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PHYSICAL ACTIVITY AND ITS ASSOCIATION WITH HYPERTENSION AMONG ELDERLY INDONESIANS: FINDINGS FROM THE 2023 INDONESIA HEALTH SURVEY

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ABSTRACT

Introduction: Hypertension is a major contributor to cardiovascular morbidity and mortality among Indonesia's elderly. Physical activity is a key nonpharmacological approach to managing high blood pressure, yet national data on its association with hypertension in older Indonesians remain limited. **Objective:** This study examined the relationship between physical activity and hypertension in adults aged ≥60 years using data from the 2023 Indonesia Health Survey. A cross-sectional analysis was conducted on 97,339 elderly respondents from the national survey. **Methods:** Hypertension status was based on self-reported physician diagnoses, and physical activity was categorized as active or inactive. Covariates included age, gender, marital status, education, employment, and residence. Bivariate analyses employed chi-square tests, with survey design adjustments using IBM SPSS (version 27.0.1). Statistical significance was set at $p < 0.05$. **Result:** among respondents, 21.9% had hypertension, and 77.7% were physically inactive. Hypertension was significantly more prevalent in inactive individuals (45.4%) than in active ones (54.6%, $p < 0.001$). Additional factors significantly associated with hypertension included older age, female gender, unmarried status, lower education, unemployment, and urban residence (all $p < 0.001$). **Conclusion:** Physical activity is significantly linked to lower hypertension prevalence in Indonesia's elderly. These findings highlight the need for targeted public health initiatives that encourage physical activity, especially among vulnerable subgroups such as urban dwellers, women, and those with lower socioeconomic status.

Keywords: elderly, hypertension, Indonesia Health Survey, non-communicable disease, physical activity

AKTIVITAS FISIK DAN HUBUNGANNYA DENGAN HIPERTENSI PADA LANSIA DI INDONESIA: TEMUAN DARI SURVEI KESEHATAN INDONESIA TAHUN 2023

ABSTRAK

Pendahuluan: *Hipertensi merupakan penyebab utama morbiditas dan mortalitas kardiovaskular pada lansia di Indonesia. Aktivitas fisik merupakan salah satu pendekatan nonfarmakologis penting dalam pengendalian tekanan darah tinggi, namun data nasional mengenai hubungannya dengan hipertensi pada lansia Indonesia masih terbatas.* ***Tujuan:*** *Penelitian ini bertujuan untuk menganalisis hubungan antara aktivitas fisik dan hipertensi pada individu berusia ≥60 tahun menggunakan data Survei Kesehatan Indonesia tahun 2023.* ***Metode:*** *Analisis cross-sectional dilakukan pada 97.339 responden lansia dari survei nasional. Status hipertensi ditentukan berdasarkan diagnosis dokter yang dilaporkan sendiri oleh responden, sedangkan aktivitas fisik dikategorikan menjadi aktif dan tidak aktif. Kovariat penelitian meliputi usia, jenis kelamin, status perkawinan, pendidikan, pekerjaan, dan tempat tinggal. Analisis bivariat menggunakan uji chi-square dengan penyesuaian desain survei menggunakan IBM*

SPSS versi 27.0.1. Tingkat signifikansi statistik ditetapkan pada p < 0,05. ***Hasil:*** *Sebanyak 21,9% responden mengalami hipertensi dan 77,7% tergolong tidak aktif secara fisik. Hipertensi ditemukan secara signifikan lebih tinggi pada individu yang tidak aktif dibandingkan dengan individu yang aktif secara fisik (p < 0,001). Faktor lain yang berhubungan signifikan dengan hipertensi meliputi usia yang lebih tua, jenis kelamin perempuan, status tidak menikah, pendidikan rendah, tidak bekerja, dan tinggal di wilayah perkotaan (seluruhnya p < 0,001).* ***Kesimpulan:*** *Aktivitas fisik berhubungan signifikan dengan rendahnya prevalensi hipertensi pada lansia di Indonesia. Temuan ini menegaskan pentingnya inisiatif kesehatan masyarakat yang mendorong aktivitas fisik, terutama pada kelompok rentan seperti masyarakat perkotaan, perempuan, dan individu dengan status sosial ekonomi rendah.*

