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Hypertension risk factors among productive-age adults: A cross-sectional study in Kendari, Indonesia

Faktor risiko hipertensi pada orang dewasa usia produktif: Sebuah studi potong lintang di Kendari, Indonesia

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Abstract

Hypertension is increasingly affecting individuals in their productive years, yet evidence from primary care settings remains insufficient to explain how smoking behaviour, dietary patterns, and age jointly contribute to its occurrence at the local level. This study aimed to determine the relationship between smoking habits, eating patterns, and age with the incidence of hypertension among the productive-age group in the working area of Poasia Community Health Center, Kendari City. A quantitative cross-sectional study was conducted using an accidental sampling technique. Data were collected from 110 respondents aged 18–59 years through structured questionnaires and direct blood pressure measurements. The independent variables were smoking habits, eating patterns, and age, while the dependent variable was hypertension status. Data were analysed using the Chi-square test with SPSS version 25.0 at a 95% significance level. The results showed that active smoking was significantly associated with hypertension among productive-age respondents (p = 0.000). Unhealthy eating patterns were also significantly related to hypertension (p = 0.002), indicating that poor dietary behaviour may contribute to elevated blood pressure risk. In addition, respondents aged more than 45 years had a significant association with hypertension incidence (p = 0.000). These findings indicate that smoking habits, unhealthy eating patterns, and age above 45 years are important risk factors for hypertension in the productive-age group. Strengthening health promotion, smoking cessation, dietary education, and early blood pressure screening is needed to support hypertension prevention and control in primary health care settings.

Abstrak

Hipertensi semakin banyak menyerang individu yang berada pada usia produktif, namun bukti yang diperoleh dari fasilitas pelayanan kesehatan primer masih belum memadai untuk menjelaskan bagaimana perilaku merokok, pola makan, dan usia secara bersama-sama berkontribusi terhadap terjadinya hipertensi di tingkat lokal. Penelitian ini bertujuan untuk mengetahui hubungan antara kebiasaan merokok, pola makan, dan usia dengan kejadian hipertensi pada kelompok usia produktif di wilayah kerja Puskesmas Poasia, Kota Kendari. Penelitian kuantitatif dengan desain potong lintang dilakukan menggunakan teknik accidental sampling. Data dikumpulkan dari 110 responden berusia 18–59 tahun melalui kuesioner terstruktur dan pengukuran tekanan darah secara langsung. Variabel independen meliputi kebiasaan merokok, pola makan, dan usia, sedangkan variabel dependen adalah status hipertensi. Analisis data dilakukan menggunakan uji Chi-square dengan SPSS versi 25.0 pada tingkat signifikansi 95%. Hasil penelitian menunjukkan bahwa merokok aktif berhubungan signifikan dengan kejadian hipertensi pada responden usia produktif (p = 0,000). Pola makan tidak sehat juga berhubungan signifikan dengan hipertensi (p = 0,002), yang menunjukkan bahwa perilaku makan yang kurang baik dapat berkontribusi terhadap peningkatan risiko tekanan darah. Selain itu, usia lebih dari 45 tahun memiliki hubungan signifikan dengan kejadian hipertensi (p = 0,000). Temuan ini menunjukkan bahwa kebiasaan merokok, pola makan tidak sehat, dan usia di atas 45 tahun merupakan faktor risiko penting hipertensi pada kelompok usia produktif. Penguatan promosi kesehatan, penghentian merokok, edukasi pola makan, dan skrining tekanan darah dini diperlukan untuk mendukung pencegahan dan pengendalian hipertensi di pelayanan kesehatan primer.

Keywords :

age; behavior; eating patterns; hypertension; smoking habits

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INTRODUCTION

Hypertension is a major public health problem within the category of non-communicable diseases because it often develops without clear symptoms and contributes substantially to premature mortality. As a "silent killer," hypertension may remain undetected until complications occur, including cardiovascular disease, stroke, and kidney failure (Lee et al., 2025). Globally, the World Health Organization has reported that approximately 1.4 billion adults aged 30–79 years live with hypertension, with the highest burden occurring in low- and middle-income countries. A considerable proportion of affected individuals are unaware of their condition, indicating persistent gaps in early detection, health literacy, and routine blood pressure screening (Ahmad et al., 2025). This issue is highly relevant to the Sustainable Development Goals, particularly SDG 3, which emphasises the reduction of premature mortality from non-communicable diseases through prevention, treatment, and health promotion.

