



## SLEEP DEFICIENCY AS A RISK FACTOR FOR HYPERTENSION: A SYSTEMATIC REVIEW

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### ABSTRACT

The importance of sleep to one's physical, mental, and emotional health cannot be overstated. In addition to contributing to neurological and psychological issues, a lack of sleep has also been shown to negatively affect the cardiovascular system, according to research in the literature. Heart disease (CVD) risk factors such as hypertension, obesity, diabetes, and dyslipidemia have been linked to decreased sleep quantity and quality. We searched PubMed, Web of Science, Science Direct, EBSCO, and the Cochrane library. Using Rayyan QCRI, study papers were first screened by title and abstract before a full-text analysis was done. Results: This review covered a total of 8 research, with participants ranging in age and sex. More than half were male. In all included studies, the hypertension prevalence was obtained and then studied concerning sex and age group. Different methods of measuring sleep duration were used in the included studies, but they are all valid. The key finding of the majority of the research under consideration is that adolescents with short sleep duration had elevated blood pressure. Long periods of sleep may be linked to high blood pressure, although the evidence does not make this connection evident.

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### Introduction

Despite advancements in knowledge, care, and management of the condition, the prevalence of hypertension has grown during the last ten years [1]. Leading causes of cardiovascular disease, stroke, renal damage, and disability include hypertension [2]. Significant health and financial advantages come from early identification, timely treatment, and improved control of hypertension. There are many risk factors responsible for hypertension in adults and adolescents. These factors include the integration and accumulation of genetic and environmental factors [3].

Some of the current strategies being considered to reduce the risk of hypertension include maintaining a healthy body weight (BMI = 18.5-24.9 kg/m<sup>2</sup>) and waist circumference (102 cm for men and 88 cm for women), addressing behavioral risk factors like an unhealthy diet, harmful alcohol use, lack of exercise, and smoking, adhering to a diet including more fruit and vegetables, low-fat dairy products, and limiting sodium intake from all sources.

Our lives are essentially one-third taken up by the physiological process of sleep. Due to the accelerated pace of modern life, the average nightly sleep duration has decreased considerably. Sleep deprivation has long been associated with neurocognitive impairment, physical strength, skill attenuation, and increased impaired judgment [4, 5]. However, excessive long sleep may also lead to health injury. Several studies have reported an association between sleep duration and chronic conditions, including type 2 diabetes, obesity, atherosclerosis, and hypertension [6, 7]. Numerous studies have revealed a link between the length of sleep and hypertension. The first research to demonstrate that the relationship between sleep length and hypertension followed a U-shaped curve found that sleep duration of 7 or >8 h was related to an elevated risk of hypertension [8].

The correlation between sleep disturbances and blood pressure readings is significant since high blood pressure may be a cardiovascular risk factor that may be modified. Long-term exposure to brief sleep intervals may contribute to the development

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and maintaining cardiovascular and vascular effects of hypertension consequences [9]. both heart rate and blood pressure exhibit an everyday trend, with sleep having a low-level reading. With the commencement of sleep, blood pressure progressively drops and then stays low until the waking moment, when it abruptly rises [10]. Therefore, sleeping less each night would result in higher average 24-hour blood pressure and heart rate. prolonged contact with heightened activity of the sympathetic nervous system and awakening pressures both physical and psychological would also follow from shorter sleep lengths. It has been demonstrated that increased stress increases salt intake while decreasing renal salt-fluid excretion. Short sleep durations and increased total 24-hour hemodynamic load over time may cause anatomical changes, including the remodeling of the left ventricle and arteries, that eventually reset the entire circulatory system to function at a raised pressure equilibrium. Through extended exposure to heightened 24-hour blood pressure and heart rate, elevated sympathetic nervous system activity, awake physical and psychological stresses, and increased salt retention, habitually short sleep durations may contribute to the development and maintenance of hypertension. Numerous studies have already demonstrated that, in children, adolescents, and adults, the length of sleep is a significant risk factor for developing hypertension and other cardiometabolic illnesses [11-13]. However, several in-depth investigations using objective sleep measurement techniques, such as polysomnography, found no link between senior people's high blood pressure and their short sleep duration [14-16]. In this systematic review study, we discuss the previously reported relation between hypertension and sleeping duration in previously published studies in the database.

### *Objectives*

To examine the epidemiological data supporting the link between teenage blood pressure and sleep duration.

