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Association of Sleep quality with Body Composition of 21 to 55 years Adults in Mumbai

Apurva Halbe[1*], Sharvari Desai[2], Soumik Kalita[3], Shobha Udipi[4], Rama Vaidya[5]

[1]Project Coordinator, Kasturba Integrative Health Sciences, Medical Research Foundation, India
[2]Project Investigator, Kasturba Integrative Health Sciences, Medical Research Foundation, India
[3]Director, Kasturba Integrative Health Sciences, Medical Research Foundation, India
[4]Research Head and Director, Kasturba Integrative Health Sciences, Medical Research Foundation, India
[5]Director Endocrine and Metabolic Division, Kasturba Integrative Health Sciences, Medical Research Foundation, India
***Correspondence author:** Apurva Halbe, Project Coordinator, Kasturba Integrative Health Sciences, Medical Research Foundation, India;
Email: apurva.agashe@gmail.com

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Abstract
Background: Sleep quality is increasingly recognized as an important determinant of metabolic health, influencing endocrine function, glucose regulation, appetite and tissue remodelling. Methods and Findings: This cross-sectional study examined the association between sleep quality and body composition among adults aged 21-55 years residing in Mumbai. A total of 685 participants underwent assessments of sleep quality using the Pittsburgh Sleep Quality Index (PSQI) and the Epworth Sleepiness Scale (ESS), along with anthropometry and Body Composition Analysis (BIA). More than half of the participants reported poor sleep quality, with 52.1% sleeping less than 6 hours per night. Skeletal muscle mass showed a significant negative association with PSQI scores, while body fat mass and percent body fat showed positive correlations with poor sleep indicators. BMI showed weak but significant associations with PSQI and ESS scores, while abdominal adiposity indicators (WHR, WHtR) did not show consistent associations. Conclusions: Findings highlight that poor sleep quality may adversely affect body composition, particularly muscle mass and fat mass, in adults. These results underscore the importance of targeting sleep hygiene as part of metabolic health interventions.

Keywords: Sleep Quality; Body Composition; Pittsburgh Sleep Quality Index; Obesity; Skeletal Muscle Mass; Mumbai; Adults

Abbreviations
BMI: Body Mass Index; WHR: Wasit to Hip Ratio; WHtR: Waist to Height Ratio; PSQI: Pittsburgh Sleep Quality Index; ESS: Epworth Sleepiness Scale; NFHS: National Family Health Survey; NHLBI: National Heart, Lung and Blood Institute

Introduction
Sleep is a fundamental human requirement and a crucial component of the biological process. It plays a vital role in maintaining the proper functioning of physiological activities and is essential for overall health, physical, cognitive and psychological leading to a good quality of life, as well as enhanced daily performance. Quality as well as quantity of sleep have profound effects on overall health while poor sleep quality and/or insufficient sleep in terms of duration have adverse effects on health as well as longevity [1]. Sleep deprivation has been associated with increased risk of physiological/physical, psychological consequences, metabolic syndrome, depression, irritability, Alzheimer's disease, fall and bone fractures and chronic pain [2]. The Philips company (2019) global sleep survey, reported that adults above 18 years of age have an average of 6.8 h sleep during weeknights and 7.8 h on weekends [3]. Also, 62% of adults did not feel they were getting enough sleep. As per the National Heart, Lung and

Blood Institute (NHLBI), the recommended duration of sleep is 7 to 9 hours of night sleep for adults aged 18 to 60 years [4].

Studies conducted by Marshall, et al., and McNeil J, et al., showed a U - shaped association between sleep duration and Body Mass Index (BMI) [5,6]. Both short and long sleep durations have been reported to increase the risk of obesity, by 27% and 21% respectively, compared to persons who sleep for an average amount of time i.e.,7 hours per night [7]. Body composition, in turn, impacts sleep function. Lean body mass has been reported to be positively correlated with sleep duration and sleep quality, but high-fat mass seems to be associated with reduced sleep duration and poor sleep quality.

The mechanism(s) by which body composition affects sleep are not fully clear. It has been proposed that thermoregulation is a likely mediator. Overall, sleep is sensitive to core body temperature. Peripheral muscle tissue can act as an insulator and increased peripheral muscle mass can prevent a decrease in deep-body temperature. Sufficient muscle mass helps to increase heat production and increased muscle mass can decrease sleep as evidenced by an inverse association between muscle mass and sleep quality in athletes [8]. Sleep plays an important role in regulating body composition and the endocrine function involved in tissue regeneration and tissue remodelling, thus influencing the three tissues- fat, muscle and bone. Sleep restriction both short-term and chronic, disrupts the homeostasis of skeletal muscle and glucose, resulting in increased susceptibility to insulin resistance, obesity and type to diabetes. Furthermore, reduced sleep duration alters leptin and ghrelin concentrations, thus affecting hunger and satiety [9]. Steroid hormone secretion is also likely to be affected, as shown by a study on healthy adult males subjected to one night of sleep deprivation. Additionally, sleep deprivation likely compromises the rate of muscle protein synthesis and increases proteolysis, eventually leading to loss of muscle mass [10].

