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The Relationship Between Night Eating Syndrome, Sleep Quality, and Nutrition: An Analysis of Meal-Based Nutrient Intake

Gece Yeme Sendromu, Uyku Kalitesi ve Beslenme İlişkisi: Öğün Bazlı Besin Alımı Üzerine Bir Analiz

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ABSTRACT

The aim of this study was to examine the relationship between Night Eating Syndrome (NES), sleep quality, and meal-based energy and macronutrient intake among young adults aged 18–24 years. In this cross-sectional study, NES status was assessed using the Night Eating Questionnaire (NEQ), while sleep quality was evaluated via the Pittsburgh Sleep Quality Index (PSQI). Dietary intake was collected using a 24-hour dietary recall and categorized into main meals, snacks, and night meals. Participants with NES reported significantly higher total daily intakes of energy, protein, carbohydrate, and saturated fat ($p < 0.05$), with night meals being the primary contributor to this increase. As a result of the linear regression analysis, night-time energy intake ($\beta = 0.0075$; $p < 0.001$), PSQI score ($\beta = 0.4606$; $p = 0.0019$), and age ($\beta = –0.4463$; $p = 0.0048$) were identified as significant predictors of NES severity. These findings emphasize the multifactorial nature of NES and underscore the importance of considering both sleep quality and nutrient timing in its assessment and management. These results suggest that public health initiatives and clinical interventions targeting young adults should incorporate strategies to improve sleep quality and regulate night-time eating behaviors to reduce the risk of NES.

Keywords: Feeding Behavior, Night Eating Syndrome, Nutritional Intake, Sleep Quality

ÖZ

Bu çalışmanın amacı, 18–24 yaş arası genç yetişkinlerde Gece Yeme Sendromu (GYS) ile uyku kalitesi ve öğün bazlı enerji ile makro besin ögesi alımı arasındaki ilişkiyi incelemektir. Kesitsel tasarıma sahip bu çalışmada, GYS durumu Gece Yeme Anketi (GYA) ile değerlendirilmiş, uyku kalitesi ise Pittsburgh Uyku Kalitesi İndeksi (PUKİ) kullanılarak ölçülmüştür. Bireylerin besin tüketim kayıtları, 24 saatlik geriye dönük hatırlama yöntemi ile belirlenmiş ve ana öğün, ara öğün ve gece öğünü olarak sınıflandırılmıştır. GYS olan bireylerin toplam günlük enerji, protein, karbonhidrat ve doymuş yağ alımları anlamlı derecede daha yüksek bulunmuştur ($p<0.05$); bu artışın en büyük kısmı gece öğünlerinden kaynaklanmıştır. Doğrusal regresyon analizi sonucunda, gece enerji alımı ($\beta=0.0075$; $p<0.001$), PUKİ puanı ($\beta=0.4606$; $p=0.0019$) ve yaş ($\beta=–0.4463$; $p=0.0048$) değişkenleri, GYS şiddetinin anlamlı yordayıcıları olarak saptanmıştır. Bulgular, GYS'nin çok etmenli yapısını ortaya koymakta ve değerlendirme ile yönetim süreçlerinde uyku kalitesi ve besin alım zamanlamasının dikkate alınması gerektiğini göstermektedir. Elde edilen bulgular, genç yetişkinlerde GYS riskini azaltmak amacıyla, uyku kalitesini iyileştirmeye ve gece yeme davranışlarını düzenlemeye yönelik stratejilerin halk sağlığı girişimleri ve klinik müdahalelere entegre edilmesi gerektiğini göstermektedir.

Anahtar Kelimeler: Beslenme Davranışı, Gece Yeme Sendromu, Besin Alımı, Uyku Kalitesi

Highlights

*People with night eating syndrome have higher total daily energy intake.
*Poor sleep quality is linked to night eating behavior.
*Increased night meal intake predicts NES severity.

The study protocol was approved by the Non-Clinical Research Ethics Committee of Ankara University, under decision number 56786525-050.04.04/1335461, with approval code 06/55.

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INTRODUCTION

Night Eating Syndrome (NES) is an eating disorder characterized by excessive food intake during the night or recurrent awakenings accompanied by a need to eat (1). Individuals with NES tend to consume a substantial portion of their daily caloric intake after dinner, particularly during late-night hours (2). NES is classified in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) under "Other Specified Feeding or Eating Disorders". It is increasingly recognised for its clinical significance (3). Given its classification as an emerging eating disorder, it is critical to understand the comprehensive impact of Night Eating Syndrome on health behaviours and sleep.

