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Analysis of Risk Factors Contributing to Hypertension in Pre-Elderly and Elderly Populations in the Kedaung Subdistrict, Depok, Indonesia

Analisis Faktor Risiko Kejadian Hipertensi pada Pra Lansia dan Lansia di Kelurahan Kedaung Kota Depok

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ABSTRACT

Background: West Java Province ranks third in Indonesia's highest incidence of hypertension. According to Depok City Health Office data, 3,283 individuals aged ≥15 years in the Kedaung Subdistrict suffer from hypertension, highlighting multifactorial causes beyond aging.

Objectives: To identify the primary risk factors for hypertension in pre-elderly and elderly individuals in the Kedaung Subdistrict.

Methods: The study utilized a cross-sectional design involving pre-elderly and elderly individuals from the Kedaung Subdistrict. The research sample comprised 50 participants selected using stratified random sampling techniques. Data collection was conducted through a structured questionnaire. Univariate analysis was performed using frequency distribution, bivariate analysis using chi-square tests, and multivariate analysis using a logistic regression test.

Results: Nutritional status (p-value=0.028) and sodium intake (p-value=0.016) were significantly associated with hypertension among pre-elderly and elderly individuals in the Kedaung Subdistrict. Conversely, family history (p-value=0.615) and smoking habits (p-value=0.459) showed no significant association with hypertension.

Conclusions: Sodium (sodium) intake was identified as a significant risk factor for hypertension among pre-elderly and elderly individuals in the Kedaung Subdistrict. Individuals with excessive sodium intake have a higher likelihood of developing hypertension compared to those with lower sodium consumption. Pre-elderly and elderly populations are advised to monitor and regulate their sodium intake to reduce the risk of hypertension.

INTRODUCTION

Hypertension, commonly referred to as high blood pressure, is a medical condition where blood pressure consistently exceeds normal thresholds. Normal blood pressure is defined as values below 120/80 mmHg, while hypertension is diagnosed when blood pressure measurements reach or exceed 140/90 mmHg[1]. Hypertension is a non-communicable disease (NCD) with the potential to cause serious complications. NCDs are characterized by their inability to be transmitted between individuals, and their occurrence is predominantly influenced by lifestyle factors.

Globally, the prevalence of hypertension remains significant, with an estimated 1.28 billion individuals aged 30–79 years affected. In Indonesia, the prevalence of hypertension among individuals aged 18 years and older, based on average blood pressure measurements, was 34.11% in 2018[2]. This prevalence has decreased slightly to 30.8% as of 2023[3]. However, the burden remains substantial in certain regions. According to the 2023 Indonesian Health Survey, West Java province had a hypertension prevalence of 34.4%, ranking third among Indonesia's thirty-eight provinces[3]. According to the Health Profile of Depok City in 2023, approximately 3,283 individuals aged 15 years and older suffer from hypertension in Kedaung Subdistrict[4].

Age is a significant non-modifiable risk factor for hypertension. As individuals age, their susceptibility to hypertension increases due to physiological changes, including reduced vascular elasticity and impaired kidney function, which hinder normal blood pressure regulation. Heriziana (2017) highlighted that aging is directly associated with rising blood pressure levels[5]. Similarly, Yunus (2021) identified a correlation between advancing age and hypertension, attributing this association to the decline in organ function and immune system efficacy, which heightens vulnerability to various diseases[6].

Beyond age, several additional risk factors contribute to the development of hypertension. These are broadly categorized into non-modifiable and

modifiable risk factors. Non-modifiable factors include age, gender, and family history, while modifiable factors encompass dietary habits, sodium intake, physical inactivity, and other lifestyle behaviors. Given the high prevalence of hypertension and its associated risks, particularly among pre-elderly and elderly populations, this study aims to identify and analyze the primary risk factors associated with hypertension in Kedaung Subdistrict. By understanding these factors, targeted interventions can be developed to mitigate hypertension risk in this population.

METHODS

This study employed a cross-sectional design to investigate the pre-elderly population (aged 45–59 years) and the elderly population (aged ≥60 years) residing in Kedaung Subdistrict, Depok City. A total of 50 individuals were selected as the research sample through a stratified random sampling method. Inclusion criteria required participants to be aged 45 years or older, reside in Kedaung Subdistrict, and express willingness to participate as respondents. Individuals below 45 years were excluded from the study. Ethical clearance for this research was obtained from the Health Research Ethics Commission (KEPK) of Universitas Prima Indonesia on August 8, 2024, under letter number 025/KEPK/UNPRI/VIII/2024.

Data collection involved blood pressure assessment, family history of hypertension, nutritional status, smoking habits, and sodium intake using a combination of a digital sphygmomanometer, interviews, and a Google Forms questionnaire. Blood pressure was measured and categorized as hypertensive or non-hypertensive. Family history data were obtained through respondent interviews and recorded in Google Forms.