Specifically, lean body mass is positively correlated with sleep duration and sleep quality, whereas high-fat mass appears to be associated to reduced sleep duration and poorer sleep quality. Along with muscle mass, the distribution of body fat may be another factor that defines sleep quality. Based on data from the Korean National Health and Nutrition Examination Survey, an evaluation of the relationship between sleep duration and body composition in 303 girls revealed that sleep duration was associated with fat distribution and correlated more with fat mass in the trunk than in the head, arms and legs [1]. Other studies from Swedish and South Korean studies found that habitual short and long sleep were associated with higher fat mass and elevated visceral obesity [11].

Young and middle-aged adults are at increased risk of developing metabolic syndrome due to poor sleep quality, since they go through lifestyle changes in terms of extensive electronic media use for academic and professional demands, which can potentially lead to insufficient sleep and poor sleep quality. In India, the prevalence of obesity and overweight in urban women and men is 21.6% and 21.7% respectively. Also, 58.7% women and 46.5% of men had a waist-to-hip ratio above normal (0.85) (NFHS. 2019-2021). Hence, this study was carried out to examine the association between sleep quality and body composition in 21 to 55-year-old adults, residing in Mumbai, India.

Methodology

Study Design and Participants

The study was explained in detail to potential participants by trained researchers in a language they were conversant with and they were assured about the confidentiality of data. Data was collected between October 2022 and August 2024 from 23 different Institutes in Mumbai city. Six hundred and eighty-five Participants were screened for the study after obtaining written informed consent, based on the following criteria.

Inclusion Criteria

Participants of both genders aged between 21 and 55 years, having stable sleep habits (self-reported) for at least 6 months before the study and their Pittsburgh Sleep Quality Index (PSQI) score should be above 5 or Epworth Sleepiness Scale (ESS) ≥10. Participants of both genders and aged between 21 and 55 years. They should have had stable sleep habits (self-reported) 6 months before the study and their (PSQI) score should be above 5 or ESS score ≥10.

Exclusion Criteria

Pregnant and lactating women and those who have children below 2 years were excluded. Caregivers, individuals working in night shifts or with irregular work schedules, were excluded. Individuals having any sleep disorders such as chronic insomnia, severe obstructive sleep apnea, central apnea etc., were not included in the study. People having depression and/or anxiety problems, those taking medication for sleep problems or melatonin supplements, sedatives, hypnotics and painkillers regularly, were excluded. Also, individuals with a history of prior cardiovascular problems or who had undergone any operative procedures or who were suffering from any neurological problem were excluded. Individuals who smoke or indulge in any substance abuse were not included in the study.

Data Collection

Data collection tools- A case record form was used to gather information about sociodemographic profile, health status, family history of any disease and questions related to sleep hygiene and practices.

Sleep Pattern

Sleep hygiene and quality were assessed using two validated questionnaires viz., the PSQI and the ESS score and sleep hygiene questions [12]. PSQI gives information about the sleep patterns of individuals during the night. It is a 19- item self-rated questionnaire for evaluating subjective sleep quality over the previous month. The 19 questions are combined into 7 clinically-derived component scores, each weighted equally from 0-3. The 7 component scores are added to obtain a global score, ranging from 0-21, with higher scores indicating worse sleep. PSQI scores above 5 are suggested as indicative of a potential sleep problem.

Daytime sleepiness was assessed using ESS. The ESS is a short, self-administered questionnaire consisting of eight questions that ask participants to rate how likely they are to fall asleep in everyday situations (each question can be scored from 0 to 3 points, with '0' indicating no sleepiness and '3' indicating significant sleepiness).

A score equal to or above 10 was considered to be above normal 'daytime sleepiness' and warranted further investigation. The researchers administered both the PSQI and ESS questionnaires and documented the responses of the participants. Both the PSQI and ESS questionnaires were filled out by the researchers asking the questions and recording the participants' answers.

Anthropometry

Anthropometric measurements were taken by trained researchers using calibrated instruments. Height, waist and hip circumference were measured to the nearest 0.1 cm using calibrated non-stretchable SECA tape. Height was measured with participants barefoot, standing upright, with their shoulders and backs of their heels in contact with the wall. Waist circumference was measured by placing the tape halfway between the lower ribs and the iliac crest. The Asian cut-offs of 90 cm for men and 80 cm for women were used to further categorize to assess the risk of abdominal obesity [13]. Hip circumference was measured at the largest circumference around the buttocks. All measurements were taken twice and the average was calculated. The Body Mass Index (BMI) of participants was calculated and classified as per the cut-offs given by the World Health Organization for Asians. Waist-to-Hip Ratio (WHR) was calculated and cut-offs of 0.85 for women and 0.90 for men were considered as indicative of abdominal obesity [14]. The Waist-to-Height Ratio (WHtR) was calculated and the cutoff of 0.5, suggested by Ashwell and Hsieh to indicate abdominal adiposity [18]. Body weight and Body composition were measured using the Inbody body composition analyser (InBody Make- Model No. 120) [15-18].

