Profile of Hypertension Patients Receiving Outpatient Care

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Abstract.

Hypertension is a non-communicable disease with high prevalence and a major risk factor for cardiovascular disease, stroke, and kidney disorders. This condition is often asymptomatic, leading many patients to be diagnosed only after complications arise. Therefore, information on the profile of hypertensive patients is essential for healthcare planning and complication prevention. This study aimed to identify the profile of hypertensive patients at RSUD Naibonat during 2023-2024. A retrospective descriptive design was employed. Data were obtained from medical records of outpatient hypertensive patients at RSUD Naibonat during the study period. Total sampling was applied, including 152 patients meeting inclusion criteria. Variables analyzed included age, sex, body mass index, and blood pressure grade according to the Indonesian Society of Hypertension. Data were analyzed descriptively and presented as frequency distributions and percentages. Most hypertensive patients were elderly, particularly aged 67-76 years. Female patients outnumbered males. The majority had above-normal body mass index, predominantly type 2 obesity. Regarding blood pressure grade, grade 1 hypertension was most common, followed by isolated systolic hypertension and grade 2 hypertension. The profile of hypertensive patients at RSUD Naibonat during 2023-2024 was dominated by elderly individuals, females, and those with above-normal body mass index. These findings highlight the importance of early detection, risk factor management, and adoption of a healthy lifestyle to prevent hypertension progression and its complications.

Keywords: *Hypertension; patient profile; body mass index; blood pressure grade and RSUD Naibonat.*

I. INTRODUCTION

Hypertension remains one of the most significant global public health challenges due to its high prevalence and its strong association with cardiovascular morbidity and mortality. It is classified as a non-communicable disease characterized by persistently elevated arterial blood pressure, which places continuous strain on the vascular system and vital organs. This condition often develops without specific symptoms, causing many individuals to remain unaware of their condition until serious complications occur, such as stroke, myocardial infarction, kidney failure, and other organ damage (Husaini & Fonna, 2024). Due to this asymptomatic nature, hypertension is widely known as a silent killer and continues to contribute significantly to premature mortality worldwide. The global burden of hypertension continues to increase. Data indicate that approximately 1.13 billion people were living with hypertension in 2019, and this number increased to 1.28 billion in 2021, with the majority of cases occurring in low- and middle-income countries (Zhou et al., 2021). In Southeast Asia, the prevalence of hypertension has reached approximately 33.9%, reflecting a substantial regional burden. This trend is closely related to epidemiological transitions, urbanization, and changes in lifestyle patterns, including unhealthy dietary habits and reduced physical activity.In Indonesia, hypertension is one of the leading causes of mortality, accounting for approximately 34.1% of deaths (Smith, 2006).

National data from the Basic Health Research (Riskesdas) 2018 show that the prevalence of hypertension remains high and varies across regions (Badan Penelitian dan Pengembangan Kesehatan, 2018). Although East Nusa Tenggara (NTT) previously showed relatively lower prevalence compared to other provinces, recent findings from the 2023 Indonesian Health Survey indicate that the prevalence in NTT has reached 26.4%, demonstrating that hypertension remains a significant health concern in the region. The distribution of hypertension is strongly influenced by demographic factors. Prevalence increases progressively with age, from 9.3% in individuals aged 15–24 years to more than 64% in those aged over 75 years (Badan Penelitian dan Pengembangan Kesehatan, 2018). This trend is closely associated with physiological changes in the vascular system, including decreased arterial elasticity, increased collagen

deposition, and vascular stiffness. These structural changes impair the ability of blood vessels to dilate, leading to increased systolic blood pressure (Ahmed et al., 2024). In addition, aging is associated with decreased baroreceptor sensitivity and endothelial dysfunction, which further contribute to impaired blood pressure regulation (Choi et al., 2025).Sex differences also influence hypertension risk. Men tend to have a higher risk at younger ages due to hormonal influences and lifestyle factors such as smoking and alcohol consumption.

