

**REVIEW ARTICLE**

# Sleep Less, Weigh More: Unraveling the Sleep-Obesity Connection in Adult

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**ABSTRACT**

**Background:** Obesity is an increasingly complex and common global health problem, especially among adults. The aim of this scoping review is to examine the relationship between sleep duration and obesity in adults.

**Methods:** A scoping review was conducted following the Joanna Briggs Institute (JBI) methodology guideline. Databases including PUBMED, ScienceDirect, DOAJ, and ResearchGate were searched in 2024 with the keywords "obesity AND sleep AND adults". Articles published between 2019 and 2023 that focused on observational studies. **Results:** Of the 2960 articles found, 7 articles met the inclusion criteria. A cross-sectional research design was used by 86% of the studies, while only 14% were enrolled in cohort studies. The majority of studies showed a significant correlation between short-term and long-term sleep duration and the likelihood of becoming obese. The assessment tools used were extensive and included interviews, questionnaires, and sleep monitors such as the Actiwatch Spectrum. The obesity assessment indicators used are Body Mass Index (BMI) and waistline. **Conclusions:** The review suggests that adults whose sleep is too short or too long are more likely to be obese. Lack of sleep can trigger hormonal changes, stimulate appetite, and result in obesity.

**Keywords:** Adult, Hormonal Regulation, Metabolic Health, Obesity, Sleep Duration

**INTRODUCTION**

Obesity is a complex and escalating global health issue. In 2022, one in eight people globally was affected by obesity, with 16% of adults over 18 living with the condition and 43% classified as overweight. Since 1990, adolescent obesity has tripled, and adult obesity has more than doubled worldwide, resulting in 2.5 billion adults being overweight, 890 million of whom suffer from obesity (WHO, 2024). Obesity which characterized by an excessive accumulation of body fat that poses serious health risks, including type 2 diabetes, cardiovascular diseases, and certain cancers (Al Kibria et al., 2019; Safaei et al.,

2021). According to the World Health Organization (WHO), obesity is classified as a chronic condition, with its prevalence steadily rising, particularly among adults (WHO, 2024). In Indonesia, data from the based on Basic Health Research (Riskesdas) data, the prevalence rate of obesity in Indonesian adults has increased from 2007 with a percentage of 10.5% (Kemenkes RI, 2007), then in 2013 it continued to increase to 14.8% (Kemenkes RI, 2013), and in 2018 it increased to 21.8% (Kemenkes RI, 2018). This escalation can be attributed to a confluence of factors, including lifestyle changes, dietary habits, and reduced physical activity levels (Dhawan & Sharma, 2020).

Sleep plays a crucial role in maintaining overall health, influencing physical, emotional, and cognitive well-being (Kemenkes RI, 2013). Recent studies have highlighted the importance of adequate sleep duration, quality, and timing as essential components of a healthy lifestyle (Loredo et al., 2019; Morales-Ghinaglia & Fernandez-Mendoza, 2023). Insufficient sleep has been linked to a range of health issues, including obesity, which is characterized by excessive fat accumulation that poses significant health risks (Medic et al., 2017). Research indicates that both short (<7 hours) and long sleep durations (>9 hours) can disrupt metabolic processes, leading to weight gain and increased obesity risk (J. P. Chaput et al., 2020; Hirshkowitz et al., 2015). This relationship is particularly concerning in modern societies, where lifestyles often prioritize productivity over rest. Therefore, understanding the nuances of sleep duration is vital for developing effective interventions to combat obesity.

A body of research has consistently shown that sleep deprivation triggers hormonal changes that can stimulate appetite, particularly for high-calorie foods (Medic et al., 2017). This hormonal imbalance, characterized by elevated ghrelin levels and reduced leptin levels, can lead to increased caloric intake and poor dietary choices (Lin et al., 2020; Morin et al., 2018). Furthermore, sleep deprivation is associated with metabolic disturbances, including impaired glucose tolerance and insulin sensitivity, which promote weight gain (Parameswaran & Ray, 2022). Despite the wealth of studies, findings have been inconsistent, with some research suggesting no significant correlation between sleep duration and obesity (Tanvir et al., 2023; Vgontzas et al., 2014).

Despite the growing body of literature on obesity and its determinants, there is a notable scarcity of studies specifically focusing on the relationship between sleep duration and obesity. Most existing research primarily emphasizes

dietary and lifestyle factors, leaving a gap in understanding how sleep patterns contribute to obesity rates. Additionally, the limited studies that do address sleep often lack comprehensive data on various demographic groups, particularly among adults. This gap highlights the need for targeted research that explores the specific impacts of sleep on obesity, providing insights that could inform public health strategies tailored to this population. This scoping review aims to bridge that gap by systematically analyzing existing studies and providing a comprehensive overview of the relationship between sleep duration and obesity. The finding is essential for public health practitioners and policymakers by highlighting the critical role of sleep in obesity prevention strategies, ultimately contributing to improved health outcomes in the population.

