

NIGHT EATING SYNDROME AND ITS ASSOCIATION WITH SLEEP QUALITY AND STRESS BETWEEN MALE AND FEMALE UNDERGRADUATE STUDENTS

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Abstract

Introduction: Late-night eating habits, poor sleep hygiene, and stress are no longer uncommon due to their increasing prevalence in today's society. They typically affect young individuals, particularly students in developing nations. Nevertheless, there are limited research on night eating syndrome (NES) among Malaysian students. Thus, this cross-sectional study aimed to assess the association of night eating syndrome, sleep quality and stress level among undergraduate students. **Method:** A convenience sampling of undergraduate students aged between 19 and 25 years at International Islamic University Malaysia (IIUM) Kuantan was recruited and the total respondents were 436 students (218 female and 218 male respondents). A combination of Night Eating Questionnaire (NEQ), Pittsburgh Sleep Quality Index (PSQI), and Perceived Stress Scale (PSS) was used to collect the data from the respondents. The data were analysed using SPSS version 29 (SPSS 29.0) using Mann-Whitney U and Pearson Correlation tests. P value was set at $p < 0.05$ as statistically significant. **Results:** The percentage of students having NES was 14.7%. However, there were differences between the prevalence of NES between male and female ($p = 0.03$, $z = 2.163$). Also, there was a significant negative but weak correlation between NES and sleep quality ($r = -0.149$, $p = 0.002$). For association between NES and stress, there was a significant positive but weak correlation between those two ($r = 0.260$, $p = 0.001$). **Conclusions:** The prevalence of NES is significantly higher among male than female students. A high level of NES was associated with a higher value of stress and poor sleep quality. Therefore, corrective strategies need to be taken place accordingly to enhance their well-being. Further research is warranted as these circumstances could potentially impair undergraduate students' academic performance.

KEYWORDS: Night Eating Syndrome, Sleep quality, Stress level, Undergraduate students

Introduction

The intake of nutrients, food groups, or general dietary patterns has a favorable impact on health and helps prevent chronic non-communicable diseases (NCDs) like diabetes and cardiovascular disease, according to a significant and growing body of research (Cena & Calder, 2020). Other than eating healthily, the quantity and quality of food also play an important role in well-being. Furthermore, the social and cultural preferences of people and households have a big impact on people's understanding of food and their food choices.

Night Eating Syndrome (NES) is a unique disorder characterized by a delayed pattern of food intake in which nighttime eating and/or excessive food consumption happens often after the evening meal. Due to its association with obesity, correlation with other psychiatric diseases, and sleep issues, NES is a clinically significant disorder (Kucukgoncu et al., 2015). Energy intake is lowered in the first half of the day and dramatically raised in the second half, disrupting the sleeping pattern. The absence of accompanying compensatory behaviors, the time of food intake, and the fact that food ingestions are limited, similar to repeated snacks rather than actual binges distinguish the condition from bulimia nervosa and binge eating disorder.

Salman & Kabir (2022) also stated that NES is linked to a number of sleep disruptions, including worse overall sleep quality, longer sleep latency, reduced sleep efficiency, and more frequent sleep disruptions. Additionally, issues with mood and anxiety are linked to both eating and sleeping difficulties. The severity of eating disorder symptoms is also linked to lower sleep quality. Some of them create coping mechanisms that describe food to cope with overwhelming and unpleasant emotions. Kim et al. (2023) studied 34,358 people and discovered that those who experience episodes of night eating have higher average depression ratings than those who do not. There were significant variations in stress levels between participants who experienced episodes of night eating and those who did not. The extent of this rise was especially noticeable in people who reported sleeping nine hours or more every night. Those who are prone to emotional eating may be more inclined to eat to lessen emotions of bad impact.

Gan et al. (2019) stated that male participants showed to have NES more than females and this is prevalent among technical field students. Kwan et al. (2021) reported that males were the risk factors for NES, but this study was conducted during Covid-19. There was another study that had been conducted by Dzulkafli et al. (2020) at IIUM Kuantan, however this study only investigated female subjects. Thus, the purpose of this study is to assess whether male university students have higher NES score compared to their female counterparts post-COVID 19 pandemic. This study also aimed to assess correlation of NES with sleep quality and stress level among university students since disordered eating behaviors have recently been gaining much attention and become a global concern due to their consistent growth trends throughout time. This study is therefore at the forefront of examining this topic.

