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ASSOCIATION BETWEEN SMOKING AND INSOMNIA AMONG ELDERLY INDIVIDUALS WITH HYPERTENSION IN INDONESIA: A CROSS-SECTIONAL ANALYSIS OF THE 2023 NATIONAL HEALTH SURVEY

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ABSTRACT

Introduction: Insomnia is a common problem among older adults and may be exacerbated by chronic conditions such as hypertension. Smoking, a modifiable risk factor, affects cardiovascular and sleep health; however, its association with insomnia among older adults with hypertension in Indonesia remains unclear. This study investigated the relationship between smoking and insomnia using data from the 2023 Indonesia Health Survey (SKI). **Methods:** A cross-sectional analytic design was applied to secondary data from 20,865 older adults (≥60 years) diagnosed with hypertension. Smoking status was classified as current smoker or non-smoker, while insomnia was identified based on self-reported sleep disturbances. Associations between smoking, insomnia, and sociodemographic factors were assessed using chi-square tests, with analyses conducted using SPSS version 27.0.1. **Results:** The prevalence of insomnia in this population was 9.4%, and 20.9% of the participants reported smoking. No significant association was found between smoking and insomnia ($p = 0.407$). However, insomnia was significantly related to age, gender, marital status, education, employment, and type of residence ($p < 0.05$). **Conclusion:** Smoking was not significantly associated with insomnia among elderly hypertensive individuals, but multiple sociodemographic factors were. These findings emphasize the importance of addressing broader social determinants in interventions to improve sleep health in this population group.

Keywords: elderly with hypertension, insomnia, smoking.

HUBUNGAN MEROKOK DAN INSOMNIA PADA LANSIA DENGAN HIPERTENSI DI INDONESIA: ANALISIS CROSS-SECTIONAL DARI SURVEI KESEHATAN INDONESIA 2023

ABSTRAK

Pendahuluan: *Insomnia merupakan masalah yang umum terjadi pada lansia dan dapat diperburuk oleh kondisi kronis seperti hipertensi. Merokok sebagai faktor risiko yang dapat dimodifikasi memengaruhi kesehatan kardiovaskular dan kualitas tidur; namun, hubungan antara perilaku merokok dan insomnia pada lansia dengan hipertensi di Indonesia masih belum jelas. Penelitian ini bertujuan untuk menganalisis hubungan antara perilaku merokok dan insomnia menggunakan data Survei Kesehatan Indonesia (SKI) tahun 2023.* ***Metode:*** *Penelitian ini menggunakan desain analitik cross-sectional dengan data sekunder dari 20.865 lansia (≥60 tahun) yang terdiagnosis hipertensi. Status merokok diklasifikasikan menjadi perokok aktif dan bukan perokok, sedangkan insomnia diidentifikasi*

berdasarkan laporan gangguan tidur yang dilaporkan sendiri oleh responden. Hubungan antara perilaku merokok, insomnia, dan faktor sosiodemografi dianalisis menggunakan uji chi-square dengan bantuan program SPSS versi 27.0.1. ***Hasil:*** *Prevalensi insomnia pada populasi ini sebesar 9,4%, dan sebanyak 20,9% responden dilaporkan merokok. Tidak ditemukan hubungan yang signifikan antara perilaku merokok dan insomnia (p = 0,407). Namun, insomnia berhubungan signifikan dengan usia, jenis kelamin, status perkawinan, tingkat pendidikan, pekerjaan, dan jenis tempat tinggal (p < 0,05).* ***Kesimpulan:*** *Perilaku merokok tidak berhubungan secara signifikan dengan insomnia pada lansia penderita hipertensi, tetapi beberapa faktor sosiodemografi menunjukkan hubungan yang bermakna. Temuan ini menekankan pentingnya mempertimbangkan determinan sosial yang lebih luas dalam intervensi untuk meningkatkan kesehatan tidur pada kelompok populasi tersebut.*

Kata Kunci: *lansia dengan hipertensi, insomnia, merokok.*

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INTRODUCTION

Hypertension is one of the most common chronic diseases in the elderly and a major contributor to morbidity and mortality worldwide (Benetos et al., 2019; Chung et al., 2020). Often referred to as the "silent killer," hypertension frequently occurs without obvious symptoms, however it increases the risk of cardiovascular disease, stroke, and renal failure (Fatima & Mahmood, 2021; Kim & Thiruvengadam, 2024). The World Health Organization (WHO) estimates that 1.28 billion adults globally have hypertension, with a significant proportion residing in low- and middle-income countries, including Indonesia (WHO, 2021) . Data from the 2018 Indonesian Basic Health Research (Riskesdas) reported a hypertension prevalence of 34.1% in adults aged ≥18 years, with even higher rates among the elderly (Kemenkes, 2023). Insomnia is common yet often overlooked in older adults. It involves difficulty falling asleep, staying asleep, or waking up too early. Beyond affecting quality of life, insomnia can complicate chronic disease management, especially blood pressure control, and may increase cardiovascular risk and worsen health outcomes in individuals with hypertension. (Asri et al., 2024, 2025; Jaqua et al., 2023; Uchmanowicz et al., 2019).

