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Study On The Assessment Of Night Eating Syndrome And Its Association With Dietary Intake, Sleep Quality And Stress Scores In Young Adults Aged 18 To 26 Years

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Abstract:

Background: Night Eating Syndrome (NES) is a chrono-behavioural eating disorder characterised by a delayed circadian pattern of food intake, evening hyperphagia, and nocturnal ingestions. Despite its growing clinical relevance, NES remains under-diagnosed among urban young adults, particularly within the Indian context where lifestyle factors such as irregular sleep schedules, academic stress and 24-hour food availability are increasingly prevalent.

Methods: A cross-sectional study was conducted among 200 young adults (100 males, 100 females). Data collection included anthropometric measurements, the Night Eating Diagnostic Questionnaire (NEDQ), Pittsburgh Sleep Quality Index (PSQI), Perceived Stress Scale (PSS-10), and 3-day 24-hour dietary recall. Participants were classified into four NEDQ categories. Statistical analyses included Chi-square tests, independent samples t-test, one-way ANOVA with Bonferroni post-hoc correction, and Pearson's correlation.

Results: NES was highly prevalent, with 67% of participants exhibiting night eating behaviours and 24% meeting Full NES criteria. Increasing NEDQ severity was significantly associated with higher BMI ($p=0.023$), poorer sleep quality ($p<0.001$), and elevated perceived stress ($p<0.001$). Sleep quality and perceived stress were strongly correlated ($r=0.520$, $p<0.001$). Total energy and macronutrient intake did not differ significantly across categories; however, iron intake was significantly higher ($p<0.001$) and calcium intake significantly lower ($p=0.007$) in NES-positive groups.

Conclusion: NES is prevalent among urban Indian young adults and is significantly linked to poor sleep, elevated stress, and qualitative dietary disturbances, reinforcing its conceptualisation as a circadian disorder within a stress–sleep–eating triad. Integrated multidisciplinary interventions addressing dietary timing, sleep hygiene, and stress management are warranted.

***Index Terms* -** Night Eating Syndrome (NES), Sleep Quality, Perceived Stress, Dietary Intake, Circadian Eating Patterns, Young Adults

I. INTRODUCTION

A complex interplay of biological, psychological and environmental factors influences eating behaviours, which in turn control energy intake, meal timing and appetite throughout the day. Abnormal eating patterns that have a detrimental impact on one's physical and mental health can result from disruptions in these regulatory mechanisms. (Sakthivel et al., 2023). Among these, Night Eating Syndrome (NES) has recently come to be recognised as a significant but unidentified eating disorder marked by recurrent episodes of eating at night and altered circadian patterns of food intake. (Sakthivel et al., 2023).

A variety of psychological factors such as stress, depression, anxiety and lack of coping mechanisms, have been linked to night eating behaviours. Higher perceived stress levels may make people more prone to use nighttime eating as a coping mechanism, which can further disrupt sleep and appetite control. (Krefl, 2022) As a result, the connection between stress, sleep quality and night eating habits has grown in importance in behavioural and nutritional research.

Night eating (NE) is defined in the Diagnostic and Statistical Manual of Mental Health Disorders-5 (DSM-5) as an excessive food consumption after the evening meal which is evening hyperphagia or eating after awakening from sleep which is nocturnal ingestions, and it is the key clinical feature of NE syndrome (NES). NES is a type of Other Specified Feeding or eating disorder (OSFED) in the DSM-5. (Mannan et al., 2025)

Night Eating syndrome (NES) is an emerging eating disorder characterised by evening hyperphagia which is consuming more than 25% of daily intake after the evening meal and/or nocturnal awakenings with food intake. (Allison et al., 2008; Lundgren et al., 2012) Evening hyperphagia, nocturnal eating behaviours, morning anorexia, mood fluctuations and trouble sleeping are among the behavioural symptoms that people with NES frequently show. It is thought that abnormalities in neuroendocrine regulation and Circadian rhythm cause the symptoms. Hormones like melatonin, cortisol, Leptin and ghrelin may be secreted differently in people with NES, according to neuroendocrine research. Increased appetite and nocturnal food consumption may be caused by elevated cortisol levels in conjugation with decreased Lepton and melatonin levels at night. (Birketvedt et al., 1999) Along with that, more disorders like anxiety and depression have been frequently reported in people with NES, indicating a possible psychological component in the onset and maintenance of the disorder.

People with Night Eating Syndrome usually exhibit very different eating habits than people without the syndrome. The typical distribution of energy intake throughout the day is disrupted when people with NES consume a significant amount of their daily calorie intake in the evening or at night. Since individuals tend to consume snacks that are high in refined carbohydrates, sugars and fats instead of nutritionally balanced meals, late night eating may also contribute to poor overall diet quality. These patterns may eventually result in deficiencies in vital micronutrients like calcium and iron along with imbalances in the intake of macro nutrients. (Bodur et al., 2025)

Young adults represent a particularly vulnerable population. Academic pressures, erratic schedules, social comparison, late-night screen exposure, and growing lifestyle independence collectively predispose this group to irregular meal timing, inadequate sleep, and elevated stress all established risk factors for NES (Abreu et al., 2023).