### **Materials and Methods**

The established procedures were followed in conducting this systematic review (Preferred Reporting Items for Systematic Reviews and Meta-Analyses, PRISMA).

### *Study Design*

This was a thorough analysis and meta-analysis.

### *Study Duration*

Between July and August of 2022, the study was carried out.

### *Study Condition*

This evaluation examines the published works that have been written about the relationship between short-time sleeping and hypertension among adults and adolescents and how sleeping deprivation can be a major risk factor for hypertension.

### *Search Strategy*

To find the relevant literature, a thorough literature search was done in five main databases, including PubMed, Web of Science, Science Direct, EBSCO, and Cochrane Library. Our search was restricted to the English language, and it was customized as needed for each database. The following keywords, which were converted into Mesh terms in PubMed, were used to identify the appropriate studies; "sleeping, sleep deprivation, blood pressure, short sleep duration, night sleeping, hypertension, and hypertensive." The "OR" and "AND" Boolean operators were combined with the pertinent keywords. English, full-text publications, publicly accessible papers, and human trials were all included in the search results.

### *Selection Criteria*

Studies meeting the following criteria were included in our review:

- Cohort and retrospective cohort studies, as well as research methods that provide qualitative or quantitative information regarding the relation between short-duration sleeping and hypertension.

The following was listed as an exclusion criterion:

- Studies not carried out in English.
- Studies are not available for free.

### *Data Extraction*

To identify the duplicate components of the search strategy results, we employed Rayyan (QCRI) [11]. By filtering the combined search results according to a set of inclusion/exclusion criteria, the researchers assessed the adequacy of the titles and abstracts. The reviewers evaluated each paper's entire text which satisfied the inclusion requirements. The authors engaged in discussion to settle any disagreements. A form for data extraction was made to include the qualified. The study titles, authors, year, population, participant count, gender, incidence, paralytic ileus risk variables, and main findings were all retrieved by the authors.

*Risk of Bias Assessment*

To evaluate the caliber of the included research, the qualitative data synthesis employed the ROBINS-I technique for non-randomized studies [17]. Any anomalies in the quality rating were looked into and corrected by the reviewers.

*Strategy for Data Synthesis*

Summary tables were presented to give a qualitative summary of the included study components and data on the results, including the information gathered from the accepted research. Decisions on the best way to use the data from the included study articles were determined after the systematic review's data extraction process was complete. Studies that complied with the full-text standards but lacked any information on the relationship between sleeping time and hypertension were omitted.

**Results and Discussion***Search Results*

All in all, 220 research papers were extracted based on a thorough search, and 53 duplicates were eliminated. screening of titles and abstracts was done on 25 studies, 20 of which were eliminated. One hundred and twenty-two Only 30 of the reports that were requested for recovery were unsuccessful. 20 articles were removed due to incorrect research outcomes after 92 papers had been screened for full-text evaluation. 38 were excluded for unavailable data on the incidence of epileptic seizures, and 42 were excluded for the incorrect population. This systematic review contained eight appropriate study papers.

*Characteristics of the Included Studies*

All 8 studies were included in this review. The main topic of most of these studies ranged from the relation between sleeping time, sleeping deprivation, short sleeping duration, and hypertension was included among them. Five studies were cross-sectional [16-20], while three were designed longitudinally [21-23]. The studies' samples ranged in size from 2887 to 43 655 people. Different age groups were studied, including the elderly, adults, and adolescents. Three studies were conducted in China [17, 18, 20] and one in the United States [19].

In the **Table 1**, we included the summary of previous studies with their main objectives, key findings, and the year of publication.

