

Risk Factors Associated with Hypertension Among Adults Aged 19-64 Years in Ohoijang Watdek, Southeast Maluku

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Abstract

Hypertension is a serious condition that increases the risk of cardiovascular diseases such as coronary heart disease, heart failure, stroke, kidney failure, and other complications. This study aimed to identify risk factors associated with hypertension in the working area of the Ohoijang Watdek Public Health Center. A quantitative analytic method with a cross-sectional design was used. A total of 127 respondents aged 19–64 years, selected through convenience sampling, participated in the study. Univariate analysis described respondents' characteristics, and chi-square tests examined associations between variables. Most respondents had stage 1 hypertension (32.3%), were aged 36–45 (29.9%), female (59.1%), non-smokers (62.2%), non-alcohol consumers (73.2%), had type 1 obesity (26%), and engaged in moderate physical activity (35.4%). Significant associations were found between hypertension and age ($p=0.001$; $r=0.402$), family history ($p=0.028$; $r=0.195$), smoking ($p=0.014$; $r=0.217$), alcohol consumption ($p=0.012$; $r=0.224$), and physical activity ($p=0.002$; $r=0.320$). Gender ($p=0.256$) and nutritional status ($p=0.440$) showed no significant relationship. The study concludes that age, family history, smoking, alcohol consumption, and physical activity are significantly associated with hypertension, while gender and nutritional status are not.

Keywords: Hypertension, Risk Factors, Alcohol Consumption, Smoking

1. Introduction

Hypertension is a serious medical condition that increases the risk of cardiovascular complications such as coronary heart disease (CHD), congestive heart failure (CHF), ischemic and hemorrhagic stroke, kidney failure, and various other health problems. It is also the leading risk factor for premature death worldwide, contributing to approximately 10.8 million preventable deaths annually. According to World Health Organization (WHO) statistics, the number of adults aged 30–79 years living with hypertension has doubled globally from 650 million in 1990 to 1.3 billion in 2019 and is projected to rise to 1.5 billion by 2025.^{1,2} Indonesia ranks second in Southeast Asia in terms of hypertension prevalence, reaching approximately 40%.¹

Data from the Maluku Provincial Health Office shows that hypertension was the fourth most prevalent disease in 2020 and has continued to increase. In 2024, there were 273,763 reported cases of hypertension in the province, with the highest numbers recorded in Ambon City and Tual City. In Southeast Maluku Regency, Ohoijang Watdek Public Health Center reported the highest number of cases, with 1,088 cases in 2024, which doubled during the first quarter of 2025. These figures indicate that hypertension remains a significant public health concern, requiring increased attention in terms of prevention and management strategies.

Studies conducted in Eastern Indonesia have identified several risk factors associated with hypertension, including alcohol consumption, smoking habits, obesity, and low levels of physical activity.^{3,4} Research by

Dewi et al. (2021) found that alcohol consumption was associated with hypertension due to elevated cholesterol levels that influence the renin-angiotensin-aldosterone system.⁵ Another study by Rahmadhani (2021) found a significant association between smoking and hypertension, as nicotine increases adrenaline levels, leading to elevated blood pressure.⁶ Additionally, a study by Rosy et al. (2022) demonstrated a link between obesity and hypertension, explaining that excessive dietary intake associated with obesity increases the risk of cardiovascular diseases, including hypertension.⁷

The rising prevalence of hypertension at both global and national levels highlights the urgency of this issue. In Southeast Maluku Regency, Ohoijang Watdek has been identified as the area with the highest number of cases, reinforcing the importance of identifying the risk factors associated with the incidence of hypertension. Therefore, this study aims to examine "Risk Factors Associated with Hypertension Among Adults Aged 19–64 Years in Ohoijang Watdek, Southeast Maluku".

2. Method

This cross-sectional study was conducted among 127 individuals aged 19-64 years residing in the service area of Ohoijang Watdek Public Health Center, Southeast Maluku Regency. Participants were selected using a convenience sampling technique and were required to meet the inclusion criteria, which included providing informed consent and being able to undergo all required measurements and data collection procedures. Data collection was conducted between April and May 2025. Exclusion criteria included individuals who were unable to communicate effectively with the researchers or who could not undergo blood

pressure, weight, or height measurements due to physical limitations.

This study was approved by the Ethics Committee of the Faculty of Medicine, Pattimura University, with ethical clearance number 036/FK-KOM.ETIK/V/2025. All participants were informed about the study objectives and procedures and provided written informed consent prior to participation.

