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Sleep: A Modifiable Risk Factor? Sleep Duration and Obesity Burden in U.S. Adults

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Abstract. Obesity remains a major public health challenge globally. Sleep length has been identified as a behaviorally adjustable factor that may influence the risk of obesity. Recent research reveals that the effects of sleeping longer hours remain unclear, but it has been shown that poor sleep is linked to an increase in the prevalence of obesity. This study used data from a nationally representative sample for the period between 2021 and 2023 to examines the relationship between nighttime sleep duration and obesity in the adult population of the United States. The sample size of the dataset is 8,000 participants. Sleep duration is classified into three groups: <6 hours, 6-8 hours, >8 hours. Participants reported their usual hours of nighttime sleep using item SLD012 of the sleep questionnaire. Obesity status was determined by calculating body mass index (BMI) from height and weight data collected in the survey; individuals with a BMI of 30 kg/m² or higher were classified as obese. After controlling for age, sex, and race/ethnicity, we used logistic regression, chi-square tests, and descriptive statistics. Based on the analysis, this study confirmed that participants sleeping <6 hours had the highest obesity prevalence (approximately 48%), compared with those sleeping 6–8 hours (42%) and >8 hours (39%). Sleep duration and obesity were significantly correlated ($p<0.001$), according to chi-square tests. Short sleepers had considerably higher risks of obesity than regular sleepers, according to logistic regression result. There is currently no clear evidence showing a direct connection between long sleep duration and obesity. In contrast, studies have found that getting too little sleep may raise the chance of getting obesity among U.S. adults. These findings emphasize how crucial it is to get the right amount of sleep to prevent becoming overweight.

Keywords: Sleep Duration, Obesity, Public Health

1. Introduction

Over 40% of American people suffer from obesity, making it a serious public health concern [1]. Chronic illnesses like type 2 diabetes, heart disease, and several types of cancer are exacerbated by it [2]. In addition to diet and physical activity, sleep has emerged as a potentially important behavioral determinant of obesity [3]. Reduced energy expenditure, increased hunger, and metabolic dysregulation have all been related to short sleep duration [4]. While numerous studies have reported associations between insufficient sleep and obesity, fewer have examined long sleep duration, with mixed findings regarding its relationship with adiposity [5]. Given changing sleep

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patterns in modern societies, investigating the sleep–obesity relationship remains a timely public health priority. By demonstrating a clear association between sleep duration and the risk of overweight in the US adult population, this article provides evidence to support the integration of sleep health promotion into existing obesity prevention and health management efforts. This study also guides future research directions by emphasizing the need to advance the mechanistic understanding of how sleep duration contributes to the development of obesity.

2. Methodology

2.1. Data source

The National Health and Nutrition Examination Survey (NHANES) is a program of studies conducted by the National Center for Health Statistics (NCHS) designed to assess the health and nutritional status of adults and children in the United States. NHANES combines interviews and physical examinations and employs a complex, multistage probability sampling design to ensure national representativeness [6]. For this analysis, we used data from the 2021–2023 cycle.

2.2. Measures

Self-report data on length of sleep was collected using the questionnaire item SLD012, "Estimate your usual nightly duration of sleep on workdays." Responses were recorded in hours. Sleep durations were classified as short (less than six hours), normal (6–8 hours), and long (more than eight hours).

Height and weight measurements from the Body Measures Examination (BMX) were used to compute the body mass index (BMI). A BMI equal or exceed 30 kg/m^2 was deemed obese. RIDRETH3 categories were used to alter for age as a continuous measure, sex (male/female), and race/ethnicity.

2.3. Statistical analysis

Descriptive analyses were conducted to estimate mean BMI and Obesity prevalence across sleep duration categories. The chi-square test was used to analyze differences between groups. The odds ratio (OR) for obesity across different sleep durations and its 95% confidence interval were calculated using a logistic regression model that controlled for factors such as age, gender, and race/ethnicity. Analyses were conducted using Python 3.11 with pandas, stats models, and SciPy libraries. Sampling weights were not applied in this preliminary analysis; however, NHANES recommends the use of weights in population-level inference.

2.4. Results

In first table, Participants sleeping less than 6 hours had the highest mean BMI and obesity prevalence, whereas those sleeping more than 8 hours had the lowest obesity prevalence. Chi-square tests confirmed significant variation in obesity prevalence across sleep categories (χ^2=25.16, $p<0.001$). Logistic regression results (Table 3) indicate that, relative to 6–8-hour sleepers, short sleepers had 33% higher odds of obesity. Long sleepers did not differ significantly from normal sleepers. Figure 1 illustrates obesity prevalence by sleep category.

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Table 1. Descriptive statistics by sleep duration

SLEEP_CAT	N	Mean_BMI	Obesity_Rate
<6h	1000	30.6	0.466
6–8h	3322	29.327	0.387
>8h	2129	29.156	0.376

N, mean BMI, and obesity prevalence across sleep categories (see attached Excel for details).

