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SLEEP QUALITY IN YOUNG ADULTS: ITS RELATIONSHIP WITH APNEA-HYPOPNEA INDEX AND BODY MASS INDEX

Dr. Preeti Gupta[1*], Dr. Garima[2], Dr Arti Verma[3]

[1]Assistant Professor, Department of Physiology, Autonomous State Medical College, Kanpur Dehat*

[2]Senior Resident, Department of Otorhinolaryngology, Pandit Bhagwat Dayal Sharma Post Graduate Institute of Medical Sciences, Rohtak.

[3]Assistant Professor, Department of Community Medicine, Sarojini Naidu Medical College, Agra

Correspondence:
Dr. Preeti Gupta

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Abstract

Background: Sleep plays a vital role in maintaining physical, psychological, and cognitive well-being. Increasing prevalence of overweight and obesity has been paralleled by a decline in sleep duration and quality, contributing to sleep-disordered breathing such as obstructive sleep apnea (OSA). Young adults are particularly vulnerable due to lifestyle and academic stressors. This study aimed to evaluate the relationship between sleep quality, body mass index (BMI), and Apnea-Hypopnea Index (AHI) in young adults. ***Methods:*** A cross-sectional observational study was conducted from December 2024 to November 2025 in the Department of Physiology in collaboration with the Department of ENT at Autonomous State Medical College, Kanpur. A total of 110 students aged 18–25 years (69 males, 41 females) were included. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI). BMI was calculated according to WHO guidelines, and sleep-disordered breathing severity was evaluated using AHI. Data were analyzed to determine associations between BMI, AHI, and sleep quality ***Results:*** The mean age of participants was 21.2 ± 1.9 years. Based on BMI distribution, 50% had normal weight, 29.1% were overweight, 10.9% were obese, and 10% were underweight. Poor sleep quality (PSQI >5) was observed in 52.7% of participants. Regarding AHI, 67.3% had normal values, while 20.9% had mild OSA, 9.1% moderate OSA, and 2.7% severe OSA. A clear trend was observed between increasing BMI and poor sleep quality: 71.9% of overweight and 75% of obese participants reported poor sleep compared to 40% of normal-weight individuals. Similarly, poor sleep was more prevalent with increasing AHI severity, affecting 73.9% of mild OSA and 84.6% of moderate–severe OSA participants ***Conclusion:*** Sleep quality in young adults shows a strong association with BMI and AHI. Higher BMI is linked to poorer sleep quality and greater severity of sleep-disordered breathing. Early screening and integrated ENT and physiological evaluation are essential for timely identification and prevention of long-term cardiometabolic and neurocognitive complications

Keywords: Sleep quality, Body mass index, Apnea–Hypopnea Index, Obstructive sleep apnea, Young adults, PSQI

INTRODUCTION

Sleep plays a vital role in maintaining physical, psychological, and cognitive well-being. Adequate sleep quantity and quality are essential for optimal functioning of multiple physiological systems, including metabolism, immune regulation, hormonal balance, and cardiovascular health. [1] in recent years, increasing attention has been directed toward sleep health in adolescents and young adults, particularly in the context of changing lifestyles characterized by academic stress, increased screen exposure, irregular sleep schedules, and reduced physical activity. [2]

Epidemiological data indicate a substantial increase in the prevalence of overweight and obesity, defined by a body mass index (BMI ≥25 kg/m²), over the last decade. [3] This growing obesity epidemic has been accompanied by a parallel decline in sleep duration in modern society. From a physiological standpoint, excess body weight contributes to alterations in respiratory mechanics, reduced lung volumes, and impaired upper airway neuromuscular control during sleep. Obstructive sleep apnea (OSA) is a sleep-related breathing disorder characterized by recurrent episodes of partial or complete obstruction of the upper airway during sleep, resulting in episodic hypoxemia, repeated arousals, and fragmented sleep architecture. Anatomical factors involving the nose, nasopharynx, oropharynx, and hypopharynx play a central role in its pathophysiology from an otorhinolaryngological perspective.[4]

The rising prevalence of obesity is largely attributed to sedentary lifestyles and the easy availability of high-

calorie, high-fat diets, with incidence rates increasing in developed nations and progressively affecting developing countries over the past several decades.[5] Increased soft tissue deposition, airway narrowing, and reduced pharyngeal dilator muscle tone during sleep contribute significantly to upper airway collapse. Poor sleep quality, often associated with chronic sleep deprivation, has consequently emerged as a frequent clinical complaint. [6]

Obstructive sleep apnea has become an increasingly common disorder and represents one of the predominant sleep-related respiratory conditions, particularly in middle-aged adults. It is characterized by recurrent upper airway collapse leading to oxyhemoglobin desaturation and periodic nocturnal awakenings, thereby impairing both sleep quality and daytime functioning. [7]

Marked regional variations exist in the prevalence of overweight and obesity worldwide. In Central Latin America and the Caribbean, the prevalence among adults is reported to be 47% in men and 57.8% in women. In sub-Saharan Africa, the prevalence is 6.6% among men and 36.9% among women, while in South Asian and Southeast Asian countries, it is 21.2% among men and 25.4% among women. [8] These epidemiological trends highlight the expanding global burden of obesity and its close association with sleep-related breathing disorders such as OSA.