Sociodemographic data such as age and sex were obtained from participants' identification records at the time of data collection. Family history of hypertension was categorized as "yes" if the respondent had one or more first-degree relatives (parents or siblings) diagnosed with hypertension. Behavioral risk factors such as smoking, alcohol consumption, and physical activity were assessed through self-reported, closed-ended questions. Smoking was defined as daily smoking, individuals who had quit for ≥ 6 months or never smoked were categorized as non-smokers. Alcohol consumption was recorded as "yes" if participants reported drinking ≥ 2 glasses per week in the past month. Physical activity was assessed using the Global Physical Activity Questionnaire (GPAQ), a WHO-validated tool, and categorized as low (< 600 MET-min/week), moderate ($600\text{--}1500$ MET-min/week), or high (≥ 1500 MET-min/week or vigorous activity ≥ 3 days/week).

Blood pressure, as the dependent variable, was measured using a validated digital sphygmomanometer. Each participant had their blood pressure measured three times with a one-minute interval between each measurement. The average of the last two readings was used for analysis. The classification of hypertension followed the 2020 Global Hypertension Practice Guidelines from the International Society of Hypertension (ISH).⁸

Data were processed and analyzed using SPSS software. Chi-square tests were used to evaluate the association between independent variables and the incidence of hypertension.

3. Result

The results presented in Table 1 show the characteristics of respondents based on blood pressure status, age, sex, family history

of hypertension, smoking behavior, alcohol consumption, nutritional status, and physical activity.

The age distribution revealed that the largest proportion of respondents were in the 36-45 years age group, accounting for 38 individuals (29.9%), while the smallest proportion was in the 19-25 years age group, comprising 13 individuals (10.2%).

Tabel 1. Characteristics of Respondents in the Working Area of Ohoijang Watdek Public Health Center, Southeast Maluku Regency, in 2025.

	n	%
Blood Pressure Status		
Normal	21	16,5
Pre Hypertension	39	30,7
Hypertension Stage 1	41	32,3
Hypertension Stage 2	26	20,5
Age (Year)		
19-25	13	10,2
26-35	28	22
36-45	38	29,9
46-55	17	13,4
56-64	31	24,4
Gender		
Male	52	40,9
Female	75	59,1
Family History		
Yes	70	55,1
No	57	44,9
Smoking Behavior		
Yes	48	37,8
No	79	62,2
Alcohol Consumption Behavior	n	%
Yes	34	26,8
No	93	73,2
Nutritional Status	n	%
Underweight	14	11
Normal	25	19,7
Pre Obesity	29	22,8
Obesity 1	33	26
Obesity 2	26	20,5
Physical Activity	n	%
High	43	33,9
Moderate	45	35,4
Low	39	30,7
Total	127	100

In terms of sex, the majority of respondents were female, totaling 75 individuals (59.1%), while male respondents accounted for 52 individuals (40.9%). Regarding family history, a greater proportion of respondents 70 individuals (55.1%) reported having a first-degree relative diagnosed with hypertension, while 57 respondents (44.9%) reported no such history. In terms of smoking behavior, the majority of respondents were classified as non-smokers, accounting for 79 individuals (62.2%), whereas 48 respondents (37.8%) were identified as current smokers. As for

alcohol consumption, most respondents 93 individuals (73.2%) reported no regular alcohol intake, while 34 respondents (26.8%) reported engaging in regular alcohol consumption. For nutritional status, the highest proportion of respondents were classified as obese class I, with 33 individuals (26%), while the lowest proportion was underweight, totaling 14 individuals (11%). Based on physical activity levels, the highest number of respondents fell into the moderate activity category with 45 individuals (35.4%), while the lowest was in the low activity category with 39 individuals (30.7%).

Table 2. The Association Between Risk Factors and the Incidence of Hypertension in the Working Area of Ohoijang Watdek Public Health Center, Southeast Maluku Regency, in 2025.

	Hypertension				Total		p-value	r
	Yes		No		n	%		
	n	%	n	%				
Age								
19-25	6	46,2	7	53,8	13	100	<0,001	0,402
26-35	15	53,6	13	46,4	28	100		
36-45	16	42,1	22	57,9	38	100		
46-55	13	76,5	4	23,5	17	100		
56-64	28	90,3	3	9,7	31	100		
Gender								
Male	35	67,3	17	32,7	52	100	0,256	
Female	43	57,3	32	42,7	75	100		
Family History								
Yes	49	70	12	30	70	100	0,028	0,195
No	29	50,9	37	49,1	57	100		
Smoking Behavior								
Yes	36	75	12	25	46	100	0,014	0,217
No	42	53,2	37	46,8	81	100		
Alcohol Consumption Behavior								
Yes	27	79,4	7	20,6	34	100	0,012	0,224
No	51	54,8	42	45,2	93	100		
Nutritional Status								
Underweight	9	64,3	5	35,7	14	100	0,440	
Normal	13	52	12	48	25	100		
Pre Obesity	15	51,7	14	48,3	29	100		
Obesity 1	23	69,7	10	30,3	33	100		
Obesity 2	18	69,2	8	30,8	26	100		
Physical Activity								
High	21	48,8	22	51,2	43	100	0,014	0,217
Moderate	24	53,3	21	46,7	45	100		
Low	33	84,6	6	15,4	39	100		
Total	78	61,4	49	38,6	127	100		