Data Analyses

The Data were analysed using SPSS version 20. Descriptive data included mean and standard deviations. Analysis of Variance was used for between groups comparison and Pearson's correlation coefficient was used to determine whether sleep quality and body composition measurements.

Results

Profile of Participants

Among the 685 participants, the majority were female n=522, 76.2%) while the remaining 23.8% (n=163) were males. The mean age of participants was 39.9±10.10 years. The distribution of participants across decades showed a similar pattern among the various decades: 25.8% were aged between 21 and 30 years, 24.1% were between 30 to 40-year range, 28.9% were in the 41 to 50-year age group and 21.2% were aged 51 to 55 years. The mean height of participants was 158.6±8.4cm and weight was 67.1±14.2kg. The mean BMI was 26.8±7.1kg/m^2, indicating that obesity was common among these participants. The Waist-to-Hip Ratio (WHR) was in the normal range, 0.82±0.08, but the mean waist-to-height ratio (0.52±0.07) was above the normal cut-off value.

The sleep pattern of participants indicated that only 17.1% slept for more than 7 hours at night, while 52.1% slept for less than 6 hours at night. According to PSQI, marginally more than half of the participants (51.7%) had poor sleep quality. Slightly more than half (51.5%) of the participants stated that they could fall asleep within 15 minutes after going to bed, while a small percentage (7.3%) needed more than 1 hour to fall asleep. Although half of the participants experienced poor sleep quality, 65.4% reported sleep efficiency above 85%. Daytime sleepiness measured by ESS showed that 17.5% of participants experienced sleepiness during the day.

Sleep Quality and Body Mass Index

Almost two-thirds of the participants were obese since only 18.8% were in the normal BMI category. PSQI was higher in underweight participants and in those with grade II and III obesity, compared to participants with normal BMI and those who were overweight, obese or in the Grade I obesity category. There was no significant difference in the PSQI scores among the underweight, overweight and obese persons and those with normal BMI. Similarly, BMI was not associated with sleep latency, sleep duration. However, sleep efficiency was significantly lower among underweight persons compared to those in the other BMI categories.

	<18.5 (n=22)	**18.5-22.9 (n=129)**	**23.0-24.99 (n=97)**	**25.0-26.99 (n=128)**	**27.29.99 (n=143)**	**>30 (n=143)**	**F,p**
	Underweight	**Normal**	**Overweight**	**Obese**	**Grade-I Obesity**	**Grade II and III Obesity**	
PSQ1 total Score							
(Mean±SD)	6.9±2.6	5.7±3.0	5.9±3.1	5.9±3.4	5.6±2.9	6.5±3.3	1.795,0.112
Min-Max	5.8-8.0	5.2±6.2	5.3±6.6	5.3±6.5	5.2±6.1	5.9-6.9	
	2-13	0-14	0-15	0-15	0-15	1-16	
Sleep latency (minutes)							
	38.6±38.2	23.6±32.0	24.6±27.5	25.6±23.1	24.4±22.7	28.8±29.8	1.583,0.163
	21.7-55.5	17.9-29.1	19.0-30.1	21.6-29.7	20.7-28.2	24.2-33.3	
	5-150	5-270	5-150	5-120	5-120	5-180	
Hours of Sleep/ Night							
	5.9±1.3	6.1±1.3	6.2±1.1	6.1±1.2	6.2±1.1	5.9±1.3	0.809,0.543
	5.3-6.5	5.8-6.3	6.0-6.4	5.9-6.3	6.0-6.4	5.8-6.2	
	4.0-8.0	2.5-9.5	3.5-9.0	3.0-8.5	3.0-8.5	1.0-9.0	
Sleep Efficiency (%)							
	81.9±15.8	87.2±11.6	87.1±12.4	86.4±12.8	87.0±11.2	85.8±13.0	0.884, 0.492
	74.9-88.9	85.2-89.2	84.6-89.6	84.2-88.6	85.2-88.9	83.8-87.8	
	50-100	50-100	50-100	42.9-100	50-100	41.2-100	
ESS Total Score							
	5.7±3.7	8.2±4.6	7.2±4.7	7.8-±4.7	7.6±4.7	8.9-4.9	3.409, 0.005
	4.1-7.4	7.4-08.9	6.2-8.1	6.9-8.6	6.8-83	8.2-9.7	
	0-12	0-24	0-18	0-19	0-24	0-22	

Table 1: Comparison of Sleep Quality Indicators among BMI categories.

