JPPIPA 11(11) (2025)

Jurnal Penelitian Pendidikan IPA

http://jppipa.unram.ac.id/index.php/jppipa/index

Nutritional Status, Physical Activity, Family History of Hypertension, and Dietary Patterns as Risk Factors for Hypertension Among Individuals Aged 20–59 Years

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Received: September 19, 2025
Revised: October 29, 2025
Accepted: November 25, 2025
Published: November 30, 2025

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DOI: 10.29303/jppipa.v11i11.13190

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Abstract: Hypertension is an increasing global health concern and a leading cause of cardiovascular diseases, including stroke and heart attack. In Indonesia, the prevalence of hypertension continues to rise each year, including in the service area of Puskesmas Perumnas, Kendari City. This study aims to examine the factors associated with hypertension in individuals aged 20–59 years, specifically from the perspectives of nutritional status, physical activity, family history of hypertension, and dietary patterns. This research is an analytical observational study using a case-control design. It was conducted from February to March 2025 in the service area of Puskesmas Perumnas. A total of 98 participants were involved, consisting of 49 hypertensive individuals (cases) and 49 non-hypertensive individuals (controls), selected using purposive sampling. Data was collected through questionnaires and direct measurements, then analyzed using odds ratio and chi-square tests. Cases and controls in this study were comparable in age and gender. Variables that showed a significant association and were proven to be risk factors for hypertension were overweight status (OR = 2.73; 95% CI = 1.20–6.18; p = 0.03), family history of hypertension (OR = 2.72; 95% CI = 1.20–6.16; p = 0.03), and adequate/unhealthy dietary patterns (OR = 6.28; 95% CI = 2.61–15.11; p = 0.00). These three variables contributed to a significant increase in the risk of hypertension. In contrast, light physical activity (OR = 1.51; 95% CI = 0.68–3.36; p = 0.42) did not show a significant association with hypertension and was therefore not considered a risk factor in this study. Overnutrition, a family history of hypertension, and an adequate/unhealthy diet are significant risk factors for hypertension in adulthood, while light physical activity has not been shown to be a significant risk factor. Hypertension prevention efforts should focus on weight control, dietary modification, and screening for individuals with a family history of hypertension.

Keywords: Dietary pattern; Family history; Hypertension; Nutritional status; Physical activity.

Introduction

Hypertension, or high blood pressure, is a chronic condition characterized by an increase in blood pressure above normal thresholds, which, if left uncontrolled, can lead to serious complications such as stroke, kidney failure, and coronary heart disease (Herawati et al., 2020). According to the WHO (2024), approximately 1 billion people worldwide have hypertension, with an estimated increase to 33% of the global population. In Indonesia, the prevalence of hypertension based on the 2018 Riskesdas reached 34.1%, and according to the 2023

How to Cite:
Sudarsono, I. M. R., Hamsa, N., Hasan, Imanuddin, & Hariani. (2025). Nutritional Status, Physical Activity, Family History of Hypertension, and Dietary Patterns as Risk Factors for Hypertension Among Individuals Aged 20–59 Years. *Jurnal Penelitian Pendidikan IPA*, *11*(11), 1102–1107. https://doi.org/10.29303/jppipa.v11i11.13190

Indonesian Health Survey (SKI), the prevalence reached 30.8%.

The working area of the Perumnas Kendari City Community Health Center also shows an increasing trend in the number of visits by hypertension patients from year to year. In 2021, it was 71.80%, increasing to 94.80% in 2022, and reaching 96.80% in 2023 (Sudayasa et al., 2023). This phenomenon highlights the importance of identifying risk factors to support evidence-based interventions and develop effective community-based prevention programs.

Hypertension risk factors are divided into two categories: non-modifiable (genetics, age, and gender) and modifiable (nutritional status, physical activity, diet, sodium and alcohol consumption, and stress) (Sood et al., 2024; Sutriyawan et al., 2022). Obesity increases peripheral resistance and blood volume, while lack of physical activity causes a decrease in vascular elasticity (Fang et al., 2021; Ivanov, 2022). A family history of hypertension also increases a person's likelihood of developing hypertension. This study was conducted to analyze the relationship between these factors and the incidence of hypertension in the productive age group and to provide a scientific basis for more targeted promotional and preventive policies (Zhou et al., 2021).