In the Indian urban context, these challenges are compounded by competitive academic environments, 24-hour food availability, and cultural normalisation of late-night activity, yet research exploring NES and its associations within this population remains limited (Murthy et al., 2024). Dietary quality is also impacted in NES, with late-night eating episodes typically involving foods high in refined carbohydrates, sugars, and fats, potentially leading to micronutrient imbalances including deficiencies in calcium and iron over time (Bodur et al., 2025). Crucially, NES appears to be a disorder of food timing rather than total food quantity, distinguishing it from other eating disorders and necessitating targeted, circadian-informed dietary interventions (Nolan et al., 2012).

Given the multifactorial nature of NES and the scarcity of Indian data, the present study aimed to assess the prevalence of NES and evaluate its association with dietary intake, sleep quality, and perceived stress among young adults aged 18–26 years residing in Mumbai, Maharashtra. The specific objectives were: (1) to assess anthropometric profiles; (2) to evaluate macronutrient and micronutrient intake using a 3-day 24-hour dietary recall; (3) to assess NES severity using the Night Eating Diagnostic Questionnaire (NEDQ); (4) to analyse sleep quality using the Pittsburgh Sleep Quality Index (PSQI); (5) to assess perceived stress using the Perceived Stress Scale (PSS-10); and (6) to examine associations between diet, NES severity, sleep quality, and perceived stress.

II. MATERIALS & METHOD

The cross-sectional was conducted to assess Night Eating Syndrome (NES) and its association with dietary intake, sleep quality, and perceived stress among young adults residing in Mumbai, Maharashtra. Given the chrono-behavioural nature of NES and its multifactorial links to circadian disruption, psychological stress, and nutritional imbalances, the study aimed to explore how these modifiable factors interact within an urban young adult population.

A total of 200 participants (100 males and 100 females) were recruited using purposive sampling from various localities across Mumbai. Participants were included based on the following criteria: age between 18–26 years, residing in Mumbai, and willing to provide informed consent. Individuals with a prior diagnosis of a clinically established eating disorder, chronic medical conditions affecting metabolism or sleep, pregnancy, or currently taking medications known to influence appetite, sleep, or stress were excluded. The study was conducted over a period of approximately four months. Ethical approval was obtained from the Inter System Biomedical Ethics Committee (ISBEC), and informed written consent was collected from all participants prior to data collection. Data were gathered through face-to-face and online structured interviews using a comprehensive case record form that captured sociodemographic characteristics, anthropometric measurements, dietary intake, and psychometric evaluations.

Anthropometric assessment included height, weight, and Body Mass Index (BMI), which was calculated and classified according to standard WHO guidelines. Socioeconomic status was determined using the Modified Kuppuswamy Scale. Dietary intake was assessed using a 3-day 24-hour dietary recall method.
Macronutrient intake including total energy, protein, carbohydrates, and fats along with selected micronutrients, specifically iron and calcium, were analysed and compared against the Recommended Dietary Allowances established by the Indian Council of Medical Research - National Institute of Nutrition (ICMR-NIN, 2020).

Night eating behaviour was assessed using the Night Eating Diagnostic Questionnaire (NEDQ), a validated tool that classifies participants into four categories: No NES, Mild NES, Moderate NES, and Full NES Syndrome, based on the frequency and pattern of evening hyperphagia and nocturnal ingestions.

Sleep quality was evaluated using the Pittsburgh Sleep Quality Index (PSQI), a globally validated self-report instrument that generates a composite score across seven components of sleep, with a total score greater than 5 indicatives of poor sleep quality. Perceived stress was measured using the Perceived Stress Scale (PSS-10), a validated 10-item questionnaire assessing the degree to which individuals appraise situations in their lives as stressful. Both instruments are widely used and well-validated in clinical and nutritional research settings.

This methodology enabled a comprehensive, multi-dimensional assessment of the interrelationship between night eating behaviour, dietary intake, sleep quality, and perceived stress, contributing to a deeper understanding of NES within the urban Indian young adult context and informing the need for integrated, circadian-sensitive intervention strategies.

III. STATISTICAL ANALYSIS

Statistical analysis was performed using appropriate methods including Chi-square tests for categorical associations, independent samples t-tests for between-group comparisons, one-way ANOVA with Bonferroni post-hoc correction for multi-group comparisons, and Pearson's correlation coefficient to examine relationships between continuous variables. A p-value of less than 0.05 was considered statistically significant throughout.