Emerging epidemiological evidence suggests that NES not only disrupts eating behaviors but may also negatively affect sleep quality (4, 5). Studies have demonstrated a close association between NES and poor sleep, indicating that inadequate sleep quality can impair both metabolic health and food choices (5, 6). Sleep quality is linked to various metabolic processes, and insufficient or poor-quality sleep is considered a major risk factor for obesity, metabolic syndrome, and cardiovascular diseases (7). Individuals with NES often experience sleep disturbances, including frequent nocturnal awakenings, morning fatigue, and low daytime energy levels (8). This condition may lead to a preference for high-calorie, energy-dense, and nutrient-poor foods (9). In light of these findings, attention has shifted toward the metabolic and behavioral outcomes associated with disrupted sleep and delayed eating patterns. This relationship between eating patterns and sleep timing is conceptually linked to the field of chrononutrition, which explores how the timing of food intake interacts with circadian rhythms and metabolic regulation (10).

Recent research suggests that NES significantly changes dietary habits, particularly in terms of mealtime nutrient intake (11). A study conducted among young adults found that individuals with NES consumed more carbohydrates and fat during night-time meals, which may negatively affect body weight and metabolic health over time (12). Similarly, another study in adults reported that people who ate at night had disturbed sleep patterns, which were closely linked to the timing of meals (13). In this context, evaluating meal-specific nutrient intake among individuals with NES is essential to understanding the potential health consequences of the syndrome and to developing effective intervention strategies. Despite growing interest in the nutritional and behavioral characteristics of Night Eating Syndrome, few studies have specifically investigated the distribution of energy and macronutrient intake across meals (14). Addressing this gap, the present study aims to evaluate meal-based dietary intake patterns in relation to sleep quality and NES severity in young adults. Therefore, the aim of this study is to evaluate the impact of NES on meal-based energy and macronutrient intake and to examine its association with sleep quality in adults.

MATERIAL AND METHOD

Study Design and Participants

This cross-sectional study was conducted among healthy university students aged 18–24 years living in Ankara, Turkey. Participants were recruited from various universities across the city using a convenience sampling method, and no single institution was specifically targeted. Individuals with chronic diseases, psychiatric conditions, those using dietary supplements or medications requiring regular use, pregnant or lactating women, and those outside the specified age range were excluded. Additionally, students enrolled in Nutrition and Dietetics departments—regardless of their university—were excluded to minimize potential bias due to their academic training in nutrition.

Data were collected through face-to-face interviews using a structured questionnaire. Sample size was calculated using G*Power software with a significance level (α) of 0.05, power (1−β) of 0.85, and a medium effect size (0.25), resulting in a target of 578 participants. To account for potential dropouts or data loss, the final sample size was extended to 630.

The questionnaire used in this study consisted of four main sections. The first section included sociodemographic and health-related variables such as age, sex, educational status, smoking habits, self-reported height and weight, the number of main and snack meals consumed daily, and 24-hour physical activity levels. Physical activity data were collected through a self-reported 24-hour recall, in which participants described the type, duration, and intensity of physical activities performed throughout the previous day. This information was used to estimate each participant's physical activity level (PAL). In the second section, the Night Eating Questionnaire (NEQ) was administered to assess the presence of NES. The third section involved the Pittsburgh Sleep Quality Index (PSQI) to evaluate participants' sleep quality. Finally, dietary intake was assessed with a single-day 24-hour dietary recall. The study protocol was approved by the Non-Clinical Research Ethics Committee of Ankara University, under decision number 56786525-050.04.04/1335461, with approval code 06/55.

Night Eating Questionnaire (NEQ)

The Night Eating Questionnaire (NEQ) was used to assess night eating behavior based on the criteria includes items related to morning appetite, timing of food intake, evening and nocturnal eating, cravings, control over eating behavior, sleep disturbances, awareness during night eating, and mood (1). The questionnaire has been previously adapted and validated for use in Turkish (15).Total scores range from 0 to 52, with scores ≥25 indicating the presence of Night Eating Syndrome.

