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# Factors Associated with Hypertension Among Older Adults at Pesantren Primary Health Center

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## ABSTRACT

**Background:** Hypertension is a major cause of cardiovascular morbidity and mortality among older adults. Identifying associated factors is essential for targeted prevention in primary health care. **Objective:** To analyze factors associated with hypertension among older adults at Pesantren Primary Health Center, Kediri. **Methods:** This cross-sectional study was conducted from May to June 2026 involving 119 older adults selected from a population of 168 using proportional random sampling and the Slovin formula. Data were collected through questionnaires, blood pressure measurements, anthropometric assessments, and medical record reviews. Associations were examined using the Chi-square test and multiple logistic regression in IBM SPSS Statistics version 25. Statistical significance was set at $p < 0.05$. **Results:** Hypertension was identified in 72 respondents (60.5%). Multivariable analysis identified low physical activity (AOR = 3.41; 95% CI: 1.62–7.18; $p = 0.001$), overweight/obesity (AOR = 2.96; 95% CI: 1.41–6.22; $p = 0.004$), unhealthy dietary habits (AOR = 2.68; 95% CI: 1.25–5.72; $p = 0.011$), and family history of hypertension (AOR = 2.31; 95% CI: 1.10–4.85; $p = 0.026$) as significant factors. Moderate-to-high stress was not significant after adjustment ($p = 0.088$), while sex was not significantly associated in bivariate analysis ($p = 0.581$). **Conclusion:** Hypertension was associated with physical inactivity, overweight/obesity, unhealthy dietary habits, and family history. Nursing interventions should prioritize physical activity, healthy eating, weight management, and regular blood pressure monitoring. The cross-sectional design precludes causal conclusions, and findings from one health center may not be generalizable.

**Keywords**: hypertension; older adults; physical activity; risk factors; primary health care

## Background

Hypertension remains one of the leading non-communicable diseases and is a major contributor to cardiovascular morbidity and mortality worldwide. Older adults are particularly vulnerable because physiological aging causes structural and functional changes in blood vessels, including increased arterial stiffness, endothelial dysfunction, and reduced vascular elasticity, resulting in elevated blood pressure. If left uncontrolled, hypertension substantially increases the risk of stroke, coronary heart disease, heart failure, chronic kidney disease, cognitive impairment, and premature death. According to the Indonesian Health Survey (Survei Kesehatan Indonesia/SKI) 2023, hypertension remains one of the most prevalent non-communicable diseases in Indonesia and continues to impose a substantial burden on the national health care system. The increasing elderly population further contributes to the growing prevalence of hypertension, highlighting the importance of early detection and comprehensive management at the primary health care level (1).

Supporting the national findings reported that hypertension among older adults is strongly associated with modifiable lifestyle factors, including unhealthy dietary patterns, inadequate physical activity, smoking behavior, and poor stress management. Their study emphasized that these behavioral risk factors significantly contribute to uncontrolled blood pressure among elderly patients receiving care at primary health centers. Therefore, hypertension management should not rely solely on pharmacological therapy but should also incorporate comprehensive nursing interventions, health education, lifestyle modification, regular monitoring, and family support to reduce cardiovascular complications and improve the quality of life of older adults (6).

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The prevalence of hypertension increases markedly with age. Degenerative processes, reduced vascular compliance, hormonal changes, and cumulative exposure to behavioral risk factors make older adults more susceptible to hypertension than younger populations. Although antihypertensive therapy is widely available through primary health centers, blood pressure control among older adults remains suboptimal due to inadequate lifestyle modification, poor treatment adherence, and limited awareness of hypertension risk factors. Consequently, identifying modifiable determinants of hypertension among older adults is essential for strengthening preventive and promotive nursing interventions (2)(3).

Previous studies conducted in Indonesia have consistently demonstrated that hypertension among older adults is influenced by multiple interrelated factors. Lifestyle-related variables such as smoking, physical inactivity, unhealthy dietary patterns, excessive salt intake, obesity, sleep disturbances, stress, and family history have been reported as significant predictors of hypertension. Recent evidence also indicates that nutritional status and routine health monitoring contribute to hypertension control in elderly populations. However, the relative contribution of these factors differs across regions because of variations in socioeconomic conditions, health behaviors, and accessibility of health services, emphasizing the importance of local epidemiological studies (5)(6).

Several studies conducted in Indonesian primary health centers have identified different dominant risk factors contributing to hypertension among older adults. A study found that unhealthy lifestyle behaviors, particularly inadequate physical activity, smoking habits, obesity, and excessive salt consumption, significantly increased the risk of hypertension among elderly individuals. The study emphasized that modifiable behavioral factors should become the primary focus of community-based preventive and promotive nursing interventions (4).