IV. RESULTS AND DISCUSSION

4.1 Prevalence of Night Eating Syndrome (NES) among the study participants

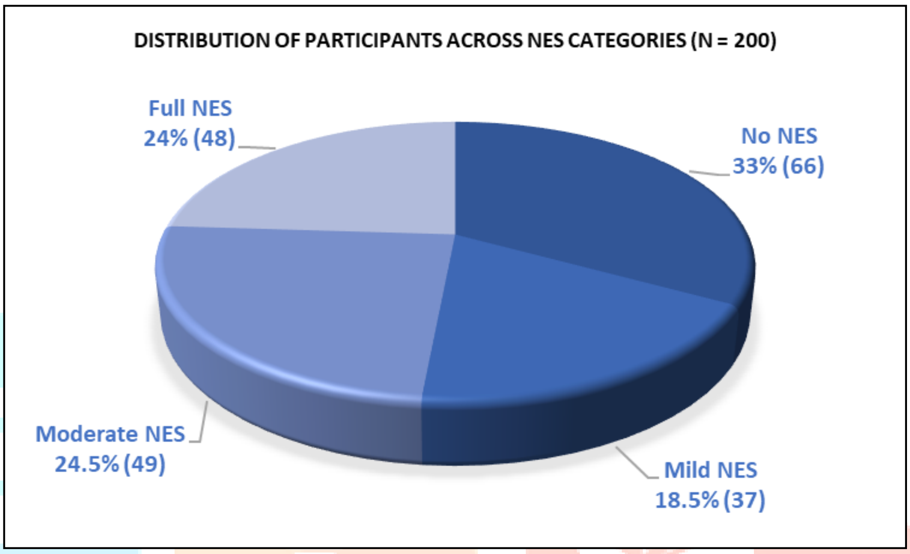

Figure 4.1.1: Prevalence of Night Eating Syndrome among the Study Participants (N = 200)

The cross-sectional study assessed 200 individuals (100 males and 100 females) aged 18 – 26 years. Figure 4.1 illustrates the distribution of Night Eating Syndrome (NES) severity across the study sample. NES was highly prevalent, with only 33% of participants classified as No NES. Of the remaining 67%, 18.5% were classified as Mild NES, 24.5% as Moderate NES, and 24% fulfilled criteria for Full NES Syndrome making Full NES the single most prevalent category in this cohort.

These findings are broadly consistent with emerging Indian literature on NES in young adult populations. Jasmine et al. (2024) reported a combined NES prevalence of 37.3% among engineering students in Tamil Nadu, while Kaur (2022) documented a prevalence of 54% among nursing students in Punjab. Singh et al. (2025) reported a rate of 13.8% among medical students in central India. Internationally, Sarach et al. (2015) reported 23.4% among Malaysian university students.
The 24% Full NES prevalence observed in the present study places Mumbai urban young adults at the upper end of the globally recognised spectrum of NES vulnerability in student and working populations.

The elevated prevalence in the present cohort may be attributed to several distinctive features of the urban Mumbai context, including the 24-hour food delivery culture facilitated by platforms operating through the night, prolonged commute times that delay evening meals to after 9 or 10 pm, and increased screen-based engagement during nighttime hours that disrupts the boundary between productivity and rest (Peuhkuri et al., 2012). These environmental and cultural factors collectively shift food intake into the evening and nocturnal hours, creating conditions highly conducive to NES.

4.2 Sociodemographic Characteristics of the Study Participants

The mean age of the study sample was 22.06 ± 2.55 years, with 100 male and 100 female participants. The mean age of male participants (22.62 ± 2.44 years) was significantly higher than that of female participants (21.50 ± 2.54 years) ($t = 3.182$, $p = 0.002$), reflecting the higher concentration of young men in postgraduate and early-career strata within the eligible age range. Table 4.2.1 presents the distribution of baseline demographic characteristics across NES categories.

Table 4.2.1: Baseline Demographic Characteristics of the Study sample between the NES Categories

Demographic Characteristics	Total (N=200) (N, %)	No NES (n=66) (N, %)	Mild NES (n=37) (N, %)	Moderate NES (n=49) (N, %)	Full NES (n=48) (N, %)	Chi-Square test value	P-value
Gender							
Male	100 (50)	28 (42.4)	22 (59.5)	21 (42.9)	29 (60.4)	5.923	0.115
Female	100 (50)	38 (57.6)	15 (40.5)	28 (57.1)	19 (39.4)		
Dietary Preference							
Vegetarian	131 (65.5)	42 (63.6)	28 (75.7)	33 (67.3)	28 (58.3)	12.448	0.053
Non-Vegetarian	43 (21.5)	14 (21.2)	6 (16.2)	6 (12.2)	17 (35.4)		
Ovo Vegetarian	26 (13)	10 (15.2)	3 (8.1)	10 (20.4)	3 (6.3)		
Living Arrangement							
With Family	130 (65)	50 (75.8)	23 (62.2)	28 (57.1)	29 (60.4)	11.517	0.074
With Friends/ Roommate	63 (31.5)	15 (22.7)	12 (32.4)	21 (42.9)	15 (31.3)		
Alone	7 (3.5)	1 (1.5)	2 (5.4)	0 (0)	4 (8.3)		
Socioeconomic Class (Kuppuswamy)							
Upper	122 (61)	45 (68.2)	18 (48.6)	37 (75.5)	22 (45.8)	15.605	0.016*
Upper Middle	67 (33.5)	16 (33.5)	16 (43.2)	11 (22.4)	24 (50)		
Lower Middle	11 (5.5)	5 (7.6)	3 (8.1)	1 (2)	2 (4.2)		

