were used to evaluate the prevalence of obesity (9). The body mass index values were calculated by the researcher and subsequently assessed based on the World Health Organization's classification system (10).

TFEQ-21 was developed by Stunkard and Messic (11) to measure and evaluate the cognitive and behavioral components of emotional eating. Turkish validity and reliability of TFEQ-21 was taken by Karakuş et al. (12). The 21 questions of scale are in a four-point Likert type. The total score ranges from 0-100. A high score on any of the subfactors of scale shows that eating behaviour related to that factor is high. In this study, the Cronbach Alpha of TFEQ 21 was 0.93.

SCOFF/REZZY is used to detect EDs and is a suitable screening test for young adulthood. The scale SCOFF was developed by Morgan et al. (13) and was adapted to Turkish by Aydemir et al. (14) and named as REZZY. The scale consists of 5 items. A score of 2 or above indicates a risk of EDs according to the cut-off point of the scale.

PSQI supplies knowledge about SQ and the variety and seriousness of sleep disturbances in previous month. Buysse et al. (15), developed the scale and validity-reliability of Turkish version applied by Ağargün et al. (16). PSQI consists of 24 questions with a total score ranging from 0-21. A score of five or higher indicates PSQ, while a score below five is considered GSQ. The Cronbach's Alpha of PSQI in our study was found to be 0.79, indicating good internal consistency.

Statistical analysis

General information of the participants was presented with numbers (n) and percentage tables (%). Mean ± standard deviation ($\bar{X}$±SD) values were used as a descriptive statistical method in data evaluation. Data that are not normally distributed are expressed as median values of the interquartile range [IQR]. The Chi-square test was used for independent, nonnormally distributed data to examine the differences between groups. Mann-Whitney U test

was used to comparison two independent groups of differences. When evaluating the data obtained from the study, IBM SPSS 25.0 package program was used. On examination of hypothesis tests 95% confidence interval, and significance p<0.05 were accepted. Binary logistic regression was used to estimate risk prediction between SQ and selected variables.

RESULTS

Table 1 presents the demographic characteristics of the participants in this study. The sample consisted of 357 university students, with 84 (23.5%) identified as male and 273 (76.5%) as female. The age range of the participants was between 18 and 25 years. Among the participants, 63.0% (n:255) were found to have PSQ, while the remaining 37.0% (n:132) had GSQ. Specifically, among those with GSQ, 77.3% (n:102) were female, and 22.7% (n:30) were male. On the other hand, among the subjects with PSQ, 76.0% (n:171) were female, and 24.0% (n:54) were male. These findings contribute to the understanding of the distribution of PSQ and GSQ among male and female university students in the specified age range. Thus, the table shows that there is no significant difference in the risk of developing a SQ condition between males and females, between people in different faculties, or between people with different BMIs, between people who smoke and people who do not smoke, and between people who use alcohol and people who do not use alcohol (p>0.05).

Table 2 presents the median and interquartile range (IQR) values of anthropometric measurements for male and female participants, categorized based on their SQ. The results indicate that there were no significant differences in body weight, height, and BMI values between males and females based on their SQ scores (p>0.05). The findings of the Table 2 suggest that SQ did not have a significant impact on the anthropometric measurements of students.

Table 3 provides an overview of the nutrition habits of students based on their PSQI scores. The results show

Table 1. Demographic properties of students according to PSQI scores (n:357)

Values	Total (n=357)	PSQ (n=225, 63.0%)	GSQ (n=132, 37.0%)	p value
	n (%)	n (%)	n (%)	
Gender				
Male	84 (23.5)	54 (24.0)	30 (22.7)	0.445 [f]
Female	273 (76.5)	171 (76.0)	102 (77.3)	
Faculty				
Health sciences	148 (41.5)	95 (42.2)	53 (40.1)	0.393 [f]
Not-health sciences	209 (58.5)	130 (57.8)	79 (59.9)	
BMI (kg/m²)				
Underweight (BMI<18.5)	50 (14.0)	34 (15.1)	16 (12.1)	
Normal (18.5≤BMI≤24.9)	232 (65.0)	142 (63.1)	90 (68.2)	0.597 [p]
Overweight &obese (BMI≥25.0)	75 (21.0)	49 (21.8)	26 (19.7)	
Chronic Illness				
No	284 (79.6)	178 (79.1)	106 (80.3)	0.450 [f]
Yes	73 (20.4)	47 (20.9)	26 (16.7)	
Smoking Status				
No	277 (77.6)	169 (75.1)	108 (81.8)	0.090 [f]
Yes	80 (22.4)	56 (24.9)	24 (18.2)	
Use of Alcohol				
No	274 (76.8)	168 (74.7)	106 (80.3)	0.138 [f]
Yes	83 (23.2)	57 (25.3)	26 (19.7)	