Materials And Methods

Study Design and Population

A cross-sectional study was conducted at IIUM Kuantan which consists of six *kulliyahs* (faculties): Kulliyah of Medicine (KOM), Kulliyah of Dentistry (KOD), Kulliyah of Allied Health Sciences (KAHS), Kulliyah of Pharmacy (KOP), Kulliyah of Sciences (KOS) and Kulliyah of Nursing (KON). Determination of sample size was calculated using a two-proportion formula based on the prevalence of night eating syndrome -among male and female public university students in Malaysia (Gan et al., 2019).

A convenient sampling method was used to select the respondents. The inclusion criteria for the respondents were undergraduate students aged 19 until 25 years. An online consent form for

participants was provided at the front page of the online questionnaire to make sure the participants were aware of the information. All information was treated as strictly confidential.

The study protocol was approved by the Kulliyah of Allied Health Sciences Postgraduate and Research Committee (Reference No: IIUM/310//14/11/2) and IIUM Research Ethics Committee.

Questionnaire

For this study, a self-administered online questionnaire in Google Form was constructed in English. The questionnaire consisted of four sections: i) Sociodemographic data (respondent's age and gender, year of study, *kulliyah*, financial status, self-reported weight, and height of the students), ii) Night eating evaluation using Night Eating Questionnaire (NEQ), iii) Sleep quality evaluation using Pittsburgh Sleep Quality Index (PSQI), iv) Stress level evaluation that assessed using Perceived Stress Scale (PSS). Body mass index (BMI) was calculated as the weight in kilograms divided by height in meters squared. It was categorized according to the World Health Organization (2000) classification: underweight (<18.50 kg/m²), normal (18.50-24.99 kg/m²), overweight (25.00-29.99 kg/m²), and obese (≥30.00 kg/m²).

Night Eating Evaluation

The respondents were assessed by using the Night Eating Questionnaire (NEQ) (Allison et al., 2008). This questionnaire was extensively used by researchers who performed studies on late-night eating behavior or night-eating syndrome (NES). In addition, this questionnaire has been validated and it is a potential measure to investigate night eating habits among general populations (Innamorati et al., 2018). Gan et al., (2019) used NEQ in their study to determine the risk factors for NES among public university students in Malaysia.

The NEQ was developed to determine whether any of the participants had NES. The NEQ has 17 measures that are capable of capturing the behavioral and psychological syndrome of NES, including the absence of morning appetite (two items), loss of control, and degree of urges to overeat before bed and during the night (four items), initial and middle sleeplessness (three items), mood (two items), frequency of eating during the night (three items), and belief that one has to eat to sleep (one item), as well as the level of awareness of these eating episodes (one item). A 4-point Likert scale was used to score each item, with the options being "not at all (0)," "a little (1)," "somewhat (2)," "moderately (3)," and "extremely (4)." Items 1, 4, and 14 were scored in reverse. The overall score for NEQ was determined by adding the scores of Items 1 through 12 and 14, and the score fall into two categories which were Non-NE (Non-Night Eater) and NE (Night Eater). The higher the score, the higher the NES possibility. A score from 0 to 5 indicates Non-NE while 5 to 64 indicates NE.

Sleep Quality Evaluation

For sleep quality evaluation, the Pittsburgh Sleep Quality Index (PSQI) questionnaire established by Buysse et al. (1989) was used. A study conducted by Farah et al. (2019) provided evidence to support the use of the PSQI-M (Pittsburgh Sleep Quality Index Malay Version) in a general Malaysian adult population. This questionnaire was widely used by many researchers to assess sleep quality and sleep habits. One research that utilizes this form was a study about poor sleep quality among medical students at IIUM by Said et al. (2020). Thus, this questionnaire was chosen for this study which also included IIUM female students as respondents. This questionnaire consists of 10 main questions and some of them have a few sub-questions. PSQI has two ways for the participant to answer, like writing information and choosing the best answer.