*Frequency Percentage (N, %); *p < 0.05*

Among the demographic variables examined, socioeconomic class showed a statistically significant association with NES category ($\chi^2 = 15.605$, $p = 0.016$). Participants from the Upper Class dominated the No NES (68.2%) and Moderate NES (75.5%) groups, while Upper Middle-class participants were most represented in the Full NES (50%) and Mild NES (43.2%) groups. This pattern aligns with emerging evidence that NES in rapidly urbanising economies is concentrated in middle- and upper-income strata, where greater affordability of food-delivery services, sedentary professional lifestyles, and the cultural normalisation of late-night dining converge to create NES risk. (Kaur, 2022; Jasmine et al., 2024).

Although the gender distribution across NES categories did not reach statistical significance ($p = 0.115$), a noteworthy numerical pattern emerged. Male participants dominated the Mild NES (59.5%) and Full NES (60.4%) groups, while female participants formed the majority in the No NES (57.6%) and Moderate NES (57.1%) groups. This modest male predominance in severe NES categories aligns with findings of Colles et al. (2007), who reported male gender as a significant predictor of Full NES in a large Australian sample, and Runfola et al. (2014), who observed similar trends among American university students. In the Indian context, young men may be more likely to remain awake late for academic work, gaming, or social activities, creating environmental conditions for evening hyperphagia (Jasmine et al., 2024).

Living arrangement, while not reaching statistical significance ($p = 0.074$), showed a meaningful directional pattern: the proportion of participants living with family declined from 75.8% in the No NES group to 57.1% in the Moderate NES group, while those living with roommates rose from 22.7% to 42.9% over the same gradient. Family-based residence appears to impose regularity on meal timing and provides social accountability for eating behaviour; its absence in shared or independent living environments removes this protective structure, consistent with observations by Kandeger et al. (2018) and Singh et al. (2025).

4.3 Mean Anthropometric Measurements of the Study Sample

The comparison of anthropometric parameters across NES categories revealed statistically significant differences for body weight ($F = 3.926$, $p = 0.009$) and BMI ($F = 3.258$, $p = 0.023$), while age and height did not differ significantly. Table 4.3.1 presents the mean anthropometric values across NEDQ categories.

Table 4.3.1: Mean Anthropometric Measurements between the NES categories

Variable	No NES (n=66) (N, %)	Mild NES (n=37) (N, %)	Moderate NES (n=49) (N, %)	Full NES (n=48) (N, %)	F - value	P-value
Age (years)	21.85 ± 2.35	22.19 ± 2.57	22.16 ± 2.74	22.15 ± 2.64	0.226	0.878
Weight (kg)	59.18 ± 10.15	63.92 ± 9.96	61.24 ± 11.55	65.73 ± 11.14	3.926	0.009*
Height (cm)	166.65 ± 7.07	168.16 ± 7.01	166.53 ± 6.18	169.19 ± 7.33	1.716	0.165
BMI (kg/m²)	21.24 ± 2.70	22.62 ± 2.99	21.84 ± 3.23	22.83 ± 3.07	3.258	0.023*

