

DOI: <http://dx.doi.org/10.33846/hn80803>
<http://heanoti.com/index.php/hn>



RESEARCH ARTICLE

URL of this article: <http://heanoti.com/index.php/hn/article/view/hn80803>

The Relationship Between Sex and the Incidence of Hypertension

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ABSTRACT

Hypertension is a major global public health problem due to its substantial contribution to cardiovascular morbidity and premature mortality. It is often referred to as a silent killer because it may remain undetected for long periods while progressively increasing the risk of stroke, kidney disease, and cardiovascular complications. This study aimed to determine the relationship between sex and hypertension among adults in the Sukaraja Community Health Center, Sukabumi Regency. A cross-sectional design was employed involving 249 outpatients aged ≥ 18 years, with blood pressure measured using standardized digital sphygmomanometers. Hypertension was defined as systolic blood pressure ≥ 140 mmHg, diastolic blood pressure ≥ 90 mmHg, or current use of antihypertensive medication. The results showed that 54% of respondents had hypertension, with a higher proportion among females (77%) compared to males (24%). Chi-square analysis demonstrated a statistically significant relationship between sex and hypertension ($p = 0.001$). These findings align with existing evidence indicating that women experience a steeper increase in blood pressure with age, particularly after menopause. The study highlights the importance of sex-specific screening and prevention strategies in community health settings to support early detection and targeted interventions for hypertension.

Keywords: hypertension; sex differences; blood pressure; epidemiology; nursing intervention

INTRODUCTION

Hypertension, also known as high blood pressure, is a common chronic disease that often occurs in society. This disease has the potential to cause dangerous complications for sufferers. Hypertension is known as an undetected killer, also called a silent killer. Although this disease does not have apparent early symptoms, it can cause serious complications such as stroke, chronic kidney failure, and kidney problems. The causes of high blood pressure are categorized into two modifiable risk factors: smoking, obesity, high-fat diets, and excessive salt and alcohol intake. Risk factors cannot be changed include age, genetics, and gender worldwide.⁽¹⁾ High blood pressure is a silent killer, along with diabetes, hypercholesterolemia, and osteoporosis. Currently, the number of hypertension is still high and tends to increase due to the lack of patient compliance in following the right diet for hypertension caused by a lack of knowledge about it longitudinal epidemiologic data have also revealed that BP elevation begins earlier in life and rises faster with aging in females.⁽²⁾

Hypertension is one of the most important public health problems worldwide because of its substantial contribution to cardiovascular morbidity and premature mortality. The condition is characterized by persistently elevated blood pressure and may remain undetected for a long period because many individuals do not experience noticeable symptoms. When hypertension is not adequately controlled, prolonged elevation of blood pressure can damage vital organs and increase the risk of cardiovascular disease, stroke, and kidney disease. The World Health Organization (WHO) reported that approximately 1.4 billion adults aged 30–79 years were living with hypertension in 2024, representing about one-third of the population in this age group. The burden is particularly substantial in low- and middle-income countries, where approximately two-thirds of adults with hypertension live.⁽³⁾

The increasing burden of hypertension highlights the importance of identifying population characteristics that may be associated with differences in hypertension occurrence. Several factors have been recognized as contributors to elevated blood pressure, including increasing age, excess body weight, inadequate physical activity.⁽⁴⁾ Unhealthy dietary patterns, tobacco use, alcohol consumption, genetic predisposition, and other

environmental and behavioral factors. However, hypertension does not affect all population groups in exactly the same way. Sex is one characteristic that has received considerable attention because differences in blood pressure patterns and hypertension prevalence have been observed between males and females.⁽⁵⁾

