ANALYSIS OF DETERMINANTS OF HYPERTENSION IN ADULTS IN KALIBAGOR SUBDISTRICT, BANYUMAS REGENCY

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ABSTRACT

Hypertension is a major risk factor for cardiovascular disease, with increasing prevalence, particularly among the elderly. Genetic and lifestyle factors are believed to contribute to the development of hypertension. This study aimed to examine the relationship between age, sex, family history of hypertension, physical activity, and smoking behavior with the incidence of hypertension among adults. This cross-sectional study involved 74 adult respondents in Kalibagor Subdistrict, Banyumas Regency. Data were analyzed using chi-square tests and logistic regression. The analysis showed that older age (OR = 3.866; 95% CI: 1.351–11.059) and family history of hypertension (OR = 3.682; 95% CI: 1.974–7.950) were significantly associated with hypertension. Smoking behavior was not significantly associated with hypertension ($p > 0.05$). Age and family history of hypertension are dominant factors contributing to the incidence of hypertension. Preventive and promotive efforts should focus on high-risk groups to reduce the prevalence of hypertension in the community.

Keywords: Hypertension, age, family history, smoking

INTRODUCTION

Hypertension is a chronic condition characterized by blood pressure levels ≥140/90 mmHg, which often presents without clinical symptoms, earning it the nickname "silent killer." According to WHO data from 2021, an estimated 1.28 billion adults aged 30–79 years worldwide suffer from hypertension, with the majority unaware of their condition. This number is projected to rise to 1.5 billion by 2025 (World Health Organization, 2021). In Indonesia, the prevalence of hypertension among individuals aged ≥18 years reached 34.1%, based on the 2018 National Basic Health Research (Badan Penelitian dan Pengembangan Kesehatan, 2019).

In Central Java, the annual trend from 2019 to 2023 shows a significant increase in hypertension prevalence. The prevalence was 67.46% in 2019, 72.02% in 2020, 76% in 2021, 76.5% in 2022, and slightly decreased to 70.28% in 2023 (Dinas Kesehatan Provinsi Jawa Tengah, 2024). In Banyumas Regency, the number of hypertension cases in 2023 was 172,022 people, an increase from 169,564 in 2022 (Dinas Kesehatan Kabupaten Banyumas, 2024). Specifically, in Kalibagor Subdistrict, there were 4,350 cases of hypertension recorded in 2023 (Dinas Kesehatan Kabupaten Banyumas, 2024).

As a cardiovascular disorder, hypertension is often seen as the result of the interaction between non-modifiable risk factors—such as sex, age, and family history—and modifiable factors such as physical activity and smoking. A study conducted in Kebumen (2022) found a significant correlation between family history and hypertension among individuals aged 35–59 years ($p=0.017$) (Mulyasari et al., 2023). In Tlogomulyo (2023), the risk of hypertension was found to increase nearly ninefold among individuals with a family history, and up to 38-fold among those aged ≥45 years ($p < 0.001$) (Nirmala, 2023). Wulandari et al. (2024) reported a hypertension prevalence of 53.3% among adults aged 19–59 years, with several significant risk factors including family history and age ($p < 0.05$).

A study by Garwahusada and Wirjatmadi (2020) on office workers

in Central Java Province showed that males and smokers had a significantly higher risk of hypertension (OR = 8.23; p = 0.003 and OR = 8.08; p = 0.019, respectively) compared to non-smokers and females. These findings are supported by a study in Malang (2023), which revealed a significant relationship between smoking behavior, physical activity level, and hypertension incidence among the elderly (p = 0.005) (Faiqoh et al., 2023), as well as data from Frontiers (2023), which emphasized that reduced physical activity (total PA, LTPA) increases hypertension prevalence (p < 0.01) (Li X et al., 2023). Furthermore, a 2024 analysis on resistance training reported that women who regularly engaged in such exercises had an 8–14% reduced risk of hypertension, while the effect was not statistically significant among men (Misnaniarti et al., 2023).