Nutritional status was assessed using Body Mass Index (BMI), calculated based on weight (measured with a digital scale) and height (measured with a microtoise). BMI was categorized into normal (≤25 kg/m²) and overweight (≥25.1 kg/m²). Smoking habits were documented through interviews, collecting data on smoking status, types of cigarettes smoked, and the number of cigarettes consumed daily, which were subsequently recorded in Google Forms.

Sodium intake data were collected using the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) method. The SQ-FFQ assessed the frequency and quantity of food and beverage consumption, categorized into groups of carbohydrate sources, proteins, fruits, vegetables, oils, dairy products, and others. Consumption frequency was classified as more than once daily, 4–6 times per week, 2–3 times per week, weekly, 1–2 times per month, or never. The quantity consumed was measured in household units (URT) and grams. The sodium content of each item was calculated using Microsoft Excel, and intake was categorized as excessive (>2000 mg) or within recommended limits (≤2000 mg)[7].

Data analysis was conducted at three levels: univariate, bivariate, and multivariate. Univariate analysis was used to describe the frequency distribution and characteristics of the studied variables. Bivariate analysis was conducted using chi-square tests to examine associations between variables. Multivariate analysis was performed using logistic regression to assess the influence of multiple independent variables on the dependent variable. Data processing and analysis were conducted using the Statistical Package for the Social Sciences (SPSS).

RESULTS AND DISCUSSIONS

Univariate Analysis

A total of 50 pre-elderly and elderly individuals participated in this study. The majority of respondents were female. Among the participants, 27 individuals (54%) were diagnosed with hypertension, while the remaining 23 individuals (46%) did not exhibit hypertension. The detailed characteristics of the respondents are summarized in Table 1.

Table 1. Distribution of respondent characteristics

Variable	n	%
Age		
Pre-Elderly (45–59 years)	25	50
Elderly (60 years and above)	25	50
Gender		
Male	7	14
Female	43	86
Blood pressure		
Hypertension (≥140/90 mmHg)	27	54
Non-Hypertension (<140/90 mmHg)	23	46
Nutritional Status		
Overweight (≥25.1 kg/m²)	30	60
Normal (≤25 kg/m²)	20	40
Family History Related to Hypertension		
Exist	28	56
None	22	44
Smoking Habits		
Yes	3	6
Not	47	94
Sodium Intake		
Excess (>2000 mg)	10	20

Amerta Nutrition

e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
Wirayudha et al. | Amerta Nutrition Vol. 8 Issue 3SP (December 2024). 269-274

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Variable	n	%
Normal (≤2000 mg)	40	80

A total of 50 individuals participated in this study, evenly distributed between the pre-elderly (25 individuals, 50%) and elderly groups (25 individuals, 50%). The majority of respondents were female, comprising 43 individuals (86%). Of the total participants, 27 individuals (54%) were identified as having hypertension, while the remaining 23 did not. Additionally, 30 individuals (60%) were classified as having excess nutritional status, 47 individuals (94%) did not have a smoking habit, and 10 individuals (20%) reported excessive sodium intake.

Bivariate Analysis

The normality of the data was assessed using the Kolmogorov-Smirnov test. A chi-square test was then performed to determine the association between independent variables and the incidence of hypertension.

Table 2. The results of the bivariate analysis

Variable	Blood Pressure		p-value
	Hypertension	Non-Hypertension	
Nutritional Status			
Overweight (≥25.1 kg/m2)	20 (66.7%)	10 (33.3%)	0.028*
Normal (≤25 kg/m2)	7 (35%)	13 (65%)	
Family History Related to Hypertension			
Exist	16 (57.1%)	12 (42.9%)	0.615
None	11 (50%)	11 (50%)	
Smoking Habits			
Yes	1 (33.3%)	2 (66.6%)	0.459
Not	26 (55.3)	21 (44.7)	
Sodium Intake			
Excess (>2000 mg)	2 (20%)	8 (80%)	0.016*
Normal (≤2000 mg)	25 (62.5%)	15 (37.5%)	

*The chi-square test is significant if the p-value is less than 0.05

The Association Between Nutritional Status and the Incidence of Hypertension

The chi-square test indicated a significant association between nutritional status and the incidence of hypertension among pre-elderly and elderly individuals, with a p-value of 0.028. This finding suggests that nutritional status is associated with the risk of hypertension in this population. The results are consistent with the findings of Rahayu et al. (2020), which reported that nutritional status significantly affects hypertension. The accumulation of body fat in individuals with higher nutritional status increases vascular resistance, requiring the heart to pump harder, thereby raising blood pressure. Women over the age of 45 experience menopause, which is associated with a decline in organ function and metabolic rate, leading to fat accumulation. This physiological change can contribute to elevated blood pressure as the cardiovascular system compensates for the increased workload[8].