Evidence suggests that the relationship between sex and hypertension is complex and may change across the life course. In general, hypertension has historically been more prevalent among men at younger ages, whereas the prevalence among women increases more rapidly with advancing age. Hormonal changes, particularly those associated with menopause, together with differences in vascular function, metabolic factors, lifestyle, and social determinants, may contribute to these patterns.⁽⁶⁾ Connelly et al. reported that although hypertension tends to be more common among males overall, women experience a steeper increase in blood pressure with age. The authors also emphasized that sex-related differences extend beyond prevalence and may influence cardiovascular outcomes associated with hypertension.⁽⁷⁾

Recent evidence further demonstrates that sex differences in hypertension should not be interpreted simply as a consistent higher risk in one sex. A longitudinal analysis published in 2024 showed that the prevalence of hypertension increased substantially with age in both sexes. The pattern of uncontrolled hypertension also differed according to age, with men showing higher levels at younger ages while women experienced a greater burden at older ages. These findings indicate that the association between sex and hypertension may be influenced by the stage of life and other accompanying risk factors.⁽⁸⁾

Evidence from Indonesia also supports the importance of examining sex as a potential factor associated with hypertension. Defianna et al. conducted a cross-sectional study among Indonesian adults and specifically examined gender differences in hypertension prevalence and its associated risk factors. Their findings demonstrated differences in hypertension prevalence between men and women, while the magnitude of the association was also influenced by other characteristics and risk factors. This Indonesian evidence provides an important basis for further investigation of the relationship between sex and hypertension within specific populations and health-care settings.⁽⁹⁾

The importance of investigating sex-related differences is also supported by international literature. Reviews of hypertension research have demonstrated that biological sex may influence blood pressure trajectories, hypertension development, cardiovascular complications, and responses to treatment.⁽¹⁰⁾ Women may experience a marked increase in hypertension prevalence after the reproductive years, while men may have a greater burden earlier in adulthood. Consequently, understanding the distribution of hypertension according to sex may contribute to more appropriate risk identification and prevention strategies.⁽¹¹⁾

Despite the availability of international and national evidence, the relationship between sex and hypertension may vary according to the characteristics of the population being studied. Differences in age distribution, socioeconomic conditions, lifestyle, health behaviors, access to health services, and the prevalence of other risk factors can produce different patterns across communities. Therefore, research conducted in a specific local population remains relevant. Identifying whether hypertension is associated with sex within the target population can provide useful epidemiological information for nurses and other health professionals when developing health promotion, screening, and hypertension prevention strategies.⁽¹²⁾

From a nursing perspective, early identification of individuals who have a higher likelihood of hypertension is an important component of preventive health care. Nurses have an important role in blood pressure screening, health education, lifestyle modification, risk assessment, and referral for further management. Information regarding differences in hypertension according to sex may help health professionals develop more focused education and screening approaches while avoiding assumptions that hypertension affects men and women in the same manner.⁽¹³⁾

Based on the evidence described above, sex is an important characteristic that warrants further investigation in relation to hypertension. However, because the magnitude and direction of this relationship may differ across populations and age groups, local empirical evidence is still needed. Therefore, this study aims to determine the relationship between sex and hypertension among adults. The findings are expected to contribute to the epidemiological understanding of hypertension and provide supporting evidence for nursing and public health interventions aimed at hypertension prevention and early detection.⁽¹⁴⁾

METHODS

This research is an analytic observational study employing a cross-sectional approach,^(15,16) utilizing structured interviews and diagnoses made by the attending physicians for outpatients at the Sukaraja Community Health Center (Puskesmas), Sukabumi Regency. Analytic observational research is conducted without intervening with the study subjects (the community) and aims to describe a specific condition or situation; the cross-sectional design entails observing each subject only once, with measurements taken simultaneously. The study was conducted within the service area of the Sukaraja Community Health Center during April and May 2024.

The study population consisted of outpatients at the Sukaraja Community Health Center, Sukabumi Regency, during the April–May 2024 period we only included subjects who were aged ≥ 18 years and participated

in the Sukabumi survey (N = 249). The complete data for analysis included 249 individuals, excluding those with missing data area of Kadudampit Health Center.