Lifestyle plays a crucial role in the occurrence of hypertension among older adults. Their findings demonstrated that older adults who adopted unhealthy lifestyles, including poor dietary habits, lack of regular exercise, insufficient rest, and ineffective stress management, were more likely to experience uncontrolled blood pressure than those maintaining healthier behaviors. The authors highlighted the importance of continuous health education and lifestyle modification programs through primary health care services (8).

In another study, identified that hypertension among older adults is influenced not only by behavioral factors but also by biological and psychosocial determinants. Family history, increasing age, obesity, psychological stress, and poor adherence to hypertension management were significantly associated with elevated blood pressure. The researchers suggested that comprehensive hypertension management should integrate routine monitoring, medication adherence, stress reduction strategies, and family involvement to achieve optimal blood pressure control (9).

A recent study conducted that the Tangkahan Durian Primary Health Center, Langkat, North Sumatra, further demonstrated that hypertension among older adults is influenced by multiple determinants, including advanced age, obesity, family history of hypertension, inadequate physical activity, and unhealthy dietary patterns. The study emphasized that these factors interact with one another in increasing the likelihood of hypertension rather than acting independently. The authors also highlighted the importance of strengthening community-based health promotion, regular blood pressure screening, and comprehensive nursing interventions to modify preventable risk factors among older adults. These findings reinforce the need for local studies in different primary health care settings because the distribution and contribution of hypertension risk factors may vary according to demographic, socioeconomic, and environmental characteristics (10).

Although previous studies in Indonesia have identified several factors associated with hypertension among older adults, evidence regarding the combined contribution of demographic, biological, behavioral, and psychological factors in the study population remains limited. Previous research has examined factors such as age, sex, body mass index (BMI), family history of hypertension, physical activity, dietary habits, and stress; however, their associations with hypertension may vary across populations and health care settings. Therefore, further investigation is needed to examine these seven factors simultaneously among older adults in the working area of the Pesantren Primary Health Center, Kediri. The novelty of the present study lies in its integrated assessment of these factors using multivariable logistic regression to identify their independent associations with hypertension status. The findings are expected to provide context-specific evidence to support risk assessment, targeted nursing interventions, and locally tailored health promotion strategies for hypertension prevention and management among older adults.


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Based on these considerations, this study aims to analyze the factors associated with hypertension among older adults at the Pesantren Primary Health Center, Kediri. The findings are expected to provide scientific evidence for community and medical-surgical nursing practice in developing comprehensive hypertension prevention and management strategies for older adults, thereby improving healthy aging and reducing hypertension-related complications.

## Methods

This study employed an analytical observational design with a cross-sectional approach. The study was conducted from May to June 2026 at the Pesantren Primary Health Center, Kediri. The population consisted of 168 older adults aged ≥60 years who were registered at the health center. The sample size was calculated using the Slovin formula with a 5% margin of error, resulting in 119 respondents. Respondents were selected using proportional random sampling (11).

The dependent variable was hypertension status. Hypertension status was determined based on direct blood pressure measurement using a calibrated digital sphygmomanometer and information recorded in the respondents' medical records. The independent variables were age, sex, body mass index (BMI), family history of hypertension, physical activity, dietary habits, and stress level. Age and sex were obtained from the respondent's identity data. BMI was determined from measured body weight and height and classified according to the study criteria. Family history of hypertension was obtained through a structured questionnaire. Physical activity, dietary habits, and stress level were assessed using structured questionnaires completed by the respondents (12).

Data collection was performed through direct interviews using structured questionnaires, blood pressure measurement, anthropometric measurements, and review of respondents' medical records. All measurements and data collection were performed during the study period using the same procedures for all respondents.

Data were analyzed using IBM SPSS Statistics version 25. Descriptive statistics were used to present the frequency and percentage distribution of the respondents' characteristics and study variables. The Chi-square test was used to examine the association between each categorical independent variable and hypertension status. Independent variables with a *p*-value <0.25 in the bivariate analysis were entered into a multivariable logistic regression model. Multiple logistic regression was used to identify factors independently associated with hypertension and to estimate adjusted odds ratios (ORs) with 95% confidence intervals (CIs). Statistical significance was determined at $p<0.05$.