Kata Kunci: *aktivitas fisik, hipertensi, lansia, penyakit tidak menular, Survei Kesehatan Indonesia.*

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INTRODUCTION

Hypertension, or high blood pressure, is one of the most prevalent non-communicable diseases globally and a leading risk factor for cardiovascular morbidity and mortality (Mills, Stefanescu, & He, 2020; Zhou et al., 2021; Kario, Okura, Hoshide, & Mogi, 2024). According to the World Health Organization, more than 1.28 billion adults worldwide suffer from hypertension, with only one in five having it under control (Liu, Chang, & Liu, 2023; Cheah, Lim, Ismail, Mohd Yusoff, & Kee, 2023). In Southeast Asia, including Indonesia, the burden of hypertension continues to rise, especially among older adults due to increased life expectancy and demographic transitions (Mohammed Nawi et al., 2021; Oktamianti, Kusuma, Amir, Tjandrarini, & Paramita, 2022). Indonesia is undergoing a significant shift in population structure, marked by a rapid increase in the proportion of older adults. The 2023 Indonesia Health Survey (Survei Kesehatan Indonesia, SKI) estimates that nearly 11% of the Indonesian population is aged 60 years and above, a figure projected to double in the coming decades (Kudrna, Le, & Piggott, 2022). Aging is strongly associated with physiological changes that affect vascular function, leading to an elevated risk of developing hypertension (Tian & Zhang, 2022; Ahn & Min, 2021; Kudrna, Le, & Piggott, 2022). Lifestyle factors such as physical inactivity, poor diet, stress, and urbanization further compound this risk. Among these factors, physical activity has been extensively studied and consistently identified as a modifiable behavioral determinant with substantial cardiovascular benefits

(Ghodeshwar, Dube, & Khobragade, 2023; Schmidt-Trucksäss, Lichtenstein, & von Känel, 2024). Regular physical activity is known to reduce blood pressure, improve arterial flexibility, enhance metabolic function, and decrease the risk of heart failure, stroke, and renal disease (Belay et al., 2023). Despite these benefits, physical inactivity remains widespread among older adults, both in Indonesia and globally, often due to social, environmental, or health-related barriers (Langhammer, Bergland, & Rydwik, 2018; Hills, Jayasinghe, Arena, & Byrne, 2024). While the global evidence base on the benefits of physical activity in hypertension prevention is well-established, there is limited large-scale, population-based data from Indonesia examining this association specifically among the elderly (Ahn & Min, 2021; Liu, Chang, & Liu, 2023). Most studies to date have focused on younger populations or have utilized small sample sizes and localized data, limiting their generalizability. Moreover, existing health promotion efforts in Indonesia have not adequately targeted older adults, despite their higher vulnerability to hypertension and lower engagement in physical activity (van Sluijs et al., 2021; Fuady et al., 2024; Mustikawati, Sulaeman, Subiyanto, & Suminah, 2024; de la Fuente-Núñez, Cohn-Schwartz, Roy, & Ayalon, 2021; Ahmed, 2025). This study is among the first to use large-scale national data to analyze the role of physical activity in hypertension risk among the elderly in Indonesia.

Physical activity is every movement of a body part that results in energy expenditure. This is crucial to maintain the improvement of physical and spiritual health as well as the living standards of the elderly so that they can live healthy and active throughout the day. This physical activity includes various types of physical movements, from exercise to daily activities at home and at work. Regular physical activity encourages change, such as strengthening the smooth muscle of the heart.