**Table 1.** Summary of characteristics of the included studies

Study	Study design	Location	Sample	Study Objective	Key findings
Su <i>et al.</i> , 2022 [16]	Cross-sectional study	NHANES	Total: 2887 Males: 1378 Females: 1509	to investigate the relationship between the amount of sleep a person gets on workdays and their blood pressure, specifically their systolic and diastolic pressure, in non-overweight and non-obese populations.	Both short sleep length (6 h) and long sleep duration (8 h) on workdays were connected with higher levels of SBP in the non-overweight/obese population, especially in females. In elderly people, shorter sleep durations (6 h) were linked to increased SBP. Sleep length (6 h or 8 h) was similarly linked to higher SBP in Whites as compared to other ethnic groups.
He and He, 2022 [18]	Cross-sectional study	Southwest China	Total: 20,053	to assess the relationship between adult adults' hypertension and length of sleep in southwest China.	The findings of this study indicate that a short sleep duration (6 h/day) is a risk factor for hypertension in individuals in southwest China and is an independent risk factor. Thus, hypertension is more prevalent in those who sleep for fewer than six hours per day, suggesting that getting enough sleep may help prevent hypertension. The findings of this study have some bearing on clinical practice in terms of reducing hypertension.
Guan <i>et al.</i> , 2019 [17]	Population-based cross-sectional study	China	Total: 43 655	to assess the relationship between people's hypertension and the amount of sleep they get in southwest China.	Age affects the relationship between sleep length and hypertension. In both sexes, getting less than 6 hours of sleep is linked to an increased prevalence of hypertension.
Ogugu <i>et al.</i> , 2022 [19]	Cross-sectional study	United States	Total: 5163	explored the connection between persons with hypertension's chronic sleep duration and blood pressure (BP) regulation.	Sleeping for less than six hours reduces the likelihood of controlling hypertension. These important findings suggest that adding measures to ensure optimal habitual sleep length to the existing hypertension management recommendations may be a worthwhile addition.

Dos Santos <i>et al.</i> , 2020 [21]	Systematic review	Online database		to examine the epidemiological data supporting the link between teenage blood pressure and sleep duration.	Teenagers with high blood pressure tend to have shorter sleep durations. The consequences for cardiovascular health in this age range are highlighted by this study.
Li <i>et al.</i> , 2019 [20]	Cross-sectional study	Northeast China	Total: 23050	We looked at the connection between self-reported sleep duration and hypertension among participants in a representative population-based survey from the northeast Chinese province of Jilin.	In northeast China, adults ages 18 to 44 had a considerably higher risk of hypertension if they slept for fewer hours each night.
Sá Gomes e Farias <i>et al.</i> , 2022 [22]	systematic literature	Online database		to comprehensively analyze existing research examining the potential connection between sleep deprivation and fluctuations in blood pressure between the hours of the day and the hours of the night.	On the night of sleep deprivation, blood pressure increased, suggesting a potential causal relationship with an acute increase in blood pressure depending on the demographic tested. Generally speaking, sleep loss is acutely linked to blood pressure rise or acute elevation of indicators that point to the involvement of compensatory mechanisms, such as enhanced natriuresis and increased parasympathetic activity.
Wang <i>et al.</i> , 2015 [23]	A Meta-Analysis	Online database		to ascertain whether hypertension and sleep length are related.	The risk of high blood pressure may increase with excessively lengthy and short sleep durations; the relationships are higher in women than in males.

Research on the association between sleeping patterns and hypertension has helped better understand the occurrence of such a problem. Previously, the lack of a standardized method to report sleep duration presented an obstacle to identifying the actual sleep duration time and quality. Measurement of sleep time is done in this way significantly as the strength of the outcomes because individual assessment of sleep time can be overestimated or underestimated using techniques like self-reporting, parental reporting, questionnaires, or sleep diaries [21, 24]. In contrast, professional Polysomnography, which measures sleep time objectively, is regarded as the gold standard [25]. The gold standard for tracking and identifying sleep disturbances is the polysomnographic study, which is conducted in a lab throughout a full night [26]. Actigraphy was employed in the absence of a polysomnography machine since it is an examination that uses tools comparable to a clock (actigraph) [27]. But a study shows there is enough congruence between self-reported and objective assessments suggesting that studies using only questionnaires are also valid [27, 28].

While all the publications included in this review was done to investigate the relationship between sleeping pattern and hypertension, different location, time, and different samples of adults and adolescents were included. It can be considered a good enough database to report the relationship between the two items. However, differences in methodology make it difficult to draw definitive conclusions.

Previously reported Results of research generally suggested the theory Those teenagers who get little sleep are considerably more likely to have elevated blood pressure [29-31]. The study conducted by Javaheri *et al.* [32] found that short sleep duration raised the risk of prehypertension by 2.5 times after controlling for sex, body mass index (BMI), and socioeconomic level. In their research, Au *et al.* [33]. Blood pressure and sleep length were inversely correlated, with a mean decrease in sleep duration of 1 hour being linked with a rise in SBP of 2 mmHg and DBP of 1 mmHg.

The odds ratio (OR) of the grouped data from a different meta-analysis by Jiang *et al.* [12] showed that short sleep duration was linked to a higher risk of high blood pressure (OR=1.51; 95% confidence interval [95% CI] 1.04-2.19, random effects model), particularly in male adolescents (OR = 1.55; 95% CI 1.24-1.93, random effects model) [12].