## Results

**Table 1. Characteristics of respondents (n = 119)**

| Characteristics | Frequency (n) | Percentage (%) |
|---|---|---|
| **Age** | | |
| 60–69 years | 70 | 58.8 |
| 70–79 years | 37 | 31.1 |
| ≥80 years | 12 | 10.1 |
| **Sex** | | |
| Male | 47 | 39.5 |
| Female | 72 | 60.5 |
| **Body mass index** | | |
| Normal | 56 | 47.1 |
| Overweight/obese | 63 | 52.9 |
| **Physical activity** | | |
| Adequate | 52 | 43.7 |
| Low | 67 | 56.3 |
| **Dietary habits** | | |


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| Characteristics | Frequency (n) | Percentage (%) |
|---|---|---|
| Healthy | 54 | 45.4 |
| Unhealthy | 65 | 54.6 |
| **Stress level** | | |
| Low | 63 | 529 |
| Moderate–high | 56 | 47.1 |
| **Hypertension status** | | |
| Hypertension | 72 | 60.5 |
| Non-hypertension | 47 | 39.5 |

A total of 119 older adults participated in this study. Most respondents were aged 60–69 years (58.8%) and female (60.5%). More than half were classified as overweight or obese (52.9%) and reported low physical activity (56.3%). Unhealthy dietary habits were reported by 54.6% of respondents, while 47.1% experienced moderate-to-high stress levels. Overall, 72 respondents (60.5%) had hypertension.

**Table 2. Bivariate analysis of factors associated with hypertension among older adults**

| Variables | Hypertension n (%) | Non-hypertension n (%) | Total n | P Value |
|---|---|---|---|---|
| Age | | | | |
| 60–69 years | 38 (54.3) | 32 (45.7) | 70 | 0.087 |
| ≥70 years | 34 (69.4) | 15 (30.6) | 49 | |
| Sex | | | | |
| Male | 27 (57.4) | 20 (42.6) | 47 | 0.581 |
| Female | 45 (62.5) | 27 (37.5) | 72 | |
| Body mass index | | | | |
| Normal | 24 (42.9) | 32 (57.1) | 56 | 0.001 |
| Overweight/obese | 48 (76.2) | 15 (23.8) | 63 | |
| Physical activity | | | | |
| Adequate | 22 (42.3) | 30 (57.7) | 52 | 0.001 |
| Low | 50 (74.6) | 17 (25.4) | 67 | |
| Dietary habits | | | | |
| Healthy | 23 (42.6) | 31 (57.4) | 54 | 0.001 |
| Unhealthy | 49 (75.4) | 16 (24.6) | 65 | |
| Stress level | | | | |
| Low | 30 (47.6) | 33 (52.4) | 63 | 0.002 |
| Moderate–high | 42 (75.0) | 14 (25.0) | 56 | |
| Family history of hypertension | | | | |
| Yes | 39 (76.5) | 12 (23.5) | 51 | 0.001 |
| No | 33 (48.5) | 35 (51.5) | 68 | |
| Total | 72 (60.5) | 47 (39.5) | 119 | |

The bivariate analysis examined the associations between selected respondent characteristics and hypertension status. Based on the reported results, age, body mass index, physical activity, dietary habits, stress level, and family history of hypertension had p-values below 0.05. Sex was not statistically significantly associated with hypertension (p = 0.538).


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**Table 3. Multivariable logistic regression analysis**

| Variables | Adjusted OR | 95% CI | p-value |
|---|---|---|---|
| Low Physical Activity | 3.41 | 1.62–7.18 | 0.001* |
| Overweight/Obesity | 2.96 | 1.41–6.22 | 0.004* |
| Unhealthy Dietary Habit | 2.68 | 1.25–5.72 | 0.011* |
| Family History of Hypertension | 2.31 | 1.10–4.85 | 0.026* |
| Moderate–High Stress | 1.82 | 0.91–3.64 | 0.088 |

Variables with bivariate p-values below 0.25 were reportedly considered for inclusion in the multivariable logistic regression model. In the reported model, low physical activity, overweight/obesity, unhealthy dietary habits, and family history of hypertension had adjusted odds ratios (AORs) above 1 and p-values below 0.05. Moderate-to-high stress was not statistically significant after adjustment (p = 0.088).

Low physical activity had the largest adjusted odds ratio in the reported model (AOR = 3.41; 95% CI: 1.62–7.18; p = 0.001). This indicates that respondents with low physical activity had approximately 3.4 times the odds of hypertension compared with those with adequate physical activity, after adjustment for the other variables included in the model. Overweight/obesity, unhealthy dietary habits, and a family history of hypertension were also statistically significant in the reported model. Although moderate-to-high stress showed an adjusted odds ratio above 1, its association was not statistically significant at the 0.05 level. These findings suggest that physical activity, body weight, dietary habits, and family history may be important considerations in hypertension prevention and management among older adults. However, because this study used a cross-sectional design, the findings indicate associations rather than causal relationships.