Prevention efforts need to be done to prevent complications due to hypertension. Lifestyle changes for individuals with hypertension include implementing a healthy diet by lementing a healthy diet by limiting the consumption of sweet foods, increasing physical activity such as regular exercise, reducing stress, and avoiding the use of cigarettes and alcohol. Preventive efforts need to be made to prevent complications due to hypertension. Lifestyle changes for people with hypertension include implementing a healthy diet by limiting the consumption of sweet foods, increasing physical activity by exercising regularly, reducing stress, and avoiding the use and

consumption of alcohol. (Nur Setya Ningrum et al., n.d.)

METHODS

Data Sources and Study Design

This study utilized data from the 2023 Indonesia Health Survey (Survei Kesehatan Indonesia/SKI), a nationally representative cross-sectional survey conducted by the Indonesian Ministry of Health. The SKI collected comprehensive health and sociodemographic information from households across all provinces in Indonesia using a multistage stratified sampling design. The data are publicly available through a controlled access system and can be obtained via the Ministry's official data portal: https://www.badankebijakan.kemkes.go.id/data-mikro-ski/.

Study Population

The target population for this study comprised Indonesian residents aged 60 years and older who participated in the 2023 SKI. A total of 97,339 older adults were included in the final analysis after applying inclusion and exclusion criteria.

Inclusion and Exclusion Criteria

Inclusion criteria:
respondents aged ≥60 years, complete information on blood pressure status (for hypertension classification), and availability of responses for all key variables, including physical activity, education level, marital status, occupation, and demographic details. Exclusion criteria: Respondents with missing data on hypertension status or physical activity. Respondents with incomplete demographic or socioeconomic variables required for the analysis. Individuals with reported pregnancy or extreme health conditions not relevant to the elderly population group (e.g., those flagged as institutionalized care or terminal illness under special codes).

Variables and Measurements

The primary dependent variable in this study was hypertension status, classified based on the SKI dataset. Respondents were categorized as hypertensive if they: Self-reported a prior medical diagnosis of hypertension by a health professional; or. Reported current use of antihypertensive medications; or. Had measured blood pressure values consistent with systolic BP ≥140 mmHg and/or diastolic BP ≥90 mmHg based on SKI's clinical examination protocols. Those who did not meet any of the above criteria were classified as non-hypertensive. The main independent variable was physical activity, measured by the SKI through self-report. Respondents were asked whether they engage in any regular physical activity (such as walking, cycling, sports, or traditional forms of activity) at least once

per week. Responses were dichotomized into: Yes (physically active). No (physically inactive). Other covariates (independent variables) included: Age Group: Categorized into 60-69, 70-79, and 80-112 years. Gender: Male or Female. Marital Status: Classified as Single, Married, or Divorced. Education Level: Stratified into None, Elementary, Junior High School, Senior High School, and College. Employment Status: Dichotomized into Working or Not Working. Residence Type: Urban or Rural, based on the national statistical coding of domicile.

Statistical Analysis

The statistical software SPSS version 27.0.1 was used for all analyses. In order to account for the intricate survey design, which included stratification, clustering, and unequal likelihood of selection, sampling weights from the dataset were applied, guaranteeing more precise and representative values. To account for the complex sampling design of the 2023 SKI, including stratification, clustering, and unequal probability of selection. Categorical variables were expressed as frequencies and percentages. Associations between physical activity and hypertension status, as well as other independent variables, were evaluated using Chi-square tests for categorical variables. A p-value <0.05 was considered statistically significant.

Ethics Approval

This study was conducted using de-identified secondary data from the 2023 Indonesia Health Survey and complied with all applicable ethical guidelines and confidentiality requirements. The data request was supported by a confidentiality agreement (no. FRM/SMKI-PUSDATIN/70/0108/2024) and received approval under ticket number 240675B7CC9C4327. Public access to the data was granted through the official SKI microdata platform: https://www.badankebijakan.kemkes.go.id/data-mikro-ski/.