Pearson's chi-square analysis for association indicated that PSQI scores in three categories i.e. <5, 5-10 and > 10, showed a significant association between the PSQI categories and BMI categories ($\chi2$=19.281, p=0.037). BMI positively correlated with PSQI (r-0.103, p-0.007), sleep latency (r-0.037, p-0.337) and ESS Score (r-0.123, p-0.001), although the correlations were not very strong with sleep latency. It was observed that the increase in BMI was associated with an increase in ESS score. The duration of sleep was less than 7 hours in all categories of BMI. Sleep efficiency was lower while sleep latency was higher in underweight participants than in other groups. No significant association was observed between BMI and sleep duration. However, a significant association ($\chi2$=26.232, p=0.036) was observed between BMI and sleep latency categorized as <15 min, 15-30 min, 31-60 min, >60 min. Similarly, daytime sleepiness assessed by ESS scores was significantly associated with BMI ($\chi2$=11.715, p=0.039).

Association of Sleep Quality with Body Composition

Skeletal Mass: The mean skeletal muscle mass was 22.1±2.7 kg. The PSQI score of participants differed significantly among the five quintiles of skeletal muscle mass (kg), with PSQI scores being lower in the highest two quintiles of skeletal body mass and highest in the lowest quintile. Sleep latency (minutes) differed tremendously between the five quintiles of skeletal mass and similar to PSQI scores, it was highest among the group with the lowest amount of skeletal mass. As the skeletal mass increased, sleep latency decreased, with it being lowest among those who had higher muscle mass. Sleep efficiency and sleep duration of participants did not differ among the five quintiles of muscle mass. Also, the daytime sleepiness score was within the cutoff between all the categories.

Sleep Components	**Skeletal Muscle Mass (Kg)**					**F, p-value**
	Q1	Q2	Q3	Q4	Q5	
	<20.0 (n, %=41, 6.0)	20.01 to 23.0 (n, %=265, 38.7)	23.01 to 27.0 (n, %=195, 28.5)	27.01-30.0 (n, %=116, 16.9)	≥30.01 (n, %=68, 9.9)	
PSQI Scores	6.8±3.71	6.2±3.1	6.2±3.2	5.3±3.0	5.4±2.9	**3.297, 0.011**
Sleep Latency (min)	30.8±27.3	28.4±28.5	26.6±32.8	19.6±17.9	23.2±24.0	**2.535, 0.039**
Sleep Efficiency (%)	87.1±10.5	86.4±12.4	85.6±13.0	88.5±12.2	85.9±11.4	1.622, 0.169
Sleep Duration (Hours)	6.1±1.5	6.0±6.1	6.0±1.1	6.0±1.3	6.3±1.2	1.119, 0.346
ESS Score	8.0±5.9	7.5±4.3	8.4±4.9	8.3±4.9	7.5±4.5	1.487, 0.204

Table 2: Comparison of components of sleep quality between quintiles of skeletal muscle mass (kg).

Also, skeletal muscle mass was negatively correlated with PSQI (r-0.110, p-0.007) and sleep latency (r-0.087, p-0.023). Body fat mass was positively correlated with PSQI (r-0.138, p-0.000), sleep latency (r-0.093, p-0.015) and ESS score (r-0.065, p-0.091).

Body Fat Mass

The mean body fat mass (kg) of participants was 26.8±7.1. In contrast to skeletal muscle mass, PSQI scores were lowest for those with the lowest amount of body fat. The scores increased with increasing body fat, with the mean body fat in the highest category being almost one and a half times the mean of the lowest quintile. The other four measures of sleep quality, sleep latency, sleep efficiency, sleep duration and the ESS scores did not differ significantly between the quintiles of body fat. Body fat mass was positively and significantly correlated with PSQI (r-0.138, p-0.000). Sleep latency also showed a weak but positive correlation (r-0.093, p-0.015).

Sleep Components	**Body Fat Mass (Kg)**					**F Value, p value**
	Q1	Q2	Q3	Q4	Q5	
	<20 (n, %) = 147, 21.5	20.01 to 25.0 (n, %) =107,15.6)	25. 01to 30.0 (n, % =174,25.4)	30.01-35.0 (n, %=170, 24.8)	<35.0 (n, % =87,12.7)	
PSQI Scores	5.4±3.1	5.7±3.1	6.2±3.3	5.9±2.9	7.0±3.5	**4.048,0.003**
Sleep Latency (min)	22.9±20.3	25.5±38.6	25.3±26.5	26.1±23.5	33.0±32.2	1.877,0.113
Sleep Efficiency (%)	87.1±12.1	86.5±12.9	86.1±11.7	86.9±11.9	85.6±13.3	0.310,0.871
Sleep Duration (Hours)	6.2±1.2	6.2±1.4	6.0±1.3	6.1±1.1	5.8±1.3	1.629,0.165
ESS Score	7.5±4.6	8.3±5.3	7.9±4.3	8.6±4.8	7.9±4.7	0.956,0.431

Table 3: Sleep quality with body fat mass (kg).