*Mean ± Standard Deviation, *p < 0.05*

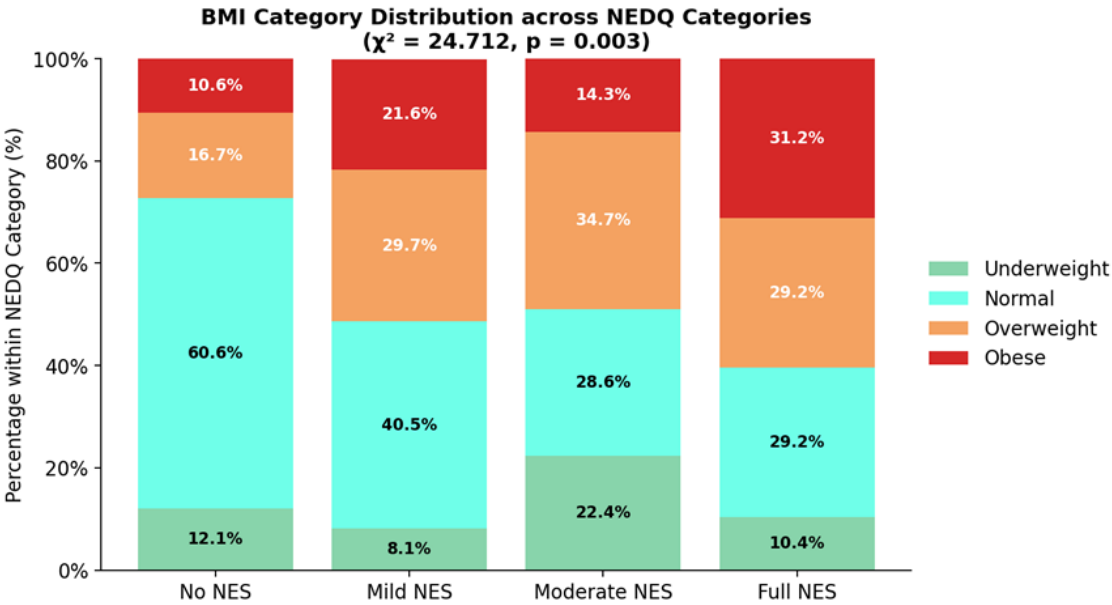

Figure 4.3.1: Comparison of Body Mass Index category distribution across NES categories

Bonferroni post-hoc analysis confirmed that the Full NES group was on average 6.55 kg heavier than the No NES group ($p = 0.009$) and exhibited a significantly higher mean BMI (22.83 vs. 21.24 kg/m², mean difference = 1.59 kg/m², $p = 0.023$).
These findings support those of Colles et al. (2007), who reported NES as an independent predictor of higher body weight after controlling for binge eating, and of Kaur (2022), who observed higher BMI among nursing students with NES. Figure 2 illustrates the comparison of BMI categories across NES categories.

Table 4.3.2 presents the distribution of BMI categories by gender, which revealed one of the most striking findings of the study. The chi-square test showed a highly significant gender difference in BMI distribution ($\chi^2 = 46.455$, $p < 0.001$).

Table 4.3.2: Distribution of BMI Categories between Male and Female Participants

BMI Category	Total (N=200) (N, %)	Male (n=100) (N, %)	Female (n=100) (N, %)	X^2 Value	P-value
Underweight (< 18.5)	27 (13.5)	2 (2.0)	25 (25.0)	46.455	<0.001**
Normal (18.5–22.9)	83 (41.5)	31 (31.0)	52 (52.0)		
Overweight (23.0–24.9)	53 (26.5)	39 (39.0)	14 (14.0)		
Obese (≥ 25.0)	37 (18.5)	28 (28.0)	9 (9.0)		

*Frequency (n, %); **p < 0.001 (Asian BMI cut-offs, WHO 2004)*

Male participants were heavily concentrated in the overweight (39.0%) and obese (28.0%) categories, with only 2.0% underweight. In contrast, 25.0% of female participants were underweight and 52.0% had normal BMI, with only 14.0% overweight and 9.0% obese. This dramatic disparity is consistent with the NFHS-5 pattern for urban Maharashtra (IIPS, 2021), but even more pronounced in the present cohort, where 67% of young men were classified as overweight or obese using Asian BMI cut-offs, compared with just 23% of young women.

The mechanism underlying the graded rise in BMI with NES severity is multifactorial, involving circadian reduction in energy expenditure and thermogenesis, neuroendocrine dysregulation of melatonin, leptin, and cortisol, and disrupted sleep architecture that independently promotes weight gain (McHill et al., 2017; Birketvedt et al., 1999; St-Onge et al., 2016).

4.4 Dietary Intake of the Study Sample:

Table 4.4.1: Mean Macronutrient and Micronutrient Intake between NES Categories

Dietary Intake	No NES (n=66) (N, %)	Mild NES (n=37) (N, %)	Moderate NES (n=49) (N, %)	Full NES (n=48) (N, %)	F - value	P-value
Macronutrients						
Energy (kcal)	2358.33 ± 367.57	2353.62 ± 316.89	2438.30 ± 271.72	2401.32 ± 219.24	0.841	0.473
RDA Energy %	106%	105.8%	109.6%	107.9%		
Protein (g)	68.68 ± 10.60	67.97 ± 7.61	68.53 ± 8.09	69.92 ± 7.54	0.389	0.761
RDA Protein %	115%	113%	114.8%	116.3%		
CHO (g)	307.52 ± 43.75	304.98 ± 39.57	317.55 ± 29.42	319.24 ± 23.19	1.889	0.133
RDA CHO %	100.5%	99.7%	103.8%	104.3%		
Fats (g)	93.58 ± 17.84	89.86 ± 17.19	97.24 ± 16.07	91.92 ± 12.21	1.667	0.175
RDA Fats %	120%	121.1%	131.1%	120.5%		
Micronutrients						
Iron (mg)	11.47 ± 2.00	11.99 ± 2.21	11.47 ± 1.69	13.14 ± 2.27	7.581	< 0.001**
RDA Iron %	60.4%	63.1%	60.4%	69.2%		
Calcium (mg)	680.58 ± 171.87	600.36 ± 107.71	650.48 ± 138.00	602.29 ± 103.24	4.185	0.007*
RDA Calcium%	80%	70%	72.3%	70.3%		