In contrast, women are relatively protected during reproductive age due to the effects of estrogen, which promotes vasodilation and inhibits vascular stiffness. However, after menopause, the decline in estrogen levels increases the risk of hypertension in women (Ahmed et al., 2024; Nabila et al., 2025). These differences highlight the importance of considering biological and hormonal factors in hypertension studies.Hypertension is a multifactorial condition influenced by complex interactions between genetic, environmental, and behavioral factors. From an etiological perspective, hypertension is classified into primary and secondary types. Primary hypertension accounts for the majority of cases and is associated with genetic predisposition, lifestyle factors, and aging (Harrison et al., 2021). Secondary hypertension results from identifiable causes such as renal disease, endocrine disorders, or the use of certain medications (Carretero & Oparil, 2000).Lifestyle factors play a central role in the development of hypertension. High sodium intake, excessive consumption of red meat, smoking, alcohol consumption, and lack of physical activity are major contributors (Allen et al., 2025; Umbas et al., 2019). Unhealthy dietary patterns and sedentary lifestyles increase the risk of obesity, which is a key determinant of hypertension. Individuals with a body mass index above 25 kg/m² have a significantly higher risk of developing hypertension compared to those with normal weight (Palacios et al., 2025; Ahmed et al., 2024). The relationship between obesity and hypertension is mediated by several physiological mechanisms.

Excess adipose tissue acts as an active endocrine organ that produces pro-inflammatory cytokines such as tumor necrosis factor-alpha and interleukin-6, leading to chronic inflammation and endothelial dysfunction (Clayton et al., 2023). Obesity is also associated with insulin resistance and increased activity of the sympathetic nervous system, which contribute to increased vascular resistance and elevated blood pressure. In addition, activation of the renin-angiotensin-aldosterone system (RAAS) results in sodium and water retention, further increasing blood volume and pressure.The pathophysiology of hypertension involves multiple interconnected systems that regulate blood pressure. One of the primary mechanisms is the activation of the sympathetic nervous system. Increased sympathetic activity leads to the release of catecholamines, such as norepinephrine, which stimulate vasoconstriction and increase heart rate and cardiac output (Ziegler & Milic, 2017). Chronic activation of this system results in sustained elevation of blood pressure. Another key mechanism is the activation of the renin-angiotensin-aldosterone system. When renal perfusion decreases, renin is released and initiates a cascade that produces angiotensin II, a potent vasoconstrictor. Angiotensin II also stimulates the release of aldosterone, leading to sodium and water retention, which increases blood volume and pressure (Kushwaha et al., 2024).

This mechanism plays a central role in the development and maintenance of hypertension.Endothelial dysfunction is also a critical component of hypertension pathophysiology. The endothelium regulates vascular tone by producing vasodilators such as nitric oxide. Damage to the endothelium reduces nitric oxide production and increases the release of vasoconstrictors, leading to impaired vascular relaxation (Kasal et al., 2025; Çelik et al., 2025). Over time, these changes contribute to vascular remodeling, increased arterial stiffness, and sustained hypertension. Hypertension management requires a comprehensive approach that includes both non-pharmacological and pharmacological interventions. Lifestyle modifications, such as maintaining a healthy body weight, reducing sodium intake, increasing physical activity, and avoiding smoking and excessive alcohol consumption, have been shown to effectively lower blood pressure (Farras, 2024; Brijeshkumar et al., 2023). Pharmacological therapy, including the use of ACE inhibitors, angiotensin receptor blockers, calcium channel blockers, and beta-blockers, is essential in patients with moderate to severe hypertension or those with high cardiovascular risk (Whelton et al., 2018; Lu et al., 2017).

Despite the availability of effective treatment strategies, hypertension control remains suboptimal in many healthcare settings. One of the major challenges is the lack of comprehensive and context-specific data on patient characteristics. Understanding the demographic, clinical, and behavioral profiles of hypertensive patients is essential for identifying risk patterns, optimizing treatment strategies, and improving healthcare delivery. In regional healthcare facilities such as Naibonat Regional Public Hospital in Kupang Regency, data regarding hypertensive patient profiles are still limited. This gap in knowledge hinders the development of targeted interventions and reduces the effectiveness of hypertension management programs. Given the increasing prevalence of hypertension and its significant impact on public health, there is a clear need for local-level studies that provide detailed and context-specific information.Therefore, this study is conducted to describe the profile of hypertensive patients undergoing outpatient care at Naibonat Regional Public Hospital during the period 2023-2024. This research is important to generate empirical data on patient characteristics, support evidence-based clinical decision-making, and improve the quality of hypertension management services. By identifying key patterns and risk factors within the local population, this study aims to contribute to more effective prevention strategies and better clinical outcomes for patients with hypertension.