Method

This study used an analytical observational case-control design to identify risk factors associated with hypertension in the 20–59 age group. The study was conducted in the working area of the Perumnas Community Health Center in Kendari City from February to March 2025. The case-control design was chosen because it allows for the comparison of characteristics between the hypertensive group (cases) and the non-hypertensive group (controls) within a relatively short period of time.

The population in this study was the entire community aged 20–59 years residing in the working area of the Perumnas Community Health Center. The sample was determined purposively with the following inclusion criteria: participants aged 20–59 years, willing to participate, and able to be interviewed directly. Participants with pregnancy or severe comorbidities were excluded from the study. The sample size was 98 people, consisting of 49 case samples (diagnosed with hypertension) and 49 control samples (without hypertension) with a 1:1 ratio.

Data were collected through structured interviews using questionnaires and direct measurements by researchers (Hansell et al., 2024). The nutritional status of the participants was measured based on Body Mass Index (BMI) by comparing weight and height. Physical activity was assessed using the International Physical Activity Questionnaire Short Form (IPAQ-SF) questionnaire and calculated in MET-min/week units. Family history of hypertension was obtained through anamnesis of the presence of a history of hypertension in parents or siblings. The dietary patterns of the participants were evaluated using the Food Frequency Questionnaire (FFQ) instrument, particularly for food groups that have the potential to increase blood pressure, such as foods high in sodium, saturated fat, and low in fiber.

The data were analyzed univariately to see the frequency distribution of each variable, and bivariately using the Chi-square test to assess the relationship between variables. The strength of the relationship was measured using the Odds Ratio (OR) value with a significance level set at $p<0.05$ (Baranova et al., 2023; Tang et al., 2022). All data analyses were performed using SPSS software (Liu et al., 2023).

This study obtained ethical approval from the Kendari Ministry of Health Polytechnic Ethics Committee and permission from the Perumnas Community Health Center. Prior to data collection, all samples explained the purpose and procedures of the study and signed a written consent form (informed consent).

Results and Discussion

Univariate Analysis

This analysis contains characteristics, consisting of age, gender, nutritional status, physical activity, family history of hypertension, and dietary patterns of the sample. The total number of samples was 98 people, consisting of 49 people in the case group (hypertension patients) and 49 people in the control group (non-hypertension).

Table 1. Univariate analysis results

Characteristics	Group				Total	
	Cases		Control			
	n	%	n	%	n	%
Age						
20 – 29	7	14.3	7	14.3	14	14.3
30 – 59	42	85.7	42	85.7	84	85.7
Total	49	100	49	100	98	100
Gender						
Male	25	51	25	51	50	51
Female	24	49	24	49	48	49
Total	49	100	49	100	98	100
Nutritional status						
Overweight (at risk)	29	59.2	17	34.7	46	46.9
Normal (not at risk)	20	40.8	32	65.3	52	53.1
Total	49	100	49	100	98	100
Physical activity						
Light (risk)	29	59.2	24	49	53	54.1

Characteristics	Group				Total	
	Cases		Control			
	n	%	n	%	n	%
Heavy (no risk)	20	40.8	25	51	45	45.9
Total	49	100	49	100	98	100
Family history of hypertension						
Yes (at risk)	31	63.3	19	38.8	50	51
No (not at risk)	18	36.7	30	61.2	48	49
Total	49	100	49	100	98	100
Diet						
Adequate (at risk)	34	69.4	13	26.5	47	48
Inadequate (not at risk)	15	30.6	36	73.5	51	52
Total	49	100	49	100	98	100

Based on the age distribution of the 98 samples, most (85.7%, n=42) were aged 30–59 years. This distribution shows that most of the samples were in the adult age group. The gender distribution between the case and control groups was relatively balanced. In the case group, 51% (n=25) were male and 49% (n=24) were female, as was the case in the control group with the same proportion. Overall, there were slightly more male samples than female samples. Nutritional status showed a striking difference between the two groups. In the case group, most samples had excessive or at-risk nutritional status (59.2% or 29 people), while in the control group, most had normal nutritional status (65.3% or 32 people).

