



Epidemiological Determinants of Hypertension Among Menopausal Women: A Case-Control Study on Age and Obesity at Yosomulyo Primary Health Care Center

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Abstract

Hypertension is a major public health problem that contributes significantly to increased morbidity and mortality, with a higher risk observed among menopausal women due to decreased estrogen levels. In 2023, the prevalence of hypertension in Indonesia reached 30.8%, while in Lampung Province it was reported at 28.45%. In the working area of Yosomulyo Primary Health Center, Metro City, the number of hypertension cases among menopausal women increased from 182 to 244 cases. This study aimed to examine the association of age and obesity with the occurrence of hypertension among menopausal women. A quantitative approach with a case-control design was applied, involving 78 respondents consisting of 39 cases and 39 controls selected through accidental sampling. Age and obesity were defined as independent variables, while hypertension status was the dependent variable. Data were collected through interviews, blood pressure measurements, and anthropometric assessments, and analyzed using the Chi-square test and Odds Ratio. The results indicated a significant association between age and hypertension (p -value = 0.001; OR = 5.570) as well as between obesity and hypertension (p -value = 0.008; OR = 3.918). In conclusion, age and obesity are significantly associated with the incidence of hypertension among menopausal women, highlighting the need for strengthened health education, early hypertension screening, and promotion of healthy lifestyle behaviors as preventive measures.

Keywords: *Hypertension in Menopausal Women, Age, Obesity.*

INTRODUCTION

Hypertension is one of the major global public health problems contributing significantly to increased mortality and disability worldwide. According to the Institute for Health Metrics and Evaluation (IHME), hypertension acts as a key trigger for various non-communicable disease complications and accounts for 61.6% of the causes of death in Indonesia (Kemenkes, 2023a). Globally, non-communicable diseases contribute approximately 72% of total deaths, exceeding mortality from infectious diseases, maternal and perinatal conditions, and nutritional disorders. This epidemiological transition highlights the growing dominance of chronic diseases in

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population health outcomes. Hypertension is of particular concern due to its high prevalence and its role as a primary risk factor for cardiovascular and cerebrovascular diseases. Consequently, hypertension has become a priority issue in both global and national health agendas (WHO, 2023; Kemenkes, 2023c).

Hypertension is clinically defined as a systolic blood pressure of ≥ 140 mmHg and/or a diastolic blood pressure of ≥ 90 mmHg, conditions that significantly increase morbidity and mortality rates (Apriliansi *et al.*, 2021). Data from the 2023 Indonesian Health Survey reported that the prevalence of hypertension based on direct blood pressure measurements reached 30.8%. However, a substantial gap exists between diagnosed and measured cases, particularly among individuals aged 60 years and older. This discrepancy shows limited awareness and underdiagnosis of hypertension in older populations. In Lampung Province, the prevalence of hypertension was reported at 28.45%, with health service coverage reaching 73.3% (Dinkes Provinsi Lampung, 2023). At the municipal level, hypertension ranks among the ten most common diseases treated at primary health care centers in Metro City, with Yosomulyo Primary Health Care Center reporting the highest prevalence at 63.68% (Dinkes Kota Metro, 2023). This condition shows that Yosomulyo Primary Health Care Center represents an area with a high disease burden and strategic setting for epidemiological investigation related to non-communicable disease control at the primary health care level.

Menopausal women represent a population group with a heightened risk of developing hypertension due to physiological and hormonal changes associated with aging. The decline in estrogen levels during menopause reduces vascular protection and contributes to increased blood pressure through mechanisms such as vasoconstriction and oxidative stress (Ridwan *et al.*, 2024; Fadli, 2021). Estrogen as a critical role in maintaining endothelial function and arterial elasticity, and its reduction accelerates vascular aging. These changes predispose menopausal women to cardiovascular disorders, including hypertension. Additionally, age-related structural and functional alterations in blood vessels further exacerbate blood pressure elevation.

Age is a non-modifiable risk factor that strongly influences the incidence of hypertension, particularly among menopausal women. Increasing age is associated with arterial stiffness, reduced baroreceptor sensitivity, and impaired renal sodium excretion, all of which contribute to elevated blood pressure. Studies have shown that the prevalence of hypertension rises significantly after the age of 50, coinciding with the menopausal transition (Ridwan *et al.*, 2024). As life expectancy increases, the proportion of older women experiencing menopause-related health issues also grows.