Yan Wang, MD. *et al.* reported in their meta-analysis that not only short sleep duration but also excessive long sleep duration are the main risk factors for hypertension, especially in the female sex [23]. The pooled odds ratios (ORs) for hypertension changed in a U pattern was observed owing to the alteration in sleeping time. Individuals who slept less than five hours compared to those who slept for seven hours had an unadjusted OR for hypertension of 1.61, 95% CI = 1.28-2.02; those who slept more than nine hours compared to those who slept for seven hours had an unadjusted OR of 1.29, 95% CI = 0.97-1.71. After age and gender adjustments, the pooled ORs remained statistically significant. Women who lacked sleep had a greater risk of hypertension than males (OR = 1.30, 95% CI = 0.93-1.83) (sleep time 5 h vs. 7 h, OR = 1.68, 95% CI = 1.39-2.03).

In another study done in northeast China by Meng Li *et al.* [20], they approved that among those aged 18 to 44, a lack of sleep was substantially linked to hypertension. Hypertension was present in 32.6% of the population overall. In comparison to those who slept 7-8 hours per night, those who slept less than 7 hours a day had a greater risk of hypertension (OR=1.24, 95% CI: 1.05 to 1.46) among participants ages 18 to 44. In the group of middle-aged people (45-59 years) or older adults, there were no connections between sleep duration and hypertension that were statistically significant (60-79 years). These results were in contrast with Southwest China by Jie He and Quan He [18], who reported shows a short sleep duration (6h/day) is associated with a higher risk of hypertension, indicating that sleep aids in preventing hypertension. They stated that 51.2% of people had

hypertension overall. Unadjusted analysis revealed that persons with short (6h/day) or long (>8h/day) sleep durations had a greater risk of developing hypertension than those with a normal (6–8 h/day) sleep length. However, compared to participants with a normal sleep duration (6-8 hours per day), the risk of hypertension was significantly higher (by 25%) in those with a short sleep duration (6 hours per day) (OR = 1.25, P = 0.02, 95% CI = 1.036-1.508), but not in those with a long sleep duration (>8 hours per day) (17.5% increase).

Even though it seems that lack of sleep contributes to hypertension, the mechanism(s) at play in this association are not fully known. There are some plausible explanations, and nocturnal sympathetic activity is probably the most important [34]. The vagal system is triggered, and catecholamine production is reduced during a typical sleep cycle [35, 36]. However, studies of serum stress hormones following sleep deprivation suggest that sleep deprivation may serve as a stressor on the organism and activate the sympathetic system [37, 38]. The result is increased central catecholamine synthesis and stimulation of the renin-angiotensin-aldosterone pathway [39, 40]. This causes blood vessels to tighten, raising blood pressure and possibly developing hypertension [41]. Another study found that intracellular magnesium concentrations and flow-mediated arterial dilation were reduced during prolonged sleep deprivation [42].

In another cross-sectional study by Ogugu EG *et al.* it was reported that sleeping habits strongly affect blood pressure control among their sample. In the subgroup of people using antihypertensive medication, those who slept for less than six hours had a poorer likelihood of maintaining blood pressure control than those who slept for seven to nine hours (OR = 0.53; 95% CI: 0.36–0.77; P = 0.002) [19]. There were no discernible variations in BP control between the reference sleep length group—consisting of those who get seven to nine hours of sleep—and the groups consisting of those who get six to seven or more hours of sleep, regardless of age and sex. These findings add to the data from earlier research that suggests insufficient sleep is a substantial risk factor for hypertension [43, 44]. These results are in line with those of another study, which found that persons who slept for less than 4, 5, or 6 hours per night had an 86%, 56%, and 27% higher risk of hypertension than those who slept for 7 hours or more [45]. For instance, research has shown that limiting sleep to fewer than 5 hours per day can reduce blood pressure in persons with normal blood pressure [46] and hypertension increases the SNS activity significantly and increases BP [47, 48].

## Conclusion

According to our study, extremely lengthy and short sleep durations Maybe both contribute to the risk of high blood pressure, and these relationships are more pronounced in women than in males. The participants' daily sleep patterns showed a clear U-shaped change in the pooled odds ratios for hypertension, with 7 hours per day of sleep having the lowest risk. However, regardless of how long they sleep at night, only those who get less than 7 hours of sleep have an increased risk of hypertension

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