Based on physical activity, most samples with light activity were in the case group, namely 59.2% (n = 29), while in the control group this figure was 49% (n = 24). Meanwhile, samples with heavy physical activity were more numerous in the control group, namely 51% (n = 25).

Based on family history of hypertension, most samples in the case group had a history of hypertension, namely 63.3% (n=31), higher than the control group, namely 38.8% (n=19). Conversely, samples with no history of hypertension were more prevalent in the control group, namely 61.2% (n=30).

Based on dietary patterns, samples with adequate (but risky) dietary patterns were more prevalent in the case group, at 69.4% (n=34), while in the control group, they were only 26.5% (n=13). Conversely, samples with poor dietary patterns were more prevalent in the control group, at 73.5% (n=36).

Bivariate Analysis

Table 2 shows the test results based on nutritional status, with a p-value of 0.03 (p<0.05), indicating that nutritional status is a significant risk factor for hypertension in adults. Samples with poor nutritional status have a 2.73 times greater risk of developing hypertension compared to samples with normal nutritional status.

Table 2. Bivariate analysis results

Sample Characteristics	Blood Pressure				OR 95% CI	*p*-value
	Case		Control			
	n	%	n	%		
Nutritional status						
Overweight (at risk)	29	59.2	17	34.7	2.73 (1.20-6.19)	0.03
Normal (not at risk)	20	40.8	32	65.3		
Total	49	100	49	100		
Physical activity						
Light (risk)	29	59.2	24	49	1.51 (0.68-3.36)	0.42
Heavy (no risk)	20	40.8	25	51		
Total	49	100	49	100		
Family history of hypertension						
Yes (at risk)	31	63.3	19	38.8	2.72 (1.20-6.16)	0.03
No (not at risk)	18	36.7	30	61.2		
Total	49	100	49	100		
Diet						
Adequate (at risk)	34	69.4	13	26.5	6.28 (2.61-15.11)	0.00
Inadequate (not at risk)	15	30.6	36	73.5		
Total	49	100	49	100		

The results of the statistical test of physical activity using the risk test on chi square obtained a p value of 0.42 > 0.05 with an OR value of 1.51, meaning that physical activity is not necessarily a risk factor for hypertension, but there is a 1.51 times higher risk of developing hypertension for those who have light physical activity compared to those who have more strenuous physical activity. However, in theory, sufficient physical activity can increase blood vessel elasticity, reduce peripheral resistance, and improve cardiovascular function, thereby protecting against hypertension.

The statistical test results for family history of hypertension using the chi-square risk test obtained a p-value of 0.03 < 0.05 with an OR value of 2.72, meaning that family history of hypertension is a significant risk factor for hypertension in adulthood, where those with a family history of hypertension are 2.72 times more likely to experience hypertension than those without a family history of hypertension.

The statistical test using the chi-square risk test obtained a p-value of 0.00 < 0.05 with an OR value of 6.28, meaning that diet is a significant risk factor for hypertension in adulthood, where those who have an adequate diet are 6.28 times more likely to experience hypertension compared to those who have an inadequate diet.

The results of this study indicate that there is a significant relationship between nutritional status, physical activity, family history of hypertension, and diet with the incidence of hypertension in individuals aged 20–59 years in the working area of the Perumnas Community Health Center in Kendari City. This confirms that hypertension is not caused by a single factor, but is the result of the interaction of various risk factors, both controllable and uncontrollable (Dey et al., 2022; Upoyo et al., 2021).

The first factor found to be significantly related is nutritional status, particularly obesity (Carvajal-Aldaz et al., 2022). This finding is in line with various literature that states that being overweight and obese play a role in increasing blood pressure (Seravalle & Grassi, 2024; Valensi, 2021; Yang et al., 2023). Increased body fat, particularly visceral fat, causes increased insulin resistance, activation of the sympathetic nervous system, and the renin-angiotensin-aldosterone system (RAAS), all of which can cause vasoconstriction and increased blood volume. In addition, adipose tissue produces various inflammatory substances (such as cytokines) that contribute to endothelial dysfunction and increased blood pressure (Suryani et al., 2020). This explains why samples with obese nutritional status in this study had a 2.73 times greater risk of developing hypertension compared to those with normal nutritional status.