The focus of the study was the prevalence of hypertension. Blood pressure was measured using a Digital Automatic Blood Pressure Monitor HEM-7200 (Omron Healthcare Co., Ltd., Kyoto, Japan) on the right arm with the position aligned with the heart. The measurements were taken three times at home by trained enumerators, in a position after rest for 15 min, with three-minute intervals for each measurement. Hypertension was defined if systolic blood pressure (SBP) ≥ 140 mmHg and/or diastolic blood pressure (DBP) ≥ 90 mm Hg or individuals taking blood pressure lowering medication. Data were analyzed using frequency and percentage,⁽¹⁷⁻¹⁹⁾ then Chi-square for hypothesis testing.⁽²⁰⁾

RESULTS

Table 1 shows that the majority of participants were female, accounting for 63 %. Most participants fell within the 51–70 age range, comprising 40 individuals (36.7%). Regarding education, the largest group consisted of primary school graduates (38.5%); knowledge can be acquired outside of formal education or through prior experience. The most common occupation was farming (35 participants or 32.1%), followed by trading or manual labor (33 participants or 30.3%); the third-largest group comprised those who were unemployed (21 participants or 19.3%), followed by civil servants or military personnel (20 participants or 18.3%).

Table 1. Distribution of demographic characteristics of respondents

Demographic characteristic	Category	Frequency	Percentage
Age	20-30 years	16	6
	31-40 years	54	22
	41-50 years	102	41
	51-70 years	77	31
Education	Elementary school	162	65
	junior high school	53	21
	Senior high school	28	11
	Higher (diploma/bachelor's/master's)	6	2
Occupation	Unemployed	92	37
	Farmer	110	44
	Private employee	32	13
	Civil servant/military/police	15	6

Table 2. Distribution hypertension, and Gender

Variable		Frequency	Percentage
Gender	Male	109	37
	Famale	140	63
Hypertension incident	Hypeetension	134	54
	No Hypertension	115	46

Table 3. The relationship of between gender and the incidence of hypertension

Gender	Hypertension Incident				p-value
	Hypertension		No hypertension		
	Frequency	Percentage	Frequency	Percentage	
Male	26	24	83	76	0.001
Famale	108	77	32	33	

In the final (Table 3), after the. Based on the results of the bivariate analysis using the Chi-square test to determine the relationship between age and the incidence of hypertension among outpatients in the Sukaraja Community Health Center (Puskesmas) working area, Sukabumi Regency, a p-value of 0.001 was obtained. Statistically, these results indicate a significant relationship between age and the incidence of hypertension.

DISCUSSION

The high prevalence of hypertension in older age groups can be attributed to heavy workloads and a lack of physical activity. Furthermore, with advancing age, the walls of the aorta and arteries stiffen, contributing to elevated blood pressure.⁽¹⁴⁾ On the other hand, our study also indicates a notably high prevalence of hypertension among younger women (aged 41–50 years). However, the risk of hypertension is significantly higher in older women; various studies have noted that in the postmenopausal years, women exhibit higher blood pressure levels than men. The high prevalence of hypertension among both men and women in urban areas reflects the adverse effects of a hectic lifestyle, reduced physical activity, and the stressful conditions experienced by city dwellers. Nevertheless, rural women face a higher risk of hypertension compared to their male counterparts. Awareness regarding healthcare services, health-seeking behavior, and access to quality healthcare among women—particularly those in rural areas—remains very limited in India.

The study found a high prevalence of hypertension in a representative sample of the general adult population in Indonesia. Less than half of hypertensives were aware and a minority were treated and controlled. Several risk factors, including sociodemographic variables (older age, lower education, being female, and lower socioeconomic status), body weight status (overweight or obese), health behaviour (physical inactivity), and psychosocial stress (depression), have been identified, which can help in guiding intervention programmes. Interventions programmes operating at multiple levels are urgently needed that can increase awareness of hypertension, access to high blood pressure treatment, and community wide health behaviour interventions that were identified and known to be effective in reducing high blood pressure levels. Future studies may want to include additional measures such as salt intake and alcohol consumption.