## Discussion

The present study demonstrates that hypertension among older adults is associated with multiple modifiable and non-modifiable factors rather than a single determinant. Hypertension was identified in 72 of 119 respondents (60.5%). In the bivariate analysis, hypertension was significantly associated with age, body mass index (BMI), physical activity, dietary habits, stress level, and family history of hypertension, whereas sex was not significantly associated with hypertension. In the multivariable analysis, low physical activity, overweight/obesity, unhealthy dietary habits, and family history of hypertension remained independently associated with hypertension. These findings suggest that hypertension among older adults may reflect the combined contribution of aging-related physiological changes, hereditary susceptibility, and lifestyle-related factors. Consequently, nursing interventions should emphasize comprehensive risk assessment, behavioral modification, early detection, and long-term monitoring alongside appropriate medical management (13).

Physical activity was the strongest factor associated with hypertension in this study, based on the largest adjusted odds ratio in the reported multivariable model. Among the 119 respondents, 67 (56.3%) reported low physical activity, and 50 of these respondents (74.6%) had hypertension. Bivariate analysis showed a significant association between low physical activity and hypertension ($p$ = 0.001). In the multivariable analysis, low physical activity remained independently associated with hypertension (adjusted OR = 3.41; 95% CI: 1.62–7.18; $p$ = 0.001). After adjustment for the other variables included in the model, respondents with low physical activity had approximately 3.4 times the odds of hypertension compared with those with adequate physical activity. This finding indicates an association and should not be interpreted as a causal effect. Regular physical activity may contribute to blood pressure control by improving cardiovascular fitness and vascular function. Therefore, these findings support the promotion of appropriate physical activity as a component of nursing interventions for older adults. Community-based exercise programs through integrated healthcare post for the elderly and primary health centers may be strengthened to encourage safe and regular physical activity, taking into account individual health status and functional capacity (14)(18).

Body mass index was also significantly associated with hypertension in this study. Of the 119 respondents, 63 (52.9%) were classified as overweight or obese, and 48 of them (76.2%) had hypertension. Bivariate analysis demonstrated a significant association between overweight/obesity and hypertension ($p$

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= 0.001). After adjustment for other factors, overweight/obesity remained independently associated with hypertension (adjusted OR = 2.96; 95% CI: 1.41–6.22; $p$ = 0.004). Respondents who were overweight or obese had approximately 3 times the odds of hypertension compared with those with a normal BMI, after adjustment for the other variables included in the model. Excess adipose tissue may contribute to increased vascular resistance, metabolic dysfunction, and physiological mechanisms that elevate blood pressure. These findings support the integration of weight monitoring, nutritional counseling, and healthy lifestyle promotion into routine nursing care for older adults (15)(16).

Dietary habits were another factor independently associated with hypertension. In this study, 65 respondents (54.6%) reported unhealthy dietary habits, and 49 of them (75.4%) had hypertension. The bivariate analysis showed a significant association between unhealthy dietary habits and hypertension ($p$ = 0.001). This association remained significant after multivariable adjustment (adjusted OR = 2.68; 95% CI: 1.25–5.72; $p$ = 0.011). Respondents with unhealthy dietary habits had approximately 2.7 times the odds of hypertension compared with those with healthy dietary habits, after adjustment for the other variables in the model. These findings support dietary modification as an important component of hypertension prevention and management, particularly through balanced dietary patterns and appropriate sodium intake. Nurses can provide individualized nutrition education, involve family members in dietary changes, and reinforce healthy eating practices during community-based health services (17).

Family history of hypertension also remained independently associated with hypertension. A total of 51 respondents had a family history of hypertension, of whom 39 (76.5%) had hypertension. Bivariate analysis demonstrated a significant association between family history and hypertension ($p$ = 0.001). In the multivariable analysis, family history remained independently associated with hypertension (adjusted OR = 2.31; 95% CI: 1.10–4.85; $p$ = 0.026). Respondents with a family history of hypertension had approximately 2.3 times the odds of hypertension compared with those without such a history, after adjustment for the other variables included in the model. This finding is consistent with the possibility that hereditary susceptibility contributes to hypertension among older adults. However, family history should not be interpreted as evidence of a purely genetic cause because shared environmental and lifestyle factors may also contribute. Therefore, family history should be considered during nursing risk assessments, alongside early blood pressure screening, health education, and lifestyle modification (18).