Note: N = weighted sample size; BMI in kg/m²; obesity defined as BMI ≥30

Table 1 summarizes the descriptive statistics across sleep duration categories. Participants sleeping fewer than 6 hours had the highest mean BMI (30.6 kg/m²) and the highest obesity prevalence (46.6%). In comparison, those sleeping 6–8 hours and more than 8 hours had lower mean BMIs and lower obesity prevalence rates.

Table 2. Contingency table and Chi-square

Sleep Category	Non-obese	Obese
<6h	534	466
6–8h	2035	1287
>8h	1329	800

Chi-square test: χ^2=25.16, df=2, p<0.0001

Cross-tabulation of sleep duration by obesity status

Table 2 presents obesity status across different sleep duration categories. Individuals who reported sleeping fewer than 6 hours showed the greatest proportion of obesity, followed by those with 6–8 hours of sleep and those exceeding 8 hours. Chi-square analysis indicates that differences in obesity rates among sleep duration groups are not evenly distributed, with the highest obesity rate observed among short sleepers.

Table 3. Logistic regression results

term	coef	OR	CI_low	CI_high	p_value
Intercept	-0.428	0.652	0.521	0.814	0.0
C(SLEEP_CAT) [T.<6h]	0.282	1.326	1.145	1.535	0.0
C(SLEEP_CAT) [T.>8h]	-0.095	0.909	0.811	1.019	0.102
C(SEX)[T.Male]	-0.229	0.795	0.717	0.881	0.0
C(RACE) [T.2]	-0.378	0.685	0.54	0.87	0.002
C(RACE) [T.3]	-0.345	0.709	0.583	0.861	0.001
C(RACE) [T.4]	0.087	1.091	0.867	1.372	0.458
C(RACE) [T.6]	-1.79	0.167	0.117	0.238	0.0
C(RACE) [T.7]	-0.272	0.762	0.584	0.995	0.046
RIDAGEYR	0.008	1.008	1.005	1.011	0.0

Odds ratios for obesity by sleep duration, age period, sex, race and ethnicity.

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Table 3 presents the modified odds ratios for obesity by sleep duration. Short sleepers remained more prone to obesity than adults sleeping 6–8 hours, even with demographic controls applied. Conversely, there was no meaningful association between sleeping more than 8 hours and obesity.

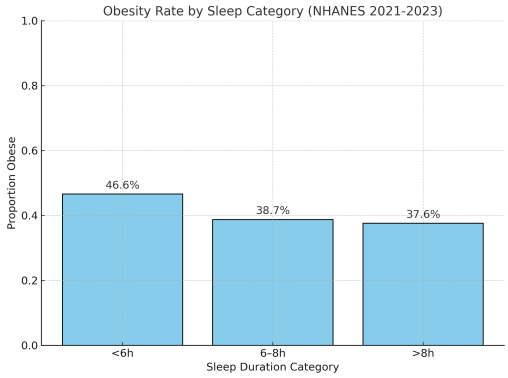


Figure 1. Obesity prevalence by sleep duration

Bar chart showing obesity prevalence (%) by sleep duration categories. Figure 1 displays the proportion of obesity across three sleep duration categories. The prevalence of obesity is highest in the <6 h group, with lower and relatively similar rates observed in the 6–8 h and >8 h groups. The visual trend indicates that shorter sleep duration is associated with a higher likelihood of obesity among U.S. adults.

3. Discussion

The study provides contemporary evidence linking short sleep duration with increased obesity risk among U.S. adults using NHANES 2021–2023 data. Short sleepers (<6h) exhibited significantly higher odds of obesity compared to normal sleepers (6–8h), independent of age, sex, and race/ethnicity. These findings are consistent with prior NHANES-based analyses and longitudinal studies showing that sleep curtailment predisposes individuals to weight gain [3,5].

Several biological mechanisms may underlie this relationship. Lack of sleep is linked to changes in hormones that control hunger, such as decreased leptin and increased ghrelin, which raise calorie intake [4]. Sleep restriction may also impair glucose metabolism, increase evening cortisol, and reduce physical activity due to fatigue [7]. On the other hand, while some studies have found increased risks at both extremes of sleep length, the observed non-significant link between obesity and long sleep (>8h) is consistent with earlier research [8]. The reasons for long sleep remain less clear, potentially reflecting underlying health conditions, depression, or socioeconomic factors.

The study's strengths include the use of objective BMI assessments as well as recent, nationally representative data. Due to reliance on self-reported sleep duration and the use of a cross-sectional study design, no conclusions regarding causality can be drawn. Furthermore, potential confounding factors such as socioeconomic status, physical activity levels, and dietary habits were excluded, resulting in certain limitations.

4. Conclusion

In conclusion, People have a short total sleep time is negatively correlated with obesity among American adults. These findings indicate that adequate sleep is a variable for preventing obesity. Besides traditional strategies such as nutrition and exercise, sleep hygiene education should be

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incorporated in public health initiatives. Although this study achieved its main goal, it also has several limitations: sleep duration was measured through self-reporting, which may lead to measurement errors; and the factors related to sleep quality, sleep duration, and sleep disorders were not examined, and further research is urgently needed. Future studies that integrate these dimensions will help to comprehensively understand the mechanism by which sleep affects obesity outcomes.

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