In Indonesia, hypertension remains a strategic health priority because of its high prevalence and strong association with severe complications. The Ministry of Health identifies hypertension as one of the main contributors to cardiovascular disease in Indonesia, with the 2023 Indonesian Health Survey reporting a prevalence of 34.11%, equivalent to approximately 63 million people, increasing from 25.8% in the 2013 Riskesdas (Kemenkes RI, 2023). Hypertension is not limited to older adults but also increasingly affects the productive-age population. National data show hypertension among individuals aged 31–44 years at 31.6%, with prevalence also observed in younger productive-age groups, including 10.7% among those aged 18–24 years and 17.4% among those aged 25–34 years (Kemenkes RI, 2023). In Southeast Sulawesi, hypertension prevalence reached 29.3% in 2024, while Kendari City recorded 27.27%. In the working area of Poasia Community Health Center, reported cases increased from 684 in 2023 to 721 in 2024 and 784 in 2025, indicating a growing local burden requiring specific epidemiological attention (Dinkes Kota Kendari, 2024).

The main research problem is the increasing burden of hypertension among the productive-age group in the working area of Poasia Community Health Center, while local evidence on its associated risk factors remains limited. Productive-age adults are an important target group because hypertension during this period may reduce work capacity, increase long-term treatment costs, and lead to premature cardiovascular complications (Davari et al., 2022; Jobe et al., 2023). Although health service data are available at the community health center level, these data have not been sufficiently analysed to determine how behavioural and demographic factors contribute to hypertension in this population. Age is an important non-modifiable risk factor due to vascular changes and increasing arterial stiffness over time, while modifiable factors such as unhealthy diet, smoking, and insufficient physical activity may accelerate blood pressure elevation in younger and middle-aged adults (Ferrari et al., 2026; Huang et al., 2024). Therefore, the general solution is to strengthen local risk factor identification, early screening, and health promotion interventions focused on lifestyle modification, especially among productive-age residents at increased risk of hypertension.

Scientific literature indicates that hypertension prevention should focus on both non-modifiable and modifiable risk factors. Age contributes to hypertension through physiological changes in blood vessels, including reduced elasticity and increased vascular stiffness, making older individuals within the productive-age category more vulnerable to elevated blood pressure (Huang et al., 2024). However, the onset and progression of hypertension are strongly influenced by modifiable lifestyle factors. Unhealthy dietary patterns, particularly high sodium intake, are directly associated with increased blood pressure. Evidence suggests that sodium restriction to less than 2 g/day, equivalent to approximately 5 g of salt/day, can lower blood pressure and reduce cardiovascular disease risk (Han et al., 2025; Robinson et al., 2025). Therefore, dietary education and salt reduction strategies are essential components of hypertension prevention at the primary care level.

Physical activity is also a key factor in hypertension prevention and control. Lack of physical activity remains a global problem, with approximately 31% of the productive-age population not meeting recommended daily physical activity levels (Wang et al., 2025). Insufficient physical activity may contribute to increased blood pressure through weight gain, impaired vascular function, and reduced cardiovascular fitness. In primary health care settings, interventions such as routine blood pressure monitoring, lifestyle counselling, community-based physical activity promotion, dietary modification, and smoking cessation support can improve early detection and reduce hypertension risk (Islam et al., 2021; Ndejjo et al., 2021; Schwalm et al., 2019). These strategies are consistent with the role of community health centers as frontline institutions for non-communicable disease prevention, particularly in

populations where many cases may remain undiagnosed or unreported.