Kalibagor Subdistrict was selected as the research location because it reported a relatively high number of hypertension cases based on the 2023 Banyumas District Health Profile, with a total of 4,350 individuals affected. This makes it one of the subdistricts with a notably high incidence of hypertension in the region. The large number of hypertension cases indicates a significant public health concern, thus warranting a more in-depth investigation into the associated risk factors.

The novelty of this study lies in its integrated analysis of five major risk factors (age, family history, sex, physical activity, and smoking behavior) in relation to hypertension among adults in a specific local population. This study also offers contextual insights that have been rarely discussed in previous research, and opens opportunities to explore interactions among these factors to support planning of promotive and preventive health programs. Moreover, existing literature suggests that age, family history, sex, smoking behavior, and physical activity interact in influencing the occurrence of hypertension, highlighting the need for contextual investigation in adult populations.

METHOD

This study is a quantitative research employing a cross-sectional approach, aiming to determine the

association between age, family history, sex, physical activity, and smoking behavior with the incidence of hypertension among adults. The population in this study comprised all adults aged ≥18 years residing in Kalibagor Subdistrict, Banyumas Regency. The sample consisted of adult individuals who met the inclusion and exclusion criteria, totaling 74 respondents. The inclusion criteria for sample selection included individuals aged 15 years or older who were willing to participate as respondents by signing an informed consent form. The exclusion criteria were pregnant respondents and those with a history of heart disease, stroke, or other cardiovascular conditions.

The sampling technique used was proportional random sampling, taking into account the distribution of the population across villages within the study area. The sample size was calculated using the Lemeshow formula, with an estimated hypertension prevalence of 30%, a 95% confidence level, and a 5% margin of error. The variables examined in this study were age, sex, family history of hypertension, smoking behavior, and physical activity. Data were collected through face-to-face interviews using a structured questionnaire that had been tested for validity and reliability. The questionnaire covered demographic data (age, sex, education), family history of hypertension, smoking status, and level of physical activity—measured using the Global Physical Activity Questionnaire (GPAQ). Hypertension status was determined by measuring blood pressure using a digital sphygmomanometer in accordance with WHO standards.

Data analysis was conducted using SPSS version 25. Univariate data were presented in frequency and percentage distributions. Bivariate analysis employed the chi-square test to examine the relationship between independent variables and hypertension. Multivariate analysis was conducted using logistic regression to identify the dominant factors influencing hypertension, with a significance level set at $p < 0.05$.

This study received ethical approval from the Health Research Ethics Committee of the Faculty of Health Sciences, Universitas Jenderal Soedirman, with approval number: 1773/EC/KEPK/I/2025. All

respondents provided informed consent prior to participation, and data confidentiality was strictly maintained.

RESULTS AND DISCUSSION

RESULTS

This study involved 74 respondents, consisting of 39 individuals without hypertension and 35 individuals with hypertension. The analysis was conducted to examine the relationship between sex, age, family history of hypertension, smoking behavior, and physical activity with the incidence of hypertension.

Table 1. Respondent Characteristics Based on Hypertension Status

Variable	No Hypertension		Hypertension		OR (95% CI)	P-value
	n = 39	%	n = 35	%		
Sex						
Female	27	50.0	27	50.0	1.00 (Reference)	–
Male	12	60.0	8	40.0	0.667 (0.235–1.889)	0.615
Age						
Adult (19–59 years)	24	68.6	11	31.4	1.00 (Reference)	–
Elderly (>60 years)	15	38.5	24	61.5	3.491 (1.334–9.135)	0.018
Family History of Disease						
None	23	69.7	10	30.3	1.00 (Reference)	–
Present	16	39.0	25	61.0	3.594 (1.360–9.500)	0.017
Smoking Behavior						
Non-Smoker	22	45.8	26	54.2	1.00 (Reference)	–
Smoker	17	65.4	9	34.6	0.448 (0.167–1.203)	0.172
Physical Activity						
Moderate	18	56.3	14	43.8	1.00 (Reference)	–
Light	21	50.0	21	50.0	1.286 (0.510–3.239)	0.765

Based on Table 1, the distribution of hypertension cases between males and females shows a relatively balanced proportion. A total of 50% of females and 40% of males experienced hypertension. The bivariate analysis indicated that there was no statistically significant association between sex and the incidence of hypertension (p = 0.615). The odds ratio (OR) of 0.667 (95% CI: 0.235–1.889) suggests that males had a lower likelihood of developing hypertension compared to females, although the association was not statistically significant.