BMI: Body mass index; [f]Fisher's Exact Test; [p]Pearson Chi-Square; PSQ: Poor Sleep Quality; GSQ: Good Sleep Quality.

Table 2. Anthropometric measurements of students according to gender and PSQI scores

Variables	PSQ Median [IQR]	GSQ Median [IQR]	p value
Male	**(n = 54)**	**(n = 30)**	
Weight (kg)	72.5 [81.0-66.0]	70.5 [85.0-65.0]	0.874 [m]
Height (cm)	179.0 [182.0-175.0]	179.5 [183.0-175.0]	0.925 [m]
BMI (kg/m^2)	22.9 [25.5-21.3]	23.2 [26.2-20.8]	0.981 [m]
Female	**(n=171)**	**(n=102)**	
Weight (kg)	58.0 [65.0-51.0]	58.0 [65.0-52.0]	0.396 [m]
Height (cm)	165.0 [168.0-160.0]	163.0 [168.0-160.0]	0.571 [m]
BMI (kg/m^2)	21.3 [24.1-19.4]	21.1 [23.8-19.5]	0.705 [m]

BMI: Body mass index (kg/m^2); IQR: Inter-quartile range; [m] Mann-Whitney-U Analysis; PSQ: Poor Sleep Quality; GSQ: Good Sleep Quality

Table 3. Nutrition habits of students according to PSQI

Valuables	Total (n=357)	PSQ (n=225)	GSQ (n=132)	p value
	n (%)	n (%)	n (%)	
Number of consumed main meals				
1	19 (5.3)	14 (6.2)	5 (3.8)	
2	185 (51.8)	122 (54.2)	63 (47.7)	0.207 [p]
3	153 (42.9)	89 (39.6)	64 (48.5)	
Skipped main meal				
No	153 (42.9)	89 (39.6)	64 (48.5)	0.207 [p]
Yes	204 (57.1)	136 (60.4)	68 (51.5)	
Breakfast	106 (52.0)	72 (59.9)	34 (50.0)	
Lunch	94 (46.1)	61 (44.9)	33 (48.5)	0.846 [f]
Dinner	4 (2.0)	3 (2.2)	1 (1.5)	
Number of consumed snacks				
Not consuming	62 (17.4)	43 (19.1)	19 (14.4)	
1	77 (21.6)	56 (24.9)	21 (15.9)	0.064 [p]
2	141 (39.5)	79 (35.1)	62 (47.0)	
3	77 (21.6)	47 (20.9)	30 (22.7)	
Skipped snack				
No	77 (21.6)	47 (20.9)	30 (22.7)	0.390 [f]
Yes	280 (78.4)	178 (79.1)	102 (77.3)	
Mid-morning	49 (17.5)	27 (15.3)	22 (21.5)	
Afternoon	47 (16.8)	29 (16.2)	18 (17.8)	
Night	44 (15.7)	22 (12.3)	22 (21.6)	
Mid-morning + Afternoon	35 (12.5)	24 (13.5)	11 (10.8)	0.112 [p]
Mid-morning + Night	31 (11.1)	25 (14.0)	6 (5.9)	
Afternoon + Night	12 (4.3)	8 (4.5)	4 (3.9)	
Mid-morning + Afternoon + Night	62 (22.1)	43 (24.2)	19 (18.5)	
Out of home consumption (times/month)				
Not consuming	24 (6.7)	19 (8.4) [a]	5 (3.8) [a]	
< 5	235 (65.8)	144 (64.0) [a]	91 (69.0) [a]	**0.003 [p]**
5-10	6 (1.7)	0	6 (4.5) [b]	
>10	92 (25.8)	62 (27.6) [a]	30 (22.7) [a]	
Daily water consumption (1 glass=200 mL)				
< 5	110 (30.8)	78 (34.7)	32 (24.2)	
5-10	155 (43.4)	96 (42.6)	59 (44.7)	0.071 [p]
>10	92 (25.8)	51 (22.7)	41 (31.1)	