Young adults represent a particularly vulnerable population, as lifestyle factors and academic demands often lead to inadequate sleep duration and compromised sleep quality. [9] an understanding of the interrelationship between sleep quality, BMI, and the apnea–hypopnea index (AHI) is therefore essential for primary healthcare providers and ENT specialists to identify early sleep-related breathing disorders. Such insight can help correlate physical and psychological health issues with impaired quality of life and guide appropriate lifestyle modifications based on BMI. [10] the present study was conducted to evaluate the relationship between sleep quality, BMI, and AHI in young adults, with a focus on its implications for ENT evaluation and timely screening of sleep-related breathing disorders. [2]

MATERIALS AND METHODS

A study was conducted in the of department of Physiology in collaboration with department of Department of ENT, a period from December 2024 November 2025 at Autonomous state medical college, Kanpur.

Study design: Cross-sectional observational study.

Inclusion criteria:

1. Male and female students aged 18–25 years.
2. Willing to participate and provide written informed consent.
3. Capable of understanding and responding to the sleep and lifestyle questionnaire.
4. Individuals present during the data collection period.

Exclusion criteria:

1. Individuals with previously diagnosed sleep disorders such as obstructive sleep apnea, insomnia, narcolepsy, or restless leg syndrome.
2. Individuals currently taking medications known to affect sleep patterns (sedatives, hypnotics, antidepressants, antipsychotics, or stimulants).
3. Individuals suffering from chronic medical illnesses such as diabetes mellitus, hypertension, cardiovascular diseases, chronic respiratory diseases, thyroid disorders, or neurological disorders.
4. Individuals with a history of psychiatric illness or those currently receiving psychiatric treatment.
5. Individuals with any acute illness at the time of data collection.
6. Individuals with a history of alcohol or substance abuse.
7. Individuals engaged in night-shift work or having irregular sleep–wake cycles.
8. Pregnant and lactating women.

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), and sleep-disordered breathing severity was evaluated using the Apnea–Hypopnea Index (AHI). BMI was calculated according to WHO guidelines.

RESULTS

Table 1: Baseline Demographic and Anthropometric Characteristics of Study Participants

Variable	Male (n=69) Mean ± SD	Female (n=41) Mean ± SD	Total Mean ± SD
Age (years)	21.4 ± 1.9	20.9 ± 1.8	21.2 ± 1.9
Height (cm)	171.6 ± 6.4	158.3 ± 5.8	166.7 ± 8.9
Weight (kg)	70.8 ± 9.6	58.7 ± 8.4	66.3 ± 10.9

Table shows the baseline characteristics of 110 young adults (69 males, 41 females). The mean age was 21.2 ± 1.9 years. Males were taller (171.6 ± 6.4 cm) and heavier (70.8 ± 9.6 kg) than females (158.3 ± 5.8 cm; 58.7 ± 8.4 kg), reflecting typical sex-related differences in body size.

Table 2: Body Mass Index (BMI) Distribution of Study Participants

BMI Category (WHO)	Male (n = 69)	Female (n = 41)	Total n (%)
Underweight (<18.5 kg/m²)	6	5	11 (10.0%)
Normal (18.5–24.9 kg/m²)	34	21	55 (50.0%)
Overweight (25.0–29.9 kg/m²)	21	11	32 (29.1%)
Obese (≥30 kg/m²)	8	4	12 (10.9%)
Total	69	41	110 (100%)

The BMI distribution shows that half of the participants (50%) had normal weight. Among the remaining, 29.1% were overweight, 10.9% were obese, and 10% were underweight. A higher proportion of males were overweight or obese compared to females, reflecting sex-related differences in body composition.

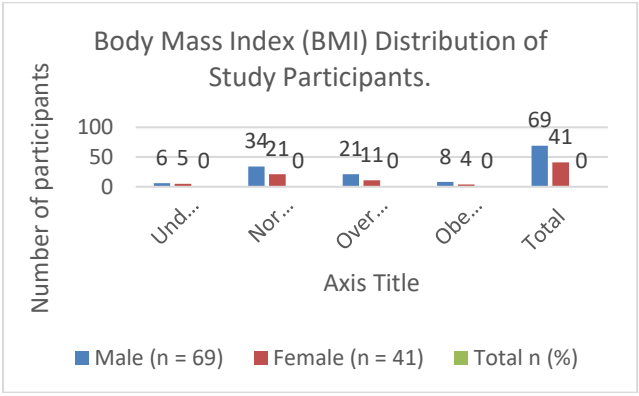

Figure: 1 Graphical represents Body Mass Index (BMI) Distribution of Study Participants

Table 3: Distribution of Sleep Quality Based on PSQI Score

Sleep Quality	Male (n = 69)	Female (n = 41)	Total n (%)
Good sleep quality (PSQI ≤5)	30	22	52 (47.3%)
Poor sleep quality (PSQI >5)	39	19	58 (52.7%)
Total	69	41	110 (100%)

Sleep quality assessment showed that 52 participants (47.3%) had good sleep, while slightly more than half (52.7%) reported poor sleep quality. Poor sleep was slightly more common among males (39/69) than females (19/41).