Among the modifiable behavioral factors that may influence both hypertension and sleep health, smoking stands out as a critical concern (Gunn & Eberhardt, 2019). Nicotine acts as a central nervous system stimulant and can disrupt circadian rhythms, delay sleep onset, and

reduce sleep quality (Singh et al., 2023). Several studies have identified smoking as a risk factor for insomnia and cardiovascular dysfunction (Gou et al., 2023; Rahman et al., 2025). However, research on the specific relationship between smoking and insomnia in older adults with hypertension, particularly in Indonesia, remains limited and inconclusive. Some studies have suggested a positive association, whereas others have found no significant correlation.

Furthermore, most existing studies have been conducted in limited or local contexts with small sample sizes and without accounting for complex survey designs. There is a lack of comprehensive, nationally representative data exploring this association in Indonesia's elderly hypertensive population (Amiri & Behnezhad, 2020; Indriani et al., 2021).

Indonesia's population is aging, and chronic diseases along with lifestyle risk factors are becoming more common. Understanding how smoking relates to insomnia in older adults is important for developing effective health interventions.(Hu et al., 2021; Sun & Li, 2024).

Identifying whether smoking contributes to sleep disturbances in elderly hypertensive individuals can inform both behavioral counseling and clinical practice. Moreover, addressing sleep quality may aid in better hypertension control and reduce complications in older adults with hypertension.

The study uses data from the nationally representative 2023 Indonesia Health Survey (SKI) to examine the relationship between smoking and insomnia among older adults with hypertension. Its findings are expected to support integrated chronic disease and behavioral health interventions for Indonesia's ageing population.

METHODS

Data Sources and Study Design

This study utilized secondary data from the 2023 Indonesia Health Survey (Survei Kesehatan Indonesia, SKI), a large-scale, nationally representative cross-sectional survey conducted by the Ministry of Health of the Republic of Indonesia. The SKI 2023 employed a complex, stratified, multistage probability sampling design to collect health-related information across Indonesian provinces. For the purposes of this study, the authors accessed the microdata publicly available through the Health Policy Agency at https://www.badankebijakan.kemkes.go.id/data-mikro-ski/.

Study Population

The study population comprised elderly individuals aged ≥ 60 years who were diagnosed with hypertension, as

recorded in the SKI 2023 dataset. From the total survey respondents, a subsample of 20,865 older adults with hypertension was selected for further analysis.

Inclusion and Exclusion Criteria

Inclusion Criteria: Respondents aged 60 years and above. Respondents with a confirmed diagnosis of hypertension, either based on self-reporting of medical diagnosis or blood pressure measurement, were included in the survey. Exclusion Criteria: Respondents with incomplete data on key variables, including insomnia, sociodemographic characteristics, or hypertension status. Respondents with cognitive impairment or proxy responses unrelated to the individual.

Variables and Measurements

The dependent variable in this study was insomnia, which was measured using responses to sleep-related questions in the SKI 2023. Respondents were classified as having insomnia if they reported difficulty falling asleep, frequent nighttime awakenings, early morning awakenings, or poor sleep quality in the past month. Responses were dichotomized as Yes (1) for those with insomnia symptoms and No (0) for those without such symptoms.

The following independent variables were analyzed for their association with insomnia: Age: Categorized into three groups: 60–69, 70–79, and ≥ 80 years. Gender: Classified as male or female. Marital Status: Categorized as single, married, or divorced/widowed. Education Level: Categorized as none, elementary, junior high school, senior high school, and college/university. Employment Status: Grouped as employed (still working) or unemployed (not working). Residence Type: Defined as urban or rural based on the official classification in the SKI. Smoking Status: Respondents were grouped into smokers and non-smokers based on their current smoking behavior.

Statistical Analysis

Descriptive statistics were used to summarize the characteristics of the study population. Frequency and percentage distributions were presented for categorical variables to explore the associations between insomnia and each independent variable. Bivariate analysis was performed using the chi-square test. All statistical analyses were performed using SPSS version 27.0.1. The sampling weights provided in the dataset were applied to adjust for the complex survey design, including stratification, clustering, and unequal probability of selection, ensuring more accurate and representative estimates. Statistical significance was set at $p < 0.05$.

