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The Relationship Between Body Mass Index and Hypertension Incidents among the Elderly

Dini Tiara Puspita Sari[1], Musthika Wida Mashitah[1]

[1] *Undergraduate Nursing Study Program, Faculty of Health Sciences, Institute of Technology, Science and Health, Dr. Soepraoen Hospital, Malang, Indonesia*

Correspondence should be addressed to:
Dini Tiara Puspita Sari
puspitatiara729@gmail.com

Abstract:
Hypertension is a prevalent health concern among older adults and is strongly associated with increased Body Mass Index (BMI). Excess body weight contributes to elevated blood pressure through physiological mechanisms, including increased peripheral vascular resistance and heightened sympathetic nervous system activity. This study aimed to examine the association between BMI and hypertension prevalence among older adults. An analytical observational study with a cross-sectional design was conducted among 60 older adults selected through purposive sampling. Data were collected using standardized procedures, including measurements of body weight, height, and blood pressure. BMI was categorized according to standard criteria. The association between BMI and hypertension was analyzed using Fisher's Exact Test, with α = 0.05. The prevalence of hypertension among participants was 58.3%. Higher proportions of hypertension were observed in overweight (68.2%) and obese (80.0%) individuals compared to those with normal BMI. Statistical analysis revealed a significant association between BMI and hypertension (p = 0.012). BMI is significantly associated with hypertension among older adults. These findings highlight the importance of weight management through nutritional education, physical activity promotion, and routine blood pressure monitoring as part of comprehensive elderly healthcare services.

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INTRODUCTION

Hypertension remains a major global public health challenge and a leading contributor to morbidity and mortality worldwide (Goorani et al., 2024). It is a primary risk factor for cardiovascular diseases, including stroke, heart failure, chronic kidney disease, and myocardial infarction (Poznyak et al., 2022). The burden of hypertension continues to rise, particularly in low- and middle-income countries, where healthcare systems often face limitations in prevention, early detection, and long-term management (Jobe et al., 2025). This condition not only affects individual health outcomes but also imposes substantial economic and social burdens on communities and healthcare systems (Metlock et al., 2024).

The prevalence of hypertension increases markedly with advancing age, making older adults one of the most vulnerable populations (Karayiannis, 2022). Age-related physiological changes, such as arterial stiffness, reduced vascular elasticity, and alterations in autonomic regulation, contribute to elevated blood pressure in the elderly (Bencivenga et al., 2022). As life expectancy continues to improve globally, the proportion of older individuals is increasing, further amplifying the public health significance of hypertension in this age group (Chaturvedi et al., 2024). Therefore,

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identifying modifiable risk factors in the elderly is essential to reduce the burden of hypertension and its complications (Dai et al., 2022).

One of the most important modifiable risk factors associated with hypertension is nutritional status, commonly assessed using Body Mass Index (BMI) (Indrapal et al., 2022). BMI is a simple, widely used anthropometric measure that reflects the relationship between body weight and height and is used to classify individuals as underweight, normal weight, overweight, and obese (Wu et al., 2024). Numerous studies have demonstrated that elevated BMI is associated with an increased risk of hypertension, making it a key target for preventive interventions, particularly in aging populations (Luo et al., 2023).

Several complex physiological mechanisms mediate the relationship between increased BMI and hypertension. Excess adipose tissue contributes to the activation of the sympathetic nervous system and the renin–angiotensin–aldosterone system (RAAS), leading to vasoconstriction and increased blood volume (Hall et al., 2024). Additionally, obesity is associated with insulin resistance and chronic low-grade inflammation, characterized by elevated levels of pro-inflammatory cytokines such as interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α) (Alaamri et al., 2025). These factors contribute to endothelial dysfunction, increased peripheral vascular resistance, and ultimately elevated blood pressure (Młynarska et al., 2024).

Given the growing burden of hypertension among older adults and the significant role of BMI as a modifiable risk factor, it is important to explore this relationship in specific community settings further (Liu et al., 2023). This study aims to examine the association between BMI and hypertension incidence in the elderly population. The findings are expected to provide evidence-based insights to support community-level strategies for hypertension prevention, early detection, and effective management, particularly through weight-control and lifestyle-modification interventions (Nyame et al., 2024).