[f]Fisher's Exact Test; [p]Pearson Chi-Square; REZZY: Rezzy Eating Disorders Scale; TFEQ-21; Three-Factor Eating Questionnaire. The use of distinct uppercase symbols highlights the presence of statistically significant differences between the column groups.

interesting patterns regarding meal preferences and eating habits for students with different PSQI scores. Regarding meal frequency, it was observed that a majority of students with PSQ scores preferred to eat two main meals a day, while students with higher GSQ scores tended to consume three mean meals a day. However, this difference in meal preference between the two groups was not statistically significant (p>0.05). Additionally, both PSQ and GSQ students reported consuming two snacks a day and showed no significant difference in skipping main meals, especially breakfast (p>0.05). Interestingly, when considering meals consumed outside of their homes within a month, students with PSQI scores were found to have meals outside less frequently, with a majority consuming meals under five times a month. In contrast, students with higher GSQI scores reported having meals outside the home between five to ten times a month. This disparity in the frequency of eating meals outside the home was statistically significant (p<0.05). Students with higher GSQI scores presumably indicating higher satisfaction or quality in some aspect of their lives tend to eat meals outside their homes more frequently. These findings suggest that while there were some differences in the nutrition habits of students with varying PSQ and GSQ, meal frequency, snack consumption, and meal skipping did not show statistically significant variations. However, the frequency of consuming meals outside the home did exhibit a significant difference between the two groups.

As presented in Figure 1, total scores of TFEQ-21 and REZZY were higher in subjects with PSQ compared to those with GSQ (p=0.020, p<0.001, respectively). Although not statistically significant, cognitive restriction (p=0.901) and emotional eating behaviour