RESULTS

The Table 1 study analyzed data from a total of 97,339 individuals aged 60 years and above. The population was categorized across multiple sociodemographic and health-related variables, including age, gender, marital status, education level, employment status, residence type, physical activity, and hypertension status. Participants were divided into three age groups. The majority (68.3%) were aged 60 - 69 years (n = 66,435), followed by 24.9% aged 70–79 years (n = 24,282), and 6.8% aged 80 - 112 years (n = 6,622). This indicates

a predominantly younger elderly cohort within the studied population.

Table 1. Frequency distribution of characteristic (n= 97,339)

Variabel	(n)	(%)
Age (Years)		
60 – 69	66,435	68,3%
70 - 79	24,282	24,9%
80 – 112	6,622	6,8%
Gender		
Male	47,662	49,0%
Female	49,677	51,0%
Marital Status		
Single	1,222	1,3%
Married	66,554	68,4%
divorced	29,563	30,4%
Education Level		
None	25,982	26,7%
Elementary	40,880	42,0%
Junior High School	10,431	10,7%
Senior High School	13,188	13,5%
College	6,858	7,0%
Job		
Doesn't Work	31,329	32,2%
Work	66,010	67,8%
Residence		
Urban	52,671	54,1%
Rural	44,668	45,9%
Physical Activity		
Yes	21,667	22,3%
No	75,672	77,7%
Hypertension		
Yes	21,351	21,9%
No	75,988	78,1%

The gender distribution was relatively balanced, with a slight female predominance. Female participants accounted for 51.0% (n = 49,677), whereas males constituted 49.0% (n = 47,662). Most participants were married (68.4%, n = 66,554), while 30.4% (n = 29,563) were divorced, and a small proportion (1.3%, n = 1,222) were single. Educational attainment varied widely among participants. A notable proportion had only completed elementary education (42.0%, n = 40,880). This was followed by 26.7% (n = 25,982) with no formal education, 13.5% (n = 13,188) with senior high school education, 10.7% (n = 10,431) with junior high school education, and 7.0% (n = 6,858) who had attained college-level education. Employment status revealed that two-thirds of participants were not working (67.8%, n = 66,010), while 32.2% (n = 31,329) were still engaged in work activities. A majority of participants resided in urban areas (54.1%, n = 52,671), with the remaining 45.9% (n = 44,668) living in rural locations.Regarding lifestyle, only 22.3% (n = 21,667) of participants reported engaging in physical activity, while a substantial 77.7% (n = 75,672) did not participate in any regular physical activity.Hypertension was prevalent in 21.9% (n = 21,351) of the population, whereas 78.1% (n = 75,988) reported no history or diagnosis of hypertension.

The Table 2 association between various demographic and lifestyle characteristics and the prevalence of hypertension was analyzed among 97,339 participants. Of these, 21,351 individuals (21.9%) had hypertension, while 75,988 (78.1%) did not. There was a statistically

significant association between age group and hypertension prevalence ($p < 0.001$). Among individuals with hypertension, the majority were aged 60–69 years (64.6%), followed by 28.2% in the 70-79 age group, and 7.2% aged 80 years or older. Conversely, in the non-hypertensive group, a higher proportion (69.3%) were also in the 60–69 age group, but the distribution of older age groups was relatively lower (24.0% for 70-79 and 6.7% for 80–112 years). These findings suggest an increasing trend of hypertension with age, though the highest burden is still concentrated in the youngest elderly cohort.Gender showed a significant relationship with hypertension prevalence ($p < 0.001$). Females had a higher prevalence of hypertension (60.9%) compared to males (39.1%). Among non-hypertensives, males made up a slightly higher proportion (51.7%) than females (48.3%). This suggests that older women in this population are more likely to experience hypertension compared to men. Marital status was also significantly associated with hypertension ($p < 0.001$). The majority of hypertensive individuals were married (62.3%), followed by those who were divorced (36.6%), and a small fraction who were single (1.1%). Among non-hypertensives, 70.1% were married and 28.6% were divorced, indicating a potential protective effect of marriage or increased vulnerability among divorced individuals. Education level was significantly related to hypertension status ($p < 0.001$). Hypertension was more prevalent among those with lower education. Among hipertensive individuals, 39.9% had only elementary education, 24.1% had no education, and 11.6% had junior high school education. Higher education levels were less common: 15.5% had completed senior high school and 8.9% had college education. In contrast, among non-hypertensive individuals, the proportion of those with elementary education was higher (42.6%) and those with no education was slightly lower (27.4%). This trend highlights the potential influence of educational attainment on health literacy and chronic disease management. A statistically significant relationship was also found between employment status and hypertension ($p < 0.001$). Among those with hypertension, 42.4% were employed, while 57.6% were not. Comparatively, a higher percentage of non-hypertensive individuals were not working (70.7%) compared to those working (29.3%). This may suggest a potential occupational or stress-related component contributing to hypertension among those who remain in the workforce in older age. The prevalence of hypertension was higher among urban residents (61.0%) compared to rural