METHOD

Research Design

This study employed an analytical observational design with a cross-sectional approach to examine the relationship between Body Mass Index (BMI) and the incidence of hypertension among older adults. The study was conducted at the Modayag Community Health Center, East Bolaang Mongondow Regency, Indonesia, from July to August 2025.

Participants

The study population consisted of all older adults aged ≥60 years registered at the Modayag Community Health Center. A total of 30 participants were selected using purposive sampling. Inclusion criteria were: (1) elderly individuals residing in the study area, (2) ability to communicate effectively, and (3) willingness to participate as indicated by informed consent. Exclusion criteria included elderly individuals with serious illness, edema, or limb amputations that could affect anthropometric measurements.

Data Collection

Data were collected through structured interviews and direct physical measurements. Body weight was measured using a calibrated digital scale, and height was measured using a stadiometer. BMI was calculated as weight in kilograms divided by height in meters squared (kg/m²) and categorized as underweight, normal weight, overweight, and obese according to standard classification criteria. Blood pressure was measured with a calibrated digital sphygmomanometer,

and hypertension was defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg. A structured questionnaire, previously tested for validity and reliability, was used to collect supporting data.

Data Analysis

Data were analyzed using the latest version of the Statistical Package for the Social Sciences (SPSS). Descriptive statistics were used to summarize participants' characteristics, including frequency distributions and percentages. Inferential analysis was conducted using Fisher's Exact Test to assess the association between BMI categories and hypertension status. Statistical significance was determined at a p-value < 0.05.

Ethical Clearance

This study received ethical approval from the Faculty of Health Sciences, Institute of Technology, Science and Health, Dr. Soepraoen Hospital. All participants provided informed consent prior to data collection, and confidentiality of personal information was strictly maintained throughout the study.

RESULT

Table 1. Distribution of Respondents' Characteristics in the working area of Modayag Health Center

Characteristics	Category	Frequency (n)	Percentage (%)
Age (years)	60–69	34	56.7
	70–79	18	30.0
	≥80	8	13.3
Gender	Man	23	38.3
	Woman	37	61.7

Table 1 shows that most respondents were in the 60–69 age group (56.7%), followed by those aged 70–79 (30.0%), and only 13.3% were aged ≥80 years. This illustrates that young elderly (early elderly) are more dominant in using health services in the study area, which is generally associated with a level of mobility and physical ability still better than that of the elderly. In addition, there were more female respondents (61.7%) than males (38.3%). This dominance of older women is in accordance with the general phenomenon that women have a higher life expectancy and more frequent use of primary health care services than men, so they are more often identified during routine check-ups.

Table 2. Distribution of Respondents based on BMI Category and Hypertension Status

Variable	Frequency (n)	Percentage (%)
BMI Categories*		
Underweight (<18.5 kg/m²)	3	5.0
Normal (18.5–24.9 kg/m²)	20	33.3
Overweight (25.0–29.9 kg/m²)	22	36.7
Obesity (≥30 kg/m²)	15	25.0
Blood Pressure Categories		
Normal (<140/90 mmHg)	25	41.7
Hypertension (≥140/90 mmHg)	35	58.3

*WHO (2020)

Table 2 shows that one-third of respondents were overweight (36.7%) and one-quarter were obese (25.0%). Meanwhile, only 33.3% had a normal BMI, and 5% were underweight. These findings

reflect a trend toward increased overnutrition among the elderly in the community health center's work area. Overweight and obesity in the elderly are indicators of a high risk for various degenerative diseases, including hypertension, diabetes, and heart disease. Therefore, these results provide an initial indication that overnutrition is a significant issue in the elderly population in the study area.

It was revealed that 58.3% of respondents had hypertension, while 41.7% had normal blood pressure. This figure indicates that more than half of the elderly in this study had hypertension, confirming that hypertension is a dominant health problem in the elderly group. The high prevalence of hypertension in the elderly may be associated with degenerative processes of blood vessels, decreased arterial elasticity, hormonal changes, and a less active lifestyle, placing this group at high risk for cardiovascular complications. The relationship between BMI categories and hypertension incidence was analyzed using Fisher's Exact Test.

