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The Association Between Social Jetlag and Hypertension in Young Adults: A Systematic Review

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ABSTRACT: Hypertension among young adults has become an increasingly important public health concern, as its rising prevalence is thought to be associated with lifestyle changes, including circadian rhythm disruption in the form of social jetlag. This study aimed to analyze the association between social jetlag and the incidence of hypertension among young adults based on the available scientific evidence. A Systematic Review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A comprehensive literature search was performed using PubMed, ScienceDirect, and Google Scholar to identify articles published between 2020 and 2026. Following the application of the predefined inclusion and exclusion criteria, a total of 16 eligible studies were included in the review, comprising observational studies, a randomized crossover trial, systematic reviews, and meta-analyses. The findings indicate that most studies reported a positive association between social jetlag and an increased risk of hypertension or cardiovascular risk factors. This association is likely mediated through several biological and behavioral mechanisms, including circadian rhythm disruption, increased sympathetic nervous system activity, metabolic alterations, obesity, unhealthy dietary patterns, and poor sleep quality. Although variations in the findings were observed due to differences in study populations, research designs, and methods used to assess social jetlag, the overall body of evidence consistently suggests an association between social jetlag and hypertension risk. Therefore, effective management of social jetlag through maintaining consistent sleep schedules aligned with the circadian rhythm may represent a promising strategy for reducing the risk of hypertension among young adults.

KEYWORDS: social jetlag, hypertension, young adults, circadian rhythm, systematic review.

INTRODUCTION

Hypertension remains a major public health problem that contributes substantially to cardiovascular morbidity and mortality worldwide (Alexander et al., 2026). Although it is commonly associated with older adults, the prevalence of hypertension among young adults has also been rising, making it a growing concern in efforts to prevent non-communicable diseases (Pantesco et al., 2026). Elevated blood pressure in early adulthood may progress to sustained hypertension and increase the risk of cardiovascular complications during the productive years of life (Alexander et al., 2026). Beyond genetic and lifestyle factors, sleep quality and regularity are now recognized as behavioral determinants of cardiovascular health (Makarem et al., 2022). Therefore, identifying modifiable risk factors such as social jetlag is essential to support the prevention of hypertension from young adulthood (Chen et al., 2026).

Changes in modern lifestyle have led many young adults to adopt irregular sleep schedules because of academic demands, work, and social activities (Sun et al., 2025). This condition is known as social jetlag, defined as a misalignment between sleep timing on workdays and free days that results in circadian rhythm disruption (Chen et al., 2026). Circadian disruption may affect the regulation of the autonomic nervous system, hormones, and metabolism, all of which play a role in blood pressure control (Nakamura et al., 2023). Studies have shown that nearly half of the adult population experiences social jetlag of at least one hour, making it an increasingly common phenomenon in modern society (Chen et al., 2026). Social jetlag is considered a potential risk factor that may influence cardiovascular health (Pantesco et al., 2026).

Several studies have demonstrated an association between social jetlag and cardiovascular disorders through various biological mechanisms (Chen et al., 2026). Experimental research has found that acute social jetlag can increase the morning blood pressure

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surge and arterial stiffness, both of which are related to elevated blood pressure (Nakamura et al., 2023). In addition, good sleep health has been reported to be associated with lower systolic blood pressure in young adults (Pantesco et al., 2026). However, most of these studies were conducted in high-income countries, whose population characteristics differ from those of the Indonesian population (Alexander et al., 2026). In Indonesia, research on social jetlag has mostly focused on mental health rather than the incidence of hypertension, so the scientific evidence remains very limited (Sun et al., 2025).

These limitations of previous studies indicate empirical and theoretical gaps that remain to be addressed. Most studies have focused on overall cardiovascular risk or sleep quality, whereas the direct association between social jetlag and the incidence of hypertension in young adults has been rarely investigated (Pantesco et al., 2026). Moreover, most studies employed a cross-sectional design, which limits the ability to explain the causal association between social jetlag and hypertension (Chen et al., 2026). Research in the Indonesian population is also scarce, even though social, cultural, and lifestyle factors may influence sleep patterns and blood pressure (Kim & Radoias, 2026). This situation highlights the need for a study examining the association between social jetlag and the incidence of hypertension among young adults in Indonesia.