The PSQI contains 19 self-rated questions and 5 questions rated by the roommate. Only self-rated questions are included in the scoring. The self-rated items are combined to form seven "component"

scores, each of which has a range of 0-3 points. In all cases, a score of “0” indicates no difficulty, while a score of “3” indicates severe difficulty. The seven component scores are then added to yield one “global” score, with a range of 0-21 points. “0” indicates no difficulty and “21” indicates severe difficulties in all areas.

Based on the participants' self-reported retrospective evaluation, the seven sleep components: sleep latency, sleep duration, habitual sleep efficiency, sleep disruptions, use of sleeping medicine, and daytime dysfunction were measured by answering the questionnaire (Buysse et al., 1989). The range of scores for each component was 0 to 3, resulting in a global PSQI score of 0 to 21. The sleeping quality of the participants was rated based on the overall score, with points ranging from no difficulty in sleeping to significant difficulty in sleeping as the points increased. The subjects were then classified based on their PSQI global scores, with a PSQI score up to 5 indicating good sleep quality and a PSQI score of > 5 indicating poor sleep quality.

Stress Level Evaluation

The Perceived Stress Scale (PSS) (Cohen, Kamarck, and Mermelstein, 1983) was utilized in this evaluation. The PSS was one of the most popular psychological tools for assessing stress perception. It is a gauge of how stressful a person perceives their life's circumstances to be. The questions were created to get a sense of how unpredictably chaotic and overburdened respondents believe their lives to be. A few direct questions about current levels of experienced stress are also included on the scale. The PSS was created to be used in community samples that have completed at least junior high school. Shariff & Azlan (2021) had also chosen this questionnaire in their research concerning stressors among Malaysian undergraduate nursing students during the COVID-19 pandemic.

The PSS consists of 10 questions and the way to answer it is by choosing a score of 0-4 for each question. The PSS score can be determined by, first, reversing the scores for questions 4,5,7, and 8. On these 4 questions, the score needs to be reversed, like 0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0. Then, the scores for each item are added up to get a total. Individual scores on the PSS can range from 0 - 40 with higher scores indicating higher perceived stress. Scores ranging from 0-13 would be considered low stress, 14-26 considered moderate stress, and 27-40 considered high perceived stress.

Statistical Analyses

The data obtained were statistically analyzed using IBM SPSS Statistics for Windows, version 29 (SPSS 29.0). Mann-Whitney U Test was to compare the prevalence of NES between male and female. The association between NES and sleep quality was analysed using Pearson Correlation and same goes to association between NES and stress. The significance level for the 95% confidence interval (CI) was set at $p < 0.05$.

Results

Sociodemographic Information

A total of 436 respondents (218 males and 218 females) were recruited in this study. The sociodemographic details are presented in Table 1.

Table 1 Sociodemographic data of respondents (N=436)

Category	Participants (n, %)
Gender	
Male	218 (50.0)
Female	218 (50.0)
Age	
19	11 (2.5)

20	103 (23.6)
21	110 (25.2)
22	126 (28.9)
23	68 (15.6)
24	15 (3.4)
25	3 (0.7)
Kulliyah	
KAHS	141(32.3)
KOD	20 (4.6)
KOM	48 (11.0)
KON	52 (11.9)
KOP	41 (9.4)
KOS	134 (30.7)
Year of Study	
Year 1	119 (27.3)
Year 2	109 (25.0)
Year 3	150 (34.4)
Year 4	55 (12.6)
Year 5	3 (0.7)
Scholarship Status	
PTPTN	89 (20.4)
JPA	65 (14.9)
MARA	114 (26.1)
Self-Sponsored	131 (30.0)
Others	37 (8.6)
BMI category	
Underweight	51 (11.7)
Normal	286 (65.6)
Overweight	69 (15.8)
Obese	30 (6.9)