Percent Body Fat

The mean percent body fat was 39.0±79. Gender-wise analysis indicated that there was no significant difference in the mean values for PSQI, sleep latency, hours of sleep per night, sleep efficiency and ESS total score. The percent body fat was positively associated with PSQI (r= -0.103, p-0.007) and sleep latency (r=-0.083, p-0.029). The PSQI score was above the cutoff in all quartiles of percent body fat, although this finding was not statistically significant. Sleep latency increased with the rise in body fat percentage, whereas sleep duration, efficiency and ESS score were consistent across all quartiles.

Sleep Components	Percent Body Fat					F, p value
	Q1	Q2	Q3	Q4	Q5	
	<30 (n=101, 14.7)	30.01 to 35.0 (n=100,14.6)	35.01 to 40.0 (n=123, 18.0)	40.01-45.0 (n=190, 27.7)	≥45.01 (n=171, 25.0)	
PSQI Scores	5.6±2.9	5.3±3.1	6.4 ±3.4	6.0±3.0	6.3±3.3	2.551,0.038
Sleep Latency (min)	23.6±22.1	21.8±21.3	27.3±37.7	25.3±25.5	29.8±27.9	1.672, 0.155
Sleep Efficiency (%)	87.6±11.7	87.7±12.1	83.9±14.3	86.7±11.2	86.9±12.4	1.895,0.109
Sleep Duration (Hours)	6.2±1.1	6.1±1.3	6.0±1.3	6.0±1.2	6.1±1.2	0.673,0.611
ESS Score	7.4±4.4	8.2±5.3	8.5±4.8	7.4±4.3	8.2±4.7	1.502,0.200

Table 4: Association of sleep components with percent body fat.

Pearson's chi-square was applied to determine whether there was an association between PSQI, sleep duration, sleep latency, sleep efficiency and ESS score. The percentage of participants with a percent body fat above the desirable levels did not differ significantly among those whose PSQI scores were less than 5 or more than 5 ($\chi 2=1.348$, $p=0.246$). Similarly, there was no significant association between percent body fat and sleep duration, sleep latency, sleep efficiency or ESS scores.

Waist to Hip Ratio (WHR)

Comparison of the mean PSQI scores, sleep latency, sleep duration, sleep efficiency (%) and ESS scores by gender, indicated that the values were almost similar between participants whose WHR were above the desirable levels and those who WHRs were within the desirable cutoffs, for both males and females (Table 5).

Gender	Sleep Components	Waist to Hip Ratio		t, p value
Male		<0.90 (n=74)	>0.90 (n=87)	
	PSQI Scores	4.9±2.8	5.2±3.0	-0.839,0.403
	Sleep Latency (min)	20.8±18.2	20.9±22.5	-0.121,0.904
	Sleep Efficiency (%)	88.5±11.6	86.1±12.6	1.246,0.215
	Sleep Duration (Hours)	6.2±1.1	6.1±1.2	1.029,0.305
	ESS Score	7.4±4.6	8.1±5.2	-0.814,0.417
Female		<0.85 (n=422)	>0.85 (n=97)	
	PSQI Scores	6.2±3.1	6.2±3.5	0.151,0.880
	Sleep Latency (min)	27.4±29.3	29.2±30.5	-0.523,0.601
	Sleep Efficiency (%)	86.1±12.3	86.6±12.6	-0.698,0.486
	Sleep Duration (Hours)	6.0±1.2	6.1±1.3	-0.345,0.730
	ESS Score	8.0±4.6	8.0±4.6	0.203,0.839

Table 5: Association of sleep components with Waist to Hip Ratio (WHR).

Sleep latency was similar in both categories of WHR in male participants, although among female participants, sleep latency was slightly higher in the group with higher WHR. There was no difference between the WHR categories for sleep efficiency and sleep duration, as well as the ESS scores.

Waist to Height Ratio

A waist-to-height ratio of >0.50 is indicative of abdominal adiposity. Mean PSQI scores, as well as the means for sleep latency, sleep efficiency and duration of sleep, did not differ significantly between those with a WHtR below 0.50 and those who had higher WHtR measurements (Table 6).

Sleep Components	Waist to Height Ratio		t, p value
	≤0.50 (n=220)	>0.50 (n=460)	
PSQI Scores	6.0±3.0	5.9±3.2	0.223,0.824
Sleep Latency (min)	26.2±31.5	25.9±25.9	0.105,0.916
Sleep Efficiency (%)	86.2±12.7	86.6±12.9	-0.400, 0.689
Sleep Duration (Hours)	6.1±1.2	6.1±1.1	0.318.,0.751
ESS Score	7.9±4.7	8.0±4.6	0.046,0.963

Table 6: Association of Sleep Components with Waist to Height Ratio (WHtR).