Pittsburgh Sleep Quality Index (PSQI)

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), to quantitatively evaluate sleep quality over the past month (16). The Turkish version of the scale has been previously validated (17). The PSQI consists of seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction. Each component is scored between 0 and 3, and the global PSQI score ranges from 0 to 21. A total score greater than five indicates poor sleep quality.

Anthropometric Measurements

Body weight was measured using a Tanita digital scale with participants wearing light clothing and no shoes. Height was measured using a non-flexible measuring tape, with participants standing barefoot, heels together, and head positioned in the Frankfort horizontal plane. Body Mass Index (BMI) was calculated by dividing weight in kilograms by the square of height in meters (kg/m²). BMI classification was based on World Health Organization (WHO) criteria: BMI ≥30 kg/m² was defined as obese, 25.0–29.9 kg/m² as overweight, and <25.0 kg/m² as normal weight (18).

Dietary Intake Assessment

Dietary intake was assessed using a single-day 24-hour dietary recall method, conducted by researchers. Participants were asked to recall all foods and beverages consumed within the previous 24 hours. To improve accuracy in portion size estimation, the Turkish Food and Photo Atlas was used (19). Nutrient intake —including energy and macronutrients —was analyzed using the Nutrition Information System software (BEBIS).

Meal-based dietary data were categorized into three groups: main meals, snacks, and the night meal. Main meals included breakfast, lunch, and dinner; energy and nutrient intake from these meals were summed to represent overall main meal intake. Snacks referred to midmorning and afternoon eating occasions, and their total intake was summarised under snack consumption. Meal categorizations

were determined by the researchers based on both time of day and participant descriptions. Snacks were defined as eating occasions occurring between main meals (i.e., between breakfast and lunch or lunch and dinner), while night meals were defined as all intake after 9:00 PM and before sleep.

The night meal included all intake after dinner and before sleep and was analyzed separately due to its relevance to NES. In this study, night meals were defined as any food or beverage consumed after 9:00 PM (21:00) and before the onset of sleep. This definition was selected in accordance with previous studies in the field of chrononutrition, where late-night eating is typically characterized by intake occurring after 21:00 hours (20, 21).

Statistical Analysis

A multiple linear regression analysis was conducted to evaluate the associations between night-time energy intake, sleep quality, age, and Body Mass Index (BMI) with the severity of night eating behavior. The independent variables included energy intake during the night, PSQI total score, age, and BMI, while sex was included as a covariate in the model. All assumptions for linear regression (linearity, independence, homoscedasticity, and normality of residuals) were checked prior to analysis. Variables demonstrating high multicollinearity were excluded based on correlation analysis, and only the most relevant predictors were retained to improve model parsimony and interpretability. Beta coefficients with 95% confidence intervals (CI) were reported for each predictor variable, and statistical significance was set at $p < 0.05$. All statistical analyses were conducted using SPSS.

RESULTS AND DISCUSSION

Table 1 shows the descriptive characteristics of the participants. Of the 629 individuals included in the analysis, 122 (19.4%) were classified as having NES. There were no significant differences in age, physical activity level (PAL) or body mass index (BMI) between the groups ($p > 0.05$). However, smoking was significantly more common in people with NES than in those without (47.5% vs. 22.9%, $p < 0.001$). NES was also more common in women than in men (68.0% vs. 19.9%, $p = 0.004$). Participants with NES had significantly higher PSQI total scores (8.29 ± 2.68 vs. 6.50 ± 2.32, $p < 0.001$) and a higher percentage of them also reported poor sleep quality (95.9% vs. 77.7%, $p < 0.001$). Regarding eating patterns, individuals with NES were less likely to consume three main meals daily and more likely to consume only one main meal ($p = 0.002$). The frequency of snacks was also lower in people with NES ($p = 0.015$). In addition, skipping breakfast was significantly more common in the NES group ($p < 0.001$).