A total of 436 students from year 1 up to year 5 consisting of all male and female students from 6 different Kulliyahs. Of all 436 students, 32.3% were from Kulliyah of Allied Health Sciences (KAHS), 4.6% from Kulliyah of Dentistry (KOD), 11.0% from Kulliyah of Medicine (KOM), 11.9% from Kulliyah of Nursing (KON), 9.4% from Kulliyah of Pharmacy (KOP) and 30.7% from Kulliyah of Sciences (KOS). All respondents are between the age of 19 and 25, and for their scholarship status, 89 (20.4%) of students funded by *Perbadanan Tabung Pendidikan Tinggi Nasional* (PTPTN), 65 (14.9%) funded by *Jabatan Perkhidmatan Awam* (JPA), 114 (26.1) funded by *Majlis Amanah Rakyat* (MARA), 131 (30.0) are self-sponsored and the balance which is 37 (8.6%) sponsored by others such as *Yayasan* from their states of origin, and scholarship from some organizations like Bank Rakyat and Sime Darby. With regards to their BMI, a total of 286 (65.6%) respondents had normal BMI, 69 (15.8%) were overweight, 51 (11.7%) were underweight, 23 (5.3%) and 7 (1.6%) of respondents were in obese class I and II, respectively.

NES based on night eating questionnaire (NEQ)

Table 2 indicates late night eating behavior of the students using NEQ. The questionnaire is to determine whether the respondents have met a NES criterion. NES criteria were divided into 2 categories which are normal (Non-NE) where the respondents did not meet any NES criteria at all and

night eater (NE) where the respondents have met almost all the NES criteria. Most respondents fall under the normal category (Non-NE) with the total number of 372 respondents (85.3%) whereas the balance fall under the night eater (NE) category with 64 respondents (14.7%)

Table 2 Respondent's night eating categories (N=436)

NES Categories	Frequency	Percentage (%)
Non - NE	372	85.3
NE	64	14.7

Stress level evaluation

Table 3 indicates the level of stress of the respondents. Based on the results, the number of respondents who were having moderate perceived stress was the highest with a total of 348 respondents (79.8%) while the lowest value was 34 respondents (7.8%) who were having high perceived stress.

Table 3 Respondent's stress levels (N=436)

Stress Categories	Frequency	Percentage (%)
Low	54	12.4
Moderate	348	79.8
High	34	7.8

Sleep quality evaluation

Table 4 below indicates the categories of sleep quality of the respondents. Based on the results shown in Table 4, respondents who were having good sleep quality is only 91 (20.9%) of respondents which was less than a quarter of the total of the respondents. Meanwhile, respondents who have poor sleep quality was 345 of respondents (79.1%).

Table 4 Respondent's sleep quality (N=436)

Sleep Quality Categories	Frequency	Percentage (%)
Good	91	20.9
Poor	345	79.1

Comparison Between Male and Female in NES

The first main objective of this study was to assess the comparison of the prevalence of night eating syndrome between male and female undergraduate students at IIUM Kuantan which was investigated using Mann - Whitney U Test. Based on Table 5, the test revealed a significant difference in NES between males and females ($p = 0.031$, $z = 2.163$).

Table 5 Comparison between male and female respondents (N=436)

Mann-Whitney U	Test Statistic	Standard Error	Standardized Test Statistic	p-value
26604.000	26604.000	1313.691	2.163	0.031

The median score for males was 17.00 which is significantly higher than females' median score (16.00).

Association between NES and Sleep Quality

Regarding the relationship between NES and sleep quality among undergraduate students at IIUM Kuantan, a negative, weak correlation between NES and sleep quality ($r = -0.149$, $p = 0.002$) was found. Thus, a higher level of NES is associated with poorer sleep quality.

Association between NES and Stress

A significant positive correlation ($r = 0.260$, $p < 0.001$) was found between NES and stress level. Therefore, a higher value of NES is associated with a higher level of perceived stress.