Table 2 presents the association between various risk factors and the incidence of hypertension in the service area of Ohoijang Watdek Public Health Center. Respondents aged 56–64 years had the highest prevalence of hypertension (90.3%), while the lowest was observed among those aged 36–45 years (42.1%). The chi-square test yielded a p-value of 0.001 and $r = 0.402$, indicating a significant association with moderate strength. In terms of sex, hypertension was more prevalent among males (67.3%) than females (57.3%), but the association was not statistically significant ($p=0.256$; $r=0.102$), indicating a very weak relationship. Respondents with a family history of hypertension showed a higher prevalence (70.0%) compared to those without (50.9%). The chi-square test produced a p-value of 0.028 and $r = 0.195$, indicating a significant association with very weak strength.

For smoking behavior, 75.0% of smokers experienced hypertension compared to 53.2% of non-smokers. The test yielded a p-value of 0.014 and $r = 0.217$, indicating a significant association with weak strength. Regarding alcohol consumption, 79.4% of alcohol consumers had hypertension, while 54.8% of non-consumers were hypertensive. The result was significant ($p=0.012$; $r=0.224$), showing a significant association with weak strength. Based on nutritional status, the highest prevalence of hypertension was among those with obesity class I (69.7%), and the lowest among those with pre-obesity (51.7%).

However, the association was not statistically significant ($p=0.440$; $r=0.119$), indicating a very weak relationship. Physical activity showed that respondents with low activity levels had the highest prevalence of hypertension (84.6%), while those with high activity had the lowest (48.8%). The association was statistically significant

($p=0.002$; $r=0.320$), indicating a significant association with weak to moderate strength.

4. Discussion

4.1 The Relationship Between Age and Hypertension Incidence

The results of this study showed that the age group with the highest prevalence of hypertension was 56–64 years, and a significant association was found between age and the incidence of hypertension. Physiologically, as age increases, blood pressure progressively rises due to a decline in arterial distensibility.⁹ This finding is consistent with the study conducted by Xiong et al. in 2023, which found a significant relationship between age and hypertension ($p\leq 0.001$). This is due to declining bodily functions with age, such as reduced vascular elasticity and increased peripheral resistance, which can lead to decreased baroreceptor function and volume sensitivity.^{10,11} In addition, endothelial cells in the vascular walls become smaller and less aligned, leading to decreased production of vasodilatory substances and impaired local regulation of vascular tone.¹⁰

Although hypertension may not be entirely preventable, it can be controlled. Therefore, it is important for all age groups especially older adults to pay attention to other modifiable risk factors associated with hypertension, such as dietary patterns, physical activity, smoking behavior, alcohol consumption, and other lifestyle factors.¹²

4.2 The Relationship Between Gender and Hypertension Incidence

The results of this study indicate that there is no significant association between gender and the incidence of hypertension in the working area of Ohoijang Watdek Public Health Center. This finding is consistent with the study conducted by Wardhani et al,¹³ in 2023 which also reported no significant relationship between gender and

hypertension ($p = 0.377$).¹³ This suggests that men and women have an equal likelihood of developing hypertension. In women, estrogen levels decline after menopause. As estrogen plays a role in increasing HDL levels, its decline may lead to an increase in LDL, thereby elevating the risk of atherosclerosis and, consequently, blood pressure. In men, the increase of androgen hormones such as testosterone after the age of 30 may also contribute to increased blood pressure.^{14,15} Conversely, a study by Nurhayati et al,¹⁶ In 2023 found a significant association between gender and hypertension (p -value= 0.000).¹⁶

The lack of statistical significance in this study may be attributed to the relatively balanced distribution of hypertension cases between male and female respondents. Moreover, other modifiable risk factors such as smoking habits, alcohol consumption, and physical activity appear to exert a greater influence on blood pressure than gender alone. It is also possible that unmeasured modifiable factors, such as stress and sodium intake, played a stronger role. Therefore, this result offers the insight that, in the studied population, gender is not a primary determinant of hypertension. Preventive strategies should thus focus more on modifiable risk factors.