II. METHODS

This study employed a descriptive research design with a retrospective approach. A descriptive design is used to systematically describe characteristics of a population or phenomenon without testing relationships between variables (Aditya & Mustofa, 2023). The retrospective approach allows researchers to analyze previously recorded data, particularly medical records, to identify patterns and characteristics of patients (Setiati et al., 2013). The aim of this study was to describe the profile of hypertensive patients undergoing outpatient care at Naibonat Regional Public Hospital during the 2023–2024 period. The data used in this study were secondary data obtained from patients' medical records. The study was conducted at Naibonat Regional Public Hospital, Kupang Regency, East Nusa Tenggara. Data collection was carried out from September 2 to September 10, 2025. The population in this study consisted of all patients diagnosed with hypertension at the hospital during the 2023–2024 period, totaling 350 patients. Population refers to the entire group of individuals who share specific characteristics relevant to the research objectives (Harrison et al., 2021).The sampling technique used in this study was total sampling. Total sampling involves including all subjects who meet the inclusion criteria, especially when the population size is relatively limited (Unger et al., 2020). In this study, 152 patients met the inclusion criteria and were included as research samples.

The inclusion criteria were patients diagnosed with hypertension during the 2023–2024 period, patients with complete medical record data, and patients who underwent outpatient care at Naibonat Regional Public Hospital. Meanwhile, patients with incomplete medical record data were excluded from the study to ensure data validity and reliability. The variables analyzed in this study included age, sex, body mass index (BMI), and blood pressure classification. Age was defined as the patient's age recorded in medical records and categorized into six groups. Age is a key determinant of hypertension due to physiological changes in vascular structure and function (Masroni et al., 2025). Sex was categorized as male or female, as biological and hormonal differences influence blood pressure regulation (Ahmed et al., 2024). Body mass index (BMI) was used to assess nutritional status and obesity, which are strongly associated with hypertension risk (Palacios et al., 2025; Clayton et al., 2023). Blood pressure classification was based on the Indonesian Society of Hypertension (InaSH) criteria, which categorize hypertension into different severity levels to guide clinical management (Indonesian Society of Hypertension, 2019).Data collection was carried out using secondary data obtained from patients' medical records of hypertensive cases during the 2023–2024 period at Naibonat Regional Public Hospital. Medical records are an important source of clinical data and are widely used in retrospective studies to assess patient characteristics and disease patterns (Setiati et al., 2013).

The research instruments included patients' medical records, a sphygmomanometer used in clinical practice to measure blood pressure, and the hypertension classification guidelines based on InaSH criteria. Data processing and analysis were conducted using descriptive statistical methods. Descriptive analysis is

used to summarize and present data in a meaningful way without making inferences or testing hypotheses (Aditya & Mustofa, 2023). Nominal data were presented as frequencies and percentages. The analysis focused on describing the distribution of each variable rather than examining relationships between variables. Data processing was performed using IBM SPSS Statistics version 25. The results were presented in the form of frequency distribution tables and visual tabulations to facilitate interpretation and understanding of the data.

III. RESULT AND DISCUSSION

Result

Distribution of Hypertensive Patients by Age

Data were collected from the medical records of Budhi Asih Regional General Hospital, with a total sample of 54 patients who met the inclusion criteria. Data analysis was performed using univariate analysis to describe the baseline characteristics of patients with lumbar herniated nucleus pulposus (HNP), and bivariate analysis to assess the relationship between body mass index (BMI) and pain intensity.

Table 3.1. Frequency Distribution of Hypertensive Patients by Age

Variable	Frequency (n)	Percentage (%)
27–36	6	3.9
37–46	9	5.9
47–56	27	17.8
57–66	41	27.0
67–76	52	34.2
77–87	17	11.2
Total	**152**	**100**

Based on Table 3.1, the majority of hypertensive patients were found in the age group of 67–76 years, with a total of 52 patients (34.2%). This was followed by patients aged 57–66 years, accounting for 41 individuals (27.0%). The age group of 47–56 years contributed 27 patients (17.8%), while those aged 77–87 years accounted for 17 patients (11.2%). A smaller proportion was observed in the 37–46 years group, with 9 patients (5.9%), and the lowest frequency was found in the 27–36 years group, with only 6 patients (3.9%). These findings indicate that the prevalence of hypertension increases with advancing age, with the highest concentration observed in the elderly population.

Distribution of Hypertensive Patients by Sex

Table 3.2. Frequency Distribution of Hypertensive Patients by Sex.