Lower subjective economic status was among women but not among men associated with hypertension. Although the prevalence of hypertension increased overall and for both sexes by age group from 18 to 29 years to 70 years and above, the prevalence of hypertension was higher among males than females at the age 18 to 29 years, while from 40 years and older the prevalence of hypertension was higher among women than men. One possible reason for this age differential among the sexes can be because the prevalence rates of obesity, as one important risk factor for hypertension, are higher in boys than girls among children, adolescents, and young adults.

Before reaching menopause at the age of 45 to 55 years, women have slightly lower blood pressure levels and also lower chance to develop hypertension than the age-matched men. A large body of evidence indicates that sex hormones are responsible for the sex differences in the regulation of blood pressure.⁽²¹⁾ It has been shown that sex hormones affect systems that are considered to play an important part in the development of hypertension, such as renin angiotensin aldosterone system, endothelin, nitric oxide (NO) system and immune system. Estrogen is believed to have beneficial effects on cardiovascular system and it possibly exerts its protective role in women in reproductive age through enhancement of NO-mediated vasodilatation and modulation of action of powerful vasoconstrictor endothelin-1 action. Expression of endothelin-1 receptor ET1A is significantly higher in hypertensive male rats than it is in the hypertensive females of the same age, and this difference in receptor density is assigned to the opposing effects of androgens and estrogen on endothelin receptor expression.⁽²²⁾

In general, the younger the age of presentation, the more likely there is a secondary cause for HTN, including parent-related factors (obesity, HTN smoker in close proximity), extreme postnatal weight gain, sedentary behavior, and obstructive sleep apnea. Obstructive sleep apnea has also been associated with higher BP and lack of nocturnal dip in children.⁽²³⁾

Changes in heart morphology, function and compliance of arterial blood vessels have all been recognized and described in postmenopausal hypertension. Postmenopausal women have higher incidence of left ventricular hypertrophy and they are at greater risk to developed diastolic dysfunction compared to young adult women.⁽²⁴⁾ Groban et al. showed that female Lewis rats that underwent bilateral ovariectomy developed progressive diastolic dysfunction. Mori et al.⁽²⁵⁾ reported that ovariectomized hypertensive rats had cardiac hypertrophy, myocardial fibroses and diastolic dysfunction, but replacement treatment prevented these changes. The isolated systolic hypertension in postmenopausal women is related to aortic stiffness, probably caused by smooth muscle cells proliferation, collagen accumulation and increased levels of vasoconstrictor molecules in the blood vessel wall due to the lack of estrogen protective effect. Maiello et al.⁽²⁶⁾ showed that global pulse wave velocity, a reliable indicator of aortic stiffness, is highly increased in postmenopausal women with hypertension.

CONCLUSION

There are still many controversies and unsolved questions in the attempts to comprehend the mechanisms that lie behind pathophysiology of hypertension in women, which surpass our need to merely satisfy scientific curiosity. With hypertension as one of the major risk factors for cardiovascular events in elderly women, and preeclampsia still being the leading cause of maternal death in the countries of developed world, better understanding of hypertension in women is needed for reevaluation of our approach to the treatment of this condition.

Hypertension is highly increased in postmenopausal women affected by hypertension, diabetes, and hypercholesterolemia all at once. As just assessed in our previous paper, and confirmed here, hypertension is the major determinant for PWV of postmenopausal women. Only the addition of diabetes on hypercholesterolemia did not increase PWV in a significant way, while the addition of both did it. Our study supports the usefulness of the assessment of aortic stiffness as a marker of cardiovascular disease and to identify at an early stage subjects at risk of cardiovascular events.

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