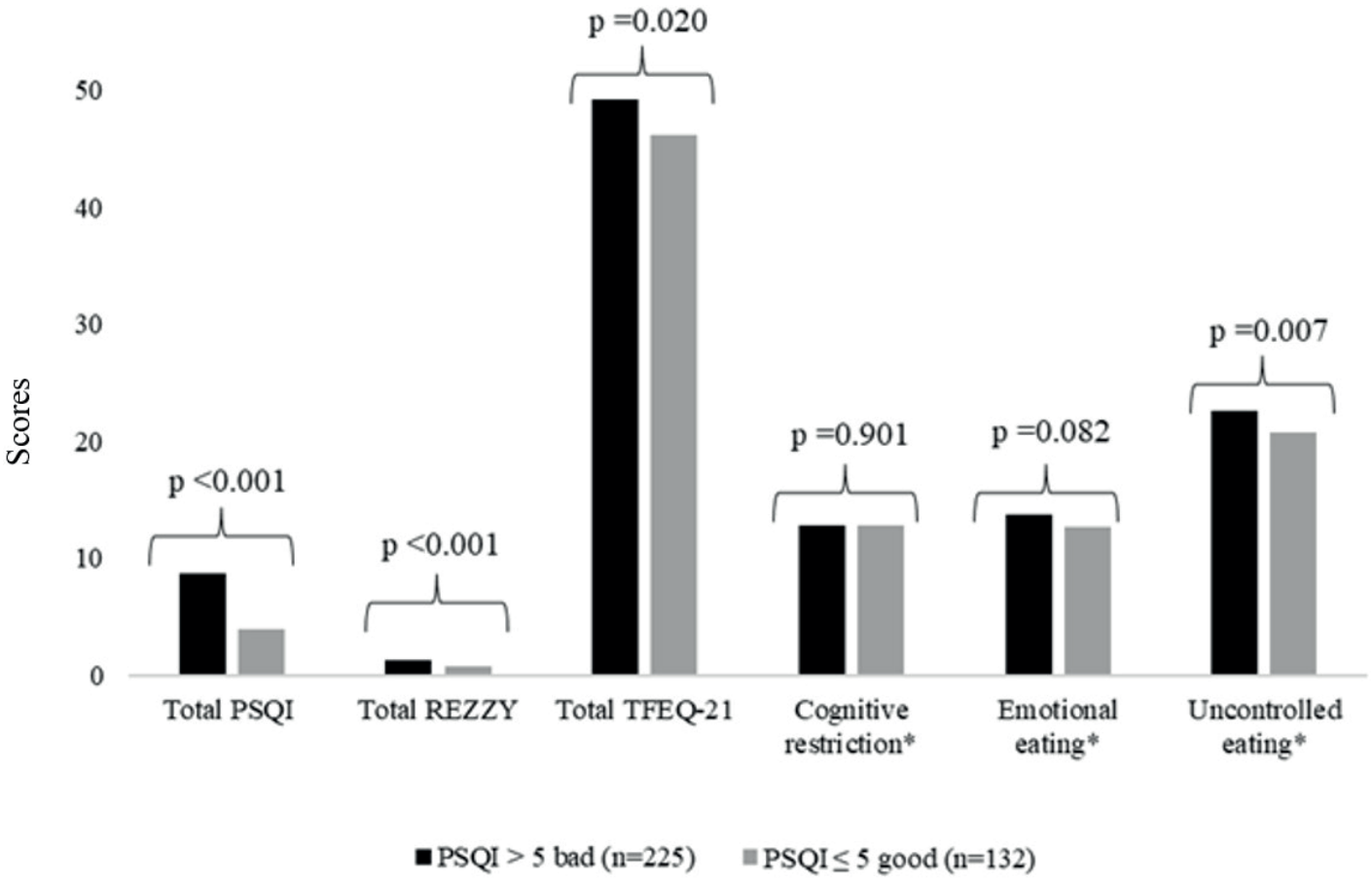

Figure 1. TFEQ-21 and REZZY scores of students according to their PSQI scores.
*Mann-Whitney U Analysis (p <0.05); PSQI: Pittsburgh Sleep Quality Index; REZZY: Rezzy/SCOFF Eating Disorders Scale; TFEQ-21; Three-Factor Eating Questionnaire; *Subdimensions of TFEQ-21.*

(p=0.082) tended to be higher in students with PSQ. On the other hand, uncontrolled eating behaviour was significantly higher in students with PSQ compared to those with GSQ (p=0.007).

The results of a binary logistic regression analysis examining the association between SQ and several variables among participants, as presented in Table 4, showed that age, BMI, and smoking were not significant predictors of SQ. However, participants with a tendency towards EDs behaviour were found to have a significantly higher risk of PSQ (odds ratio [OR]: 2.338, 95% confidence interval [CI]: 1.444-3.785, p=0.001), as were those with a tendency towards emotional eating behaviour (OR: 1.575, 95% [CI]: 1.022-2.427, p=0.040). These findings underscore the potential impact of certain EBs on SQ and suggest the importance of assessing and addressing these behaviours as part of sleep disorder management.

Table 4. Binary logistic regression examining the association between SQ and variables among students

Variables	Sleep quality	
	OR (95% CI)	**p value**
Age (year)	1.008 (0.907-1.120)	0.885
BMI (kg/m²)		
Underweight [Ref]	-	-
Normal	1.347 (0.703-2.581)	0.369
Overweight/obese	1.128 (0.629-2.005)	0.757
Smoking		
No [Ref]	-	-
Yes	0.671 (0.393-1.146)	0.144
Tendency to EDs behaviour		
No [Ref]	-	-
Yes	2.338 (1.444-3.785)	**0.001***
Tendency to anormal EE behaviour		
No [Ref]	-	-
Yes	1.575 (1.022-2.427)	**0.040***