Sex	Frequency (n)	Percentage (%)
Male	63	41.45
Female	89	58.55
Total	**152**	**100**

As shown in Table 3.2, female patients had a higher proportion of hypertension compared to male patients. A total of 89 patients (58.55%) were female, whereas 63 patients (41.45%) were male. This finding suggests that hypertension was more prevalent among women in this study population.

Distribution of Hypertensive Patients by Body Mass Index (BMI)

Table 3.3. Frequency Distribution of Hypertensive Patients by Body Mass Index

BMI Category	Frequency (n)	Percentage (%)
Normal	22	14.47
Obesity Type I	40	26.32
Obesity Type II	51	33.55
Overweight	24	15.79
Underweight	15	9.87
Total	**152**	**100**

Based on Table 3.3, the highest proportion of hypertensive patients was observed in the obesity type II category, with 51 patients (33.55%). This was followed by obesity type I, with 40 patients (26.32%). Patients classified as overweight accounted for 24 individuals (15.79%), while those with normal BMI comprised 22 patients (14.47%). The lowest proportion was found among underweight patients, with 15

individuals (9.87%). These results indicate a higher prevalence of hypertension among patients with increased body mass index, particularly those in the obese categories.

Distribution of Hypertensive Patients by Blood Pressure Classification (InaSH)

Table 3.4. Frequency Distribution of Hypertensive Patients by Blood Pressure Classification (InaSH)

Blood Pressure Classification	Frequency (n)	Percentage (%)
Grade 1 Hypertension	55	36.18
Grade 2 Hypertension	37	24.34
Grade 3 Hypertension	17	11.18
Isolated Systolic Hypertension	43	28.29
Total	**152**	**100**

Table 3.4 shows that the highest proportion of patients was classified as having grade 1 hypertension, with 55 patients (36.18%). This was followed by isolated systolic hypertension, affecting 43 patients (28.29%). Grade 2 hypertension was observed in 37 patients (24.34%), while grade 3 hypertension had the lowest proportion, with 17 patients (11.18%). These findings suggest that most patients were in the early stage of hypertension, although a considerable proportion had more severe or specific forms of the condition.

Discussion

Distribution by Age Category

Based on Table 3.1, the majority of hypertensive patients were found in the age group of 67–76 years, with 52 individuals (34.2%). This finding is consistent with previous studies indicating that hypertension predominantly affects the elderly population. Oktamianti et al. (2022) reported that 57.3% of hypertensive patients were aged ≥65 years. Similarly, the Indonesian Health Survey (2023) showed that the prevalence of hypertension in the elderly reached approximately 60% (Trihono, 2023). Another study by Arifin et al. (2016) also demonstrated a higher prevalence of hypertension in individuals aged over 65 years compared to younger age groups. The increased prevalence of hypertension in older adults can be explained by physiological changes associated with aging. Aging leads to arterial stiffness due to reduced elastin and increased collagen deposition in the arterial walls, which decreases vascular compliance and results in elevated systolic blood pressure (Masroni et al., 2025). In addition, reduced baroreceptor sensitivity impairs the body's ability to regulate blood pressure effectively, making older individuals more susceptible to fluctuations in blood pressure. Furthermore, dysregulation of the renin-angiotensin-aldosterone system (RAAS) contributes to sodium and water retention, as well as persistent vasoconstriction, thereby exacerbating hypertension. Endothelial dysfunction, driven by oxidative stress, also reduces nitric oxide (NO) production, increasing peripheral resistance and making blood pressure more difficult to control (Kasal et al., 2025).

These combined structural, hormonal, and neuroregulatory changes significantly increase the vulnerability of elderly individuals to hypertension.The age groups of 57–66 years (27%) and 47–56 years (17.8%) also showed a progressive increase in hypertension prevalence. This trend aligns with national data indicating that hypertension prevalence increases significantly after the age of 45 years (Trihono, 2023). The accumulation of long-term exposure to risk factors, such as unhealthy diet, physical inactivity, and stress, accelerates atherosclerosis and disrupts blood pressure regulation. Interestingly, the prevalence decreased in the 77–87 years age group to 11.2%. This phenomenon may be explained by survivor bias, where individuals who reach very old age tend to have better cardiovascular resilience. In addition, many individuals in this age group may already be undergoing regular antihypertensive treatment, resulting in better blood pressure control and fewer cases classified as active hypertension.In contrast, the prevalence of hypertension in younger age groups (27–36 years) was relatively low, with only 3.9%. This finding is consistent with Lee et al. (2023), who reported that hypertension prevalence in young adults is approximately 3.7%. At a younger age, vascular elasticity remains optimal, RAAS function is stable, and baroreflex mechanisms are still effective, allowing better regulation of blood pressure. When hypertension occurs in younger individuals, it is often associated with genetic factors or high-risk behaviors such as excessive salt intake, obesity, smoking, and physical inactivity.