Ethics Approval

This study was conducted using anonymized secondary data and did not involve direct interactions with human subjects. The use of SKI 2023 microdata

was granted through a formal data-sharing agreement under the confidentiality agreement number FRM/SMKI-PUSDATIN/70/0108/2024. The study protocol was approved under ticket number 240675B7CC9C4327 and adhered to all ethical standards for research involving human data. Ethical compliance was ensured in accordance with national regulations on participant privacy and data handling. The data used in this study are publicly accessible upon request through the official portal of the Health Policy Agency of the Ministry of Health at: https://www.badankebijakan.kemkes.go.id /data-mikro-ski/.

RESULTS

Among the 20,865 older adults with hypertension, most were aged 60–69 years (65.2%, n=13,607), followed by 70–79 years (28.0%, n=5,840) and 80-112 years (6.8%, n=1,418). Women comprised 61.1% (n=12,742) of the sample. Most participants were married (62.5%, n=13,043), while 36.4% (n=7,601) were divorced/widowed and 1.1% (n=221) were single. Educational attainment was generally low: 39.8% (n=8,313) completed elementary school and 24.0% (n=5,003) had no formal education; 11.7% (n=2,437) had junior high school, 15.6% (n=3,246) senior high school, and 8.9% (n=1,866) college. A little over half of the respondents were still working (58.1%, n=12,113). Most of them lived in urban areas (60.9%, n=12,713). Overall, 17.1% (n=3,571) reported insomnia and 20.9% (n=4,355) were current smokers (Table1).

Table 1. Frequency Distribution of Characteristic Among Elderly with Hypertension (n=20.865)

Variables	Frequency (n)	Percent (%)
Age (Years)		
60 – 69	13.607	65,2
70 – 79	5.840	28,0
80 – 112	1.418	6,8
Gender		
Male	8.123	38,9
Female	12.742	61,1
Marital Status		
Single	221	1,1
Married	13.043	62,5
Divorced	7.601	36,4
Education Level		
None	5.003	24,0
Elementary	8.313	39,8
Junior High School	2.437	11,7
Senior High School	3.246	15,6
College	1.866	8,9
Job		
Doesn't Work	8.752	41,9
Work	12.113	58,1
Residence		
Urban	12.713	60,9
Rural	8.152	39,1
Insomnia		
Yes	3.571	17,1
No	17.294	82,9
Smoking		
Yes	4.355	20,9
No	16.510	79,1

Table 2 presents the chi-square bivariate associations between respondent characteristics and insomnia among older adults with hypertension (n = 20,865). Age was significantly associated with insomnia (p = 0.001). Among those with insomnia (n = 3,571), 62.5% were aged 60–69 years,

29.7% were 70–79 years, and 7.7% were 80-112 years, compared with 65.8%, 27.6%, and 5.5%, respectively, among those without insomnia (n = 17,294), indicating that older age categories constitute a larger share of the insomnia group than those without insomnia. Gender showed a significant association (p = 0.001): women comprised 65.7% (n = 2,347) of the insomnia group versus 60.1% (n = 10,395) in the non-insomnia group. Marital status was also significant (P = 0.001); among those with insomnia, 58.2% were married (n = 2,077), 40.4% were divorced/widowed (n = 1,444), and 1.4% were single (n = 50), compared with 63.4%, 35.6%, and 1.0% in the non-insomnia group, respectively. Education was significantly associated with insomnia (p = 0.001); lower education levels were more prevalent in the insomnia group (no formal schooling 27.2% [n = 972]; elementary 41.5% [n = 1,483]) than in those without insomnia (23.3% and 39.5%, respectively). Employment status was significant (p = 0.001); not working was more common among respondents with insomnia (45.9%, n = 1,638) than among those without insomnia (41.1%, n = 7,114). The type of residence was significant (P = 0.001): urban residence accounted for 56.1% (n = 2,005) of the insomnia group versus 61.9% (n = 10,708) of the non-insomnia group, indicating a relatively higher share of rural residents among those with insomnia. In contrast, smoking status was not significantly associated with insomnia (p = 0.407): smokers comprised 20.4% (n = 727) of the insomnia group and 21.0% of the non-insomnia group.