**Refer to statistically significant p values; p<0.05 was considered as a statistically significant difference. OR: Odds ratio; CI: Confidence Interval; BMI: Body mass index; EDs: Eating disorders; EE: Emotional eating; Sleep quality was dichotomized as good (PSQI ≤ 5 good) vs. poor (PSQI > 5 poor) using the Pittsburgh Sleep Quality Index; Emotional Eating Behaviour was dichotomized as no (TFEQ-21 ≤ 13) vs. yes (TFEQ-21 > 13) using the Three Factors Eating Questionary-21; Eating Disorders Behaviour was dichotomized as no (REZZY< 2 NO) vs. yes (REZZY≥2 YES) using the REZZY. PSQI: Pittsburgh Sleep Quality Index; REZZY: Rezzy/SCOFF Eating Disorders Scale; TFEQ-21; Three-Factor Eating Questionnaire.*

DISCUSSION

Sleep is often disrupted during the university period due to factors such as the impact of the pandemic, academic workload, exam stress, and poor time management skills, this issue may increase the risk of developing EDs among individuals (7). Disrupted sleep patterns can have an impact on appetite regulation and metabolic processes. Irregular sleep can affect the hormones that regulate hunger and fullness, such as ghrelin and leptin, potentially leading to unhealthy eating behaviours. On the other hand, university phase is characterized as a transitional period during which individuals enter adulthood and the dietary habits adopted during this time play a crucial role, as they can have long-term effects on an individual's health and well-being in adulthood (7). Aysan et al. (17) reported that 59% of the students experienced PSQ, while Maheshwari et al. (18) found that 64.2% of the students had PSQ. According to Gómez-Chiappe et al., (19) the prevalence of PSQ was high among students. Our study found that 63.0% (n:225) of the students had PSQ, with females (47.9%, n:171) reporting higher rates than males (15.1%, n:54) (Table 1). These findings suggest that sleep problems are a prevalent issue among university students. Factors such as the impact of the pandemic, academic workload, exam stress, and poor time management skills may contribute to the development of sleep problems in this population.

The influence of smoking and alcohol consumption on SQ has been reported to have negative effects, and the quantity of consumption appears to play a crucial role in this association (19). While it is known that cigarette smokers are more susceptible to experiencing poor sleep quality (20), a specific study found no significant correlation between smoking and SQ in both male and female individuals (21). Alcohol consumption, on the other hand, can have both positive and negative impacts on SQ. Consuming low amounts of alcohol may aid in sleep onset due to its sedative properties

(22). But a higher level of alcohol intake has been associated with poor sleep quality based on a cross-sectional study (23). In our study, we examined whether there is a possible link between participants' SQ and their smoking and alcohol consumption habits. However, our findings did not reveal any statistically significant connection between participants' SQ and their engagement in smoking or alcohol intake ($p>0.05$) (Table 1). It is imperative to highlight that our study did not involve the collection of precise data concerning the daily quantity of cigarettes smoked or the quantity of alcohol consumed. Existing research has suggested that individuals with a BMI falling within the recommended range of 18.50–24.99 kg/m^2 experience fewer sleep-related issues compared to those who are either underweight or classified as pre-obese (24,25). However, these similar studies have not found a significant relationship between SQ and BMI (26,27). It is possible that other factors, such as dietary habits, levels of physical activity, and overall health status, may also influence an individual's SQ (28). In our study, we investigated the potential association between BMI and SQ. After analysing the data (Table 2), we did not find any statistically significant differences between BMI and SQ. This implies that, within the scope of this study, there was no substantial evidence to suggest a direct link between BMI and problem-solving abilities. Nevertheless, it is essential to acknowledge that various factors may collectively contribute to an individual's SQ.