Stress was significantly associated with hypertension in the bivariate analysis. Of the 56 respondents (47.1%) who experienced moderate-to-high stress, 42 (75.0%) had hypertension, and the association was statistically significant ($p$ = 0.002). However, after adjustment for other variables, moderate-to-high stress was not independently associated with hypertension at the 0.05 significance level (adjusted OR = 1.82; 95% CI: 0.91–3.64; $p$ = 0.088). Although the adjusted odds ratio was above 1, the confidence interval included 1 and the $p$-value exceeded 0.05. Therefore, the study did not establish a statistically significant independent association between stress and hypertension after adjustment. The difference between the bivariate and multivariable findings may reflect the influence of other variables in the model, although this possibility cannot be confirmed from the reported results alone. Nevertheless, stress management may remain relevant to holistic nursing care. Counseling, relaxation techniques, psychosocial support, and promotion of healthy sleep and physical activity may be considered as supportive interventions (19)(20).

Sex was not significantly associated with hypertension in the bivariate analysis. Of the 72 female respondents, 45 (62.5%) had hypertension and 27 (37.5%) did not. The association between sex and hypertension was not statistically significant ($p$ = 0.538). This result indicates that the study did not find sufficient statistical evidence of an association between sex and hypertension in this sample. It does not establish that sex has no relationship with hypertension in other populations. The finding should therefore be interpreted in the context of the study population, sample size, and other factors assessed in the analysis (15).

Overall, these findings highlight the important role of community and medical-surgical nurses in preventing hypertension among older adults. Comprehensive interventions involving routine blood pressure screening, promotion of physical activity, nutritional counseling, obesity prevention, family-centered education, stress management, and long-term follow-up should be strengthened through *Posyandu Lansia* and primary health centers. Consistent implementation of these evidence-based nursing strategies is expected to improve blood pressure control, reduce cardiovascular complications, and enhance the quality of life of older adults.


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## Conclusions and Recommendations

This study concludes that hypertension was identified in 72 of 119 older adults (60.5%) at the Pesantren Primary Health Center, Kediri. Low physical activity was significantly associated with hypertension, with 50 of 67 respondents (74.6%) with low physical activity having hypertension (p = 0.001). In the multivariable analysis, low physical activity was the strongest factor associated with hypertension (adjusted OR = 3.41; 95% CI: 1.62–7.18; p = 0.001), followed by overweight or obesity (adjusted OR = 2.96; 95% CI: 1.41–6.22; p = 0.004), unhealthy dietary habits (adjusted OR = 2.68; 95% CI: 1.25–5.72; p = 0.011), and family history of hypertension (adjusted OR = 2.31; 95% CI: 1.10–4.85; p = 0.026). Moderate-to-high stress was significantly associated with hypertension in the bivariate analysis (p = 0.002) but was not significant in the multivariable analysis (adjusted OR = 1.82; 95% CI: 0.91–3.64; p = 0.088). Sex was not significantly associated with hypertension (p = 0.538).

Based on these findings, it is recommended that primary health care providers strengthen community-based hypertension prevention programs through integrated healthcare post for the elderly, regular blood pressure screening, individualized health education, nutritional counseling, and structured physical activity programs. Family-centered interventions should also be integrated into nursing care to improve treatment adherence and support sustainable lifestyle changes among older adults. Future studies are recommended to include additional variables such as medication adherence, sleep quality, socioeconomic status, and psychosocial support using prospective cohort or interventional study designs to provide stronger evidence regarding causal relationships and the effectiveness of nursing interventions.

## Ethical Consideration and Competing Interest

This study did not undergo formal ethical clearance because it involved no experimental intervention or treatment administered to participants. The study was limited to the collection of observational and questionnaire-based data and did not involve procedures expected to cause physical harm or alter the participants' clinical condition. Nevertheless, the study was conducted in accordance with the fundamental principles of research ethics, including respect for autonomy, beneficence, non-maleficence, and justice. Prior to data collection, all participants received a clear explanation of the study objectives, procedures, potential benefits, and their rights as research participants. Written informed consent was obtained from each participant before participation. Participant confidentiality and anonymity were maintained by removing personal identifiers from the dataset, and all collected information was used exclusively for research purposes. Participation was voluntary, and participants were informed that they could withdraw from the study at any time without any consequences. The authors declare that there are no financial, professional, or personal conflicts of interest related to the conduct of this study or the publication of this manuscript.

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