*Mean ± Standard Deviation; *p < 0.05, **p < 0.001; RDA as per ICMR-NIN 2020*

No statistically significant differences were observed across NES categories for energy (p = 0.473), protein (p = 0.761), carbohydrates (p = 0.133), or fat (p = 0.175). All groups met or exceeded RDA targets for energy (105–110%), protein (113–116%), and carbohydrates (~100–104%), while fat intake substantially exceeded recommendations in every category (120–131% RDA). This null finding for macronutrients is in fact one of the most theoretically important results of this study.
It directly supports the conceptualisation of NES as a disorder of food timing rather than total food quantity (Stunkard et al., 1955; Colles et al., 2007). Individuals with NES exhibit a circadian shift in their eating pattern consuming less during morning and daytime hours and substantially more after the evening meal yet when total daily intake is summed across all episodes, the amounts appear like those of non-night eaters.

In contrast, two key micronutrients showed significant differences across NES categories. Iron intake was significantly higher in the Full NES group (13.14 mg/day) compared to the No NES (11.47 mg/day) and Moderate NES (11.47 mg/day) groups (F = 7.581, p < 0.001). Calcium intake showed the opposite pattern:

the No NES group reported the highest mean (680.58 mg/day), significantly greater than the Mild NES (600.36 mg/day) and Full NES (602.29 mg/day) groups (F = 4.185, p = 0.007). The significantly higher iron intake in the Full NES group likely reflects greater consumption of animal-source foods during nocturnal eating episodes, consistent with the significantly higher proportion of non-vegetarians observed in that group (35.4% vs. 16.2% in Mild NES) and with urban Mumbai's 24-hour availability of savoury, protein-rich non-vegetarian options.

The significantly lower calcium intake in NES-positive groups is the most clinically important dietary finding of this study. Despite being the highest among all groups, the No NES group's mean calcium intake (680.58 mg/day) still represented only 68% of the ICMR-NIN (2020) RDA of 1,000 mg/day, indicating universal inadequacy. Morning anorexia a core diagnostic feature of NES leads to breakfast skipping or substantial delay in the first meal, foregoing the primary opportunity for dairy and calcium consumption. This calcium deficit has direct neurobiological implications: calcium is a co-factor in tryptophan-to-melatonin conversion via tryptophan hydroxylase and N-acetyltransferase enzymes, meaning inadequate calcium may impair nocturnal melatonin production, further disrupting sleep onset and circadian alignment thereby perpetuating NES itself (Liu et al., 2017).

4.5 Sleep Quality of the Study Sample:

Figure 4.5.1: Distribution of Sleep Quality (PSQI Category) among the study participants

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), with a global score above 5 indicating poor sleep quality. The findings reveal a striking prevalence of poor sleep across the entire cohort: 97% (n=194) of participants were classified as poor sleepers (PSQI > 5), with only 3% (n=6) reporting good sleep quality.

Table 4.5.1: Distribution of Sleep Quality (PSQI Category) among NES Categories

PSQI Category	Total (N=200) (N, %)	No NES (n=66) (N, %)	Mild NES (n=37) (N, %)	Moderate NES (n=49) (N, %)	Full NES (n=48) (N, %)	X^2 Value	P-value
Good Sleep (≤ 5)	6 (3.0)	6 (9.1)	0 (0.0)	0 (0.0)	0 (0.0)	12.559	0.006*
Poor Sleep (> 5)	194 (97)	60 (90.9)	37 (100)	49 (100)	48 (100)		

*Frequency Percentage (N, %); *p < 0.05*

100% of participants in the Mild, Moderate, and Full NES groups were classified as poor sleepers, while the six good sleepers in the study were exclusively found within the No NES group (9.1% of that group). The chi-square test confirmed a highly significant association between NES category and sleep quality ($\chi^2 = 12.559$, $p = 0.006$). These findings are consistent with Santonicola et al. (2023), who reviewed 29 studies and concluded that the NES-sleep association is among the most consistent findings in the NES literature.

Singh et al. (2025) reported insomnia as the single most important independent predictor of NES among Indian medical students after adjusting for age, depression, and lifestyle variables. The mechanistic basis is well established: individuals with NES exhibit attenuated nocturnal rises in melatonin and leptin alongside elevated cortisol secretion, producing sleep fragmentation and reduced slow-wave sleep. Nocturnal food intake further disrupts sleep through post-prandial thermogenesis, gastroesophageal reflux, and glycaemic fluctuations creating a self-reinforcing cycle where poor sleep drives night eating and night eating worsens sleep (St-Onge et al., 2016). The clinical implication is clear that in young adults presenting with persistent insomnia or poor sleep, a targeted screen for nocturnal eating behaviour may be warranted because addressing the nighttime food intake may be the key to breaking the sleep-eating cycle. Conversely, in young adults identified as exhibiting night eating behaviour, sleep should be a foundational component of management, alongside nutritional and physiological interventions (Allison et al., 2010).