Indeed, there is evidence to suggest that eating habits can have an impact on SQ. For example, skipping meals, particularly breakfast, has been associated with poorer SQ in a study. It is thought that this may be because of meal timing on circadian rhythms and the regulation of sleep-wake cycles. Additionally, the composition of one's diet may also play a role, with high-fat diets and diets low in certain nutrients (such as magnesium) being associated with poorer SQ (29). In our study, a significant percentage of students reported skipping breakfast and lunch as their main meals and opting for two main meals or two snacks instead. In literature, skipping breakfast is the most frequently reported meal skipped, with prevalence rates ranging from 14% to 88.5% (30). Several studies have investigated the relationship between breakfast skipping and sleep quality. Breakfast consumption improved appetite, satiety, and diet quality and may support some aspects of sleep health in healthy young adults (31,32). However, we did not find statistically significant differences between the main and snacks meal status and SQ (Table 3). A study marked that breakfast frequency can indirectly affect sleep quality by adjusting sleep chronotypes. Regular breakfast can increase morning and intermediate sleep chronotypes, and thus improve SQ (33). These results suggest that subjects' chronotype has a crucial role among SQ. And most university students have already inappropriate and unbalanced eating habits, which may be due to several factors such as lack of time to prepare meals, unfavourable conditions for meal preparation, and irregular sleep patterns. Additionally, the overlap of meal and snack times with class hours may contribute to students skipping these meals. It is important for students to have access to healthy and balanced meals to promote GSQ and overall well-being.

According to the study's findings, individuals with PSQ displayed higher total scores in both the TFEQ-21 and REZZY scales, indicating an increased risk of uncontrolled eating behaviour and emotional eating (see Figure 1). The results suggest that college students are particularly susceptible to PSQ and unhealthy eating behaviours. These findings are consistent with prior research that has explored the relationship between sleep quality and eating behaviour (34,35). A study showed that a significant proportion of college students exhibit unhealthy eating attitudes. The decline in sleep quality can disrupt regular meal patterns and hinder the ability to prepare meals, potentially leading to the development of eating behaviour disorders among students (36). A meta-analysis of studies conducted among university students found that the prevalence of eating disorder risk was 10.4%, and individuals experiencing PSQ may face a higher risk of developing disordered eating behaviors (37).

The results of the binary logistic regression analysis indicate that participants with a tendency towards EDs and emotional eating behavior are at a significantly higher risk of having PSQ. These findings are consistent with previous research, which has highlighted the interrelationship between eating behaviours and SQ. Studies have shown that individuals with disordered EBs, such as binge eating or night eating syndrome, have higher rates of SQ (38,39). Similarly, emotional eating has been linked to PSQ, as emotional eaters may use food as a coping mechanism to manage negative emotions, which can disrupt sleep (40).

This study has some strengths and limitations. It is important to note that the use of validated and reliable scales and the inclusion of anthropometric measurements are strengths of the study. Additionally, the large sample size is also a strength. However, a limitation of the study is the sample being mostly comprised of young adults and females, which may limit the generalizability of the findings to other populations. Furthermore, the study is cross-sectional in nature, which limits the ability to establish causal relationships between variables.

The present study contributes to the growing body of literature highlighting the complex interplay between eating behaviours and SQ, and the need for comprehensive assessments and interventions to address both domains in individuals with sleep disturbances. The study suggests that irregular meal consumption, smoking, alcohol use, and eating out can disrupt sleep patterns, SQ, and thought the indirect way EBs. For improving sleep quality, adherence to a healthy balanced dietary pattern should be encouraged and awareness of the benefits of consumption of main meals and snacks should be increased. Also, enough hydration should be provided. To address these issues, the level of nutritional knowledge among students should be improved, and awareness should be raised about healthy eating. One major step in promoting healthy EBs is to provide a healthy nutrition course should be added to all departments at the university.

Author contributions ▪ Yazarlık katkısı: *Study design: MK, SÇ; Data collection: MK, SÇ; Data analysis: SÇ, MK; Draft preparation: SÇ, MK; Critical review for content: SÇ, MK; Final approval of the version to be published: SÇ, MK. ▪ Çalışmanın tasarımı: MK, SÇ; Çalışma verilerinin elde edilmesi: MK, SÇ; Verilerin analiz edilmesi:SÇ, MK; Makale taslağının oluşturulması: SÇ, MK; İçerik için eleştirel gözden geçirme: SÇ, MK; Yayınlanacak versiyonun son onayı: SÇ, MK.*

Ethics approval ▪ Etik Kurul Onayı: *The Ethics Committee Permission-2022/02-27 was obtained from the Ethics Committee of Non-Interventional Clinical Research of İzmir Democracy University on 27.02.2022. ▪ Etik Kurul İzni-2022/02-27, 27.02.2022 tarihinde İzmir Demokrasi Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu'ndan alınmıştır.*