In addition to age, obesity is a major modifiable risk factor that significantly contributes to the development of hypertension in menopausal women. Hormonal changes during menopause lead to a decrease in basal metabolic rate, promoting weight gain and fat accumulation (Izzah *et al.*, 2022). Excess body fat increases cardiac output and activates the Renin-Angiotensin-Aldosterone System, resulting in elevated blood pressure. Globally, approximately 16% of adults are classified as obese, showing a growing public health concern (WHO, 2024). In Indonesia, the prevalence of obesity among adult women has reached 16.58%, showing a higher burden compared to men (Puspapertiwi & Dzulfaroh, 2024).

Based on preliminary data from Yosomulyo Primary Health Care Center, there were 460 menopausal women registered, with 182 cases of hypertension that increased to 244 cases during the study period. This trend shows a substantial and growing burden of hypertension among menopausal women in the Yosomulyo service area. In addition to its high prevalence, the Yosomulyo service area is characterized by limited routine screening coverage, suboptimal lifestyle modification adherence, and a predominance of

middle-to-late age women, which may exacerbate the interaction between age, obesity, and hypertension at the community level. The high prevalence suggests the presence of multiple interacting risk factors, particularly age and obesity. Despite the magnitude of the problem, local evidence examining these associations remains limited.

Previous studies by Hidayah and Hartatik (2022) and Ridwan *et al.* (2024) have documented the association between age, obesity, and hypertension among menopausal women; however, these studies were conducted in different demographic and health service and did not specifically focus on primary health care settings with the highest disease burden. Therefore, the novelty of this study lies in its focus on a high-prevalence primary health care center, using a case-control design to simultaneously assess age and obesity as epidemiological determinants of hypertension among menopausal women. This study provides context-specific evidence that can support targeted public health interventions and strengthen non-communicable disease prevention strategies at the primary care level. Accordingly, this study aims to analyze the relationship between age and obesity and the incidence of hypertension among menopausal women at Yosomulyo Primary Health Care Center in 2025.

RESEARCH METHOD

This study employed a quantitative approach using an analytic survey method with a retrospective case-control design to identify risk factors associated with hypertension among menopausal women (Notoatmodjo, 2018). The retrospective case-control design was selected to compare exposure factors between respondents with and without hypertension. The study was conducted in the working area of Yosomulyo Primary Health Care Center in 2025. The study population consisted of all menopausal women registered at the health center, totaling 460 individuals. A total sample of 78 respondents was included in the study, comprising 39 cases (menopausal women diagnosed with hypertension) and 39 controls (menopausal women without hypertension). Samples were selected using an accidental sampling technique based on respondent availability during the data collection period.

The inclusion criteria were menopausal women aged ≥ 45 years who were registered at Yosomulyo Primary Health Care Center, willing to participate in the study, and able to communicate effectively during interviews. Menopausal status was defined as the permanent cessation of menstruation for at least 12 consecutive months. The exclusion criteria included menopausal women who were undergoing hormone replacement therapy (HRT), had a documented history of congenital heart disease, chronic kidney disease, or secondary hypertension, as well as those with incomplete data or uncooperative during the data collection process. These criteria were applied to minimize potential confounding factors and reduce selection bias.

The independent variables in this study were age and obesity, while the dependent variable was the incidence of hypertension. Age was operationally categorized into “at-risk age” defined as ≥ 55 years and “not at-risk age” defined as < 55 years, based on evidence showing increased hypertension risk after the menopausal transition. Obesity status was determined using Body Mass Index (BMI), calculated as weight in kilograms divided by height in meters squared (kg/m^2). Respondents with a BMI $\geq 25.0 \text{ kg}/\text{m}^2$ were classified as obese according to the Asia-Pacific classification, while those with a BMI $< 25.0 \text{ kg}/\text{m}^2$ were classified as non-obese.

Data were collected through structured interviews using a questionnaire, blood pressure measurements, and anthropometric assessments. Blood pressure was measured using a calibrated digital sphygmomanometer (Omron®, automatic upper-arm type), which had been routinely calibrated by the primary health care center to ensure

measurement accuracy and reliability. Measurements were conducted in a seated position after the respondent had rested for at least five minutes, following standard blood pressure measurement procedures. Blood pressure measurements were used to classify respondents into hypertensive and non-hypertensive groups, while anthropometric measurements were conducted to determine obesity status.