The majority of elderly respondents (>60 years) experienced hypertension (61.5%), while only 31.4% of adults aged 19–59 years were hypertensive. The analysis showed a significant association

between age and the incidence of hypertension (p = 0.018), with an OR of 3.491 (95% CI: 1.334–9.135). This indicates that elderly respondents had a 3.5 times higher risk of developing hypertension compared to adults.

Among respondents with a family history of hypertension, 61% had hypertension, compared to 30.3% of those without such a history. The chi-square test revealed a significant association between family history of hypertension and the incidence of hypertension (p = 0.017), with an OR of 3.594 (95% CI: 1.360–9.500). This means that respondents with a family history of hypertension were approximately 3.6 times more likely to develop the condition.

Among smokers, 34.6% had hypertension, compared to 54.2% of non-smokers. Although the proportion appears lower among smokers, statistical testing indicated no significant association between smoking behavior and hypertension (p = 0.172), with an OR of 0.448 (95% CI: 0.167–1.203). Among respondents with light physical activity, 50% experienced hypertension, while among those with moderate activity, the proportion was 43.8%. The analysis showed no significant association between physical activity and the incidence of hypertension (p = 0.765), with an OR of 1.286 (95% CI: 0.510–3.239).

Table 2 Odds Ratios (95% CI) of Determinants of Hypertension

Variable	OR1 (95% CI)	OR2 (95% CI)
Age		
Adult (19–59 years)	1,00 (Reference)	1,00 (Reference)
Elderly (>60 years)	3,895 (1,349-11,243)	3,866 (1,351-11,059)
Family History		
None	1,00 (Reference)	1,00 (Reference)
Present	3,667 (1,055-9,507)	3,682 (1,974-7,950)
Smoking Behavior		
Non-Smoker	1,00 (Reference)	-
Smoker	0,457 (0,147-1,417)	-

Further analysis was conducted using logistic regression to identify the most influential factors associated with the incidence of hypertension. The results are presented as odds ratios (OR) from both bivariate (OR1) and multivariate (OR2) analyses, along with their respective 95% confidence intervals (CI).

According to Table 2, the elderly age group (>60 years) demonstrated a significantly increased risk of

hypertension. In the bivariate analysis, this group had a 3.895 times greater risk of developing hypertension compared to the adult group (19–59 years), with a 95% CI of 1.349–11.243. After adjusting for other variables in the multivariate analysis, age remained a significant predictor of hypertension, with an OR of 3.866 (95% CI: 1.351–11.059). These results indicate that advanced age is a strong and consistent risk factor for hypertension.

Respondents with a family history of hypertension also showed a higher risk. The bivariate analysis yielded an OR of 3.667 (95% CI: 1.055–9.507). This association remained statistically significant in the multivariate model, with an OR of 3.682 (95% CI: 1.974–7.950). Thus, family history of hypertension is a significant influencing factor, both independently and after adjustment with other variables.

In the bivariate analysis, smokers had a lower risk of hypertension compared to non-smokers, with an OR of 0.457 (95% CI: 0.147–1.417). However, this relationship was not statistically significant, and the variable was not included in the multivariate regression model.

Based on both bivariate and multivariate analyses, it can be concluded that age and family history of hypertension are the most significant factors influencing the incidence of hypertension among respondents. Meanwhile, smoking behavior did not show a statistically significant association, although it exhibited a non-significant protective tendency numerically.