## METHODS

This scoping review was conducted in accordance with the Joanna Briggs Institute (JBI) guidelines for scoping reviews (Santos, Secoli, & Püschel, 2018) and utilized the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) to ensure a systematic and transparent approach. The study aimed to examine the relationship between sleep duration and obesity among adults through a systematic review methodology. A comprehensive literature search was performed across multiple electronic databases, including DOAJ, ScienceDirect, ResearchGate, and PubMed, using keywords structured around the PCC framework (Population, Concept, Context). Specifically, the framework was defined as P: Adults, C: The link between sleep duration and obesity, and C: Obesity in adults. In the literature search, the keywords used in English are "obesity AND sleep AND adult" which have been adjusted according to the keywords in the electronic database used.

The review was guided by four key research questions: (1) What is the prevalence of obesity among adults? (2) What measurement tools are used to assess sleep duration in adults? (3) What indicators are used in obesity assessment? (4) What is the relationship between sleep duration and obesity?

The literature selection process was conducted systematically to ensure the included studies were relevant to the topic of this scoping review. The selection of literature studies was based on predetermined inclusion and exclusion criteria (Table 1).

**Table 1.** Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Observational study articles	Not observational study articles
Articles published within 5 years (2019-2023)	Articles not published within 5 years (2019-2023)
Free full text	Article is not fully accessible
English studies	Studies not in English
Studies involving adult aged 18 years and above	Studies not involving adult aged 18 years and above
The article discusses the relationship between sleep duration and obesity	The article does not discuss the relationship between sleep duration and obesity.
The article contains information on sleep duration measurement tools, obesity assessment indicators, and the prevalence of obesity in adults.	The article did not contain information on sleep duration measurement tools, obesity assessment indicators, and prevalence of obesity in adults.

The quality of the included articles was assessed using the JBI Critical Appraisal Checklist for Analytical Cross-Sectional Studies to ensure methodological rigor. The assessment found that most of the articles met the checklist criteria.

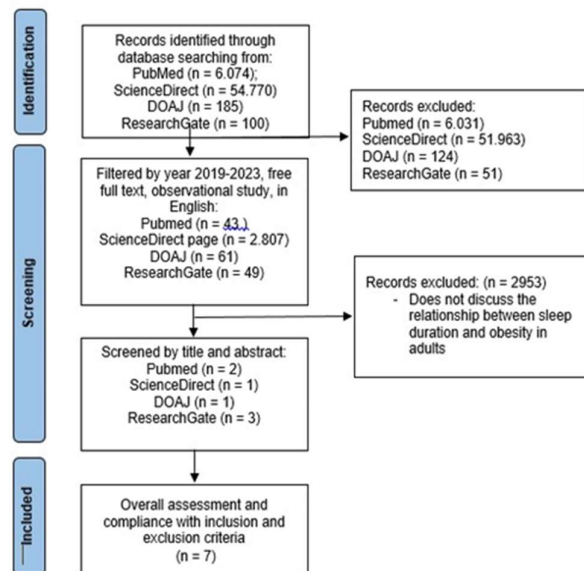
The findings were compiled and summarized in Table 2, which was designed to align with the study's objectives. This table provided a structured overview of the assessment tools used to measure sleep duration, the indicators employed in obesity assessment (e.g., BMI and waist circumference), the prevalence of obesity among adults, and the association between sleep duration and obesity. The synthesis of these findings highlighted the complexity of the relationship between sleep duration and obesity, emphasizing the need for multifaceted approaches in both research and intervention strategies. By systematically organizing and analyzing the data, this review offers a comprehensive understanding of the topic, serving as a valuable resource for future studies and public health initiatives.

## RESULTS AND DISCUSSION

During the search process, 2960 titles were found. After identification by abstract, 7 articles were selected and included in the final review. Of the 7 studies analyzed, 6 studies (86%) used a cross-sectional design, while 1 study (14%) used Cohort design. These studies included an assessment of sleep duration, indicators are used in obesity assessment, prevalence of adult obesity and the link between sleep duration and obesity in adults (Figure 1).