Table 1. Sociodemographic and Behavioral Characteristics by Night Eating Syndrome Status

Variable	NES Absent (n=507)	NES Present (n=122)	p
Age (years)	21.05 ± 2.5	21.12 ± 2.7	0.761
Smoking Status			
Smoker	116 (22.9)	58 (47.5)	<0.001
Non-smoker	391 (77.1)	64 (52.5)	
Physical Activity Level (PAL)	1.39 ± 0.14	1.40 ± 0.13	0.551
Sex			
Female	406 (19.9)	83 (68.0)	0.004
Male	101 (80.1)	39 (32.0)	
BMI (kg/m²)	22.09 ± 3.3	22.20 ± 2.9	0.847
BMI Categories			
Underweight	62 (12.2)	14 (11.5)	0.948
Normal	354 (69.8)	87 (71.3)	
Overweight/Obese	91 (17.9)	21 (17.2)	

Table 1 (continued)

PSQI Total Score	6.50 ± 2.32	8.29 ± 2.68	<0.001
Sleep Quality			
Good	113 (22.3)	5 (4.1)	<0.001
Poor	394 (77.7)	117 (95.9)	
Main Meal (n %)			
1	22 (4.3)	12 (9.8)	
2	267 (52.7)	76 (62.3)	0.002
3	218 (43.0)	34 (27.9)	
Snack Meal (n %)			
0	112 (22.1)	34 (27.9)	
1	246 (48.5)	48 (39.3)	0.015
2	132 (26.0)	29 (23.8)	
3	17 (3.4)	11 (9.0)	
Skipping Main Meal (n %)			
Morning	193 (47.9)	51 (60.0)	
Lunch	168 (41.7)	18 (21.2)	<0.001
Dinner	42 (10.4)	16 (18.8)	

Continuous variables are presented as mean ± SD and compared using independent samples t-test. Categorical variables are presented as n (%) and compared using Chi-square test. $p < 0.05$ was considered statistically significant.

In the present study, Night Eating Syndrome (NES) was found to be associated with several behavioral and demographic factors. Smoking was more prevalent among individuals with NES, which may reflect shared mechanisms involving stress regulation and circadian rhythm disruption (11). The higher prevalence of NES among females may be related to sex-specific vulnerabilities such as emotional eating tendencies and hormonal fluctuations (22).

Participants with NES had significantly poorer sleep quality and higher PSQI scores, supporting the close relationship between night eating behavior and sleep disturbances (23, 24). Sleep problems may not only lead to late-night eating episodes, but also contribute to the persistence of this pattern by altering appetite-regulating hormones and by intensifying unhealthy behaviors (12).

Dietary behaviors also differed across NES status. Individuals with NES were more likely to consume fewer main meals and snacks and more likely to skip breakfast. These eating patterns may reflect a shift in energy intake toward the evening and nighttime hours, in line with the circadian misalignment observed in NES (25). Although BMI and physical activity levels were not significantly different between groups, the cumulative effects of night eating behaviors may still carry long-term metabolic risks (5). Taken together, the findings emphasize the multifactorial nature of NES, highlighting the need for integrative approaches in the prevention and management of this condition in young adults.

Although the present study primarily focused on macronutrient intake, the increased consumption of saturated fat, carbohydrates, and total energy during night meals in individuals with NES may suggest a shift toward energy-dense, low-fiber, and potentially nutrient-poor food choices. This pattern is consistent with previous studies indicating that night eating episodes often involve highly palatable, processed foods rich in simple sugars and saturated fats, but low in fiber and essential micronutrients. Such tendencies may impair satiety regulation and contribute to unfavorable metabolic consequences over time (11, 26) Beyond increased total energy intake, the dietary patterns associated with NES may also reflect reduced overall dietary quality. Higher intake of saturated fat, greater night-time energy consumption, and the potential preference for energy-dense, low-nutrient foods suggest a shift away from balanced, nutrient-rich diets. This pattern has been observed in previous studies and may partially explain the adverse metabolic profiles associated with NES (11, 27)

Comparisons of daily nutrient intake and meal-based distribution by NES status are shown in Table 2. Participants with NES had a significantly higher daily total energy intake