4.3 The Relationship Between Family History and Hypertension Incidence

The results of this study indicate a statistically significant association between family history and the incidence of hypertension in the working area of Ohoijang Watdek Public Health Center. This finding is in line with a study conducted by Zhao et al,¹⁷ in 2021 reported a significant association between family history of hypertension and the occurrence of hypertension ($p = 0.013$). Similarly, research by Mulyasari et al,¹⁸ (2023) demonstrated a significant relationship between family history and hypertension ($p =$

0.017), with individuals who had a family history of hypertension being 2.6 times more likely to develop the condition compared to those without such a history.¹⁸ This association may be attributed to genetic factors, which are inherited through Mendelian patterns (monogenic hypertension) involving specific gene mutations, as well as polygenic mechanisms, in which multiple major and minor genes interact within physiological systems that contribute to blood pressure regulation.¹⁸ Theoretically, several gene mutations have been identified in humans that may lead to hypertension, particularly those associated with increased reabsorption of sodium and water in the renal tubules, such as mutations affecting sodium or chloride transport in renal tubular epithelial cells.⁹

Conversely, a study by Rambing et al,¹⁹ reported no significant association between family history and the incidence of hypertension ($p = 0.11$). This discrepancy may be explained by the multifactorial nature of hypertension, where non-genetic and modifiable risk factors such as smoking, alcohol consumption, poor dietary habits, and obesity also play a substantial role in its development.¹⁹

4.4 The Relationship Between Smoking Behavior and Hypertension Incidence

The results of this study indicate a significant relationship between smoking behavior and the incidence of hypertension. Consistent with these findings, a study by Hu et al,²⁰ (2024) also found a relationship between smoking, tobacco use, and the incidence of hypertension ($p < 0.001$).²⁰ Similarly, research by Apriza and Nurman,²¹ showed a significant association between smoking behavior and hypertension ($p = 0.003$), with respondents who smoked being 6.067 times more likely to develop hypertension compared to non-smokers.²¹

This is because cigarettes contain harmful substances such as nicotine, carbon monoxide, and tar.²²

Nicotine absorbed through the lungs can circulate to the brain's blood vessels and trigger the release of epinephrine (adrenaline), leading to vasoconstriction and increased cardiac workload, which raises blood pressure.²³ Carbon monoxide from cigarettes binds with red blood cells to form carboxyhemoglobin, resulting in tissue hypoxia and potential damage to the heart and blood vessels.²² Tar can damage lung cells and increase the risk of lung cancer.²⁴

In contrast, a study by Nafi and Putriningtyas (2023),²⁵ in 2023 found no significant relationship between smoking behavior and hypertension ($p=0.072$), likely because respondents who did not smoke also had other risk factors that contribute to hypertension, such as high salt intake and obesity.²⁵

4.5 The Relationship Between Alcohol Consumption and Hypertension Incidence

The study found a significant relationship between alcohol consumption behavior and the incidence of hypertension. This result is consistent with a study by Biddinger et al,²⁶ in 2022 which found a significant association between alcohol consumption and hypertension ($p = 0.000$), and also in line with the findings of Apriyanto et al,²⁷ which reported a significant relationship between alcohol intake and the incidence of hypertension ($p = 0.029$).²⁷ This is because alcohol, being an addictive substance, leads to increased cortisol levels when consumed excessively and continuously, which can affect the hormonal system that regulates fluid balance in the body, thereby increasing blood pressure. Additionally, alcohol consumption can impair organ function, including the liver, which in

turn reduces heart performance and contributes to elevated blood pressure. Blood viscosity also increases with continuous alcohol intake. Consuming alcohol more than three times a day can raise the risk of developing hypertension by up to 75%.²⁸

In contrast, a study by Tombokan and Thalib,²⁹ in 2024 found no significant association between alcohol consumption behavior and the incidence of hypertension ($p = 0.117$).²⁹ This may be attributed to the fact that individuals over the age of 45 are generally less inclined to engage in unbeneficial behaviors and tend to prioritize their family's economic needs. As a result, alcohol consumption becomes occasional rather than frequent.³⁰

The significant relationship between alcohol consumption behavior and hypertension in the working area of Ohoijang Watdek Health Center, Southeast Maluku Regency, is likely influenced by the local culture in Maluku, where alcohol is consumed not only to boost energy for work but also as part of social life. This cultural norm may contribute to the incidence of hypertension.³¹