Previous studies and health reports have demonstrated that hypertension is influenced by multiple risk factors, including age, dietary behaviour, physical inactivity, obesity, smoking, and other lifestyle-related conditions (Ferrari et al., 2026; Han et al., 2025; Huang et al., 2024; Robinson et al., 2025; Wang et al., 2025). National and regional data further indicate that hypertension is a growing public health problem in Indonesia, Southeast Sulawesi, and Kendari City (Dinkes Kota Kendari, 2024; Kemenkes RI, 2023; Kemenkes RI, 2023). However, most available data describe prevalence at broader administrative levels and do not sufficiently explain the specific risk factors associated with hypertension among productive-age adults in particular community health center catchment areas. This creates a gap in local evidence needed to design more targeted prevention and control strategies.

The novelty of this study lies in its focus on hypertension risk factors among the productive-age group in the working area of Poasia Community Health Center, Kendari City, where hypertension cases have continued to increase in recent years. By examining the relationship between smoking habits, eating patterns, and age with hypertension incidence, this study provides local epidemiological evidence that can support more context-specific primary care interventions. This focus is important because productive-age adults may remain economically and socially active while already experiencing undetected or poorly controlled hypertension. Therefore, this study aimed to determine the relationship between smoking habits, eating patterns, and age with the incidence of hypertension among the productive-age group in the working area of Poasia Community Health Center, Kendari City.

METHODS

This study used a quantitative analytical method with a cross-sectional design. The study was conducted from September to November 2025 in the working area of Poasia Community Health Center, Kendari City, Indonesia. This design was used to examine the relationship between smoking habits, eating patterns, and age with the incidence of hypertension among productive-age adults at a single point in time.

The population in this study consisted of all male residents of productive age, defined as individuals aged 18–59 years, who were registered in the working area of Poasia Community Health Center. Based on community health center records, the productive-age population in this area was approximately 1,000 people. The sample size was calculated using the Slovin formula, resulting in 110 respondents. The sampling technique used was accidental sampling, in which respondents who visited or were registered at Poasia Community Health Center during the study period and met the eligibility criteria were invited to participate.

The inclusion criteria were male productive-age adults aged 18–59 years, registered in the working area of Poasia Community Health Center, and willing to participate in the study. The exclusion criteria were respondents with severe chronic diseases other than hypertension, such as heart disease, stroke, or kidney failure, because these conditions could influence blood pressure measurement and interpretation.

The variables in this study consisted of independent variables and a dependent variable. The independent variables were smoking habits, eating patterns, and age. Smoking habits were assessed based on respondents' smoking status and related smoking behaviour. Eating patterns were assessed based on the frequency of consumption of high-salt foods, high-fat foods, fruits, and vegetables. Age was categorized according to productive-age group classification. The dependent variable was hypertension status, determined through direct blood pressure measurement.

Data were collected using a structured questionnaire and blood pressure measurement. The questionnaire was used to obtain information on respondent characteristics, smoking habits, eating patterns, and other relevant demographic data, including age and occupation. The instrument used a Likert-scale format for dietary pattern assessment and had been tested for validity and reliability. Blood pressure was measured using a digital sphygmomanometer, with a double-check technique applied to improve measurement accuracy.

The research procedure began with obtaining ethical clearance and permission from the relevant institution and Poasia Community Health Center. Eligible respondents were identified during the data collection period, informed about the purpose and procedures of the study, and asked to provide consent before participation. Respondents who agreed to participate completed the questionnaire, followed by blood pressure measurement by the researcher or trained data collector.

Data were processed and analyzed using theSPSS version 26. Descriptive analysis was used to

Table 1
Results of univariate analysis

Variable	n	%
Age		
≥45 years	79	71.8
<45 years	31	28.2
Hypertension		
Yes	75	68.2
No	35	31.8
Smoking habits		
Active smokers	65	59.1
Passive smokers	45	40.9
Dietary pattern		
Unhealthy	82	74.5
Healthy	28	25.5

present respondent characteristics and variable distributions in the form of frequencies and percentages. Bivariate analysis was conducted using the Chi-square test to examine the relationship between smoking habits, eating patterns, age, and hypertension incidence. Statistical significance was determined at a 95% confidence level.