This study adds to the existing literature by synthesizing evidence on the association between social jetlag and hypertension among young adults, a topic that has rarely been addressed in studies from Indonesia. Rather than assessing sleep pattern disruption alone, this review links it to hypertension and blood pressure as clinically relevant outcomes in the productive age group. The findings are expected to strengthen the scientific evidence on social jetlag as a potentially modifiable risk factor for hypertension. Furthermore, the results may serve as a basis for developing screening and educational efforts on sleep regularity as part of hypertension prevention in young adults. Accordingly, this study aims to synthesize the available evidence on the association between social jetlag and hypertension among young adults.

METHODOLOGY

This study was a systematic review conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The review aimed to analyze the association between social jetlag and hypertension among young adults by synthesizing evidence from published studies. The literature search strategy was developed using the PICO framework (Population, Intervention/Exposure, Comparison, Outcome). The population was young adults, the exposure was social jetlag, the comparison was individuals without social jetlag or with a lower degree of social jetlag, and the outcome was hypertension or elevated blood pressure.

Articles were searched in three electronic databases: PubMed (n = 70), ScienceDirect (n = 65), and Google Scholar (n = 65), yielding a total of 200 articles. The keywords used were a combination of Boolean operators as follows: (“social jetlag” OR “sleep timing”) AND (“hypertension” OR “blood pressure”) AND (“young adults” OR “early adults”). The search was limited to articles published between 2020 and 2026, available in full text, and written in English or Indonesian.

The article selection process followed the PRISMA flow diagram, which consists of the identification, screening, eligibility, and inclusion stages. In the identification stage, 200 articles were retrieved from the three electronic databases: PubMed (n = 70), ScienceDirect (n = 65), and Google Scholar (n = 65). Before screening, 35 duplicate articles and 100 articles deemed irrelevant based on their titles were removed, leaving 65 articles for screening. Titles and abstracts were then screened, and 34 articles were excluded because they did not address social jetlag and hypertension (n = 22) or were not relevant to the research topic (n = 12), leaving 31 articles for eligibility assessment. In the eligibility stage, full texts were reviewed, and 15 articles were excluded for not meeting the inclusion criteria, comprising 6 articles that did not meet the inclusion criteria, 4 articles with inappropriate outcomes, 3 articles with inappropriate study designs, and 2 articles without available full text. Consequently, 16 articles met all inclusion criteria and were included in the synthesis. The flow diagram of the article selection process based on the PRISMA guidelines is presented in Figure 1.