Table 2. Bivariat Analysis Using Chi Square

Variables	Insomnia				p-value
	Yes		No		
	n (3.571)	%	n (17.294)	%	
Age (Years)					
60 – 69	2.233	62,5	11.374	65,8	**0,001***
70 – 79	1.062	29,7	4.778	27,6	
80 – 112	276	7,7	1.142	5,5	
Gender					
Male	1.224	5,9	6.899	33,1	**0,001***
Female	2.347	7,1	10.395	49,8	
Marital Status					
Single	50	0,2	171	0,8	
Married	2.077	10,0	10.966	52,6	**0,001***
Divorced	1.444	6,9	6.157	29,5	
Education Level					
None	972	4,7	4.031	19,3	
Elementary	1.483	7,1	6.830	32,7	
Junior High School	423	2,0	2.014	9,7	**0,001***
Senior High School	454	2,2	2.792	13,4	
College	239	1,1	1.627	7,8	
Job					
Doesn't Work	1.638	7,9	7.114	34,1	**0,001***
Work	1.933	9,3	10.180	48,8	
Residence					
Urban	2.005	9,6	10.708	51,3	**0,001***
Rural	1.566	7,5	6.586	31,6	
Smoking					
Yes	727	3,5	3.628	17,4	**0,407**
No	2.844	13,6	13.666	65,5	

***p<0.05**

DISCUSSION

This study investigated the association between insomnia and various sociodemographic characteristics among elderly individuals with hypertension in Indonesia using data from the 2023 Indonesia Health Survey (SKI). The findings highlighted significant relationships between insomnia and age,

gender, marital status, education level, employment status, and residence type.

The study found a strong link between older age and insomnia, aligning with previous research. Age-related physiological changes, such as decreased melatonin, circadian rhythm shifts, and more chronic illnesses, contribute to sleep problems. Insomnia was most common in participants aged 70–79 years, indicating that biological aging combined with comorbid conditions increases their susceptibility to sleep disturbances compared to younger elderly groups (Benjafield et al., 2025; Casagrande et al., 2022).

Gender also showed a strong correlation with insomnia, with females reporting a higher prevalence. This is consistent with prior evidence suggesting that hormonal changes, caregiving responsibilities, and a higher likelihood of comorbid depression may contribute to greater sleep disturbances among women (Baldi et al., 2025; Zeng et al., 2020)

Marital status showed that divorced or widowed elderly were more likely to report insomnia, possibly due to emotional stress, loneliness, and lack of social support, factors previously reported as important psychosocial contributors to poor sleep quality (Pan et al., 2022; Vedder et al., 2024).

Education level had a significant inverse relationship with insomnia. Respondents with lower levels of education were more likely to experience sleep problems. Education may act as a proxy for health literacy, with better-informed individuals being more capable of managing their health and lifestyle factors that impact sleep (Luo et al., 2021; Stores et al., 2023).

Regarding employment status, those who were not working had a higher prevalence of insomnia. While this may reflect the natural shift in retirement status, it could also indicate reduced physical activity and psychological engagement, both known contributors to poor sleep (Palmer et al., 2017; Park et al., 2024; Silver et al., 2022).

Urban dwellers were more likely to report insomnia compared to rural residents. Urban environments may be more exposed to environmental stressors, such as noise and pollution, which disrupt sleep (Chu et al., 2025; O et al., 2021).

Interestingly, smoking status was not significantly associated with insomnia in this hypertension elderly sample, a result that is mixed in existing literature (Grigoriou et al., 2024). Some studies have found that smoking is linked to sleep disturbance, while others, including our findings, suggest that smoking may not independently predict insomnia when other factors are controlled. (Amiri & Behnezhad, 2020; Hu et al., 2021)

This study had several limitations. The cross-sectional design prevented causal inference between the variables and insomnia. Self-reported data may be susceptible to recall or social desirability bias, particularly regarding health behaviors such as smoking. Insomnia measurement was not based on clinical diagnosis but rather on self-reported symptoms, which could lead to under- or overestimation. Other potential confounding factors, such as medication use, physical activity level, and mental health status, were not analyzed.

The findings have several implications: policymakers and health workers should prioritize sleep health in elderly hypertensive populations, particularly for females, divorced individuals, and those with low education. Community-based interventions, including sleep hygiene education, social support, and mental health services, should be tailored to high-risk groups. Future longitudinal studies are needed to explore the causal pathways and test interventions targeting these determinants.

CONCLUSION

In this nationally representative sample of Indonesian older adults with hypertension, insomnia was common (17%) and clustered among women, those in older age groups, divorced/widowed individuals, people with lower education, non-working individuals, and rural residents. In contrast, current smoking showed no significant bivariate association with insomnia in the present study. These findings support routine screening and management of insomnia within hypertension care, prioritizing the identified at-risk subgroups, while recognizing that smoking cessation remains critical for overall cardiovascular health. Because the analysis was cross-sectional and relied on self-reported measures, causal inference was limited; multivariable and longitudinal studies are warranted to clarify the independent effects (including smoking) and inform targeted interventions.

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DATA AVAILABILITY STATEMENT

The dataset utilized in this research can be accessed by requesting it from the Ministry of Health of the Republic of Indonesia through this link: https://www.badankebijakan.kemkes.go.id/data-mikro-ski/

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