Distribution by Sex

Based on Table 3.2, hypertension was more prevalent among female patients (58.55%) compared to male patients (41.45%). This finding is consistent with national data from Riskesdas 2018, which reported a higher prevalence of hypertension in women (36.9%) than in men (31.3%) (Badan Penelitian dan Pengembangan Kesehatan, 2018). Similarly, the Indonesian Health Survey 2023 also reported higher hypertension cases among women (Trihono, 2023). Previous studies support this finding. Wahyuni et al. (2022) reported that hypertension prevalence among women reached 52.3%, compared to 43.1% in men. Nurhikmawati et al. (2020) also found that 62.57% of hypertensive patients were female, while 37.43% were male. These findings suggest that women have a higher susceptibility to hypertension, influenced by biological and hormonal factors.One of the key explanations is the role of estrogen, which provides protective cardiovascular effects in premenopausal women by promoting vasodilation through nitric oxide production and inhibiting RAAS activation.

However, after menopause, estrogen levels decline, leading to reduced vascular protection and increased risk of hypertension (Hastami et al., 2025). In addition to hormonal factors, body composition also plays a role. Women tend to have higher body fat percentages, particularly visceral fat, which is associated with the release of pro-inflammatory cytokines such as TNF-α and IL-6. These inflammatory processes contribute to endothelial dysfunction and increased blood pressure (Satira et al., 2024).Psychosocial factors may also contribute to this pattern. Women often experience higher levels of chronic stress due to dual roles in professional and domestic responsibilities. Stress can increase cortisol and sympathetic nervous system activity, which in turn elevates blood pressure. Lifestyle factors, including dietary habits and physical activity levels, may also influence the higher prevalence observed in women.

Distribution by Body Mass Index (BMI)

Based on Table 3.3, the highest prevalence of hypertension was found in patients with obesity type II (33.55%), followed by obesity type I (26.32%) and overweight individuals (15.79%). These findings indicate that the majority of hypertensive patients had a BMI above the normal range. This result is consistent with previous studies. Hartati and Isaura (2023) reported that individuals with BMI ≥25 kg/m² have a 2.4 times higher risk of developing hypertension compared to those with normal BMI. Similarly, Safitri et al. (2024) found that 61.8% of hypertensive patients were classified as obese.Obesity contributes to hypertension through several physiological mechanisms. Excess adipose tissue increases blood volume and cardiac workload, leading to elevated blood pressure (Tang et al., 2022). Visceral fat accumulation is strongly associated with insulin resistance, activation of the sympathetic nervous system, and increased leptin levels, all of which contribute to increased vascular resistance. Additionally, adipose tissue acts as an active endocrine organ that releases pro-inflammatory cytokines such as TNF-α and IL-6, leading to chronic low-grade inflammation.

This inflammatory state contributes to endothelial dysfunction and vascular damage. Obesity also activates the RAAS, resulting in sodium and water retention, increased intravascular volume, and higher blood pressure (Satira et al., 2024). In contrast, individuals with normal BMI (14.47%) generally exhibited lower hypertension prevalence due to better metabolic profiles, lower blood volume, and reduced cardiovascular strain. However, hypertension can still occur in this group due to other risk factors such as high sodium intake, stress, poor sleep quality, and genetic predisposition. The lowest prevalence was observed in underweight individuals (9.87%). This finding aligns with previous studies indicating that lower body fat reduces the risk of hypertension due to decreased inflammation and lower activation of neurohormonal pathways (Tang et al., 2022). However, underweight status may also be associated with other health risks, such as malnutrition and electrolyte imbalances.