This study received ethical approval from the Health Research Ethics Committee of the Faculty of Public Health, Halu Oleo University. All respondents provided informed consent before data collection. Respondent confidentiality was maintained, and all data were used only for research purposes.

RESULTS

Table 1 shows that of the 110 respondents, the majority were aged > 45 years, totaling 79 respondents (71.8%), while those aged < 45 years old were only 39 respondents (28.2%) and those with hypertension were 75 respondents (68.2%) while 35 respondents (31.8%) did not have hypertension. Regarding smoking habits, the majority were active smokers, namely 65 respondents (59.1%), compared to passive smokers, namely 45 respondents (40.9%). The respondents' eating patterns showed that more of them had unhealthy eating patterns, namely 82 respondents (74.5%), while 28 respondents (25.5%) had healthy eating patterns.

Table 2 shows that of the total 110 respondents, 65 were active smokers, most of whom had hypertension (58 respondents, or 89.2%), while 7 respondents (10.8%) did not have hypertension. The statistical test results obtained a p-value of 0.000 <0.05, which can be concluded that there is a relationship between smoking habits and the occurrence of hypertension. In the diet variable, it was found that of the 82 respondents with unhealthy diets, the majority experienced hypertension, namely 63 respondents (76.8%), compared to those with healthy diets, which numbered 16 respondents (57.1%). The statistical test results obtained a p-value of 0.002 <0. 05, meaning that there is a relationship between dietary patterns and the incidence of hypertension. In terms of the age of respondents, 79 respondents aged >45 years were more likely to experience hypertension than those who did not, totaling 65 respondents (82.2%), while 31 respondents aged <45 years were less likely to experience hypertension, totaling 21 (67.8%) respondents. The statistical test results obtained a p-value of 0.000 <0.05, so it can be concluded that there is a relationship between the age of respondents and the incidence of hypertension.

DISCUSSION

The relationship between smoking habits and hypertension

The results of this study indicate a significant relationship between smoking habits and the incidence of hypertension among the productive age group in the working area of the Poasia Community Health Center, Kendari City. Based on the analysis conducted, it was found that active smokers had a much higher prevalence of hypertension compared to non-smokers or passive smokers. These results indicate that smoking habits can directly contribute to an increased risk of hypertension in individuals.

These results are in line with Khuzaimah et al (2024), stating that smoking habits in the light smoking category had normal blood pressure and prehypertension, namely 36 people (39.6%) with normal blood pressure and 48 people (52.7%) with prehypertension. while moderate smoking habits resulted in stage 1 hypertension in 7 people

Table 2
Cross tabulation between variables

Variable	Hypertension: Yes n (%)	Hypertension: No n (%)	Total N (%)	p-value
Smoking habits				
Active smokers	58 (89.2)	7 (10.8)	65 (100.0)	0.000
Passive smokers	17 (37.8)	28 (62.2)	45 (100.0)	
Dietary pattern				
Unhealthy diet	63 (76.8)	19 (23.2)	82 (100.0)	0.002
Healthy diet	12 (42.9)	16 (57.1)	28 (100.0)	
Age group				
>45 years	65 (82.3)	14 (17.7)	79 (100.0)	0.000
≤45 years	10 (32.3)	21 (67.7)	31 (100.0)	

(7.7%). It can be concluded that active smoking can cause a significant increase in blood pressure, mainly because the nicotine contained in cigarettes can trigger blood vessel constriction and increased heart rate, which in turn can increase blood pressure.

Research by Anri and Kartadarma (2024) shows that active smoking is directly related to the risk of hypertension, especially in individuals who smoke more than 10 cigarettes a day. This study shows that more than half of the respondents smoke (53.7%), most respondents have no family history of hypertension (55.2%), and more than half of the respondents suffer from hypertension (52.2%). The higher blood pressure reduction in active smokers is caused by the body's reaction to harmful chemicals in cigarettes that can affect the cardiovascular system. The long-term effects of smoking can also cause damage to blood vessels, increase arterial stiffness, and affect the balance of salt and water in the body, which in turn affects blood pressure (Anri & Kartadarma, 2024).