Data analysis was performed using the Chi-Square test to assess the association between independent variables and hypertension. The strength of the associations was measured using Odds Ratio (OR) analysis. All statistical analyses were conducted at a significance level of $\alpha = 0.05$ to determine relationships between risk factors and the incidence of hypertension.

RESULTS

Univariate Analysis

Among the 39 respondents in the case group (menopausal women with hypertension), the majority were classified in the at-risk age category, accounting for 79.5% (31 respondents) as shown in Table 1. In contrast, only 20.5% (8 respondents) in the case group were categorized as not at-risk age. In the control group, a lower proportion of respondents were in the at-risk age category (41.0%), while most respondents were in the not at-risk age category (59.0%). These findings show a clear difference in age distribution between menopausal women with and without hypertension. The higher proportion of at-risk age among hypertensive respondents suggests age may play an important role in the occurrence of hypertension.

Table 1. Distribution of Age Among Menopausal Women

Age Category	Cases (Menopausal Women with Hypertension)		Controls (Menopausal Women without Hypertension)	
	n	%	n	%
At-risk age	31	79.5	16	41.0
Not at-risk age	8	20.5	23	59.0
Total	39	100	39	100

Table 2, shows that among menopausal women with hypertension, 46.2% (18 respondents) were classified as obese. Meanwhile, 53.8% (21 respondents) in the case group were not obese. In the control group, only 17.9% (7 respondents) were obese, while the majority, 82.1% (32 respondents), were not obese. These findings show a noticeable difference in obesity prevalence between hypertensive and non-hypertensive menopausal women. The higher proportion of obesity among the case group suggests that obesity may contribute to the development of hypertension.

Table 2. Distribution of Obesity Among Menopausal Women

Obesity Status	Cases (Menopausal Women with Hypertension)		Controls (Menopausal Women without Hypertension)	
	n	%	n	%
Obese	18	46.2	7	17.9
Not obese	21	53.8	32	82.1
Total	39	100	39	100

Bivariate Analysis

Based on Table 3, the majority of menopausal women with hypertension were in the at-risk age category (79.5%), whereas the proportion was considerably lower among women without hypertension (41.0%). The Chi-Square test revealed a statistically significant relationship between age and the incidence of hypertension among menopausal women (p-value = 0.001). The Odds Ratio (OR) value of 5.570 with a 95% Confidence Interval (CI) of 2.038-15.227 shows a strong association. This result suggests that menopausal women in the at-risk age category were approximately 5.6 times more likely to experience hypertension compared to those in the not at-risk age category. The wide confidence interval still lies entirely above one, reinforcing the strength of this association.

Table 3. Relationship Between Age and Hypertension Among Menopausal Women

Age Category	Hypertension (Cases)		No Hypertension (Controls)		Total		p-value	OR (95% CI)
	n	%	n	%	n	%		
At-risk age	31	79.5	16	41.0	47	60.3	0.001	5.570 (2.038-15.227)
Not at-risk age	8	20.5	23	59.0	31	39.7		
Total	39	100	39	100	78	100		

Table 4 shows that obesity was present in 46.2% of menopausal women with hypertension, while only 17.9% of women without hypertension were classified as obese. The Chi-Square test showed a statistically significant relationship between obesity and hypertension among menopausal women (p-value = 0.008). The Odds Ratio of 3.918 with a 95% Confidence Interval of 1.396-10.998 shows a meaningful association between obesity and hypertension. This finding implies that obese menopausal women had nearly four times higher risk of developing hypertension compared to non-obese menopausal women. The confidence interval does not include one, showing statistical significance. Therefore, obesity is confirmed as an important risk factor for hypertension in menopausal women.

Table 4. Relationship Between Obesity and Hypertension Among Menopausal Women

Obesity Status	Hypertension (Cases)		No Hypertension (Controls)		Total		p-value	OR (95% CI)
	n	%	n	%	n	%		
Obese	18	46.2	7	17.9	25	32.1	0.008	3.918 (1.396-10.998)
Not obese	21	53.8	32	82.1	53	67.9		
Total	39	100	39	100	78	100		

DISCUSSION

Proportion of Age Among Menopausal Women with Hypertension

The results of this study show that the proportion of menopausal women with hypertension was considerably higher in the at-risk age group (79.5%) compared to the control group (41.0%). This finding is consistent with previous studies conducted by

