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Association Between Stress and Night Eating Syndrome Among University Students

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Abstract **Background:** Night eating syndrome (NES) is a common disorder observed among not only individuals with obesity but also those with psychological disorders such as de-pression, anxiety, and stress. Identifying an association between NES and stress among young adults can aid in the prevention of obesity and other comorbidities. **Objectives:** To investigate the association between stress and NES among Saudi students. **Methods:** The cross-sectional study involved 331 healthy students aged 18 years and above from King Saud University, Riyadh, Saudi Arabia. The Depression, Anxiety, and Stress Scale-21 item questionnaire was used to evaluate stress symptoms among the par-ticipants, while the Night Eating Questionnaire was used to assess eating patterns. Of the 331 participants, 53% exhibited symptoms of NES and 40.5% scored above the cut-off point for stress. **Results:** Psychological distress, including stress, and NES were significantly positively correlated ($P < 0.001$). The correlation coefficients for stress, anxiety, and depression were 0.413**, 0.429**, and 0.455**, respectively ($P < 0.001$), indicating that the levels of night eating and stress, anxiety, and depression were moderately positively correlated. **Conclusion:** Further research, encompassing different Saudi universities from various regions, is required to confirm the association between NES and stress.

Keywords: *obesity, night eating, psychological distress, stress, weight*

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1. Introduction

Night eating syndrome (NES) was first described by Stunkard et al. in 1955 as recurrent episodes of nighttime eating. As per the Diagnostic and Statistical Manual for Mental Disorders Fifth Edition of the American Psychiatric Association [1], NES manifests as eating after awakening from sleep or indulging in excessive food consumption after the evening meal. NES is associated with elevated weight in individuals with morbid obesity due to increased nighttime food intake, significantly impacting their quality of life [2,3]. The diagnosis criteria for NES encompass intentional binge eating of at least 25% of daily intake after dinner, along with symptoms such as morning anorexia, a strong urge for nighttime eating, insomnia, a belief that eating is necessary to induce or regain sleep, or worsening mood in the evening [3]

NES is estimated to affect 2% of the general population, with prevalence rates ranging between 6% and 14% among individuals with obesity [4]. In Turkey, NES prevalence was reported at 16% among patients with depression [5], whereas in Saudi Arabia, NES was found to affect 10% of medical students, with men being at higher risk [6]. Furthermore, He et al. (2018) conducted a cross-sectional study involving 909 Chinese college students to ascertain NES prevalence and its association with psychological distress [7]. This study used the Chinese version of the Night Eating Questionnaire (NEQ) to examine the prevalence and demographics of NES, as well as its association with psychological distress, among Chinese college students. A 2.8% prevalence of NES was reported among the participants; compared to females, males exhibited a significantly higher likelihood of NES, along with concomitant psychological distress, specifically depression ($P < 0.001$), anxiety ($P < 0.001$), and stress ($P < 0.001$) [8]. This study leads us to assume a potential association between stress and NES among Saudi students.

Along with being related to obesity, NES is correlated with psychological disorders such as depression, anxiety, and stress. The prevalence of depression among individuals with NES was found to be 22%–55%, compared to 9%–30% among those without NES [8,9] Similarly, the prevalence of anxiety disorders in individuals with NES was 34%–59%, compared to 9%–28% in those without NES [8,10]. Therefore, examining the association between NES and stress among young adults may provide insights into factors contributing to the obesity epidemic. To the best of our knowledge, limited studies have examined this association among the Saudi population; thus, this study aims to identify the association between stress and NES among college students in Saudi Arabia.

2. Materials and Methods

2.1. Study Design

This cross-sectional study comprised 331 healthy students aged 18 years and above. Data were collected through online invitations using a Google Form, which provided information about the study's purpose, and the participants' voluntary consent to participate was obtained.

This study received approval from the Ethics Committee of King Khalid University Hospital (KSU-IRB No. E-21-5810). All participants provided informed consent before participating and were informed of their right to withdraw from the study at any time.

2.2. Sample Size

The original sample size was calculated using Raosoft software [11]. With an alpha error of 5%, a power of 80%, a minimal model R-squared of 5%, and allowance for 20 predictors in the model, the minimum required sample size was 382 participants. However, only 331 participants met the eligibility criteria and were included in this study. The participants were randomly selected from various colleges within King Saud University, Riyadh, Saudi Arabia.