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Study Selection

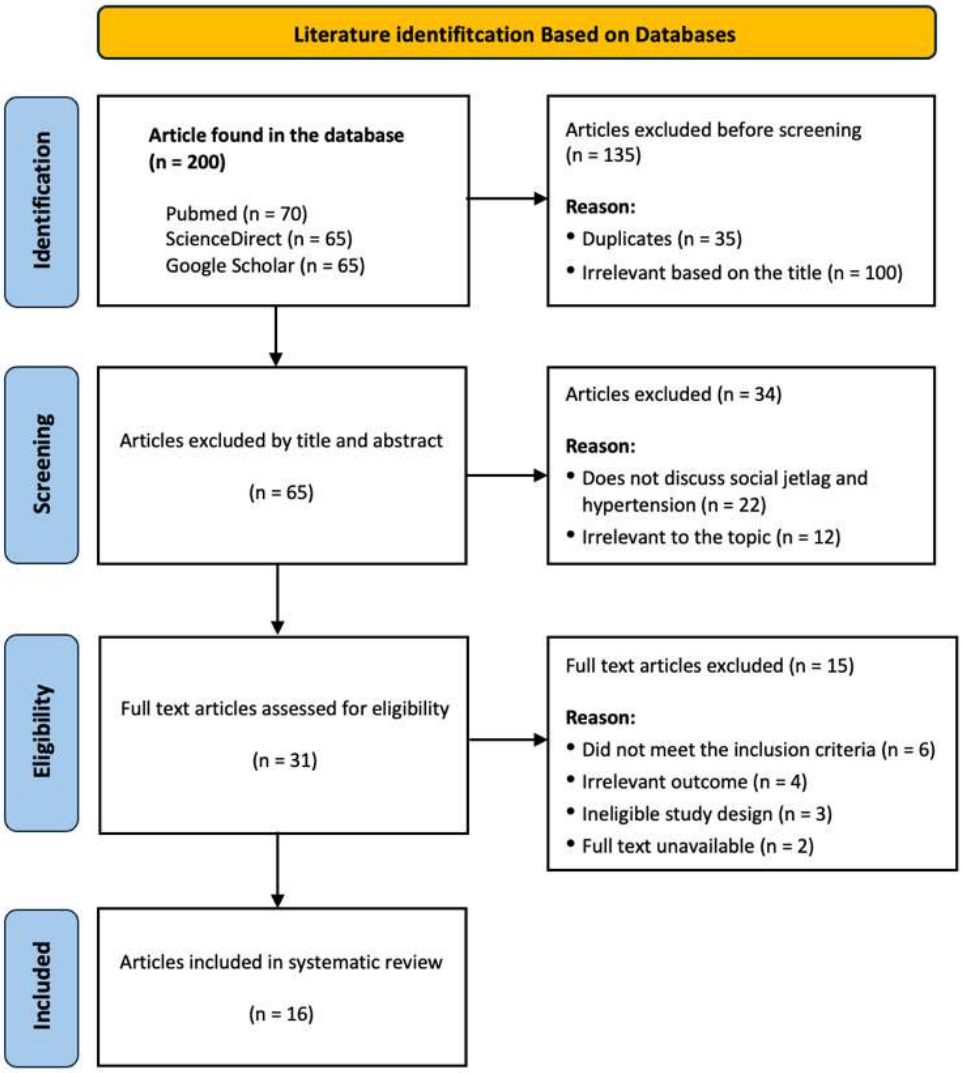


Figure 1. PRISMA 2020 flow diagram

Inclusion and Exclusion Criteria

The inclusion criteria were as follows: (1) original research articles, systematic reviews, or meta-analyses, (2) published between 2020 and 2026, (3) examining the association between social jetlag and hypertension, blood pressure, or cardiovascular risk in young adults, (4) available in English or Indonesian, and (5) available in full text. The exclusion criteria were editorials, letters to the editor, commentaries, case reports, conference proceedings, articles whose full text could not be accessed, and articles irrelevant to the study objectives.

All articles meeting the inclusion criteria were analyzed descriptively and qualitatively through data extraction, which covered the author's name, year of publication, country of study, study design, respondent characteristics, method of social jetlag measurement, method of hypertension assessment, and main findings. A narrative synthesis was then performed to identify patterns in the association between social jetlag and hypertension in young adults and to explain the underlying mechanisms based on the available evidence.

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RESULTS

Table 1. Article Characteristics

No	Author (Year)	Country	Study Design	Sample	Social Jetlag Measurement	Outcome	Main Results
1	Johnson et al. (2020)	United States of America	Cross-sectional	1.208	Difference in sleep midpoint between workdays and weekends (>2 hours)	Hypertension and cardiometabolic risk factors	Social jetlag is associated with several cardiometabolic risk factors.
2	Caliandro et al. (2021)	Netherlands	Narrative Review	-	Review of various definition of social jetlag	Health risks	Social jetlag is associated with metabolic disturbances and cardiovascular risk.
3	Makarem et al. (2022)	United States of America	Scientific Statement	-	Sleep health	Cardiovascular disease	Poor sleep health contributes to an increased risk of cardiovascular disease.
4	Nakamura et al. (2023)	Japan	Randomized Crossover Trial	20	Acute social jetlag manipulation	Morning blood pressure surge	Acute social jetlag increases the morning blood pressure surge.
5	Arab et al. (2024)	Multinational	Systematic Review & Meta-analysis	231.648	Social jetlag	Obesity	Social jetlag is associated with an increased risk of obesity and metabolic disorders.
6	Bouman et al. (2024)	Netherlands	Cross-sectional	1.784	Sleep midpoint	BMI	Social jetlag is associated with higher BMI and may be linked to lifestyle factors.
7	Chang et al. (2024)	Taiwan	Longitudinal	4.287	Social jetlag trajectory	BMI	Chronic social jetlag exposure is associated with an increased risk of obesity among young adults.
8	Lyu et al. (2024)	United States of America	Cross-sectional	1.356	Midpoint of sleep	Diet quality	Social jetlag is associated with poorer diet quality in certain population.
9	Kyung et al. (2024)	South Korea	Cross-sectional	Shift worker	Social jetlag	Metabolic syndome	Social jetlag is associated with an increased prevalence of metabolic syndrome among shift workers.
10	Faraci & Scheer (2024)	United States of America	Review	-	Circadian misalignment	Hypertension	Circadian rhythm disruption play a role in the pathophysiology