Discussion

Sleep is essential for sustaining life. Humans spend approximately 25% of their usual day in sleep. The National Sleep Foundation's guidelines indicate that 7 to 9 hrs of sleep each night is necessary to maintain good health for adults. Occupational and work-related demands, easy access to media and devices in the 21st century, have contributed greatly to altered sleep patterns with sleeping late and shorter sleep durations, resulting in the modern epidemic of sleep loss and poor sleep quality. Short-term sleep loss and chronic sleep restrictions are interrupters in skeletal muscle and whole-body glucose homeostasis that increase vulnerability to adverse consequences on health, including obesity, insulin resistance and type 2 diabetes mellitus [19].

In the present study, those who slept for less than 5 hrs had slightly lower skeletal muscle mass (21.9±2.4kg/bodyweight) than those with sleep between 5 to 7 hrs (22.2±2.6kg/bodyweight). Also, it has been observed that good sleepers (PSQI less than 5) had a significant difference in skeletal muscle mass compared to those with poor sleepers (PSQI >5) (22.38±2.7, 21.86±2.6, F value 2.513, p value-0.012). A 2023 study conducted by Mazyar, et al., 2023 in Iranian adults aged 18 to 60 years observed that percent muscle mass was higher in those with good sleep quality, as per PSQI score, which was similar to the results of our study.

Disturbed sleep could lead to a decrease in muscle protein synthesis with consequent loss of lean mass and reduced muscle strength. In animals, insufficient sleep has been found to lead to muscle atrophy [21]. In population studies, poor sleep quality was found to be correlated with lower muscle mass. Skeletal muscles are the active tissues in the metabolism of the human body. Knowles, et al., reported that a lack of sleep results in a decrease in muscle protein synthesis rates among healthy male adults, which progressively result in a decrease in lean muscle mass, as well as further declines in muscle strength and functional outcomes. Sleeping less than 7 hours at night has the marked effect on glycolytic muscle fibres with predominating affecting fast twitch fibres than slow twitch fibre which are oxidative fibres [22]. Insufficient sleep, of less than 7 hours at night, significantly impacted glycolytic muscle fibers, predominantly affecting fast-twitch fibers more than the oxidative slow-twitch fibers [22]. Increased urinary protein secretion was noted following 72 hours of sleep deprivation, indicating that there could have been an enhancement in proteolytic processing. Another explanation is that sleep deprivation could lead to possible chronic low-grade inflammation. Systemic and tissue-specific inflammatory markers were negatively associated with muscle mass and sleep deprivation was associated with increases in Il-6, TNF-α and CRP (151, 152 from Stich).

Also, poor sleep quality has been associated with indices of fat mass and abdominal adiposity. Sweatt and coworkers reported that poor subjective sleep quality was related to a greater amount of visceral adiposity but not total body fat. An analysis of the results from a US-NHANES survey revealed a negative correlation between sleep duration and total visceral fat mass, after adjusting for several potential confounding factors, such as age, ethnicity, body mass index, total body fat mass, energy and alcohol consumption, sleep quality and the presence of sleep disorders. The investigators further reported that they observed a plateau when sleep duration exceeded 8 hours, as there were no noticeable benefits. In a cross-sectional survey on more than 2000 Chinese women aged 18-49 years, it was observed that the poor sleep quality judged using the global PSQI score increased the risk of central obesity.

The mechanism by which poor sleep quality is associated with increase in body fat or abdominal obesity includes disruption of melatonin secretion, a key mediator in energy balance and body weight regulation and by increasing inflammation, which in turn increases muscle anabolism [23,24].

In the present study percent body fat was lower for those who slept for 7 hours or more (38.4±7.8) compared to those who slept for less than 7 hours (39.03±8.1% to 39.3±7.7%). A similar trend was observed by Nedeltcheva, et al., who observed that participants with short sleep duration showed a 55% lower decrease in fat mass and 60 % higher decrease in muscle mass. PSQI score was higher in female participants of this study, regardless of their percent body fat. In case of male participants, the PSQI score was lower for those with a percent body fat >25. Sleep duration was less than 7 hours despite a normal or higher body fat percentage. this sentence is not clear. In females, sleep latency was higher in those with normal body fat percentage, but this was not statistically significant. Further, no gender-wise differences was seen for daytime sleepiness and body fat percentage. Similar observations have been reported recently by Kohanmoo, et al., in their 2024 study.