4.6 The Relationship Between Nutritional Status and Hypertension Incidence

The results of the study showed that there was no significant relationship between nutritional status and the incidence of hypertension in the working area of Ohoijang Watdek Public Health Center. This is consistent with the study conducted by Apriliani et al,³² in 2024 which stated that there was no meaningful association between nutritional status and hypertension ($p = 0.622$).³² This may be due to the fact that some respondents were already aware of the effects of nutritional status on blood pressure and therefore made efforts to maintain their nutritional status. In addition, other factors such as family history and sodium intake habits were more dominant in influencing

respondents' experience of hypertension.³² On the other hand, several previous studies have shown different results. The study by Safitri and Aminah,³³ in 2023 found a significant relationship between nutritional status and the incidence of hypertension ($p=0.004$).³³

Theoretically, being overweight and obese can cause hypertension due to increased cardiac output as a result of the additional blood flow required for the extra adipose tissue. Long-term obesity may lead to persistent hypertension, increasing total peripheral vascular resistance. Furthermore, sympathetic nervous system activity increases, levels of angiotensin II and aldosterone rise two to three times in most obese patients, and the kidney pressure natriuresis mechanism becomes impaired, all of which contribute to hypertension.⁹

The lack of a significant relationship between nutritional status and hypertension may be due to the measurement of nutritional status using Body Mass Index (BMI). BMI does not always reflect specific fat distribution in the body, particularly visceral fat, which plays an important role in blood pressure regulation. BMI also does not distinguish between muscle mass and body fat, potentially leading to classifications that do not fully represent actual risk for hypertension.^{34,35} Moreover, these findings may reflect increasing public awareness of the importance of maintaining an ideal body weight to prevent non-communicable diseases. Promotive efforts such as diet regulation, increased physical activity, and regular blood pressure monitoring can influence the outcome, meaning that individuals with excessive nutritional status do not always exhibit high blood pressure.^{34,35}

Other risk factors such as family history of hypertension, smoking behavior, alcohol consumption, and physical activity have been shown to be associated with the incidence of

hypertension. Therefore, the absence of a significant relationship between nutritional status and hypertension in this study actually indicates that the etiology of hypertension is multifactorial and highlights the need for a more comprehensive approach in prevention and control efforts among the population in the Ohoijang Watdek area.

4.7 The Relationship Between Physical Activity and Hypertension Incidence

The results of the study indicate a significant relationship between physical activity and the incidence of hypertension. This finding is in line with research conducted by Setiandari et al, in 2020, which also identified a relationship between physical activity and the incidence of hypertension ($p=0.001$).³⁶ This may be due to regular bodily movement causing physiological changes such as a stronger cardiac muscle and increased elasticity of blood vessels, as these structures become conditioned through consistent physical activity. Conversely, low levels of physical activity over an extended period may cause vasoconstriction, particularly in the lower limbs, forcing the heart to work harder and eventually leading to hypertension.³⁷

The observed relationship between physical activity and the incidence of hypertension in the working area of Ohoijang Watdek Public Health Center, Southeast Maluku Regency, may be attributed to the low levels of physical activity among respondents with hypertension. Contributing factors include job-related sedentary behavior, which requires respondents to sit for long periods, as well as advancing age, which leads to reduced physical productivity, both of which may influence the occurrence of hypertension.³⁸

This study has several limitations that should be considered. The use of convenience sampling may have introduced selection bias and limited the generalizability of the results to the wider adult population in Southeast

Maluku. A relatively small sample size may have reduced the statistical power to detect more subtle associations. The potential presence of unmeasured confounding variables such as dietary habits, psychological stress, or socioeconomic factors could not be fully controlled. Additionally, behavioral variables such as smoking, alcohol consumption, and physical activity were collected through self-reported questionnaires, which may be affected by social desirability or recall bias. These limitations suggest that the findings should be interpreted with caution and highlight the need for further research using larger, more representative samples and more rigorous methodological designs.

5. Conclusion

This study identified that the majority of respondents had stage 1 hypertension and were predominantly within the 36–45-year age group, female, and had a family history of hypertension. Most participants were non-smokers, non-alcohol consumers, and classified as obesity class I, with moderate levels of physical activity. A significant association was found between age and hypertension, indicating a moderate positive correlation. Additionally, family history, smoking behavior, alcohol consumption, and physical activity were significantly associated with hypertension, although the strength of these correlations was weak to very weak. No significant associations were found between gender or nutritional status and hypertension. These findings highlight the multifactorial nature of hypertension and underscore the importance of age, lifestyle behaviors, and family history in its development. Preventive strategies should prioritize modifiable risk factors such as smoking, alcohol consumption, and physical activity to reduce the burden of hypertension in the community.

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