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Multifactorial Risk Factors of Hypertension in Patients Aged 45-55 Years in Kota Kotamobagu: A Cross-Sectional Study

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Abstract

Hypertension in adults aged 45-55 years has a significant impact on heart health and morbidity. Hypertension is estimated to affect 1.56 billion people by 2025 and become a leading cause of death. In Indonesia, the prevalence is 18.7% in the 45-54 age group, with North Sulawesi ranking third highest. In Kotamobagu, hypertension ranks second among non-communicable diseases with 24,956 cases. This high number emphasizes the importance of prevention and control. A deep understanding of modifiable risk factors is needed to develop effective prevention strategies. This study aims to identify the primary risk factors that influence the prevalence of hypertension in the adult population of Kotamobagu City. This descriptive-quantitative study used an analytical observational study design with a cross-sectional technique. The study was conducted in Kotamobagu City, North Sulawesi Province, Indonesia, from July to August 2024. This study used an analytical observational design with a cross-sectional method, data collection using a digital sphygmomanometer to measure blood pressure, an Easy Touch GCU Meter to analyze dyslipidemia and blood sugar levels, and a questionnaire to assess physical activity, diet, salt consumption, alcohol consumption, and smoking habits. The sample consisted of 388 hypertensive patients selected using the Slovin Formula, and the statistical analysis used was chi-square. The results showed that diet, dyslipidemia, obesity, high salt consumption, alcohol, and smoking were significantly correlated with hypertension. Based on the odds ratio, the factors that had the strongest relationship with the incidence of hypertension were poor diet (OR = 1.53), dyslipidemia (OR = 1.49), and excessive salt consumption (OR = 1.46).

Introduction

Hypertension is a significant public health problem, particularly in Indonesia, where rapid urbanization has led to lifestyle changes that increase the risk of non-communicable diseases, especially hypertension (Rahut *et al*., 2023; Sivanantham *et al*., 2021). With the prevalence of hypertension having reached 12.1%, it is crucial to understand modifiable risk factors and important to develop effective prevention strategies (Hasnani *et al*., 2023; Sarma *et al*., 2019). Hypertension is one of the major health problems that urgently needs to be addressed, both in Indonesia and worldwide, due to its high prevalence and the health risks it poses (Panchanan *et al*., 2024), and the increase at a high rate among adults, ranging from 26.1% to 40% (Alfaqeeh *et al*., 2023; Defianna *et al*., 2021; Mashuri *et al*., 2022).

Hypertension is one of the NCDs whose prevalence continues to increase and is a significant risk factor for heart disease,

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kidney failure, and stroke. The high prevalence of hypertension in Indonesia exacerbates the health burden, especially in lower economic groups and urban areas, as many cases are undiagnosed, and awareness and treatment are more concentrated in higher economic groups (Adisasmito *et al*., 2020; Mashuri *et al*., 2022; Oktamianti *et al*., 2022). Adults with undiagnosed hypertension face a high risk of heart attack, atherosclerosis, heart enlargement, stroke, and kidney damage, resulting in increased morbidity and mortality rates (Debora *et al*., 2023; Wangdi & Jamtsho, 2020).

Hypertension is a leading cause of premature death, with a high prevalence across Indonesia. Identifying its contributing factors is crucial to low (Ikhlasia *et al*., 2025). It is estimated that by 2025, more than 1.56 billion people worldwide will suffer from hypertension. This will exacerbate the problem in the next few decades. Hypertension, which is one of the leading causes of death in the Western world, can also lead to stroke, kidney problems, and even kidney failure. Nearly 7.6 million people worldwide die from high blood pressure (Indonesia Health Survey, 2024). Hypertension data in Indonesia, aged 45-54 years, reaches 18.7% (78,040), dominated by females (10.5%), with the highest education level being high school. (206,812) Hypertension in North Sulawesi reaches 12.1%. North Sulawesi ranks third in Indonesia after DKI Jakarta and Yogyakarta (Ministry of Health of the Republic of Indonesia, 2019). Hypertension cases in Kotamobagu City rank second out of 10 non-communicable diseases with a total of 24,956 cases (Darmin *et al*., 2023).