(1766.4 ± 761.9 kcal vs. 1577.3 ± 517.3 kcal, $p < 0.001$), as well as higher daily protein, fat and carbohydrate intakes ($p < 0.05$ for all). There was no significant difference in daily fibre intake ($p > 0.05$). Although energy and macronutrient intakes from main meals did not differ significantly between groups ($p > 0.05$), individuals with NES consumed significantly more energy from snacks than those without NES (184.1 ± 407.5 kcal vs. 132.7 ± 217.4 kcal, $p = 0.048$). However, protein, fat and carbohydrate intakes from snacks were not significantly different. At night, energy intake was significantly higher in the NES group (389.0 ± 439.3 kcal vs. 241.8 ± 401.6 kcal, $p < 0.001$), and this pattern was similarly reflected in nighttime protein ($p = 0.012$), fat ($p = 0.020$), carbohydrate ($p < 0.001$), fiber ($p < 0.001$), and saturated fat ($p < 0.001$) intake. Furthermore, individuals with NES derived approximately 22.0% of their total daily energy intake from night meals, compared to 15.3% among non-NES participants ($p<0.001$)(data is not shown). In addition, interestingly, participants with NES had significantly higher fiber and saturated fat intakes during nighttime meals. While the increased fibre intake may reflect the consumption of certain solid food sources rather than beverages or snacks, the increased saturated fat intake is of concern because of its potential impact on lipid metabolism and cardiometabolic risk. This pattern is consistent with previous research showing that late-night eating is often associated with the consumption of energy-dense, high-fat foods (11, 28, 29).

Table 2. Daily and Meal-Specific Nutrient Intake in Participants with and without Night Eating Syndrome

Variable	NES Absent (n=507)	NES Present (n=122)	p
Daily Energy Intake (kcal/day)	1577.3 ± 517.3	1766.4 ± 761.9	<0.001
Daily Protein Intake (g)	61.8 ± 25.2	68.8 ± 35.6	0.044
Daily Fat Intake (g)	69.5 ± 26.6	74.9 ± 38.2	0.148
Daily Saturated Fatty Acids (g)	24.9 ± 10.8	28.3 ± 14.7	0.016
Daily Carbohydrate Intake (g)	172.5 ± 69.0	195.8 ± 91.8	0.009
Daily Fiber Intake (g)	15.2 ± 7.2	15.3 ± 9.2	0.842
Energy Main Meals	1310.86 ± 455.57	1394.08 ± 572.31	0.090
Protein Main Meals	55.11 ± 24.80	59.16 ± 30.07	0.122
Fat Main Meals	58.64 ± 27.45	62.91 ± 31.52	0.122
Carbohydrate Main Meals	157.79 ± 65.84	169.07 ± 79.97	0.140
Fiber Main Meals	16.67 ± 8.37	18.40 ± 9.20	0.326
Saturated Fat Main Meals	20.30 ± 9.94	21.78 ± 11.40	0.100
Energy Snacks	139.72 ± 217.46	175.90 ± 253.50	0.048
Protein Snacks	3.67 ± 6.92	4.15 ± 8.07	0.343
Fat Snacks	5.76 ± 9.86	6.78 ± 10.74	0.355
Carbohydrate Snacks	17.57 ± 32.33	21.81 ± 41.05	0.323
Fiber Snacks	1.55 ± 2.90	1.81 ± 3.47	0.191
Saturated Fat Snacks	1.76 ± 3.21	1.99 ± 3.13	0.136
Energy Night	241.82 ± 211.60	389.04 ± 337.67	<0.001
Protein Night	6.44 ± 6.40	9.63 ± 8.31	0.012
Fat Night	11.02 ± 10.90	16.30 ± 13.82	0.020
Carbohydrate Night	27.94 ± 26.07	45.91 ± 40.56	<0.001
Fiber Night	2.57 ± 2.79	3.84 ± 3.48	<0.001
Saturated Fat Night	3.62 ± 3.71	5.58 ± 4.71	<0.001

Values are presented as mean ± SD. Group differences were assessed using independent samples t-test. $p < 0.05$ was considered statistically significant.

A linear regression model was conducted to examine the association between night-time energy intake, sleep quality, age, and Body Mass Index (BMI) with NES (Table 3). The model showed several significant predictors. Energy intake during the night was positively associated with NES ($\beta = 0.0075$, $p <0.001$), indicating that greater caloric intake after dinner was related to higher levels of night eating behavior. Sleep quality also showed a

significant positive association with NES (β = 0.4606, p = 0.002), suggesting that poorer sleep quality was linked to greater severity of NES symptoms. In addition, age demonstrated a significant negative association with NES (β = –0.4463, p = 0.005), indicating that younger individuals tended to have higher NES scores compared to older participants. BMI was not significantly associated with NES (p >0.05), implying that body weight status alone may not independently predict the severity of night eating behaviors when other factors are considered (30, 31).