2.3. Assessment of Sociodemographics, Stress, and NES

The participants self-reported their sociodemographic data on sex, age, marital status, smoking habits, sleep timing, height, and weight. The NEQ developed by Elsadek et al. (2014) and the Depression, Anxiety, and Stress Scale (DASS) developed by Alharbi et al. (2023) were utilized for assessment [12,13].

NEQ comprises 14 items assessing NES symptoms, including morning hunger, time of breakfast, cravings, control over eating after dinner but before bedtime, cravings and control over eating during the sleep period, percentage of food eaten after dinner, depressed mood, timing of depressed mood, initial insomnia, awakening from sleep, belief in needing to eat to fall back to sleep, frequency of nocturnal ingestion, and awareness of eating during the night. The item assessing awareness of eating (item 13) was not included in the total score but was used to differentiate NES from sleep-related eating disorder. Additionally, a 15th item, used for assessing the symptom duration descriptively, was not included in the total score.

The participants responded to each item using a five-point scale ranging from 0 to 4. The total score for the NEQ ranged from 0 to 52. The NEQ was also used to screen for NES and determine the severity levels of NES: <13 (very low level of night eating), 13–15 (low level), 15–21 (moderate level), 21–26 (high level), and >26 (very high level).

Table 1. The Depression, Anxiety, and Stress Scale (DASS) scores

Level	Depression	Anxiety	Stress
Normal	0–4	0–3	0–7
Mild	5–6	4–5	8–9
Moderate	7–10	6–7	10–12
Severe	11–13	8–9	13–16
Extremely Severe	14+	10+	17+

Furthermore, the DASS was used to quantify distress levels related to depression, anxiety, and stress. The scores for these indicators were determined as shown in Table 1.

2.4. Statistical Analysis

Descriptive analyses were conducted to summarize the sociodemographic characteristics of the study population and determine the prevalence of NES and stress. Frequency calculations were used for categorical variables, while mean and standard deviation were computed for continuous variables. The Pearson correlation coefficient test was used to assess the association between the NES and distress levels measured with the DASS. A value of $P \leq 0.05$ was considered statistically significant. Data analysis was performed using SPSS 26.0 (SPSS Inc., Chicago, IL, USA).

3. Results

3.1. General Characteristics of the Participants

Table 2. Participants' sociodemographic characteristics (n = 331)

Items		Frequency (%)
Sex		
	Female	291 (87.9%)
	Male	40 (12.1%)
Age (Mean ± SD)		21.49 ± 2.62
Marital status		
	Unmarried	304 (91.8%)
	Married	27 (8.2%)
Smoking		
	Yes	22 (6.6%)
	No	309 (93.4%)
Timing of sleep		
	Morning	163 (49.2%)
	Night	168 (50.8%)
BMI		
	Underweight	27 (8.2%)
	Healthy weight	193 (58.3%)
	Overweight	78 (23.6%)
	Obese	33 (10%)

BMI = Body Mass Index

Table 2 shows that most of the participants were female (87.9%), with only 12.1% being male. This suggests that the study was not representative of the general population of students at King Saud University, and that the females were more responsive than males to participate in the study. The average age of the participants was 21.49 years with a standard deviation of 2.62 years, falling within the typical age range for undergraduate students. Additionally, most participants were unmarried (91.8%), with only 8.2% being married. This is likely because most of the participants were undergraduate students. Moreover, only a small percentage of participants reported smoking (6.6%), a positive finding suggesting a low prevalence of smoking among students, particularly females. Furthermore, the participants were almost evenly split between morning and night sleepers (49.2% and 50.8%, respectively), indicating no clear preference for morning

or night sleep among the students. Finally, regarding BMI, the most common category was healthy weight (58.3%), followed by overweight (23.6%), obesity (10%), and underweight (8.2%), reflecting a relatively healthy distribution among the participants.