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							of hypertension.
11	Sun et al. (2025)	China	Systematic Review & Meta-analysis	-	Social jetlag	Depressive symptoms	Social jetlag is associated with an increased risk of depression among young adults.
12	Hu et al. (2025)	China	Cross-sectional	945	Chronotype	Hypertension	Evening chronotype is associated with an increased risk of hypertension.
13	Pantesco et al. (2026)	United States of America	Cross-sectional	Young adults	Sleep health	Resting blood pressure	Poor sleep quality associated with higher blood pressure.
14	Chen et al. (2026)	United States of America	Cross-sectional	NHANES	Social jetlag	10 years cardiovascular risks	Social jetlag increases estimated cardiovascular risks.
15	Flanagan et al. (2026)	United Kingdom	Longitudinal	101	Social jetlag	Energy intake timing	Social jetlag is associated with higher energy intake during the evening.
16	Kao et al. (2026)	Taiwan	Cross-sectional	65.832	>2 hours social jetlag	Metabolic Syndrome	The association between social jetlag and metabolic syndrome is influenced by BMI.

DISCUSSION

Taken together, the reviewed studies point in a consistent direction, but the evidence linking social jetlag to hypertension is mostly indirect. Chen et al. (2026) reported that individuals with social jetlag had a higher estimated 10-year cardiovascular disease risk than those without it. Nakamura et al. (2023), using a randomized crossover design, found that acute exposure to social jetlag increased the morning blood pressure surge, a marker associated with cardiovascular risk. Makarem et al. (2022) also emphasized that sleep health and circadian alignment contribute to cardiovascular health. However, studies that examined hypertension itself as the primary outcome in young adults were limited, and this should be kept in mind when interpreting the findings.

Much of the available evidence comes from intermediate outcomes. Johnson et al. (2020) reported an association between social jetlag and cardiometabolic risk factors in adolescents. Kyung et al. (2024) found that short sleep duration combined with social jetlag increased the risk of metabolic syndrome in shift workers, and Kao et al. (2026) found that the association with metabolic syndrome was stronger in overweight individuals. Systematic and meta-analytic evidence points the same way. Caliandro et al. (2021) linked social jetlag to adverse metabolic and cardiovascular outcomes, and Arab et al. (2024) linked it to obesity, larger waist circumference, and other adiposity indicators. Hu et al. (2025) reported more hypertension and metabolic disturbances in people with an evening chronotype, although chronotype is a related but distinct concept from social jetlag. These findings suggest that hypertension may be a downstream consequence of metabolic changes rather than a direct effect of social jetlag alone.

Several mechanisms have been proposed. The first involves autonomic and vascular regulation. Circadian rhythms regulate autonomic activity, hormone secretion, endothelial function, and the 24-hour blood pressure profile, and Faraci and Scheer (2024) explained how circadian disruption can alter vascular regulation and blood pressure. Sustained sympathetic activation is generally

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understood to raise heart rate and peripheral vascular resistance, which could explain the higher morning blood pressure surge seen by Nakamura et al. (2023). In a laboratory study with a 28-hour forced desynchrony protocol, Scheer et al. (2009) found that circadian misalignment increased mean arterial pressure by about 3% and reversed the daily cortisol rhythm. This protocol produced a much larger misalignment than typical social jetlag, so the result should be seen as supportive biological evidence rather than direct proof.