Table 3. Linear Regression Analysis of Predictors of Night Eating Syndrome Severity

Variable	Coefficient (β)	Std. Error	*p*-value	95% CI
Intercept	21.4761	4.6629	<0.001	(12.2994, 30.6527)
Energy night	0.0075	0.0015	<0.001	(0.0045, 0.0105)
BMI	0.1391	0.1277	0.277	(-0.1122, 0.3904)
PSQI total score	0.4606	0.1469	0.0019	(0.1715, 0.7498)
Age	–0.4463	0.1571	0.0048	(–0.7555, –0.1372)

Linear regression model assessing the association between night-time energy intake, BMI, sleep quality (PSQI), and age with NES total score.

In the linear regression model predicting NES total score, night-time energy intake was found to be a significant positive predictor. This result suggests that as energy intake during the night increases, NES symptom severity also tends to rise. These results are in line with recent chrononutrition studies reporting that increased caloric intake in the late evening is associated with disruptions in central and peripheral circadian rhythms, leading to adverse metabolic outcomes (32, 33). Late eating has been shown to impair glucose tolerance and insulin sensitivity, which may, over time, contribute to behavioral patterns reinforcing night eating tendencies (27).

Sleep quality also significantly predicted NES severity, indicating that poorer sleep is associated with higher NES symptom burden. This aligns with growing evidence that sleep disturbances—particularly in sleep latency and sleep efficiency—are closely related to delayed eating behaviors and nocturnal food intake (4, 34). The bidirectional relationship between sleep and eating behaviors underscores the importance of integrated lifestyle interventions.

Interestingly, age was found to be a negative predictor of the NES score, suggesting that younger individuals in the sample were more likely to be vulnerable to night eating behaviors. This is supported by recent observational evidence that adolescents and young adults are more likely to eat in the evening, often due to irregular schedules, stress or environmental factors (35, 36). No significant association was found between BMI and NES score in this model, supporting the idea that NES can be present regardless of weight status, and that behavioral and psychological variables may play a more prominent role in its development (31).

CONCLUSION AND RECOMMENDATIONS

This study demonstrates that Night Eating Syndrome (NES) is associated with increased total daily intake of energy and macronutrients—particularly during night-time meals—and with poorer sleep quality. Notably, individuals with NES consumed approximately 22% of their total daily energy intake after 9:00 PM, compared to 15.3% among non-NES participants. Nocturnal energy intake and poor sleep were significant predictors of NES severity, independent of body mass index. These findings align with existing literature suggesting that delayed eating and disrupted sleep may contribute to circadian misalignment and impaired metabolic regulation.

In light of these findings, clinical assessment of Night Eating Syndrome should include not only the evaluation of total nutrient intake, but also the timing of meals and adherence to sleep hygiene practices. The observed dietary patterns—including greater

intake of saturated fat and carbohydrates during the night—may also reflect reduced overall dietary quality. Therefore, health professionals should be encouraged to assess both quantitative and qualitative aspects of dietary intake when addressing NES.

Preventive strategies targeting young adults may benefit from integrated interventions that simultaneously address dietary behavior and sleep regulation. In particular, university-based awareness and behavior change programs that emphasize regular, balanced daytime eating—alongside education on sleep hygiene and circadian meal timing—may serve as effective and accessible tools for early intervention.

Future research lshould explore the effectiveness of multidimensional treatment models, such as combining cognitive behavioral therapy (CBT) with tailored dietary education, to reduce night-time eating behaviors and improve sleep-related outcomes. Longitudinal and experimental studies are also warranted to better understand causal mechanisms and to develop age-specific, personalized interventions for at-risk populations.

Limitations

This study has several limitations. First, its cross-sectional design limits the ability to make causal inferences among Night Eating Syndrome, sleep quality, and dietary patterns. Second, dietary intake was assessed using a single 24-hour recall, which may not reflect participants' habitual intake due to daily dietary variability. Third, self-reported data on sleep quality may be subject to recall or reporting bias, potentially affecting the accuracy of subjective sleep assessments. In addition, the use of a convenience sampling method may limit the generalizability of findings to the broader young adult population. Furthermore, the study did not account for differences in dietary intake across different days of the week (e.g., weekdays vs. weekends), which may influence energy distribution and eating patterns. Despite these limitations, the study provides valuable insight into the behavioral and nutritional correlates of Night Eating Syndrome in young adults.