Discussion

This study examined NES and its association with sleep quality and stress level among undergraduate students. Findings of this study indicated that male respondents have higher median score than females which reflected a higher rate of NES. Gan et al. (2019) study demonstrated that men were 3 times more likely than women to have NES. Also, based on Dzulkafli et al. (2020), the prevalence reported from the study was only 4.2% and that applied for female since their research only focused on female. Moreover, Kwan et al. (2021) conducted research during COVID-19 pandemic found that male have higher NES prevalence than female which are 51.3% and 27.3%, respectively.

Furthermore, the existence of food delivery companies like Food Panda, Grab Food and McDelivery increase the opportunities for the students to buy food because they do not need to go out to purchase. The process of online food order is as simple as browsing through mobile application, choosing the desired food, making the payment and subsequently the process completed. In addition, women often tend to choose healthier food options and are more concerned in maintaining appropriate eating practices to keep in shape, according to Alkazemi (2019). Additionally, women have healthier living habits and engage in health-promoting behaviors than males do. Even though males were aware of "healthy eating guidelines," they frequently expressed skepticism and a lack of interest in nutrition education messages while frequently viewed good eating as boring and uninteresting. The author went on to highlight that women are more aware of nutrition and the consequences of the relationship between diet and health, accepting suggested dietary modifications, and display higher degrees of dietary constraint and disinhibition than men. This can also be explained by the fact that women have larger degrees of body dissatisfaction with the desire to be skinny than men (Thompson et al., 2015). Thus, it is notable that there are disparities between male and female perspectives on eating practices.

University students typically sleep for shorter periods with lower-quality sleep. According to Yu and Wan's study in 2022, which also used PSQI as one of their research tools, 62.3% of the 377 undergraduate participants were bad sleepers. They slept for roughly 6.5 hours each day in total. 79.1% of the respondents in this present study had trouble sleeping. It should be noted that the prevalence is significantly higher than the finding reported by Yu and Wan (2022). Canuto et al. (2013) claimed that irregular sleep-wake patterns can lead to internal circadian desynchrony, poor sleep quality, and delayed timing of calorie intake. People are more likely to become bored and feel the want to eat if their sleep time is cut short.

Chung et al. (2020), who identified meal timing related to the NES associated with sleep quality, found that gastroesophageal reflux and regular digestion could be the contributors for the correlation between these, because eating close to bedtime has been linked to gastroesophageal reflux as well as disturbed sleep. In addition, the time it takes for the stomach to empty is between two and four hours. Besides, according to Kee et al. (2021), lifestyle factors that affect university students' ability to regulate their sleep include excessive late-night technology use, caffeine consumption that affects sleep arousal and physiological regulation, and cultural norms that place little value on sleep.

According to Gan et al. (2019), students with mild stress level possessed a high tendency (3.58 times) in practicing NES. Besides, students with higher levels of depression had significantly higher NES scores (Braga et al., 2017). It was also discovered that NES was correlated with increased stress, worsened depressive symptoms, trouble falling asleep, and daytime drowsiness (Gundogdu, 2022). Additionally, stressed students who were prone to emotional eating were more likely to get up in the middle of the night and eat to lessen the harmful impacts of their negative emotions. The hypothalamic-pituitary-adrenal (HPA) axis, which controls the cortisol stress response, may become disturbed in people with NES.

Cortisol, a stress hormone, was discovered to be higher in the NES group than in the control group, which may contribute to hunger among NES sufferers. According to research by AlJaber et al. (2019), stressed-out students prefer to eat more high-calorie, high-fat items including fast food, sweets, and snack-type foods. Additionally, stress-related eating factors, such as workloads or assignments, as well as the accessibility of fast-food restaurants close to their university, increase their temptation to frequently purchase unhealthy foods due to its high accessibility.

A limitation of this study is that the scope was only within a single university campus. Nevertheless, the use of validated questionnaires which are globally recognized was a major strength to ensure reliability of the study findings.

Conclusion

The prevalence of NES is significantly higher among male than female students. It has also been established that stress levels and sleep quality are related to NES. A high level of NES was associated with a higher value of stress and poor sleep quality. Hence, this issue needs to be addressed by educating students about healthy eating patterns and healthier options for snacks to prevent any further adverse effects related to their physical and mental health.

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