Hypertension is a significant risk factor for cardiovascular disease and death, so it is essential to understand its risk factors, such as genetics, lack of physical activity, poor diet, obesity, and high salt and alcohol intake (Grau-Perez & Redon, 2020; Mills *et al*., 2020; Schiffrin, 2020; Watso *et al*., 2023). These factors, if not controlled, can lead to hypertension and worsen overall public health. Hypertension has become a significant health problem among young to middle-aged adults, contributing to the substantial burden of cardiovascular disease (CVD) and related death and disability worldwide (Liu *et al*., 2021; C. Wang *et al*., 2020; Y. Wang, 2022). This study aims to; 1) Identifying the characteristics and variable of hypertension in hypertensive patients aged 45-55 years, 2) Analyze the relationship between each factor and the incidence of hypertension in adults aged 45-55 years in the city of Kotamobagu, 3) Identify the factors that have the strongest relationship with the incidence of hypertension in patients aged 45-55 years in the city of Kotamobagu.

Method

This descriptive-quantitative research uses an analytic observational study design with a cross-sectional technique. Conducted in Kotamobagu City, North Sulawesi Province, from July to August 2024. This study was conducted by analyzing variables of predisposing factors, such as dyslipidemia (Wong *et al*., 2006), physical activity (Séogo *et al*., 2022), obesity (Majgi *et al*., 2024), diet (Sudayasa *et al*., 2020), diabetes (Whelton, 2009), excess salt consumption (Tan *et al*., 2019), alcohol consumption, and smoking (Klag *et al*., 1993). The samples were 388 hypertensive patients aged 45-55 years, according to the inclusion and exclusion criteria from a population of 15,004. Samples were taken from 7 working areas of health centers in Kotamobagu City, using the Slovin Formula. This Study period is from March to August 2024.

This study utilized various instruments to assess hypertension risk factors. Hypertension degree was measured using a digital sphygmomanometer, while dyslipidemia and diabetes mellitus (DM) were assessed with an Easy Touch GCU Meter 3-in-1. Obesity was determined using BMI calculations based on height and weight measurements. Physical activity was evaluated using the Global Physical Activity Questionnaire (GPAQ), and dietary habits were assessed with a Semi-Quantitative Food Frequency Questionnaire (SQFFQ). Smoking status, alcohol consumption, and salt intake were measured using structured questionnaires with categorical classifications. This study conducted a chi-square test to explore the relationship between hypertension and the categorized independent factors. The classical assumption test was conducted as

Table 1. Distribution of Respondent Characteristics (n = 388)

Characteristics	Total	Percentage (%)
Education		
Elementary School	1	0,26
Junior High School	2	0,54
High School	281	72,4
Undergraduate	104	26,8
Jobs		
Housewives	237	61,1
Farmers	56	14,4
Driver	25	6,4
State Civil Service	39	10,1
Private Employee	31	8
Gender		
Female	237	61,1
Male	151	38,9

Source: Primary Data 2024

a preliminary step before applying multiple linear regression, which was used to determine the effect of the independent variables on the dependent variable and identify which variables most significantly influenced the degree of hypertension. This analysis used categorical data for descriptive analysis, and numerical data (total score of respondents) was used for inferential statistical analysis.