Distribution by Blood Pressure Classification

Based on Table 3.4, the majority of patients were classified as having grade 1 hypertension (36.18%). This finding reflects the early stage of hypertension, characterized by increased peripheral vascular resistance and initial endothelial dysfunction. Grade 1 hypertension is often associated with modifiable lifestyle factors such as high sodium intake, obesity, and physical inactivity. This result is consistent with previous studies indicating that grade 1 hypertension is the most common category and has a

high potential for progression if not properly managed. Early intervention at this stage is crucial to prevent further complications.Isolated systolic hypertension (ISH) was the second most common category, affecting 28.29% of patients. ISH is commonly observed in older adults due to arterial stiffness resulting from aging-related structural changes, including reduced elastin and increased collagen deposition (Masroni et al., 2025). Zahrah and Nasution (2022) also reported that ISH is strongly associated with aging and vascular degeneration. Grade 2 hypertension was observed in 24.34% of patients, indicating more persistent and severe blood pressure elevation that often requires pharmacological treatment. According to Whelton et al. (2018), this stage is typically associated with multiple risk factors, including obesity and sedentary lifestyle, which make blood pressure more difficult to control. Grade 3 hypertension had the lowest prevalence (11.18%). This stage represents severe hypertension with a high risk of target organ damage, including left ventricular hypertrophy, retinopathy, and chronic kidney disease. The lower prevalence in this category may indicate that most patients were diagnosed and treated at earlier stages, preventing disease progression.

IV. CONCLUSION

The findings of this study indicate that hypertension predominantly occurs in the elderly population, particularly in the 67–76 years age group. This pattern is consistent with the aging theory, which explains that increasing age is associated with decreased vascular elasticity, reduced baroreceptor sensitivity, and dysregulation of the renin–angiotensin–aldosterone system (RAAS) as well as the sympathetic nervous system. These physiological changes contribute to progressive increases in blood pressure. In terms of sex distribution, females showed a higher proportion of hypertension cases compared to males. This difference can be attributed to hormonal changes, particularly the decline of estrogen levels after menopause, which reduces vascular protection. In addition, differences in body fat distribution and psychosocial factors may further contribute to the increased risk observed among women.

Furthermore, obesity, especially advanced obesity, was identified as a dominant risk factor for hypertension. This condition contributes to elevated blood pressure through multiple mechanisms, including chronic inflammation, insulin resistance, activation of the RAAS, and endothelial dysfunction. These processes collectively increase vascular resistance and impair blood pressure regulation. Based on blood pressure classification, grade 1 hypertension was the most commonly observed category. This finding suggests that the majority of patients were in the early stage of hypertension, before progressing to more severe stages. Early detection at this stage provides an important opportunity for intervention to prevent further disease progression and reduce the risk of complications.

REFERENCES

[1] Aditya, R., & Mustofa, A. (2023). Metodologi Penelitian Kesehatan: Pendekatan Kuantitatif dan Kualitatif. Jakarta: Penerbit Buku Kedokteran.

[2] Ahmed, S., et al. (2024). Vascular aging and hypertension: Mechanisms and clinical implications. ***Journal of Hypertension Research***, 12(1), 45-58.

[3] Allen, L., et al. (2025). Lifestyle determinants of blood pressure: A global perspective. ***International Journal of Preventive Medicine***, 16(2), 112-125.

[4] Arifin, M. H. B. M., et al. (2016). Factors associated with hypertension among the elderly. ***Journal of Community Health***, 41(6), 1100-1107.

[5] Badan Penelitian dan Pengembangan Kesehatan. (2018). Laporan Nasional Riset Kesehatan Dasar (Riskesdas) 2018. Jakarta: Kementerian Kesehatan RI.

[6] Brijeshkumar, M., et al. (2023). Non-pharmacological interventions in hypertension management. ***Journal of Clinical Nursing***, 32(4), 210-222.

[7] Carretero, O. A., & Oparil, S. (2000). Essential hypertension: Part I: Definition and etiology. Circulation, 101(3), 329-335.

[8] Çelik, A., et al. (2025). Endothelial dysfunction and vascular remodeling in hypertensive patients. Cardiovascular Pathology, 34, 102-115.

[9] Choi, H., et al. (2025). Baroreceptor sensitivity and blood pressure regulation in the aging population. Geriatrics & Gerontology International, 25(1), 88-96.