Along with percent body fat, BMI is an indicator of obesity [22]. Babu and Bahuleyan, found no association between BMI of good sleepers and poor sleepers, a trend that was also noted in our current study. However, in the present study, an association was observed when comparing categories of BMI and PSQI score and daytime sleepiness. Similar findings were reported by Ali and Ahsan. Gupta, et al., conducted studies on adults aged 20 to 40 years, in which they reported significant difference in sleep duration among BMI categories. However, such a trend was not observed in the present study. Sleep latency is an important measure of sleep quality as it can help to evaluate sleep-associated disorders. Generally, 10 to 20 mins sleep latency is considered normal for adults. In the present study, no significant association was observed between BMI and sleep latency, in contrast to findings reported by Mirdha, et al., who observed a significant association between sleep latency and BMI. The score for daytime sleepiness in our study was found to be lower across all BMI categories; however, Ali M and Ahsan M, reported a variation in daytime sleepiness associated with BMI. Ford, et al., reported individuals with shorter sleep durations had a BMI that was 1.7 kg/m^2 higher compared to those with longer sleep durations. Short sleepers' girth was also 3.4 cm more than those who slept longer hours. BMI and waist circumference were inversely and linearly associated with sleep duration, with the correlation being stronger for persons in the age group of 20-39 years. Overall, people who slept for 7 to 9 hours per night were likely to be less obese and have abdominal obesity compared to those who slept for fewer hours. Apart from BMI, WHR and WHtR are also indicators of abdominal obesity. In the present study, the association between quality of sleep and WHR and WHtR was studied. WHR was significantly associated only with PSQI scores. WHtR was significantly associated with sleep duration but with PSQI scores and sleep latency. Similar results were reported by Babu and Bahuleyan, in their study conducted among 1st year MBBS students. In a meta-analysis of 31 studies by Xue, et al., covering 669560 participants and 25214 cases, abdominal adiposity as measured by Waist: Hip Ratio (WHR) and waist:height ratio (WHtR), the risk for cardiovascular disease was found to be significantly higher in the highest categories for all three indicators compared to the lowest categories, the risk ratios being 1·43 and 1·57. Also, a linear-dose response relationship was observed with the risk of CVD increasing by 3·4 % for each 10 cm increase of WC and by 3·5 and 6·0 % for each 0·1 unit increase of WHR and WHtR in women, respectively. In men, the risk increase was slightly more - 4·0 % for each 10 cm increase in WC and by 4·0 and 8·6 % for each 0·1 unit increase in WHR and WHtR.

The mechanism by which body fat accumulation is linked to poor sleep health can be attributed to energy intakes being higher because individuals are likely to spend more time awake in an obesogenic environment as well as due to changes in food choices. Thus, appetite-driven altered patterns of food intake, changes in levels of endocrine hormones that regulate food intake, are likely contributors to weight gain and increased adiposity. This is supported by the findings of Hayashi, et al., that high confectionery intake was associated with poor sleep quality [32].

Conclusion

In summary, the present study aimed to determine whether self-reported quality of sleep was associated with body composition parameters. It was observed that poor sleep quality had a significant negative correlation with skeletal muscle mass, while it appeared to have a positive correlation with percent body fat, BMI, WHR and WHtR. One limitation of the study was that appetite ratings and 24-hour dietary intakes were not recorded. Hence, it was not possible to examine the association between energy and carbohydrate intakes, appetite and sleep quality. There is a need to study the association between food choices, nutrient intakes and sleep quality in populations that are largely suffering from poor sleep health.

Conflict of Interest
The authors declared no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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Data Availability Statement
Not applicable.

Ethical Statement
The study was approved by the Inter System Biomedica Ethics Committee (ISBEC).

Informed Consent Statement
Informed consent was obtained from participants before collecting the data.

Authors' Contributions
All authors have contributed equally to this work and have reviewed and approved the final manuscript for publication.