Results and Discussion

The characteristics of respondents obtained in this study, consisting of education, occupation, and gender, the complete distribution can be presented in Table 1, as follows:

Table 1 depicts the distribution of demographic characteristics of the 388 respondents who participated in the study. Based on education level, most respondents (72.4%) had their last education at the senior high school level, followed by those who had attended university (26.8%). Only a few respondents had primary school (0.26%) and junior high school (0.54%) education. In terms of occupation, the majority of respondents were housewives (61.1%), while the rest worked as farmers (14.4%), drivers (6.4%), State Civil Apparatus (ASN) (10.1%), and private employees (8%). The composition of respondents by gender shows that the majority are women (61.1%), while men only amount to 38.9%. This data shows that the respondent population is dominated by women with a high school education who work as housewives. The variables obtained in this study consisted of: Degree of Hypertension, Dyslipidemia, Physical Activity, Obesity, Diet, Diabetes, High Salt Consumption, Alcohol Consumption, and Smoking. Complete details can be seen in Table 2 below:

Table 2. Variable distribution (n=388)

Variables	n	%
Degree of Hypertension		
	228	58,8
2nd degree	160	41,2
1st degree		
Dyslipidemia		
High (>200 mg/dL)	253	65,2
Normal (<200 mg/dL)	135	34,8
Physical Activity		
Underactivity (metabolic equivalent/week < 600)	248	63,9
Overactivity (metabolic equivalent/week ≥ 600)	140	36,1
Obesity		
Yes (BMI ≥ 30)	247	63,6
No (BMI < 30)	141	36,4
Diet		
Bad (risky food types)	254	65,5
Good (food type is not risky)	134	34,5
Diabetes		
Yes (>125 mg/dL or Fasting Blood Sugar)	177	45,6
No (90-125 mg/dL Fasting Blood Sugar)	211	54,4
Excess Salt Consumption		
Yes	252	64,9
No	136	35,1
Alcohol Consumption		
Yes (4-5 times a week with doses above 500 ml)	248	63,9
No (alcohol consumption below 200 ml or not at all)	140	36,1
Smoking		
Yes (active smoking)	246	63,4
No (never smoked)	142	36,6

Source: Primary Data 2024

Table 2 illustrates the distribution of health variables from 388 respondents, showing that most respondents had high health risk factors. Most of the respondents were in Grade 2 hypertension (58.8%) and had dyslipidemia with high cholesterol levels (65.2%). In addition, 63.9% had low physical activity (<600 METs per week), and 63.6% were classified as obese (BMI ≥30). In terms of diet, 65.5% of respondents consumed risky food types, while 45.6% had high blood sugar levels, showing signs of diabetes. Excess salt consumption was found in 64.9% of respondents, and high doses of alcohol consumption (4-5 times per week) were found in 63.9%. Smoking habits were also everyday, with 63.4% of respondents being active smokers. Overall, this data indicates a high prevalence of health risk factors in the respondents, primarily related to hypertension, dyslipidemia, obesity, risky diet, excessive salt and alcohol consumption, and smoking habits.

Table 3. Risk Factor Distribution With Hypertension (n=388)

Variables	Degree of Hypertension				Total		*p*	OR (95% CI for Exp.B)
	2nd degree		1st degree					
	n	%	n	%	n	%		
Dyslipidemia								
High (>200 mg/dL)	135		119	46,9	253	65,2	0,004*	1,49 (1,12-1,99)
Normal (<200 mg/dL)	93	24,0	42	10,8	135	34,8		
Physical Activity								
Less activity	135		113	29,1	248	63,9	0,028*	1,35 (1,03-1,78)
Overactivity	93	24,0	47	12,1	140	36,1		
Obesity								
Yes (BMI ≥ 30)	135		112	28,9	247	63,7	0,039*	1,13 (1,01-1,74)
No (BMI < 30)	93	24,0	48	12,4	141	36,4		
Diet								
Bad (risky food)	135		119	30,7	254	65,5	0,003*	1,53 (1,15-2,04)
Good (food is not at risk)	93	24,0	41	10,6	134	34,5		
Diabetes								
Yes (>125 mg/dL)	99		78	20,1	177	45,6	0,350	1,13 (0,89-1,43)
No (90-125 mg/dL)	129	33,2	82	21,1	211	54,4		
Excess Salt Consumption								
Yes	135		117	30,2	252	64,9	0,007*	1,46 (1,10-1,94)
No	93	68,4	43	31,6	136	35,1		
Alcohol Consumption								
Yes (above 500 ml, 4-5x/week	135		113	29,1	248	63,9	0,028*	1,35 (1,03-1,78)
No (below 200 ml/not at all	93	24,0	43	12,1	140	36,1		
Smoking								
Yes (current smoking)	134		112	28,9	246	63,4	0,031*	1,36 (1,03-1,78)
No (no smoking)	94	24,2	48	12,4	142	36,6		