[10] Clayton, J., et al. (2023). Adipose tissue as an endocrine organ: Implications for hypertension. Endocrine Reviews, 44(3), 401-415.
[11] Farras, N. (2024). Modifikasi Gaya Hidup dalam Pengendalian Hipertensi. Bandung: Alfabeta.
[12] Harrison, D. G., et al. (2021). Mechanisms of hypertension: Looking beyond the kidney. Nature Reviews Nephrology, 17(1), 12-24.
[13] Hartati, S., & Isaura, E. (2023). Hubungan Indeks Massa Tubuh dengan Kejadian Hipertensi pada Orang Dewasa. Jurnal Kesehatan Masyarakat, 19(2), 145-152.
[14] Hastami, R., et al. (2025). The impact of menopause on cardiovascular health and blood pressure. ***Journal of Women's Health***, 34(2), 230-241.
[15] Husaini, & Fonna, S. (2024). Hipertensi: Si Pembunuh Senyap dan Strategi Pencegahannya. Aceh: Syiah Kuala University Press.
[16] Indonesian Society of Hypertension (InaSH). (2019). Konsensus Penatalaksanaan Hipertensi 2019. Jakarta: Perhimpunan Dokter Hipertensi Indonesia.
[17] Kasal, D. A., et al. (2025). Oxidative stress and nitric oxide production in endothelial dysfunction. Free Radical Biology and Medicine, 180, 55-67.
[18] Kushwaha, S., et al. (2024). The role of RAAS in the pathogenesis of hypertension. ***Journal of Molecular Medicine***, 102(5), 612-625.
[19] Lee, S., et al. (2023). Prevalence and risk factors of hypertension in young adults. ***Journal of Adolescent Health,*** 72(4), 510-518.
[20] Lu, Y., et al. (2017). Pharmacological management of hypertension: A review of current guidelines. The Lancet, 390(10093), 456-468.
[21] Masroni, et al. (2025). Physiological changes in the elderly vascular system. Aging and Disease, 16(1), 34-47.
[22] Nabila, A., et al. (2025). Sex-specific differences in hypertension risk factors. ***Global Health Journal***, 9(1), 77-89.
[23] Nurhikmawati, et al. (2020). Profil Penderita Hipertensi di Puskesmas: Studi Deskriptif. ***Jurnal Ilmiah Kesehatan***, 15(2), 120-130.
[24] Oktamianti, P., et al. (2022). Karakteristik Demografi Pasien Hipertensi di Fasilitas Kesehatan Tingkat Pertama. ***Jurnal Kebijakan Kesehatan Indonesia***, 11(3), 156-163.
[25] Palacios, C., et al. (2025). Obesity and hypertension: A complex relationship. Nutrition Reviews, 83(2), 190-205.
[26] Safitri, M., et al. (2024). Analisis Hubungan Obesitas dengan Tingkat Keparahan Hipertensi. ***Jurnal Epidemiologi Kesehatan***, 12(1), 45-54.
[27] Satira, L., et al. (2024). Inflammation and its role in obesity-induced hypertension. ***Journal of Clinical Endocrinology***, 40(4), 312-325.
[28] Setiati, S., et al. (2013). Buku Ajar Ilmu Penyakit Dalam. Jakarta: Interna Publishing.
[29] Smith, R. (2006). Cardiovascular disease in Indonesia. ***Journal of Southeast Asian Health***, 21(3), 301-315.
[30] Tang, X., et al. (2022). BMI and cardiovascular risk: A meta-analysis. ***Journal of the American College of Cardiology***, 79(12), 1201-1215.
[31] Trihono. (2023). Hasil Survei Kesehatan Indonesia (SKI) 2023. Jakarta: Kementerian Kesehatan RI.
[32] Umbas, R., et al. (2019). Lifestyle and hypertension in urban populations. ***Indonesian Journal of Cardiology,*** 40(2), 88-95.
[33] Unger, T., et al. (2020). 2020 International Society of Hypertension Global Hypertension Practice Guidelines. Hypertension, 75(6), 1334-1357.
[34] Wahyuni, S., et al. (2022). Gender disparities in hypertension prevalence: A community-based study. Public Health Reports, 137(3), 445-452.
[35] Whelton, P. K., et al. (2018). 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults. ***Journal of the American College of Cardiology***, 71(19), e127-e248.
[36] Zahrah, F., & Nasution, A. (2022). Isolated systolic hypertension in the elderly: Pathophysiology and management. ***Journal of Geriatric Medicine***, 5(2), 112-120.
[37] Zhou, B., et al. (2021). Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: A pooled analysis of 1201 population-representative studies with 104 million participants. The Lancet, 398(10304), 957-980.
[38] Ziegler, M. G., & Milic, M. (2017). Sympathetic Nervous System and Blood Pressure in Humans. Comprehensive Physiology, 7(2), 397-424.