Hidayah and Hartatik (2022) as well as Maringga and Sari (2020), which reported that the incidence of hypertension increases with advancing age. Age is recognized as a non-modifiable risk factor, as the aging process leads to structural and functional changes in the cardiovascular system. These changes include reduced arterial elasticity and narrowing of blood vessels, which contribute to increased peripheral resistance and elevated blood pressure (Sari, 2017). Consequently, older individuals are more susceptible to developing hypertension. This pattern reinforces the importance of age as a critical determinant of hypertension among menopausal women. These findings align with the Vascular Aging theory, which explains that progressive arterial stiffening and endothelial dysfunction accumulate over time and substantially elevate systolic blood pressure in older adults.

In postmenopausal women, particularly those aged 55-59 years, the risk of hypertension increases due to the combined effects of aging and a decline in estrogen levels. Estrogen plays a vital role in maintaining vascular function, and its reduction results in decreased vasodilation capacity and increased oxidative stress. Prior to the age of 60 years, approximately 30-50% of women experience hypertension associated with menopausal hormonal changes, while the prevalence of hypertension among postmenopausal women reaches 38% (Izzah *et al.*, 2022; Maas & Franke, 2024). These hormonal and physiological changes accelerate vascular aging and elevate blood pressure. Conceptually, this mechanism can be showed through a biological pathway in which declining estrogen leads to endothelial dysfunction, increased arterial stiffness, and ultimately sustained hypertension, particularly when combined with advancing age. Therefore, menopausal age represents an important risk factor for hypertension. Routine blood pressure screening and early preventive measures should be emphasized starting from the early menopausal period.

Proportion of Obesity and Hypertension Among Menopausal Women

The findings of this study show that 46.2% of menopausal women with hypertension were obese, while only 17.9% of women in the non-hypertensive control group were classified as obese. This result aligns with previous research demonstrating a positive association between obesity, both general and central, and hypertension among women (Khasanah, 2022; Pratiwi *et al.*, 2024). Obesity is a well-established risk factor for various chronic diseases, including hypertension, particularly among menopausal women. The observed difference between the case and control groups highlights the substantial role of excess body weight in the development of hypertension. From a mechanistic perspective, obesity amplifies cardiovascular load and exacerbates metabolic dysregulation, thereby accelerating blood pressure elevation during menopause.

Obesity results from an imbalance between energy intake and energy expenditure, leading to abnormal fat accumulation that increases the risk of chronic diseases such as hypertension (Kemenkes, 2022; WHO, 2024). National data show that the prevalence of obesity among adult women in Indonesia is 16.58%, while global data from the World Health Organization report that 16% of adults worldwide are obese (Puspapertiwi & Dzulfaroh, 2024; WHO, 2024). These statistics illustrate the growing burden of obesity both nationally and globally. In menopausal women, metabolic changes further exacerbate weight gain and fat redistribution. The coexistence of obesity and menopause significantly elevates the risk of hypertension. The interaction between obesity and estrogen decline creates a synergistic effect, intensifying vascular inflammation and neurohormonal activation that contribute to hypertension.

Relationship Between Age and the Incidence of Hypertension Among Menopausal Women

This study showed a statistically significant relationship between age and the incidence of hypertension among menopausal women ($p = 0.001$; OR = 5.570; 95% CI = 2.038-15.227). Menopausal women in the at-risk age group were 5.57 times more likely to develop hypertension compared to those in the not at-risk age group. This finding is consistent with earlier studies reporting an increased risk of hypertension with advancing age, particularly among women aged 55-59 years (Hidayah & Hartatik, 2022; Maringga & Sari, 2020). Aging is associated with progressive vascular changes that elevate blood pressure. These changes become more pronounced during and after menopause. Therefore, age plays a pivotal role in hypertension development among menopausal women.

The increased risk of hypertension in older menopausal women is attributed to the combined effects of postmenopausal estrogen decline and physiological aging processes. These processes include narrowing of the vascular lumen and stiffening of arterial walls, which reduce vascular elasticity and increase blood pressure (Sari, 2017; Maas & Franke, 2024). Estrogen provides vascular protection through vasodilatory effects, antioxidant activity, and inhibition of the renin-angiotensin-aldosterone system (Ridwan *et al.*, 2024; Fadli, 2021). Loss of these protective mechanisms leads to heightened vascular resistance and hypertension. Postmenopausal women are particularly vulnerable to blood pressure elevation.