4.6 Perceived Stress Scores of the Study Sample:

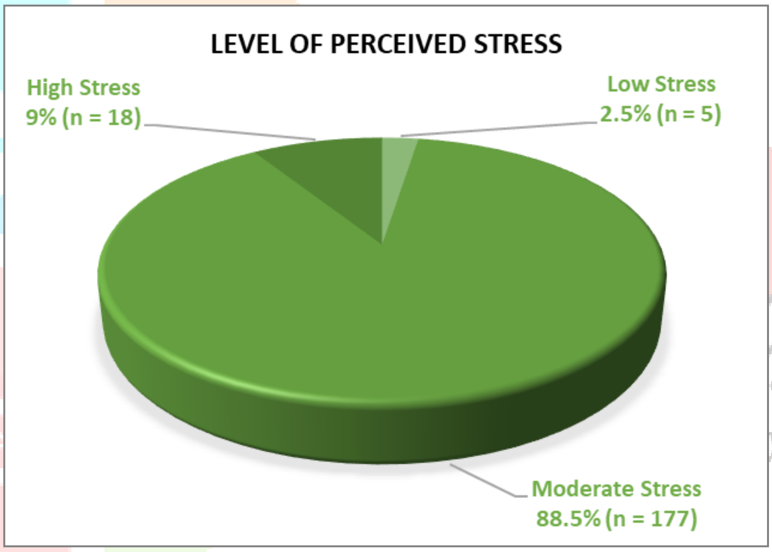

Figure 4.6.1: Perceived Stress Scores among the Study Participants

Perceived stress was assessed using the Perceived Stress Scale (PSS-10) and classified into Low, Moderate, and High categories. The vast majority of participants (88.5%) experienced moderate stress, 9.0% reported high stress, and only 2.5% reported low stress.

Mean perceived stress scores rose monotonically with NES severity from 21.48 (No NES) to 24.40 (Full NES), with a highly significant ANOVA ($F = 6.711$, $p < 0.001$) (Figure 4.6.1). This result is consistent with the foundational observation of Stunkard et al. (1955) that NES emerged during 'periods of stress,' and with the work of He et al. (2019), who reported significant correlations between NES and overall psychological distress among Chinese college students. Lavery and Frum-Vassallo (2022) identified the NES-stress association as one of the most cross-culturally consistent findings in the NES literature.

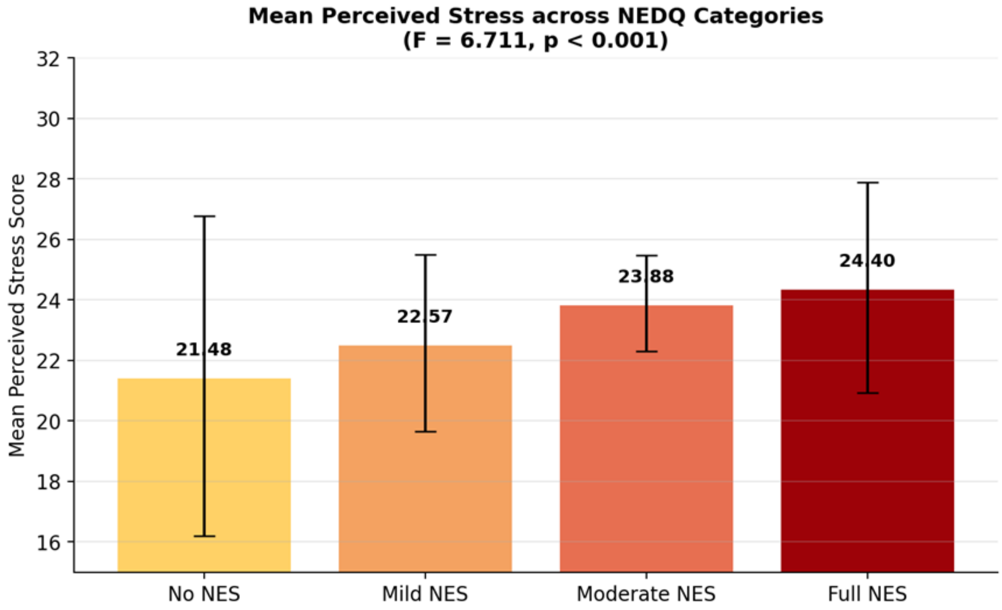

Figure 4.6.2: Comparison of Mean Perceived Stress Scores across NES Categories

The physiological basis is well-characterised: chronic psychological stress activates the HPA axis, generating elevated circulating cortisol that promotes appetite, stimulates preference for energy-dense palatable foods, and preferentially deposits visceral fat (Tomiyama, 2018). In NES specifically, Birketvedt et al. (1999) demonstrated an overexpressed HPA axis with attenuated cortisol response, indicating chronic HPA activation consistent with sustained stress exposure. At the behavioural level, nighttime eating functions as a maladaptive coping mechanism for emotional distress the privacy of the evening and night hours, combined with reduced social surveillance and inhibitory control, make this a particularly fertile ground for stress-driven food consumption (Nolan & Geliebter, 2012).