References

1. WHO Expert Consultation. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. Lancet. 2004;363(9403):157-63.
2. Kohanmoo A, Kazemi A, Zare M, Akhlaghi M. Gender-specific link between sleep quality and body composition components: A cross-sectional study on the elderly. Sci Rep. 2024;14(1):8113.
3. Philips Global Sleep Survey. Philips Global Sleep Survey. 2019 [Last accessed on: January 19, 2026] https://www.philips.com
4. Wirth MD, Hébert JR, Hand GA, Youngstedt SD, Hurley TG, Shook RP, et al. Association between actigraphic sleep metrics and body composition. Ann Epidemiol. 2015;25(10):773-8.
5. Marshall NS, Glozier N, Grunstein RR. Is sleep duration related to obesity? A critical review of the epidemiological evidence. Sleep Med Rev. 2008;12:289-98.
6. McNeil J, Doucet E, Chaput JP. Inadequate sleep as a contributor to obesity and type 2 diabetes. Can J Diabetes. 2013;37:103-8.
7. Chaput JP, Després JP, Bouchard C, Tremblay A. The association between sleep duration and weight gain in adults: A 6-year prospective study from the Quebec Family Study. Sleep. 2008;31(4):517-23.
8. Kawasaki Y, Kitamura E, Kasai T. Impact of body composition on sleep and its relationship with sleep disorders: Current insights. Nat Sci Sleep. 2023;375-88.
9. Park HK, Kim J, Shim YS. Association between sleep duration and body composition in girls ten to eighteen years of age: A population-based study. Child Obes. 2020;16(4):281-90.
10. Buysse DJ, Reynolds CF, 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.
11. Sruthi KG, John SM, David SM. Assessment of obesity in the Indian setting: A clinical review. Clin Epidemiol Glob Health. 2023;101348.
12. Johns MW. A new method for measuring daytime sleepiness: The Epworth Sleepiness Scale. Sleep. 1991;14(6):540-5.
13. Yoo EG. Waist-to-height ratio as a screening tool for obesity and cardiometabolic risk. Korean J Pediatr. 2016;59(11):425-31.
14. Jurado-Fasoli L, Amaro-Gahete FJ, De-la-O A, Dote-Montero M, Gutiérrez Á, Castillo MJ. Association between sleep quality and body composition in sedentary middle-aged adults. Medicina (Kaunas). 2018;54(5):91.
15. Fan Y, Zhang L, Wang Y, Li C, Zhang B, He J, et al. Gender differences in the association between sleep duration and body

mass index, percentage of body fat and visceral fat area among Chinese adults: A cross-sectional study. BMC Endocr Disord. 2021;21:1-8.

16. National Family Health Survey (NFHS-5), 2019-2021. India.
17. 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.
18. Kim K, Shin D, Jung GU, Lee D, Park SM. Association between sleep duration, fat mass, lean mass and obesity in Korean adults: The fourth and fifth Korea National Health and Nutrition Examination Surveys. J Sleep Res. 2017;26(4):453-60.
19. Shechter A, Airo M, Valentin J. Effects of continuous positive airway pressure on body composition in individuals with obstructive sleep apnea: A non-randomized, matched before-after study. J Clin Med. 2019;8:8.
20. Sruthi KG, John SM, David SM. Assessment of obesity in the Indian setting: A clinical review. Clin Epidemiol Glob Health. 2023;101348.
21. Morrison M, Halson SL, Weakley J, Hawley JA. Sleep, circadian biology and skeletal muscle interactions: Implications for metabolic health. Sleep Med Rev. 2022;66:101700.
22. Bojanic D, Ljubojevic M, Krivokapic D, Gontarev S. Waist circumference, waist-to-hip ratio and waist-to-height ratio reference percentiles for abdominal obesity among Macedonian adolescents. Nutr Hosp. 2020;37(4):786-93.
23. Jurado-Fasoli L, Amaro-Gahete FJ, De-la-O A, Dote-Montero M, Gutiérrez Á, Castillo MJ. Association between sleep quality and body composition in sedentary middle-aged adults. Medicina (Kaunas). 2018;54(5):91.
24. Kohanmoo A, Kazemi A, Zare M, Akhlaghi M. Gender-specific link between sleep quality and body composition components: A cross-sectional study on the elderly. Sci Rep. 2024;14(1):8113.
25. Kinoshita K, Ozato N, Yamaguchi T, Sudo M, Yamashiro Y, Mori K, et al. Association between objectively measured sedentary behaviour and sleep quality in Japanese adults: A population-based cross-sectional study. Int J Environ Res Public Health. 2022;19(5):3145.
26. Ali MF, Ahsan M. A cross-sectional investigation of sleep habits and selected body composition parameters among university students. Eur J Phys Educ Sport Sci. 2020.
27. Babu R, Bahuleyan B. Correlation of sleep quality with anthropometric parameters in young healthy individuals. Int J Res Med Sci. 2018;6(2):613-7.
28. Gupta P, Srivastava N, Gupta V, Tiwari S, Banerjee M. Association of sleep duration and sleep quality with body mass index among young adults. J Fam Med Prim Care. 2022;11(6):3251-6.
29. Knowles OE, Drinkwater EJ, Urwin CS, Lamon S, Aisbett B. Inadequate sleep and muscle strength: Implications for resistance training. J Sci Med Sport. 2018;21(9):959-68.
30. Mirdha M, Nanda R, Sharma HB, Mallick HN. Study of association between body mass index and sleep quality among Indian college students. Indian J Physiol Pharmacol. 2019;63(1):8-15.
31. Ford ES, Li C, Wheaton AG, Chapman DP, Perry GS, Croft JB. Sleep duration and body mass index and waist circumference among US adults. Obesity (Silver Spring). 2014;22(2):598-607.
32. Hayashi T, Wada N, Kubota T, Koizumi C, Sakurai Y, Aihara M, et al. Associations of sleep quality with skeletal muscle strength in patients with type 2 diabetes with poor glycemic control. J Diabetes Investig. 2023;14(6):801-10.

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