Source: Primary Data 2024
Noted: *Significant (P = <0.05)

Table 3. The results of the analysis show that there is a significant relationship between several risk factors and the incidence of hypertension in adults aged 45-55 years in Kotamobagu City. Factors that have a significant relationship with hypertension include dyslipidemia (p = 0.004; OR = 1.49; 95% CI: 1.12-1.99), physical activity (p = 0.028; OR = 1.35; 95% CI: 1.03-1.78), obesity (p = 0.039; OR = 1.13; 95% CI: 1.01-1.74), diet (p = 0.003; OR = 1.53; 95% CI: 1.15-2.04), excessive salt consumption (p = 0.007; OR = 1.46; 95% CI: 1.10-1.94), alcohol consumption (p = 0.028; OR = 1.35; 95% CI: 1.03-1.78), and smoking (p = 0.031; OR = 1.36; 95% CI: 1.03-1.78). Patients aged 45-55 years in Kotamobagu City with a risky diet are 1.53 times more likely to experience hypertension than those who have a healthy diet. Similarly, patients with high cholesterol levels (> 200 mg / dL) are 1.49 times more at risk of hypertension than those with normal cholesterol levels. In addition, excessive salt consumption increases the risk of hypertension by 1.46 times compared to those who consume normal amounts of salt. Meanwhile, lack of physical activity, obesity,

excessive alcohol consumption, and smoking were also found to contribute to an increased risk of hypertension with varying degrees of risk. On the other hand, the results of the analysis show that diabetes mellitus has no significant relationship with the incidence of hypertension in this study (p = 0.350; OR = 1.13; 95% CI: 0.89-1.43). Although diabetes has often been associated with hypertension in various previous studies, the results obtained in this study show that the relationship is not significant. This is likely due to confounding factors or the effect of antihypertensive drugs on diabetic patients that can control blood pressure.

Based on the odds ratio (OR) value, the factor with the strongest relationship with the incidence of hypertension in this study was poor diet (OR = 1.53), followed by dyslipidemia (OR = 1.49) and excessive salt consumption (OR = 1.46). This shows that lifestyle, especially an unhealthy diet, is the main risk factor that contributes to hypertension in patients aged 45-55 years in Kotamobagu City. Therefore, hypertension prevention strategies need to focus on improving diet, such as reducing salt and saturated fat intake, increasing fiber intake, and adopting an active lifestyle to reduce the risk of hypertension. This result is in line with previous studies, which found that excessive sodium consumption and low intake of vegetables and fruits may increase the risk of hypertension (Grillo *et al*., 2019; Rust & Ekmekcioglu, 2017). In addition, these results support research showing that the DASH (Dietary Approaches to Stop Hypertension) dietary intervention effectively reduces blood pressure in various populations (Jeong *et al*., 2020; Tsioufis *et al*., 2020).

In addition, the results of this study also show that dyslipidemia and excessive salt consumption are statistically significant through the chi-square test, but not dominant enough, although both can generally be considered as risk factors for hypertension. This can be caused by several contextual factors (Bhattacharya *et al*., 2022; Imaizumi *et al*., 2017; Wu *et al*., 2020). These findings suggest that local factors, such as genetics or cultural factors, influence the body's response to dyslipidemia and high salt consumption in the context of hypertension. In this study, it was identified that cultural factors have a strong influence on the diet and health of the local community, especially in the context of hypertension. Dyslipidemia is exacerbated by the community's consumption of high-fat foods made from coconut milk. Furthermore, this poor diet is exacerbated by excessive salt consumption, coupled with the habit of serving salt at every meal, and a lack of education about the impact of excessive salt consumption and lack of attention. Thus, the cultural factors and habits of the people in this area play a large role in increasing the risk of hypertension, which shows the need for intervention and dietary changes to improve public health.