residents (39.0%) ($p < 0.001$). This is in contrast to the non-hypertensive group, where 52.2% lived in urban areas and 47.8% in rural areas. The findings may reflect urban lifestyle factors such as higher stress levels, dietary habits, and sedentary behaviors that contribute to hypertension risk. A strong and statistically significant association was observed between physical activity and hypertension status ($p < 0.001$). Among hypertensive individuals, only 54.6% reported engaging in physical activity, while 45.4% did not. In comparison, the non-hypertensive group showed a higher prevalence of physical activity: 59.9% were active, while 40.1% were inactive. This finding supports the protective role of regular physical activity in reducing the risk of hypertension among older adults.

Table 2. Association between demographic characteristics and physical activity with hypertension risk (n= 97,339)

Variables	Hypertension				p-value
	Yes		No		
	n(21,351)	%	n(75,988)	%	
Age(Years)					
60 -69	13,799	64,6%	52,636	69,3%	0,001
70 -79	6,013	28,2%	18,269	24,0%	
80 – 112	1,539	1,6%	5,083	6,7%	
Gender					
Male	8,355	39,1%	39,307	51,7%	0,001
Female	12,996	60,9%	36,681	48,3%	
Marital Status					
Single	225	1,1%	997	1,3%	0,001
Married	13,302	62,3%	53,252	70,1%	
Divorced	7,824	36,6%	21,739	28,6%	
Education Level					
None	5,150	24,1%	20,832	27,4%	0001
Elementary	8,514	39,9%	32,366	42,6%	
Junior High School	2,470	11,6%	7,961	10,5%	
Senior High School	3,317	15,5%	9,871	13,0%	
College	1,900	8,9%	4,958	6,5%	
Job					
Doesn't Work	9,054	42,4%	22,275	29,3%	0,001
Work	12,297	57,6%	53,713	70,7%	
Residence					
Urban	13,033	61,0%	39,638	52,2%	0,001
Rural	8,318	39,0%	36,350	47,8%	
Physical Activity					
Yes	11,662	54,6%	45,508	59,9%	0,001
No	9,689	45,4%	30,480	40,1%	

DISCUSSION

This study explored the association between physical activity and hypertension in older adults using nationally representative data from the 2023 Indonesia Health Survey (SKI). The findings indicate a significant inverse relationship between physical activity and the risk of hypertension among individuals aged 60 years and older (Hayes et al., 2022;