Table 3. Relationship between BMI and the Incidence of Hypertension in the Elderly

BMI Category	Hypertension Status		Total	p-value
	Hypertension (n)	No Hypertension (n)		
Underweight	0	3	3	0.012
Normal	8	12	20	
Overweight	15	7	22	
Obesity	12	3	15	

Table 3 shows a pattern of increasing proportion of hypertension with increasing BMI category. Only 40% of the elderly with normal BMI experienced hypertension, while 68.2% of the overweight elderly experienced hypertension, and 80% of the obese elderly experienced hypertension. There were no cases of hypertension in the underweight group. This pattern clearly indicates a dose-response relationship, meaning the higher a person's BMI, the greater the chance of developing hypertension. The Fisher's Exact Test showed p = 0.012, indicating a significant relationship between BMI and hypertension in the elderly. This finding supports evidence that excess weight contributes to increased blood pressure through pathophysiological mechanisms such as increased peripheral resistance, sympathetic nervous system hyperactivity, and renin–angiotensin–aldosterone activation. Thus, this table confirms that BMI is an important factor to consider in efforts to prevent and control hypertension in the elderly population.

DISCUSSION

The findings of this study demonstrate a statistically significant association between Body Mass Index (BMI) and hypertension among older adults (p = 0.012). A higher proportion of hypertension was observed among participants classified as overweight (68.2%) and obese (80.0%) compared to those with normal BMI (40.0%). These results suggest that increasing body mass is associated with a greater likelihood of developing hypertension in the elderly population. This finding is consistent with a growing body of evidence indicating that excess body weight is a key modifiable risk factor for elevated blood pressure (Koebnick et al., 2023).

Several interrelated physiological mechanisms can explain the relationship between elevated BMI and hypertension. Excess adiposity increases circulating blood volume and cardiac output, elevating arterial pressure. Furthermore, obesity is associated with activation of the sympathetic nervous system and the renin–angiotensin–aldosterone system (RAAS), both of which promote vasoconstriction and sodium retention (Shams et al., 2022). In addition, adipose tissue acts as an active endocrine organ, releasing pro-inflammatory cytokines such as tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6). These inflammatory mediators contribute to endothelial dysfunction,

impaired vasodilation, and increased peripheral vascular resistance, ultimately leading to sustained elevations in blood pressure (Alaamri et al., 2025).

The prevalence of hypertension observed in this study (58.3%) is comparable to national and regional data, indicating that more than half of the elderly population is affected by hypertension. This consistency reinforces the growing burden of hypertension among older adults, particularly in low- and middle-income settings. In addition to BMI, other demographic factors such as advanced age and sex distribution may have contributed to the observed prevalence. The predominance of female participants (61.7%) is noteworthy, as postmenopausal hormonal changes, particularly decreased estrogen levels, are known to increase vascular stiffness and elevate blood pressure. These findings align with previous studies highlighting the multifactorial nature of hypertension in aging populations (Muhammad et al., 2022).

The results of this study have important implications for primary healthcare interventions targeting older adults. Given that BMI is a modifiable risk factor, weight management strategies should be prioritized. These include promoting balanced nutritional intake, encouraging regular physical activity, and implementing routine blood pressure screening programs. Community-based initiatives, such as integrated health service posts for the elderly, can play a crucial role in early detection and ongoing management of hypertension. Strengthening these programs may help reduce the burden of cardiovascular disease and improve the quality of life among older populations (Khan et al., 2024; Made et al., 2025).

Several limitations should be considered when interpreting the findings of this study. First, the relatively small sample size may limit the generalizability of the results. Second, the cross-sectional design precludes establishing causal relationships between BMI and hypertension. Third, potential confounding variables, such as dietary patterns, physical activity levels, smoking status, and family history of hypertension, were not controlled for in the analysis (Da Silva et al., 2022). Future studies are recommended to employ longitudinal designs with larger, more diverse samples, as well as more comprehensive measurements of variables, to better understand the complex determinants of hypertension among older adults, particularly in rural and community-based settings.

CONCLUSION

This study demonstrates a significant association between Body Mass Index (BMI) and hypertension among older adults, with overweight and obese individuals exhibiting a higher prevalence of elevated blood pressure compared to those with normal BMI. These findings reinforce the role of excess body weight as an important modifiable risk factor for hypertension in the elderly population. From a public health perspective, the results highlight the need to strengthen weight management strategies by promoting balanced nutrition, regular physical activity, and routine blood pressure monitoring in primary healthcare settings. Integrating these interventions into community-based elderly care programs may contribute to more effective prevention and control of hypertension and its associated complications.

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