Conflict of Interest

The authors declare no conflict of interest related to the publication of this manuscript.

Authors' Contributions

Conceptualization: MB; Methodology: MB; Formal Analysis: MB; Investigation: MB, MC, EK; Data Collection: MC, EK; Data Curation: MB, MC, EK; Writing – Original Draft: MB; Writing – Review & Editing: MB, MC, EK; Visualization: MB; Supervision: MB; Project Administration: MB. All authors read and approved the final version of the manuscript.

REFERENCES

1. Allison KC, Lundgren JD, O'Reardon JP, Martino NS, Sarwer DB, Wadden TA, et al. The Night Eating Questionnaire (NEQ): psychometric properties of a measure of severity of the Night Eating Syndrome. Eat Behav. 2008;9(1):62-72.
2. Vander Wal JS. Night eating syndrome: a critical review of the literature. Clin Psychol Rev. 2012;32(1):49-59.
3. American Psychiatric A. Diagnostic and Statistical Manual of Mental Disorders 2013.
4. Alwafa RA, Jallad S, Al-Sheikh RA, Adwan R, Badrasawi M. Relationship between night eating syndrome and sleep quality among university students in Palestine. Sleep Science and Practice. 2024;8(1).
5. Sakthivel SJ, Hay P, Mannan H. A Scoping Review on the Association between Night Eating Syndrome and Physical Health, Health-Related Quality of Life, Sleep and Weight Status in Adults. Nutrients. 2023;15(12).
6. Yoshida J, Eguchi E, Nagaoka K, Ito T, Ogino K. Association of night eating habits with metabolic syndrome and its components: a longitudinal study. BMC Public Health. 2018;18(1):1366.
7. St-Onge MP, Grandner MA, Brown D, Conroy MB, Jean-Louis G, Coons M, et al. Sleep Duration and Quality: Impact on Lifestyle Behaviors and Cardiometabolic Health: A Scientific Statement From the American Heart Association. Circulation. 2016;134(18):e367-e86.
8. O'Reardon JP, Peshek A, Allison KC. Night eating syndrome : diagnosis, epidemiology and management. CNS Drugs. 2005;19(12):997-1008.
9. Striegel-Moore RH, Franko DL, Thompson D, Affenito S, May A, Kraemer HC. Exploring the typology of night eating syndrome. Int J Eat Disord. 2008;41(5):411-8.
10. Johnston JD, Ordovas JM, Scheer FA, Turek FW. Circadian Rhythms, Metabolism, and Chrononutrition in Rodents and Humans. Adv Nutr. 2016;7(2):399-406.
11. Gallant AR, Lundgren J, Drapeau V. The night-eating syndrome and obesity. Obes Rev. 2012;13(6):528-36.

12. Goel N, Stunkard AJ, Rogers NL, Van Dongen HP, Allison KC, O'Reardon JP, et al. Circadian rhythm profiles in women with night eating syndrome. J Biol Rhythms. 2009;24(1):85-94.

13. Chung N, Bin YS, Cistulli PA, Chow CM. Does the Proximity of Meals to Bedtime Influence the Sleep of Young Adults? A Cross-Sectional Survey of University Students. Int J Environ Res Public Health. 2020;17(8).

14. Pinto TF, Silva FG, Bruin VM, Bruin PF. Night eating syndrome: How to treat it? Rev Assoc Med Bras (1992). 2016;62(7):701-7.

15. Atasoy N, Saracli O, Konuk N, Ankarali H, Guriz S, Akdemir A, et al. The reliability and validity of Turkish version of The Night Eating Questionnaire in psychiatric outpatient population. Anatolian Journal of Psychiatry. 2014;15(3).

16. Buysse DJ, Reynolds CF, 3rd, 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.

17. Ağargün MY, Kara, H., & Anlar, O. Pittsburgh uyku kalitesi indeksinin geçerliği ve güvenirliği. Türk Psikiyatri Dergisi. 1996;7:107-15.

18. Obesity WCo. Obesity : preventing and managing the global epidemic : report of a WHO consultation. World Health Organization2000.

19. Rakıcıoğlu N, Tek, N., Ayaz, A., & Pekcan, A. G. Yemek ve Besin Fotoğraf Kataloğu Ölçü ve Miktarlar. Ankara: Ata Ofset Matbaacılık; 2010.