3.2. Association between Night Eating and Depression, Anxiety, and Stress

Table 3. Level of night eating and those of depression, anxiety, and stress among the participants (n = 331)

Items		Frequency (%)
NEQ		
	Very low	91 (27.5%)
	Low	66 (19.9%)
	Moderate	97 (29.3%)
	High	50 (15.1%)
	Very high	27 (8.2%)
Stress		
	Normal	134 (40.5%)
	Mild	33 (10%)
	Moderate	69 (20.8%)
	Severe	52 (15.7%)
	Extremely Severe	43 (13%)
Anxiety		
	Normal	94 (28.4%)
	Mild	64 (19.3%)
	Moderate	43 (13%)
	Severe	29 (8.8%)
	Extremely Severe	101 (30.5%)
Depression		
	Normal	131 (39.6%)
	Mild	51 (15.4%)
	Moderate	74 (22.4%)
	Severe	24 (7.3%)
	Extremely Severe	51 (15.4%)

NEQ = Night Eating Questionnaire

The association between the level of night eating and the state of depression, anxiety, and stress among the participants was examined using the employed methodology and scale, with the results presented in Table 3. A significant proportion of the participants (47.4%) exhibited low to very low NEQ scores, indicating minimal to no night eating. This is a positive finding, as night eating is linked with various health risks, including obesity, diabetes, and heart disease. In terms of stress levels, a considerable proportion of the participants (40.5%) reported normal stress levels. However, a notable percentage also experienced moderate to severe stress levels (49.5%). Regarding anxiety levels, a particularly concerning finding was that the majority of the participants (30.5%) reported extremely severe anxiety, with 28.4% reporting normal levels, 19.3% reporting mild anxiety, 13% reporting moderate anxiety, and 8.8% reporting severe anxiety. Finally, a substantial number of participants reported moderate to severe depression (29.7%), with 39.6% reporting normal levels, 15.4% reporting mild depression, and 15.4% reporting extremely severe depression. Overall, a considerable number of participants reported moderate to high levels of night eating. Additionally, a notable proportion experienced moderate to extremely severe levels of depression, anxiety, and stress.

3.3. Association between the Level of Night Eating and those of Depression, Anxiety, and Stress

The Pearson correlation coefficient test illustrates that the level of night eating and those of depression, anxiety, and stress were significantly correlated (all P values < 0.001). In particular, for stress, the correlation coefficient was 0.413**, indicating a moderate positive correlation between the levels of night eating and stress. This suggests that as the level of night eating increases, so does the level of stress. Similarly, for anxiety, the correlation coefficient was 0.429**, signifying a moderate positive correlation between the levels of night eating and anxiety. This implies that as the level of night eating increases, the level of anxiety also tends to increase. Finally, the correlation coefficient for depression was 0.455**, indicating a moderate positive correlation between the levels of night eating and depression. This means that as the level of night eating increases, the level of depression also tends to increase. Overall, these findings strongly suggest a significant positive relationship between the level of night eating and those of stress, anxiety, and depression among the participants.

4. Discussion

This study aimed to identify the association between stress and NES among college students. Of the 331 participants, 53% exhibited symptoms of NES and 40.5% scored above the cut-off point for stress. Psychological distress, including stress, and NES were significantly positively correlated (P < 0.001). The correlation coefficients for stress, anxiety, and depression were 0.413**, 0.429**, and 0.455**, respectively (P < 0.001), indicating that the level of night eating and those of stress, anxiety, and depression were moderately positively correlated. These results align with those obtained by Gundogdu (2022), who suggested that hyperphagia in the evening and nocturnal ingestion are correlated with stress [3].

Another study conducted by Wichianson et al. (2009) examined the association between night eating and stress among 95 undergraduates and found it to be significant positive ($\beta = 0.259$, $P < 0.05$) [14]. In addition, Lundgren et al. (2008) found that NES is associated with elevated perceived stress, further supporting our findings [15]. Moreover, another study reported a significant positive association between stress and NES (P = 0.02) [16]. Our results also demonstrated an association between NES and depression, consistent with a previous study's findings, which reported that depressive symptoms are correlated with and predictive of emotional eating, including increased evening energy intake [10]. Furthermore, consuming food during night hours is associated with an increased incidence or history of other eating disorders and depression [17].

Kucukgoncu and Bestepe (2014) studied the clinical markers of NES in 300 outpatients with psychiatric disorders from Bakırköy State Hospital for Mental Health and Neurological Disorders in Istanbul [8]. These patients presented with general anxiety disorder and major depression. The Structured Clinical Interview for the

Diagnostic and Statistical Manual for Mental Disorders Fifth Edition Axis I Disorders (SCID-I) was used for psychiatric diagnosis, and the NES Evaluation Questionnaire and NEQ were used for NES diagnosis. The findings showed that 21.3% of the patients diagnosed with depression met the criteria for NES.