A total of seven studies in this review investigated the assessment of sleep duration and its relationship with obesity in adults. These studies employed a variety of tools to measure sleep duration, including the Mexican National Health and Nutrition Survey (ENSANUT), interviews, structured questionnaires, the Pittsburgh Sleep Quality Index (PSQI), online questionnaires using Google Forms, and Actiwatch Spectrum (Philips Respironics). To assess obesity, all seven studies utilized Body Mass Index (BMI) as the primary metric, which classifies individuals based on weight and height

to identify obesity risk. Additionally, four studies incorporated waist circumference as a supplementary indicator (Kolovos et al., 2021; Yao et al., 2022; Kshatri et al., 2022; Loredo et al., 2019), providing insight into abdominal fat distribution, which is closely linked to metabolic health risks. The combination of BMI and waist circumference enhances the robustness of the findings, acknowledging that obesity is a multifaceted condition best understood through multiple measurements. This dual approach not only enriches the research but also highlights the complex interplay between sleep duration and obesity, informing future studies and interventions.



**Figure 1.** Scoping Review flowchart

The prevalence of overweight and obesity varied significantly among participants across the studies. One study found that 78.2% of participants were overweight, with 73.61% having general obesity and 72.39% abdominal obesity (Kolovos et al., 2021). Another study reported that 100% of participants were obese (Kshatri et al., 2022), while a different study found that 43% of participants were obese, with 62% of them having abdominal obesity (Kshatri et al., 2022). Furthermore, an association between sleep duration and overweight/obesity was observed,

with the prevalence of overweight/obesity reaching 34.4% in individuals with short sleep duration, 11.7% in those with normal sleep duration, and 15.2% in individuals with long sleep duration (Tanvir et al., 2023). Additionally, one study highlighted that 11.89% of students who regularly consumed coffee and had short sleep duration were obese, compared to 8.76% of non-coffee-drinking students with longer sleep duration who were obese (Utami & Ayuningtyas, 2023).

Among the seven studies, six found a significant association between sleep duration and obesity, indicating that both too short and too long sleep patterns are associated with an increased risk of obesity (Kolovos et al., 2021; Kshatri et al., 2022; Loredo et al., 2019; Momayyezi et al., 2022; Tanvir et al., 2023; Yao et al., 2022). However, one study concluded that there was no significant association between sleep duration and obesity, suggesting that results may vary based on other influencing factors (Utami & Ayuningtyas, 2023). These findings underscore the complexity of the relationship between sleep duration and obesity, emphasizing the need for further research to explore additional variables that may contribute to this association.

These studies highlight a pressing public health issue given the rising obesity rates in the country. Our findings indicate a consistent association between inadequate sleep and an increased risk of obesity, as evidenced by the studies included in the review. The predominant use of BMI as an obesity indicator highlights its role in identifying individuals at risk of weight-related health issues. Furthermore, the inclusion of waist circumference in some studies underscores the importance of assessing fat distribution, which provides deeper insights into the metabolic consequences of obesity. Together, these indicators allow for a more nuanced understanding of how sleep patterns may influence various aspects of body composition.

**Table 2.** Selected articles on sleep duration and obesity in adult

Country; authors	Study Design	Sleep Duration Assessment Tool	Obesity Assessment Indicator	Sample Size	Participants Characteristics	Result
Mexico; (Kolovos et al., 2021)	Cross-sectional study	Mexican National Health and Nutrition Survey (ENSANUT) which contains two components: Sleep duration for a day Symptoms of insomnia and the length of time they have experienced these symptoms	BMI and waistline  BMI Classification: 1. Underweight: <18,49 2. Normal: 18,5 - 24,9 3. Overweight: 25-29,9 4. Grade I obesity: 30-34,9 5. Grade II obesity: 35-39,9 6. Grade III obesity: >40	6419	Adults Age = above 20 years and have complete records of BMI, physical activity, and sleep duration.	Compared to normal weight participants, participants in obesity category II spent an average of 0.60 hours per day in front of a screen (95% CI 0.36-0.84, p=0.001), and participants in obesity category III spent 0.54 hours per day (95% CI 0.19-0.89, p=0.001). Obese II participants experienced a decrease in sleep time by 0.55 hours per day (95% CI (- 0.67)-(- 0.43), p < 0.001) and obese III participants had a lower propensity to engage in strenuous activity (OR=0.60, 95% CI (-0.43)-0.84, p=0.003) or walking (OR=0.65, 95% CI 0.49-0.88, p=0.005).
Yazd, Iran; (Momayyezi et al., 2022)	Cross-sectional study	Interviews by trained interviewers covering typical sleep times, morning wake up time, periodic limb movements in sleep (PMLS), nap duration and sleeping pill consumption	BMI 1. Underweight: <18,5 2. Normal: 18,5-25 3. Overweight: 25-30 4. Obesity: >30	9533	Adults Age = 35-70 years old living in the Yazd region cities of Shahideh, Zark, and Ashkezar.	Long-term sleep (>8 hours) was correlated with high cholesterol (p=0.009) and triglycerides (p=0.009). In addition, sleep latency or duration correlated with elevated cholesterol (r=0.03, p=0.004), triglycerida (r=0.04, p=0.001), and LDL-c (r=0.04, p=0.001) Increase sleep duration was proportional to a decrease in BMI (p=0.21). Sleep latency >15 minutes (p=0.006), PLMS (p=0.001), sleeping during the day (p=0.001), or taking sleeping pills regularly had a higher BMI.