The second mechanism involves glucose metabolism and body composition. In the same experiment, circadian misalignment raised glucose levels despite higher insulin levels (Scheer et al., 2009). Leproult et al. (2014) showed that under controlled sleep restriction, circadian misalignment reduced insulin sensitivity and increased inflammation, and in men these changes were about twice as large as in the circadian-aligned condition, independent of sleep loss. These laboratory findings are consistent with the epidemiological results of Arab et al. (2024) and Kao et al. (2026), which link social jetlag to adiposity and metabolic syndrome, both of which are established risk factors for hypertension.

The third mechanism involves behavior. Bouman et al. (2024) reported that the association between social jetlag and higher body mass index was partly mediated by lifestyle factors. Lyu et al. (2024) found lower diet quality in individuals with social jetlag, and Flanagan et al. (2026) found a greater share of energy intake at night. Such behaviors may amplify the metabolic effects described above and therefore represent an indirect pathway to higher blood pressure.

The fourth mechanism is psychological. Sun et al. (2025), in a meta-analysis, reported that social jetlag was associated with more depressive symptoms in younger individuals. Pantesco et al. (2026) found that negative affect played a role in the association between sleep health and resting blood pressure in young adults. Psychological stress may therefore be an additional pathway, although the evidence in this area is still limited and mostly cross-sectional.

The heterogeneity across studies deserves attention. First, the outcomes differed, ranging from resting blood pressure and morning blood pressure surge to metabolic syndrome, obesity, and estimated cardiovascular risk. Second, the designs differed. Nakamura et al. (2023) evaluated short-term physiological responses in a randomized crossover trial, whereas Chen et al. (2026), Bouman et al. (2024), and Chang et al. (2024) used population-based observational designs that cannot establish causality. Third, the age range varied from adolescents to older adults, which may change physiological responses to circadian disruption. Finally, most studies measured social jetlag as the difference in mid-sleep time between workdays and free days, but the cutoffs for defining its severity were not uniform. Caliandro et al. (2021) noted that the absence of standardized measurement makes direct comparison between studies difficult.

This review has several strengths. It covers studies published between 2020 and 2026, which gives a current picture of the topic, and it includes different designs, namely observational studies, a randomized crossover trial, systematic reviews, and meta-analyses. This diversity allowed the topic to be examined from clinical, mechanistic, and behavioral perspectives.

Several limitations should be acknowledged. Most included studies were observational, especially cross-sectional, so a causal association between social jetlag and hypertension cannot be established. Many studies used metabolic syndrome, obesity, sleep quality, or cardiovascular risk as the main outcome and analyzed hypertension only as a related variable, so direct evidence on social jetlag and hypertension in young adults remains limited. The included populations also varied, and the definitions of social jetlag were not uniform. In addition, most studies were conducted in high-income countries whose social, cultural, and sleep characteristics may differ from those in Indonesia, so the findings should be applied to Indonesian young adults with caution.

The available evidence suggests that social jetlag is associated with cardiovascular and metabolic risk factors relevant to hypertension, but direct evidence for hypertension in young adults is still limited. Because social jetlag is potentially modifiable, a consistent sleep schedule could be considered as part of health education for young adults. Whether this reduces the incidence of hypertension still needs to be tested in well-designed longitudinal studies and trials, including in Indonesian populations.

CONCLUSION

The available evidence suggests that social jetlag is associated with cardiometabolic risk factors relevant to hypertension in young adults, possibly through circadian disruption, autonomic, metabolic, and behavioral pathways. However, hypertension was rarely

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the primary outcome, and most evidence was observational and indirect, so a causal association cannot be established. Heterogeneity in study design, populations, and measurement of social jetlag further limits the strength of this conclusion. Maintaining consistent sleep timing may be considered as part of health education for young adults, but its effect on hypertension incidence needs to be tested in prospective studies and trials, including in Indonesian populations.

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