Additionally, Orhan et al. (2011) conducted a case-control study to estimate the prevalence of NES in patients with depression. Their cohort included 162 patients with depression and 172 healthy control participants from a university in Turkey [18]. The participants were interviewed by a psychiatrist using the Turkish version of the Structured Clinical Interview for Diagnostic and Statistical Manual for Mental Disorders Fifth Edition Axis I Disorders and Statistical Manual of Mental Disorders, 4th edition, Axis I Diagnosis–Clinician Version (22) to diagnose depression; the proposed research diagnostic criteria for NES were used. The authors found considerably more instances of night eating among people with depression (n = 57) than among controls (n = 33).

Similar to our findings regarding anxiety and NES, a previous study found NES to be associated with an increase in the comorbidity of mood and anxiety symptoms [19]. Moreover, the article suggested that nocturnal eating is driven by the belief that one cannot go to bed without having food, which contributes to the desire to control the anxiety related to this belief. Meanwhile, a study comparing the psychological effects of NES between NES and non-NES groups indicated a significant positive relationship between NES and anxiety [20]. Comparisons between the two groups in terms of anxiety showed a higher rate of anxiety in the NES group ($P < 0.05$, Cohen's $d = 0.30$) than in the non-NES group ($P < 0.001$, Cohen's $d = 0.43$) [20].

This discrepancy between our findings and those reported in the literature could be due to several factors. First, we did not evaluate appetite levels at different times. For example, there is a known variation in appetite between daytime and nighttime. Some individuals experience reduced appetite in the morning, when they are occupied with work or running errands, and increased appetite in the evening, when they are alone or engaged in leisure activities such as watching television. Moreover, our study participants did not exhibit increased food consumption during the late evening or when experiencing feelings of depression. This could be attributed to our lack of measurement of mood variation throughout the day, making it uncertain whether they experienced depressive symptoms or anxiety during the late night. Furthermore, none of the participants in the current study were formally diagnosed with a clinical condition associated with NES, which could have impacted the results.

Most participants above the cut-off points were aged 21–30 years (n = 42), constituting 13% of the total participants, which aligns with the findings of Sevincer et al. (2016), who stated that NES is more prevalent in individuals aged 18–30 years [21]. This may be because students in junior and/or senior years of university and master's or PhD students are more likely to stay up late at night to study.

So far, only a few NES studies have been conducted with patients with psychiatric disorders, particularly depression. Until recently, NES research has primarily focused on individuals with obesity, often overlooking patients with psychiatric disorders, including stress. Birketvedt et al. (1999) conducted a study examining neuroendocrine levels in 33 women with obesity, including 12 nighttime eaters who consumed over 50% of their dietary intake after 8 pm and 21 controls, at a University Hospital in Norway for one day. According to the results, individuals with NES exhibited worsening mood in the evening or at night [22].

Our study has some strengths and limitations. The Arabic versions of the questionnaires, including the NEQ and DASS-21, were found to be reliable and valid [12], [23]. The limitations include the failure to collect enough responses to meet the goal sample size, as only 331 responses were collected compared to the original sample size estimate of 382. Additionally, due to the COVID-19 pandemic, we only included students from one university. The analysis was not adjusted for marital status, income, sex, BMI, and sleeping hours. Moreover, the questionnaires sent online were self-administered, which might have affected the accuracy of the results.

5. Conclusion

NES and stress were significantly positively correlated among college students, whereas NES and depression or anxiety were not significantly correlated. Stress was highly prevalent among the study participants. Further research on NES and stress, involving universities from different regions of Saudi Arabia, should be conducted to confirm this association. This study can also be expanded to include other nationalities to compare lifestyle differences and their impact on NES and stress. Our results suggest that anxiety and depression are not associated with NES, indicating a need for future literature to explore these variables' relationship with NES.

Ethics Approval and Consent to Participate

All participants provided informed consent before participating. This study received approval from the Ethics Committee of King Saud Hospital (KSU-IRB No. E-21-5810).

Availability of Data and Materials

The authors confirm that some data supporting the study findings are attached as supplementary materials; however, some data are not available publicly as they can compromise the privacy of the participants.

Competing Interests

Authors declare that they have no conflict of interest.

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