4.7 Correlations between NES, Sleep Quality, Perceived Stress, and Dietary Intake

Pearson's correlation analysis was used to examine the relationships between PSQI and PSS scores and macronutrient and micronutrient intake, as well as the relationship between PSQI and PSS scores with each other. Table 6 summarises the key correlations.

Table 4.7.1: Summary of Pearson Correlation Coefficients between PSQI, PSS and Nutrient Intake

Variable Pair	Pearson r	p-value
PSQI × PSS	0.520	< 0.001**
PSQI × Energy	0.211	0.003**
PSQI × Protein	0.314	< 0.001**
PSQI × Carbohydrates	0.225	0.001**
PSQI × Fat	0.150	0.034*
PSQI × Iron	0.246	< 0.001**
PSQI × Calcium	0.092	0.197 (NS)
PSS × All nutrients	—	All NS (p > 0.05)

*NS = Not Significant, *p < 0.05, **p < 0.01*

Highly significant positive correlations were found between PSQI (poor sleep) and protein intake ($r = 0.314$, $p < 0.001$), iron ($r = 0.246$, $p < 0.001$), carbohydrates ($r = 0.225$, $p = 0.001$), energy ($r = 0.211$, $p = 0.003$), and fat ($r = 0.150$, $p = 0.034$). Calcium intake was not significantly associated with PSQI ($r = 0.092$, $p = 0.197$). All significant correlations were positive, indicating that participants with poorer sleep quality consumed more of all macronutrients and iron.
This pattern aligns with the bidirectional sleep-diet relationship documented internationally: poor sleep elevates ghrelin, reduces leptin, and impairs prefrontal dietary self-control, leading to increased consumption of energy-dense palatable foods (St-Onge et al., 2016).

In contrast, perceived stress (PSS) showed no statistically significant correlations with any nutrient in total daily intake (all $p > 0.05$). This null finding is not contradictory but rather conceptually consistent with NES as a disorder of food timing rather than food quantity: stress influences when and what young adults eat specifically promoting evening palatable food preferences more than how much they consume in absolute 24-hour terms (Lavery & Frum-Vassallo, 2022). Future research should employ time-stamped food records and ecological momentary assessment to capture these qualitative, timing-specific dietary shifts induced by stress.

The most robust finding of the correlation analysis was the strong positive correlation between perceived stress (PSS) and poor sleep quality (PSQI): $r = 0.520$, $p < 0.001$. This indicates that as perceived stress scores increased, sleep quality deteriorated proportionally. This correlation falls within the pooled range of 0.42–0.58 reported in a 2025 meta-analysis by Bhatt et al. of 47 studies involving over 18,000 young adults, which identified perceived stress as the single most consistent psychological predictor of poor sleep quality. The mechanistic basis is well established: chronic stress activates the HPA axis, producing sustained cortisol elevations that delay sleep onset, fragment sleep architecture, and reduce slow-wave sleep (Kalmbach et al., 2018). Conversely, poor sleep impairs prefrontal cortical regulation of emotion and increases reactivity to stressors, creating a bidirectional feedback loop (Kalmbach et al., 2018).

These findings support the conceptualisation of NES as embedded within a tightly coupled stress-sleep-eating triangle (Tomiyama, 2018; Lavery & Frum-Vassallo, 2022): stress disrupts sleep, poor sleep amplifies appetite and impairs dietary self-regulation, and the resulting nocturnal eating delivering calories at a circadian low point of energy expenditure drives progressive weight gain that further elevates stress and worsens sleep.

V. CONCLUSION

The study highlights that participants with higher NES severity demonstrated greater body weight, higher BMI, higher perceived stress and poorer sleep quality. Sleep quality and perceived stress were strongly inter-correlated, indicating a tightly linked stress - sleep - eating triangle. Total dietary intake did not differ significantly across NEDQ categories, supporting the conceptualisation of NES as a circadian disorder of food timing rather than food quantity. Together, these findings underscore the need for multidisciplinary management of NES integrating dietary timing counselling, sleep education, stress management and behavioural therapy and establish NES as a significant but under-recognised public health concern in contemporary urban Indian young adults.

Declaration by Authors

Ethical Approval: Approved the Inter System Biomedica Ethics Committee, and informed written consent was collected from all participants prior to data collection.

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