Conflict of interest ▪ Çıkar çatışması: *The authors declare that they have no conflict of interest. ▪ Yazarlar çıkar çatışması olmadığını beyan ederler.*

REFERENCES

1. Crivello A, Barsocchi P, Girolami M, Palumbo F. The meaning of sleep quality: a survey of available technologies. IEEE. 2019;7:167374-90.
2. Sejbuk M, Mirończuk-Chodakowska I, Witkowska AM. Sleep quality: A narrative review on nutrition, stimulants, and physical activity as important factors. Nutrients. 2022;14(9).
3. 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.
4. Iddir M, Brito A, Dingeo G, Fernandez Del Campo SS, Samouda H, La Frano MR, et al. Strengthening the immune system and reducing inflammation and oxidative stress through diet and nutrition: Considerations during the COVID-19 crisis. Nutrients. 2020;12(6):1562.
5. Treasure J, Duarte TA, Schmidt U. Eating disorders. Lancet. 2020;395(10227):899-911.
6. Sysko R, Glasofer DR, Hildebrandt T, Klimek P, Mitchell JE, Berg KC, et al. The eating disorder assessment for DSM-5 (EDA-5): Development and validation of a structured interview for feeding and eating disorders. Int J Eat Disord. 2015;48(5):452-63.
7. Menculini G, Brufani F, Del Bello V, Moretti P, Tortorella A. Circadian rhythms disruptions and eating disorders: clinical impact and possible psychopathological correlates. Psych Danub. 2019;31(Suppl 3):497-502.