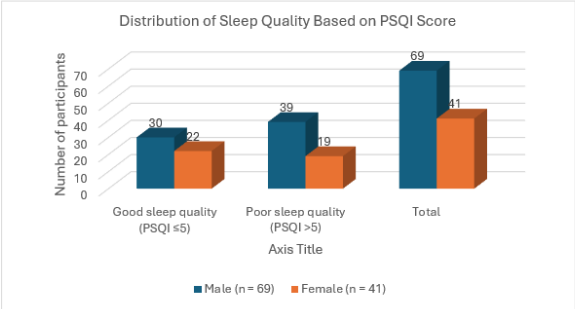

Figure: 2 Graphical represents distribution of sleep quality based on PSQI Score

Table 4: Distribution of Apnea–Hypopnea Index (AHI)

AHI Category	AHI Range (events/hour)	Male (n = 69)	Female (n = 41)	Total n (%)
Normal	<5	44	30	74 (67.3%)
Mild OSA	5–14.9	16	7	23 (20.9%)
Moderate OSA	15–29.9	7	3	10 (9.1%)
Severe OSA	≥30	2	1	3 (2.7%)
Total		69	41	110 (100%)

The distribution of the apnea–hypopnea index (AHI) indicates that the majority of participants (67.3%) had normal AHI (<5 events/hour). Mild OSA was observed in 20.9% of participants, while moderate and severe OSA were less common,

affecting 9.1% and 2.7%, respectively. Overall, OSA was more prevalent among males than females, consistent with the higher risk of sleep-disordered breathing in young adult men.

Table 5: Association Between BMI Category and Sleep Quality

BMI Category	Good Sleep n (%)	Poor Sleep n (%)	Total
Underweight	7 (63.6%)	4 (36.4%)	11
Normal	33 (60.0%)	22 (40.0%)	55
Overweight	9 (28.1%)	23 (71.9%)	32
Obese	3 (25.0%)	9 (75.0%)	12
Total	52	58	110

The association between BMI and sleep quality shows that participants with higher BMI tended to report poorer sleep. While most underweight (63.6%) and normal-weight (60%) participants had good sleep quality, a majority of overweight (71.9%) and obese (75%) participants experienced poor sleep. This suggests a clear trend of declining sleep quality with increasing BMI.

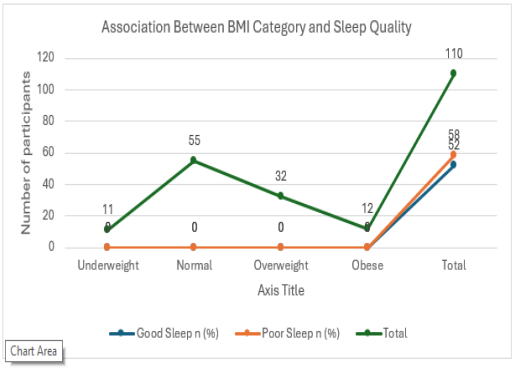

Figure: 3 Graphical represents association between BMI category and sleep quality.

Table 6: Association of AHI with Sleep Quality

AHI Category	Good Sleep n (%)	Poor Sleep n (%)	Total
Normal	44 (59.5%)	30 (40.5%)	74
Mild OSA	6 (26.1%)	17 (73.9%)	23
Moderate–Severe OSA	2 (15.4%)	11 (84.6%)	13
Total	52	58	110

The relationship between AHI and sleep quality shows that participants with normal AHI (<5 events/hour) mostly reported good sleep (59.5%). In contrast, those with mild OSA had predominantly poor sleep quality (73.9%), and participants with moderate to severe OSA showed the highest prevalence of poor sleep (84.6%). These findings indicate a clear trend of worsening sleep quality with increasing severity of sleep-disordered breathing.

DISCUSSION

The present study demonstrates a significant association between increased BMI, higher AHI, and poor sleep quality in young adults. From a physiological perspective, increased adiposity adversely affects respiratory mechanics and sleep architecture, contributing to fragmented sleep and reduced restorative sleep stages. From an ENT viewpoint, elevated BMI predisposes individuals to upper airway narrowing and collapsibility, explaining the higher prevalence of OSA and poor sleep quality observed in overweight and obese participants.

The progressive decline in sleep quality with increasing AHI highlights the importance of early ENT evaluation in young adults presenting with poor sleep, even in the absence of classical OSA symptoms. These findings underscore the need for integrated ENT and physiological screening strategies to identify sleep-disordered breathing at an early stage.

CONCLUSION

Sleep quality in young adults shows a strong association with BMI and Apnea–Hypopnea Index. Increasing BMI is linked to poorer sleep quality and higher prevalence of sleep-disordered breathing. An integrated ENT and physiological approach is essential for early detection, evaluation of upper airway factors, and prevention of

long-term cardiometabolic and neurocognitive consequences of disturbed sleep.

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