Fukushima et al., 2024). Older adults who reported engaging in physical activity were less likely to have hypertension compared to those who were physically inactive ($p < 0.001$) (Masanovic et al., 2018; You et al., 2018; Hayes et al., 2022). These findings align with previous studies conducted in China, Korea, and Ethiopia that demonstrated the protective effects of physical activity on hypertension and other cardiovascular risk factors. Specifically, regular engagement in moderate to vigorous physical activity has been shown to improve vascular health, reduce systolic and diastolic blood pressure, and lower the incidence of cardiovascular disease in older adults (Ke et al., 2025; Huang & Lu, 2024; Li et al., 2020; Li et al., 2024). The current study also highlights the role of demographic and socioeconomic variables in hypertension risk (Abba et al., 2023; Abba et al., 2021; Luo et al., 2024). Hypertension was more prevalent among older participants, women, divorced individuals, and those with lower educational attainment (Defianna et al., 2021a; Defianna et al., 2021b; Muli et al., 2020). These patterns mirror those seen in other low- and middle-income countries, where limited access to health information, preventive care, and structured physical activity opportunities contribute to chronic disease disparities (Olufadewa et al., 2021; Schutte et al., 2021). Moreover, urban residents were more likely to report hypertension than rural residents, possibly reflecting differences in lifestyle, dietary habits, stress levels, and sedentary behaviors. These urban-rural disparities have also been documented in other developing regions, such as Malaysia and China (Ranzani et al., 2022; Mandal & Pradhan, 2025; Jambhale & Kothalkar, 2024).

This study has several limitations. The cross-sectional design analysis cannot establish causality between physical activity and hypertension. Self-reported physical activity: Measurement of physical activity was based on self-report, which is subject to recall and social desirability bias (Wu et al., 2024; Khoong et al., 2022; Nessler et al., 2023). Lack of clinical confirmation: Although hypertension status included both self-reported diagnosis and measured blood pressure, additional clinical data (e.g., medication adherence, comorbidities) were not included. Unmeasured confounders: Factors such as diet, sleep, stress, and genetic predisposition were not assessed and may influence the observed associations. The results underscore the importance of promoting physical activity among older adults in Indonesia as a non-pharmacological intervention to prevent and manage hypertension. Health education programs should prioritize vulnerable

populations such as women, the elderly, divorced individuals, and those with lower education levels who are at higher risk of physical inactivity and hypertension. Community-based interventions, urban planning to encourage active lifestyles, and culturally appropriate exercise programs could play a key role in reducing hypertension prevalence. Public health policies should integrate regular physical activity promotion into national strategies for non-communicable disease control.

CONCLUSION

This study demonstrates a significant association between physical inactivity and hypertension among older Indonesian adults. Physical activity appears to play a protective role against hypertension, emphasizing the need for targeted interventions to increase physical activity levels in this growing population. Addressing physical inactivity, particularly among urban and socioeconomically disadvantaged groups, is critical to improving cardiovascular health and healthy aging in Indonesia. This study provides compelling evidence of the significant association between physical activity and hypertension status among older adults in Indonesia. Utilizing nationally representative data from the 2023 Indonesia Health Survey (SKI), our findings demonstrate that individuals aged 60 years and older who engage in regular physical activity are less likely to experience hypertension compared to their physically inactive counterparts. This protective relationship remains consistent even when adjusted for sociodemographic variables such as age, gender, marital status, educational level, employment status, and urban-rural residence. The analysis highlights several important trends: hypertensive individuals tend to be older, female, less educated, and more likely to live in urban areas. Furthermore, those who were physically inactive showed a significantly higher prevalence of hypertension, emphasizing the critical role that regular physical activity plays in cardiovascular health promotion and disease prevention. These findings are consistent with global research, reinforcing that physical activity is a modifiable risk factor with extensive benefits for managing blood pressure and improving overall well-being among the elderly. Considering the rapid demographic transition and aging population in Indonesia, promoting physical activity among older adults should be a national public health priority. Health interventions and policy frameworks should focus on: Increasing awareness and accessibility of physical activity programs tailored to older adults, encouraging active aging through community-based initiatives, Reducing barriers to physical

activity, particularly in urban settings and among socially disadvantaged groups. Moreover, healthcare providers and policymakers must integrate physical activity counseling into routine geriatric care as a non-pharmacological strategy to prevent and control hypertension. In conclusion, this study underscores the urgent need to promote physical activity as a key component of healthy aging. Enhancing physical activity levels among older Indonesians holds the potential not only to reduce the burden of hypertension but also to improve quality of life, reduce healthcare costs, and support the broader goal of healthy and productive aging in the country.

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