Similarly, Fariqi et al. (2021) demonstrated a correlation between nutritional status and hypertension in pre-elderly and elderly populations, emphasizing that excess nutritional status can directly influence blood pressure[9]. Ahsana et al. (2022) also highlighted the significant association between excess nutritional status and hypertension. The study suggested that individuals with excess body weight who fail to engage in weight loss interventions are more likely to experience hypertension. Excess nutritional status is thus recognized as a critical factor in the development of hypertension[10].

The Association Between Family Medical History and the Incidence of Hypertension

Hypertension is a genetically influenced condition where a family history of the disease can increase an individual's susceptibility. This association is linked to factors such as salt metabolism and renin activity regulation at the cellular level[11]. However, in this study, the chi-square test yielded a p-value of 0.615, indicating no significant association between family medical history and hypertension among pre-elderly and elderly individuals in the Kedaung Subdistrict.

This finding contrasts with Maulidina's (2019) research, which reported a significant association between family history and hypertension[12]. Conversely, the results align with studies by Ariyani (2020) and Aja (2018), which found no correlation between family history and hypertension[13,14]. The lack of association in this study may be attributed to the multifactorial nature of hypertension, where genetic predisposition interacts with modifiable risk factors such as lifestyle choices.

The Association Between Smoking and the Incidence of Hypertension

Smoking contributes to the accumulation of harmful substances in blood vessels, potentially leading to cardiovascular diseases, including arteriosclerosis and hypertension. This is attributed to the damaging effects of nicotine and tar on vascular walls[15]. Despite these mechanisms, the chi-square test in this study revealed a p-value of 0.459, indicating no significant association between smoking habits and hypertension among pre-elderly and elderly individuals in the Kedaung Subdistrict.

This result is consistent with Imelda's (2020) and Lauren's (2023) findings, which reported no significant association between smoking and hypertension[16,17]. However, it contradicts Umbas's (2019) research, which identified a link between smoking and hypertension[18]. The discrepancy may stem from other contributing factors, such as dietary habits, stress, or physical activity levels, as well as the low prevalence of smoking among the respondents (n=47 individuals were non-smokers).

The Association Between Sodium Intake and the Incidence of Hypertension

Sodium plays a critical role in regulating blood volume by binding water. Excessive sodium consumption increases solute concentration in the bloodstream, leading to greater water absorption, increased blood volume, and elevated blood pressure[19]. The chi-square test in this study demonstrated a significant association between sodium intake and hypertension, with a p-value of 0.016.

This finding corroborates the research by Firman (2024), which established a positive correlation between sodium intake and hypertension[20]. Similarly, Purwono's (2020) study found that higher sodium intake is associated with an increased likelihood of hypertension due to increased blood volume and arterial narrowing, necessitating greater cardiac effort[21]. These results emphasize the importance of dietary sodium management to reduce hypertension risk.

Multivariate Analysis

Logistic regression analysis was conducted to identify the primary risk factor associated with hypertension among pre-elderly and elderly individuals in the Kedaung Subdistrict. The results are summarized in Table 3.

Table 3. The results of the multivariate analysis

Variable	B	p-value	OR
Nutritional Status	-1.216	0.066	0.296
Family History Related to Hypertension	-0.358	0.594	0.699
Smoking Habits	0.714	0.631	2.042
Sodium Intake	1.968	0.029	7.160
Constant	0.353	0.531	1.423

The analysis revealed that sodium intake was a significant risk factor, with an Odds Ratio (OR) of 7.160, indicating a 7.160-fold increased likelihood of hypertension among individuals with excessive sodium intake. This finding aligns with Diba's (2023) research, which reported a strong association between sodium intake and hypertension[22]. Ramadhini's (2023) study further supports this, highlighting the proportional relationship between sodium consumption and hypertension risk[23]. Elevated sodium intake increases extracellular fluid volume, triggering higher blood pressure due to augmented blood volume and vascular resistance[24]. This study benefited from accessible data collection and the openness of respondents, enhancing result accuracy. However, a limitation was the focus on a limited number of risk factors, suggesting the need for further research to explore additional contributors to hypertension in pre-elderly and elderly populations.

CONCLUSIONS

This study identified that nutritional status and sodium intake are significantly associated with the incidence of hypertension among pre-elderly and elderly individuals in the Kedaung Subdistrict. Of these factors, sodium intake emerged as the most prominent risk factor. Individuals with excessive sodium intake have a 7.160-fold higher likelihood of developing hypertension compared to those with lower sodium consumption. These findings highlight the critical need for dietary sodium management in reducing the risk of hypertension in this population.

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