DISCUSSION

The results of this study indicate a significant association between age and family history of hypertension with the incidence of hypertension, whereas smoking behavior did not show a statistically significant relationship. This study found that elderly individuals (>60 years) had approximately 3.9 times greater risk of developing hypertension compared to adults aged 19–59 years, both in bivariate and multivariate analyses. These findings are consistent with those of Li et al. (2023) and Unger et al. (2020) who stated that advancing age is one of the main determinants of hypertension due to physiological changes, such as

decreased arterial elasticity and increased peripheral resistance. Age is also closely associated with cumulative exposure to unhealthy lifestyle habits and other chronic conditions, which progressively burden cardiac function over time. These findings reinforce the results of the 2018 Basic Health Research (RISKESDAS), which reported that the prevalence of hypertension increases sharply among individuals aged ≥55 years (Balitbangkes, 2019).

This study also demonstrated that respondents with a family history of hypertension had a 3.7 times greater risk of developing hypertension compared to those without such a history. This finding is consistent with a study by Mulyasari et al. (2023), Rejeki, D. S. S. (2021), and Xu et al. (2020) which identified family history as a strong predictor of hypertension among individuals aged 35–59 years. Genetic factors play a crucial role in the regulation of blood pressure through mechanisms involving the renin–angiotensin system, sodium sensitivity, and endothelial function. In addition to genetic influences, shared lifestyle patterns within families—such as dietary habits and physical activity—may further increase the likelihood of hypertension among family members (Goyal and Sharma, 2022).

Although the analysis showed that smokers tended to have a lower risk of developing hypertension (OR = 0.457), this association was not statistically significant. This finding contrasts with numerous previous studies, such as that by Misnaniarti et al. (2023), Sengupta, P (2023), and Zhang and Liu (2023) which reported a significant association between smoking and increased risk of hypertension. Several possible explanations for this discrepancy include: the relatively small number of smokers in the sample, which may not represent the broader population; the possibility that smoking respondents were still in the early stages of exposure, so the effects on blood pressure had not yet manifested; and the presence of information bias due to self-reported data, which may have led to underreporting of smoking status. Despite the non-significant result, biologically, smoking is still known to cause vascular damage, increase sympathetic nervous system activity,

and reduce arterial elasticity—all of which contribute to elevated blood pressure.

These findings underscore the importance of promotive and preventive approaches targeting the elderly population and individuals with a family history of hypertension. Early screening and lifestyle modification education should be prioritized for these high-risk groups. Although smoking was not significantly associated with hypertension in this study, anti-smoking campaigns remain relevant due to the well-established adverse effects of smoking on cardiovascular health in general.

This study has a limitation that should be noted, namely the use of self-reported questionnaires for data collection, which may introduce information bias, such as the underreporting of smoking behavior or inaccurate reporting of physical activity. To minimize this bias, data collection was conducted with the support of trained enumerators who provided clarification and guidance during interviews, along with the use of standardized instruments such as the Global Physical Activity Questionnaire (GPAQ).

CONCLUSION

This study demonstrates a significant association between age and family history of hypertension with the incidence of hypertension among adults. Elderly respondents (>60 years) were found to have an approximately 3.9 times higher risk of developing hypertension compared to the adult age group, as shown in both bivariate and multivariate analyses. Similarly, respondents with a family history of hypertension had an almost 3.7 times greater risk of experiencing hypertension. Meanwhile, smoking behavior was not significantly associated with the incidence of hypertension, although bivariate analysis showed a non-significant protective trend.

Thus, advanced age and a family history of hypertension are two dominant factors that should be prioritized in efforts to prevent and control hypertension within the community. Promotive and preventive measures should focus on the elderly and individuals with a family history of hypertension through health education, routine

blood pressure screening, and monitoring of other risk factors. Early detection programs for hypertension in primary healthcare facilities, such as community health centers (puskesmas) and integrated service posts (posbindu), should be strengthened—particularly for older adults—by taking into account the potential genetic risks individuals may carry.

Although smoking behavior was not significantly associated with hypertension in this study, anti-smoking campaigns should continue, given the well-documented negative effects of smoking on overall cardiovascular health. Further research is recommended to involve a larger sample size and to consider additional factors such as dietary patterns, stress levels, alcohol consumption, and socioeconomic status in order to obtain a more comprehensive understanding of the determinants of hypertension.

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