China; F. Yao et al., 2022	Cohort study	Structured questionnaire	BMI and waistline BMI: 1. Overweight $\geq 23$ 2. Obesity $\geq 27,5$ Waistline (abdominal obesity): 1. Men $\geq 90$ cm 2. Women $\geq 80$ cm	9061	Adults Age = above 45 years from CHARLS (2011-2015)	Napping for 0-30 minutes and more than 30 minutes can reduce the risk of overweight by 30% (HR: 0.70, 95% CI: 0.56-0.87) and 35% (HR: 0.65, 95% CI: 0.55-0.78) compared to people who do not nap. The risk of abdominal obesity was also lower in naps (HR: 0.68, 95% CI: 0.48-0.96) for 0-30 minutes and HR: 0.73, 95% CI: 0.59-0.91) for more than 30 minutes, especially in women and middle-aged people. Individuals who slept 5-7 hours a night had a lower risk of being overweight (HR: 0.59, 95% CI: 0.47-0.74). In contrast, long night sleep duration negatively impacted abdominal obesity in the elderly (HR: 2.33, 95% CI: 1.35-4.04) and men (HR: 2.24, 95% CI: 1.17-4.29). Participants with less than adequate sleep (<7 hours/day) showed an increased risk of overweight (HR: 1.13, 95% CI: 1.00-1.28), which was also found in the middle-aged. Population that was overweight due to insufficient sleep was approximately 10.77%.
India; Ankita, et al., 2022	Cross-sectional study	Pittsburgh sleep quality index (PSQI)	BMI and waistline BMI: Obesity $\geq 25$ Waistline: Obesity $\geq 102$ cm	100	Obese adult male Age = 18-60 years	Global mean PSQI score for the metabolically healthy obese group was $6.65 \pm 3.58$ , while that for the metabolically abnormal obese group was $8.24 \pm 3.60$ . There was a statistically significant difference indicating that the obese group with abnormal metabolism experienced poorer sleep quality compared to the metabolically healthy group.

Indonesia; Utami, Ayuningtyas, 2023	Cross-sectional study	Online questionnaire using google forms	BMI Classification (Ministry of Health, 2014): 1. Underweight: <18,5 2. Normal: 18,5-25 3. Overweight: 23,1-27 4. Obesity: >27	459	Adults Age = 18-20 years = 354 21-23 years = 102 24-26 years = 3	In this study, the duration of sleep (<7 or ≥7 hours per day) did not show a significant relationship with nutritional status (p>0,05). There is no strong evidence to suggest that the length of a person's sleep affects whether they have a good or poor nutritional status that can lead to obesity.
United States; Loredo et al., 2019	Cross-sectional study	Over a 7-day period, the sample was fitted with a Spectrum Actiwatch (Philips Respironics) on the non-dominant wrist and sleep duration was recorded in a diary.	BMI and waistline BMI: Obesity ≥ 30 kg/m2  Waistline (abdominal obesity): 1. Men > 102 cm 2. Women >88 cm	2156	Adults in several cities in the United States (San Diego, California; Chicago, Illinois; Bronx, New York and Miami, Florida)  Age = 18 – 64 years	Each one-hour decrease in sleep duration was associated with a 4.1% (95% CI, 1.6-6.6; p=.002) increase in obesity prevalence and a 3.6% (95% CI, 1.1-6.1) increase in heart disease prevalence. abdominal obesity. The prevalence of heart disease increased by 3.6% (95% CI, 1.6-6.6; p= .007). This decrease was also associated with an increase in BMI by 0.67 kg/m <sup>2</sup> (95% CI 0.30 to 1.10, p=.001) and waist circumference by 1.5 cm (95% CI 0.5 to 2.5, p=.002).
India; Tanvir M et al., 2023	Cross-sectional study	Structured questionnaire	BMI BMI Category (WHO 2013): 1. Underweight <18,5 2. Normal 18,5-25 3. Overweight 25-30 4. Obesity >30	100	Adults Age = 18-30 years	This study found a significant association between short sleep and an increase in overweight or obesity. In addition, the percentage of sleep deprived people who had prehypertension or hypertension was significantly increased, with a p value of 0.029. In addition, the percentage of prehypertension and hypertension among overweight or obese people increased significantly, with a p value of <0.001.