Exposure to cigarette smoke can affect cardiovascular function through mechanisms similar to active smoking, albeit at a lower intensity. Cigarette smoke contains more than 7,000 harmful chemicals, some of which can damage blood vessels and increase strain on the cardiovascular system, which increases the likelihood of hypertension in exposed individuals, even if they do not smoke directly (Salehi et al., 2025)

In the passive smoking group, 37.8% of respondents had hypertension, while 62.2% did not. Although the prevalence of hypertension in this group was lower than in active smokers, it still shows that passive smokers have a higher risk of developing hypertension than non-smokers. This confirms that exposure to secondhand smoke can also have adverse effects on health, particularly in terms of blood pressure. Research by Akpa et al. revealed that exposure to secondhand smoke increases the risk of hypertension, especially in people who are frequently exposed in their home or work environment (Akpa et al., 2021)

Nicotine in cigarettes is known to have a vasoconstrictive effect that causes blood vessels to narrow, while other chemicals such as carbon monoxide and tar can worsen this condition by reducing blood oxygen capacity and exacerbating inflammation in the blood vessels. In addition, smoking also disrupts the body's electrolyte balance, which can cause sodium retention and trigger an increase in blood pressure (Saiki et al., 2025).

The relationship between dietary patterns and hypertension

In this study, the group with unhealthy eating patterns showed a 76.8% prevalence of hypertension, meaning that nearly three-quarters of individuals with unhealthy eating patterns had hypertension. Meanwhile, in the group with a healthy diet, the prevalence of hypertension was much lower, at 42.9%. The P-Value of 0.000 obtained indicates that the difference between the groups with unhealthy and healthy diets in terms of hypertension incidence is statistically significant. These findings support the theory that an unhealthy diet, which includes consumption of foods high in salt, saturated fat, and low in fiber, can increase the risk of hypertension.

Researchers assume that the dietary patterns of the community in the working area of the Poasia Community Health Center in Kendari City are not yet fully in accordance with the principles of balanced nutrition. Many people still do not have regular meal schedules and consume unhealthy foods. They have a habit of consuming fast food and foods high in salt, such as instant noodles and saturated fats, and do not consume enough fruits and vegetables. Therefore, it can be concluded that there is a significant relationship between dietary patterns and the incidence of hypertension

in the working area of the Sukamerindu Community Health Center in Lahat Regency.

Previous research conducted by Ningrum et al. (2025) found that of 21 elderly people with poor diets, 16 (76.2%) had hypertension and 5 (23.8%) did not. Meanwhile, out of 10 elderly individuals with good dietary patterns, 7 (70%) did not have hypertension and 3 (30%) had hypertension. The results of the Chi-square test between the dietary pattern variable and the level of hypertension in the elderly obtained a p-value of 0.014 ($p < 0.05$), which indicates a relationship between dietary patterns and the level of hypertension in the elderly in the Molibagu Community Health Center working area (Ningrum et al., 2025).

A healthy diet, which includes eating fruits, vegetables, high-fiber foods, and reducing salt and saturated fat intake, can help lower blood pressure and prevent hypertension. Research conducted by Manurung et al. using the Dietary Approaches to Stop Hypertension (DASH) approach shows that a diet rich in potassium, magnesium, and fiber can significantly lower blood pressure in individuals with hypertension or those at risk of hypertension. The DASH diet reduces salt intake and increases consumption of healthy foods such as fruits, vegetables, low-fat dairy products, and healthy protein sources (e.g., fish and nuts), which have been proven effective in lowering blood pressure (Manurung et al., 2024).

These results also reflect the importance of healthy eating education in hypertension prevention, especially among the productive age group. Reducing salt and saturated fat intake and increasing fiber intake from vegetables and fruits can be key strategies in controlling hypertension in the community (Charchar et al., 2023; Filippou et al., 2022). Health education at the community health center level, especially about the importance of low-salt and high-fiber foods, can help reduce the prevalence of hypertension and other cardiovascular diseases.