8. Önay D. Üniversite öğrencilerinin kahvaltı alışkanlıklarının değerlendirmesi: Akşehir Sağlık Yüksekokulu örneği. Gazi Üniversitesi Endüstriyel Sanatlar Eğitim Fakültesi Dergisi. 2011;27:95-106.
9. Bowring AL, Peeters A, Freak-Poli R, Lim MSC, Gouillou M, Hellard M. Measuring the accuracy of self-reported height and weight in a community-based sample of young people. BMC Med Res Meth. 2012;12(1):175.
10. WHO. World Health Organization. Global Database on Body Mass Index.WHO; 2022 . Available at: http://www.assessmentpsychology.com/icbmi.htm#:~:text=Global%20Database%20on%20Body%20Mass%20Index%20%2D%20World%20Health%20Organization&text=Body%20Mass%20Index%20(BMI)%20is,(kg%2Fm2) Accessed March 26, 2023.
11. Stunkard AJ, Messick S. The three-factor eating questionnaire to measure dietary restraint, disinhibition and hunger. Journal of Psychosomatic Research. 1985;29(1):71-83.
12. Karakuş SŞ, Yıldırım H, Büyüköztürk Ş. Üç faktörlü yeme ölçeğinin Türk kültürüne uyarlanması: Geçerlik ve güvenirlik çalışması. TAF Prevent Med Bull. 2016;15(3):229-37.
13. Morgan JF, Reid F, Lacey JH. The SCOFF questionnaire: assessment of a new screening tool for eating disorders. BMJ. 1999;319(7223):1467-8.
14. Aydemir Ö, Köksal B, Sapmaz SY, Yüceyar H. Kadın üniversite ögrencilerinde REZZY Yeme Bozukluklari Ölçegi Türkçe formunun güvenilirlik ve geçerliligi/ Reliability and validity of Turkish form of SCOFF Eating Disorders Scale. Anadolu Psikiyatri Dergisi. 2015;16:31-5.
15. Buysse DJ, Reynolds III CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psych Res. 1989;28(2):193-213.
16. Agargun M. Pittsburgh uyku kalitesi indeksinin gecerligi ve guvenirligi. Turk Psikiyatri Dergisi. 1996;7:107-15.
17. Aysan E, Karakose S, Zaybak A, Ismailoglu E. Sleep quality in university students and affecting factors. Dokuz Eylul Univ School Nurs Electron J. 2014;7(3):193-8.
18. Maheshwari G, Shaukat F. Impact of poor sleep quality on the academic performance of medical students. Cureus. 2019;11(4).
19. Gómez-Chiappe N, Lara-Monsalve PA, Gómez AM, Gómez DC, González JC, González L, et al. Poor sleep quality and associated factors in university students in Bogotá DC, Colombia. Sleep Sci. 2020;13(2):125.
20. Purani H, Friedrichsen S, Allen AM. Sleep quality in cigarette smokers: Associations with smoking-related outcomes and exercise. Addict Behav. 2019;90:71-6.
21. Mesquita G, Ferreira S, Rossini S, Evelise A, Soares E, Reimão R. Effects of tobacco and alcohol consumption on sleep quality of university students. Riv Neurobiol. 2010;74:19-27.
22. Colrain IM, Nicholas CL, Baker FC. Alcohol and the sleeping brain. Handb Clin Neurol. 2014;125:415-31.
23. Helaakoski V, Kaprio J, Hublin C, Ollila HM, Latvala A. Alcohol use and poor sleep quality: a longitudinal twin study across 36 years. Sleep Advances. 2022;3(1).
24. Piekarska M, Pszczółka M, Parol D, Szewczyk P, Śliż D, Mamcarz A. Sleeping disorders in healthy individuals with different dietary patterns and BMI, questionnaire assessment. Int J Environ Res Public Health. 2021;18(23):12285.
25. Krističević T, Štefan L, Sporiš G. The associations between sleep duration and sleep quality with body-mass index in a large sample of young adults. Int J Environ Res Public Health. 2018;15(4):758.
26. Yılmaz B, Çiçek B, Kaner G. The effect of body weight on sleep quality and sleep s-a-duration in adolescents. J. Contemp. Med. 2022;12(2):238-43.
27. Martin LE, Pollack L, McCune A, Schulte E, Savage CR, Lundgren JD. Comparison of obese adults with poor versus good sleep quality during a functional neuroimaging delay discounting task: A pilot study. Psychiatry Res. Neuroimaging 2015;234(1):90-5.
28. Li Y, Bai W, Zhu B, Duan R, Yu X, Xu W, et al. Prevalence and correlates of poor sleep quality among college students: a cross-sectional survey. HRQOL. 2020;18(1):1-11.
29. St-Onge MP, Mikic A, Pietrolungo CE. Effects of diet on sleep quality. Adv Nutr. 2016;7(5):938-49.
30. Pendergast FJ, Livingstone KM, Worsley A, McNaughton SA. Correlates of meal skipping in young adults: a systematic review. Int J Behav Nutr Phys Act. 2016;13(1):125.
31. 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;2(11):nzy074.
32. Chang ZS, Boolani A, Conroy DA, Dunietz T, Jansen EC. Skipping breakfast and mood: The role of sleep. Nutr Health. 2021;27(4):373-9.
33. 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):2678.
34. Faris ME, Vitiello MV, Abdelrahim DN, Cheikh Ismail L, Jahrami HA, Khaleel S, 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.

35. Zerón-Rugerio MF, Doblas-Faxeda S, Diez-Hernández M, Izquierdo-Pulido M. Are emotional eating and other eating behaviors the missing link in the relationship between inadequate sleep and obesity? a systematic review. Nutrients. 2023;15(10):2286.
36. ud Din Z, Iqbal K, Khan I, Abbas M, Ghaffar F, Iqbal Z, et al. Tendency towards eating disorders and associated sex-specific risk factors among university students. Noro Psikiyatr Ars. 2019;56(4):258.
37. Jahrami H, Sater M, Abdulla A, Faris MeA-I, AlAnsari A. Eating disorders risk among medical students: a global systematic review and meta-analysis. Eat Weight Disorders. 2019;24(3):397-410.
38. Suna G, Ayaz A. Is poor sleep quality related to disordered eating behavior and mental health among university students? Sleep Biol. Rhythms. 2022;20(3):345-52.
39. Yeh SS, Brown RF. Disordered eating partly mediates the relationship between poor sleep quality and high body mass index. Eat Behav. 2014;15(2):291-7.
40. Zerón-Rugerio MF, Hernáez Á, Cambras T, Izquierdo-Pulido M. Emotional eating and cognitive restraint mediate the association between sleep quality and BMI in young adults. Appetite. 2022;170:105899.