The studies reviewed suggest that sleep deprivation is linked to hormonal imbalances that can promote weight gain, particularly through increased appetite and cravings for high-calorie foods. Disruptions in hormones such as ghrelin and leptin, responsible for regulating hunger and satiety (J.-P. Chaput et al., 2023), were noted in several studies, indicating that poor sleep may lead to overeating (Liu et al., 2022; Mosavat et al., 2021). Interestingly, the relationship between sleep duration and obesity was different. Some studies indicated that both insufficient and excessive sleep could contribute to weight gain (J. P. Chaput et al., 2020; Liu et al., 2022; Mahdieh Momayyezi, Hossein Fallahzadeh, Leila Fakhravari, 2021; Rodrigues et al., 2021; Yao et al., 2022). This complexity emphasizes that both extremes of sleep duration warrant attention in public health discussions. Research consistently demonstrates the crucial role of sleep duration in regulating metabolism and appetite. Both insufficient sleep (<7 hours) and excessive sleep (>9 hours) can disrupt hormonal balance, particularly affecting ghrelin and leptin levels, which control hunger and satiety (Kim et al., 2015; Li et al., 2023; Mosavat et al., 2021).

Sleep deprivation has been associated with decreased insulin sensitivity, impaired glucose tolerance, and increased diabetes risk (Parameswaran & Ray, 2022). Epidemiological studies have shown a correlation between short sleep duration and obesity, supporting the hypothesis that inadequate sleep contributes to weight gain (Caples, 2013; Liu et al., 2022; Tanvir et al., 2023). Furthermore, sleep dysregulation can negatively impact energy metabolism through alterations in neuroendocrine and autonomic nervous systems (Liu et al., 2022). Circadian disruption, often caused by shift work or travel, may lead to impaired glucose and lipid homeostasis, affecting overall metabolic health (Mosavat et al., 2021; von Schantz et al., 2021). These findings emphasize the importance of maintaining appropriate sleep duration for

preventing hormonal imbalances and metabolic disorders. Understanding these dynamics is crucial for developing effective interventions aimed at obesity prevention.

In examining the implications of these findings, it is essential to consider the broader socio-cultural context. Rapid urbanization, lifestyle changes, and shifting dietary patterns have created an environment conducive to weight gain, which is further exacerbated by sleep deprivation (Baez et al., 2023; Macicame et al., 2021; Thapa et al., 2024). The interplay of these factors highlights the need for comprehensive public health strategies that address sleep alongside lifestyle modifications. Educating the population about the importance of adequate sleep, healthy eating, and regular physical activity can help mitigate the rising obesity rates. Such initiatives can foster a holistic approach to health and well-being.

However, the limited number of studies specifically focusing on adult population presents a significant gap in the existing literature. While the findings are compelling, they should be interpreted with caution due to variability in study designs and methodologies. Future research should aim to include larger and more diverse samples, employing longitudinal designs to better understand the causal relationships between sleep duration and obesity. Additionally, exploring other potential mediating factors, such as stress and lifestyle habits (Jakubiak et al., 2021), could further clarify the complexities of this relationship.

Finally, this review highlights the critical need for increased awareness of the relationship between sleep duration and obesity in adult. The findings suggest that promoting healthy sleep patterns could serve as an effective strategy in combating the rising tide of obesity. As public health initiatives evolve, integrating sleep education into broader health campaigns may enhance their effectiveness. By addressing this multifaceted issue, it could contribute to

improved health outcomes and a better quality of life for adults. Ultimately, a comprehensive approach that considers both sleep and lifestyle factors is essential for tackling obesity in this population.

## CONCLUSIONS

There is a significant association between sleep duration and obesity in adults. These findings indicate that both insufficient sleep and excessive sleep can increase the risk of obesity, so it is important to maintain a balance in sleep patterns. Therefore, it is recommended that public health initiatives include the promotion of healthy sleep patterns as part of obesity prevention strategies. The implications of these findings underscore the need for health policies that integrate sleep as an important component in efforts to improve overall health. In addition, more research is needed to understand the mechanisms that link sleep and obesity and other factors at play, so that they can lead to more effective interventions in different populations.

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