The habit of consuming foods high in fat and salt, as seen in some populations, contributes to an increased risk of hypertension. In China, for example, a diet rich in salt and fat has been linked to a higher risk of hypertension. In addition, the lack of education about the impact of excessive salt consumption exacerbates this situation, hindering the behavioral changes necessary to reduce the risk of hypertension (Mills *et al*., 2020; Wan *et al*., 2024). The consumption of oil that contains a lot of saturated fat has been proven to significantly increase total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C), both of which are risk factors for cardiovascular disease that can trigger hypertension (Dhanasekara *et al*., 2022; Jayawardena *et al*., 2020; Neelakantan *et al*., 2020). Individuals with dyslipidemia often consume more salt than is recommended, which can worsen cardiovascular risk (Guastadisegni *et al*., 2020). A poor diet pattern, including a high intake of saturated and trans fats, is common in people with dyslipidemia (Valença *et al*., 2021).

In the West African region, high consumption of fat, red meat, junk food, and alcohol was identified to contribute to a greater risk of hypertension. In contrast, consuming fruits and vegetables had a protective effect (Batubo *et al*., 2023). Meanwhile, populations in Latin America tend to have a higher genetic predisposition to hypertension, especially regarding ACE genes that interact with food consumption patterns (Zambrano *et al*., 2023). These findings reinforce the indication that genetic factors and local culture may

influence the body's response in the context of hypertension risk. Recent research has highlighted the complex relationship between lifestyle factors, cultural practices, and the risk of hypertension. The healthy lifestyle index, which combines factors such as physical activity and diet, is inversely proportional to hypertension in Sri Lanka (Fukunaga *et al*., 2020). In rural areas of northern Thailand, frequent consumption of prepared foods, eating out, and the use of MSG are associated with an increased risk of hypertension (Rusmevichientong *et al*., 2021). Cultural factors, such as the consumption of high-fat coconut milk and excessive salt intake, have been identified as contributors to the risk of hypertension (Morales & Rusmevichientong, 2020). Dietary habits show a sex-specific association with dyslipidemia in Saudi Arabia, with Turkish coffee and carbonated drinks increasing risk in men, while vegetable intake increases risk in women (Enani *et al*., 2020). These findings underscore the importance of interventions tailored to local dietary practices and cultural factors to reduce the risk of hypertension in different populations

Overall, this study addresses the research objectives by showing that poor diet, dyslipidemia, and excessive salt consumption are significant risk factors for hypertension in Kotamobagu City. It also underlines the importance of recognizing that specific conditions and local cultural adaptations strengthen the relationship between hypertension and these risk factors. Further research is expected to deepen understanding of the local factors that influence hypertension so that prevention efforts can be carried out more effectively in the local cultural and social context. The limitation of this study is that it only observes one region and does not consider genetic factors and the influence of the broader socioeconomic environment.

Conclusions

This study concluded that dyslipidemia, poor diet, and consumption of high-salt foods are the main factors closely related to higher levels of hypertension. Other factors such as low physical activity, obesity, alcohol, and smoking also show a significant relationship with hypertension. In implementing hypertension prevention and control programs, special attention should be given to middle-aged adults in areas such as Kotamobagu City. Top priority should be given to community-based interventions, such as dietary counseling, salt reduction, and promotion of a healthy lifestyle, including increased physical activity, reduced alcohol consumption, and smoking cessation, and a sustainable follow-up mechanism is needed to demonstrate the feasibility and ideal model for integrating cultural sensitivity into hypertension management programs in the 45-55 age group.

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