In addition, early menopause occurring before the age of 45 years further increases the risk of hypertension due to the premature loss of estrogen's protective effects. Early estrogen deficiency promotes vasoconstriction, activation of the renin-angiotensin-aldosterone system, insulin resistance, dyslipidemia, and central adiposity (Anagnostis *et al.*, 2020; El Khoudary *et al.*, 2020). These metabolic and vascular changes accelerate the development of hypertension at a younger age. Therefore, hypertension management among menopausal women, particularly those at high-risk ages or with early menopause, should focus on healthy lifestyle modification. Regular blood pressure monitoring, stress management, and non-communicable disease screening at health facilities are essential components of prevention efforts.

Relationship Between Obesity and Hypertension Among Menopausal Women

The analysis revealed a significant relationship between obesity and hypertension among menopausal women ($p = 0.008$; OR = 3.918; 95% CI = 1.396-10.998). Obese menopausal women were found to have a 3.9 times higher likelihood of developing hypertension compared to non-obese women. This finding is consistent with previous studies demonstrating a positive correlation between obesity, both general and central, and hypertension among menopausal women (Khasanah, 2022; Pratiwi *et al.*, 2024). Obesity significantly increases cardiovascular workload and blood pressure. The strong association observed in this study emphasizes the importance of weight management in preventing hypertension.

Obesity in menopausal women is influenced by declining estrogen levels, which affect basal metabolism, body fat distribution, and weight gain. These changes contribute to hypertension through multiple mechanisms, including increased cardiac output due to greater body mass, stimulation of the sympathetic nervous system, and activation of the renin-angiotensin-aldosterone system, leading to sodium and water retention (Izzah *et al.*, 2022; Hastuti, 2018). Additionally, visceral obesity increases intrarenal pressure and triggers inflammatory processes that further exacerbate hypertension. These physiological pathways explain the strong link between obesity and elevated blood pressure in menopausal women.

Nutritional factors also play a significant role in the development of hypertension during menopause. Reduced intake of calcium, magnesium, vitamin D, B-complex vitamins, and antioxidants during menopause can impair vascular elasticity and disrupt blood pressure regulation (Sari & Tandra, 2023; Harvard T.H. Chan School of Public Health, 2021). These deficiencies further increase the risk of hypertension among obese menopausal women. Therefore, obesity control through balanced nutrition, low sodium intake, high fiber consumption, and diets rich in micronutrients and antioxidants is essential. Combined with regular physical activity and effective stress management, these strategies are vital in preventing hypertension among menopausal women.

The markedly higher OR for age shows that aging represents a more dominant and cumulative risk factor compared to obesity, as age encompasses irreversible biological processes such as vascular remodeling, arterial stiffness, and prolonged hormonal deficiency. These findings are highly relevant to Indonesia's national strategy for non-communicable disease control and healthy aging, which emphasizes early detection and risk factor management among older adults. The strong association between age, obesity, and hypertension supports national policies promoting integrated screening at primary health care centers, particularly for menopausal and elderly women.

CONCLUSION AND RECOMMENDATION

Based on the study conducted among 78 menopausal women at Yosomulyo Primary Health Care Center in 2025, the proportion of hypertension among menopausal women was found to be 53.0%. Menopausal women in the at-risk age group had a 5.57 times higher risk of developing hypertension compared to those in the not at-risk age group ($p = 0.001$; OR = 5.570; 95% CI = 2.038-15.227). Meanwhile, menopausal women with obesity had a 3.92 times higher risk of hypertension compared to non-obese women ($p = 0.008$; OR = 3.918; 95% CI = 1.396-10.998). These findings show that age and obesity are significant risk factors for hypertension among menopausal women. The increased risk is influenced by a combination of physiological and hormonal factors, including decreased estrogen levels, reduced vascular elasticity, and increased body mass.

Health care providers are encouraged to strengthen health education for menopausal women, particularly regarding weight management, healthy dietary patterns low in sodium and rich in fiber and antioxidants, and routine blood pressure monitoring. The findings of this study may serve as a foundation for further research exploring hypertension risk factors among menopausal women, including nutritional interventions, lifestyle modifications, and hormonal aspects. For midwifery education programs, the results of this study can be utilized as reference material and teaching resources to enhance students knowledge and competencies in managing hypertension among menopausal women.

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