The relationship between age and hypertension

Among the respondents, 79 respondents aged >45 years were more likely to have hypertension than the 65 respondents (82.2%) who did not have hypertension, while among the 31 respondents aged <45 years, more respondents did not have hypertension, totaling 21 (67.8%) respondents. The statistical test yielded a p-value of 0.000 <0.05, indicating that there is a significant association between the respondents' age and the occurrence of hypertension.

As we age, blood pressure tends to increase. Artery walls thicken due to collagen accumulation in the muscle layer, causing blood vessels to become narrow and stiff. Due to the natural aging process, arteries and blood vessels tend to deteriorate, leading to an increased risk of high blood pressure. Increasing age is associated with a greater risk of hypertension, resulting in a high prevalence of high blood pressure among the elderly (Indrasari et al., 2025)

These results are in line with the research by Pramono and Sugiyarti, which states that more adults suffer from hypertension. The results of the statistical test show a p-value of 0.000 < 0.05, so it can be concluded that there is a significant relationship between age and the incidence of hypertension in the working area of the Pedamaran Community Health Center UPTD in Ogan Komering Ulu Regency. The statistical test shows a p-value of 0.000 < 0.05, so it can be concluded that there is a significant relationship between age and the incidence of hypertension in the working area of the Pedamaran Community Health Center, Ogan Komering Ilir Regency, in 2021. This shows that age greatly influences the occurrence of hypertension. Hypertension is 8,000 times more likely to occur in people aged ≥45 years compared to those aged ≥45 (45-65) years, who are more at risk of experiencing hypertension than respondents aged (Pramono & Sugiyarti, 2023).

On the other hand, the <45 age group had a lower prevalence of hypertension, with only 32.2% of respondents experiencing hypertension, while 67.8% did not. Although the prevalence of hypertension in this age group is lower than in the >45 age group, the P-Value of 0.000 still indicates that there is a significant relationship between young age (under 45 years) and the incidence of hypertension, even though the difference in prevalence is quite large.

Risk factors that influence the incidence of hypertension in this age group can vary, including unhealthy diets, lack of physical activity, and smoking, which are often found in productive age groups. This study also shows that although the prevalence of hypertension in those under 45 years of age is lower, there is still a risk that cannot be ignored. This reminds us that although age is a stronger risk factor in older age groups, young people who experience secondary hypertension or have high risk factors must be detected and intervened immediately (de Freminville et al., 2024; Prasert et al., 2025; Yudhawati et al., 2025).

CONCLUSION

This study concludes that smoking habits, dietary patterns, and age were significantly associated with the incidence of hypertension among productive-age adults in the working area of Poasia Community Health Center, Kendari City. These findings indicate that hypertension prevention in productive-age populations should not only focus on clinical management but also on modifiable lifestyle factors, particularly smoking behaviour and unhealthy eating patterns. Age also remains an important factor, requiring closer attention to individuals in older productive-age groups who may have a higher risk of elevated blood pressure.

The findings emphasize the need to strengthen promotive and preventive hypertension programs at the community health center level. Poasia Community Health Center should enhance counselling on healthy diets, reduced salt and fat intake, and smoking risks, along with regular blood pressure screening for older adults and high-risk productive-age groups. Collaboration with health cadres and local communities is important to support effective health promotion. Future studies should evaluate community-based interventions to reduce smoking, improve dietary behaviour, and lower hypertension risk.

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AUTHORS' CONTRIBUTIONS

La Ode Liaumin Azim contributed to the conceptualisation of the study, study design, data analysis, manuscript drafting, and manuscript revision. Agnes Mersantika Hartoyo contributed to data collection, fieldwork implementation, interpretation of findings, and manuscript review. Both authors have read and approved the final manuscript

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COMPETING INTERESTS

The authors affirm that there are no conflicts of interest related to the research, writing, or publication of this article.

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