20. Almoosawi S, Vingeliene S, Karagounis LG, Pot GK. Chrono-nutrition: a review of current evidence from observational studies on global trends in time-of-day of energy intake and its association with obesity. Proc Nutr Soc. 2016;75(4):487-500.

21. Garaulet M, Gomez-Abellan P, Alburquerque-Bejar JJ, Lee YC, Ordovas JM, Scheer FA. Timing of food intake predicts weight loss effectiveness. Int J Obes (Lond). 2013;37(4):604-11.

22. Anthonisamy AN, Misra S, Barua A. Prevalence of night eating syndrome among inbound call centre employees in Kuala Lumpur, Malaysia. Nutr Health. 2023;29(3):505-12.

23. Kazgan Kılıçaslan A, Oktay M, Kurt O. Night-Eating Syndrome, Sleep Quality, and Eating Mindfulness in Psychiatric Outpatients. Istanbul Medical Journal. 2024:190-8.

24. Köse AG, Sarıkaya B, İçer MA. Evaluation of the Effects of Night Eating Syndrome and Mindful Eating on Sleep Quality Among Female Students in the Faculty of Health Sciences. Gümüşhane Üniversitesi Sağlık Bilimleri Dergisi. 2024;13(4):1496-506.

25. Ni Y, Wu L, Jiang J, Yang T, Wang Z, Ma L, et al. Late-Night Eating-Induced Physiological Dysregulation and Circadian Misalignment Are Accompanied by Microbial Dysbiosis. Mol Nutr Food Res. 2019;63(24):e1900867.

26. Allison KC, Wadden TA, Sarwer DB, Fabricatore AN, Crerand CE, Gibbons LM, et al. Night eating syndrome and binge eating disorder among persons seeking bariatric surgery: prevalence and related features. Obesity (Silver Spring). 2006;14 Suppl 2:77S-82S.

27. Imai S, Saito Y, Kajiyama S, Nitta A, Miyawaki T, Matsumoto S, et al. Late-night-dinner deteriorates postprandial glucose and insulin whereas consuming dinner dividedly ameliorates them in patients with type 2 diabetes: A randomized crossover clinical trial. Asia Pac J Clin Nutr. 2020;29(1):68-76.

28. Barragan R, Tam V, Scaccia S, Cochran J, RoyChoudhury A, St-Onge M-P. Abstract MP58: Eating Behaviors Influence Diet Quality: Impact Of Sleep Restriction. Circulation. 2022;145(Suppl_1).

29. Donnelly M, Woolf K. Nighttime Eating Is Associated with Poor Diet Quality in Adult Females (P21-055-19). Current Developments in Nutrition. 2019;3.

30. Lent MR, Atwood M, Bennett WL, Woolf TB, Martin L, Zhao D, et al. Night eating, weight, and health behaviors in adults participating in the Daily24 study. Eat Behav. 2022;45:101605.

31. Sayed Ahmed HA, Abo El-Ela SG, Joudeh AI, Moawd SM, El Hayek S, Shah J, et al. Prevalence and Correlates of Night Eating Syndrome, Insomnia, and Psychological Distress in Primary Care Patients with Obesity: A Cross-Sectional Study. Obes Facts. 2024;17(3):274-85.

32. Akbar Z, Shi Z. Unfavorable Mealtime, Meal Skipping, and Shiftwork Are Associated with Circadian Syndrome in Adults Participating in NHANES 2005-2016. Nutrients. 2024;16(11).

33. Depner CM, Stothard ER, Wright KP, Jr. Metabolic consequences of sleep and circadian disorders. Curr Diab Rep. 2014;14(7):507.

34. Tzischinsky O, Tokatly Latzer I, Alon S, Latzer Y. Sleep Quality and Eating Disorder-Related Psychopathologies in Patients with Night Eating Syndrome and Binge Eating Disorders. J Clin Med. 2021;10(19).

35. Grummon AH, Sokol RL, Lytle LA. Is late bedtime an overlooked sleep behaviour? Investigating associations between sleep timing, sleep duration and eating behaviours in adolescence and adulthood. Public Health Nutr. 2021;24(7):1671-7.

36. Striegel-Moore RH, Franko DL, Thompson D, Affenito S, Kraemer HC. Night eating: prevalence and demographic correlates. Obesity (Silver Spring). 2006;14(1):139-47.