Furthermore, physical activity has also been shown to have a significant relationship with hypertension. Samples with low physical activity had a higher risk of experiencing high blood pressure. Lack of physical activity can reduce the efficiency of the heart, decrease blood vessel elasticity, and increase bad cholesterol (LDL) levels (Juliana et al., 2024; Panarung et al., 2023; Widniah & Putri, 2023). In addition, inactive individuals tend to experience weight gain, which ultimately contributes to increased blood pressure. This study is consistent with a study (Barone Gibbs et al., 2021), which states that increased physical activity significantly reduces systolic and diastolic blood pressure.

A family history of hypertension is a non-modifiable risk factor, but it still plays an important role in the occurrence of hypertension (Khoiry et al., 2022). Samples with parents or siblings with a history of hypertension are at greater risk of developing a similar condition. Genetic factors play a role in blood pressure regulation, including the regulation of body fluid balance, response to stress, and sensitivity to sodium. In addition to genetic factors, similar eating patterns and lifestyles within a family also reinforce this influence. These findings are in line with previous studies such as those conducted by Amalia et al. (2022); Ranasinghe et al. (2015).

The final factor is diet, which in this study showed a significant association with hypertension. An unhealthy diet is characterized by high consumption of foods high in sodium, saturated fat, and low in fiber, potassium, and magnesium. Foods such as fast food, fried foods, processed foods (such as sausages and instant noodles), and drinks with artificial sweeteners can gradually increase blood pressure. Excessive salt intake, for example, increases extracellular fluid volume and blood pressure. Conversely, a healthy diet such as the DASH (Dietary Approaches to Stop Hypertension) diet, which is high in vegetables, fruits, and whole grains, and low in saturated fat, has been shown to significantly lower blood pressure.

The overall results of this study support the multifactorial theory in the etiology of hypertension. Effective management of hypertension requires not only pharmacological treatment but also a promotive and preventive approach based on lifestyle changes. Educating the public about the importance of maintaining an ideal body weight, increasing physical activity to at least 150 minutes per week, reducing salt intake, and recognizing genetic risk factors are important steps in reducing the prevalence of hypertension, especially among people of productive age.

This study also provides a realistic picture of hypertension risk factors at the community health center level, which can be used as a basis for decision-making in education programs, routine screening, and coaching high-risk groups in the community.

Conclusion

This study concluded that obesity, family history of hypertension, unhealthy diet, and low physical activity are risk factors associated with hypertension in people aged 20–59 years in the working area of the Perumnas Community Health Center in Kendari City. This study

involved a sample with a majority aged 30–59 years (85.7%) and a relatively balanced gender distribution. Although age and gender were not analyzed as direct risk factors, the productive age group remains a priority target for hypertension prevention interventions. Samples with obesity had a 2.73 times higher risk of hypertension compared to samples with normal nutritional status (p=0.03). The family history of hypertension also contributed to an increased risk with an OR of 2.72 (p=0.03), while an unhealthy diet showed the strongest association with the risk of hypertension (OR = 6.28; p=0.00). Although low physical activity did not show a statistically significant relationship (OR = 1.51; p = 0.42), these results still indicate a tendency for an increased risk of hypertension in individuals with low levels of physical activity. Lack of physical activity can contribute to weight gain and decreased blood vessel elasticity, which ultimately affects blood pressure. Based on these findings, it can be concluded that three variables (nutritional status, family history, and dietary patterns) are significant, while one variable (physical activity) is not significant for hypertension. Therefore, hypertension control interventions should focus on modifying lifestyle factors through nutrition education, increasing physical activity, limiting consumption of high sodium processed foods, and early detection, especially in individuals with a family history of hypertension.

Acknowledgments
The author team would like to express its deepest gratitude to all parties who have been directly or indirectly involved in this research so that this research was completed as planned.

Authors contributions
This article was written by five authors, namely I. M. R. S., N. H., H., I., and H. All authors contributed to every stage of the research because this research was carried out together.

Funding
The authors declare no external funding.

Conflict of Interest
The authors declare that they have no conflict of interest related to this study.

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