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# The Effect of Stress, Dietary Patterns, and Body Mass Index on The Incidence of Hypertension among Patients at Denkesyah Clinic, Madiun, East Java

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## ABSTRACT

**Background**: Hypertension remains a major global health problem and one of the leading risk factors for cardiovascular disease. Both non-modifiable and modifiable factors, such as stress, diet, and obesity, play a crucial role in its development. In Indonesia, hypertension continues to account for a high burden of morbidity, with an increasing prevalence reported in Madiun. This study aimed to analyze the association of stress, dietary patterns, and body mass index (BMI) with hypertension among patients at Denkesyah Clinic, Madiun, East Java. **Methods**: This study employed a cross-sectional study conducted at Denkesyah Clinic, Madiun, East Java, in October 2024. A total of 87 respondents were selected using purposive sampling from patients enrolled in the chronic disease management program (Prolanis). Data on stress were collected using the Self Reporting Questionnaire-20 (SRQ-20), dietary patterns were assessed with a Food Frequency Questionnaire (FFQ), and body mass index (BMI) was calculated using weight and height measurements. Hypertension was defined as systolic blood pressure ≥140 mmHg and/or diastolic ≥90 mmHg. Data analysis included univariate, bivariate (Chi-square test), and multivariate logistic regression. **Results**: The study found that 52.9% of respondents experienced high stress levels, 59.8% had poor dietary patterns, and 44.8% were obese. Stress, poor dietary pattern, and elevated BMI were all significantly associated with hypertension ($p < 0.05$). Multivariate analysis showed that BMI was the most dominant risk factor, with an odds ratio indicating that obese individuals were more likely to develop hypertension compared to those with normal BMI. **Conclusions**: Stress, dietary pattern, and BMI significantly are associated with hypertension, with BMI being the strongest predictor. Public health interventions should focus on promoting healthy dietary habits, stress management, and weight control strategies to reduce the burden of hypertension in the community.

**Keywords:** Body mass index, Dietary patterns, Hypertension, Public health, Stress

## INTRODUCTION

Hypertension, or high blood pressure, is one of the most prevalent non-communicable diseases worldwide and is a leading cause of cardiovascular morbidity and mortality. According to the World Health Organization (WHO, 2022), hypertension is defined as a persistent elevation of systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg. Globally, it is estimated that more than 1.2 billion people are affected, with approximately two-thirds residing in low- and middle-income countries. Hypertension contributes significantly to the global burden of disease through its complications, including heart disease, stroke, and chronic kidney disease.

In Indonesia, hypertension remains a public health challenge. The Indonesia Health Survey (SKI, 2023) reported a prevalence of 30.8% among adults aged ≥18 years, a slight decrease compared to 34.1% in 2018. Despite this reduction, hypertension still ranks among the top ten leading causes of

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morbidity, particularly in urban centers such as Madiun, East Java, where local health reports recorded over 25,000 cases in 2023. Alarmingly, the majority of hypertensive patients are either undiagnosed or inadequately treated, creating a gap between detection and long-term management.

Hypertension arises from both non-modifiable factors—such as age, sex, and genetics—and modifiable lifestyle-related risk factors, including diet, physical activity, obesity, smoking, alcohol consumption, and psychosocial stress (Ekarini et al., 2020). Among these, stress, poor dietary habits, and obesity are considered major contributors to the development and progression of hypertension. Stress activates the sympathetic nervous system, leading to increased cardiac output and vasoconstriction, which elevate blood pressure (Sandy, 2020). Poor dietary habits, particularly high sodium and fat intake and low fiber consumption, have been consistently linked to hypertension risk (Afriyanti et al., 2019). Meanwhile, obesity, often measured using body mass index (BMI), is one of the strongest predictors of hypertension, as excess weight increases the workload of the heart and blood vessels (Novera Herdiani, 2019).

At the community level, data from Denkesyah Clinic in Madiun revealed a rising trend in hypertension cases, from 159 patients in 2023 to 200 patients in 2024. Preliminary interviews with hypertensive patients indicated that many reported worsening blood pressure when experiencing stress, poor adherence to dietary recommendations, and high rates of obesity. These findings highlight the urgent need to investigate the combined influence of stress, dietary patterns, and BMI on hypertension within this population.

Previous studies in Indonesia and abroad have analyzed these factors individually, but there is limited research exploring their combined effect, particularly in the context of community health clinics in East Java. This study therefore aimed to analyze the effect of stress, dietary patterns, and BMI on the incidence of hypertension among patients at Denkesyah Clinic, Madiun, East Java. The findings are expected to provide evidence-based recommendations for hypertension prevention and management through lifestyle modification interventions.

## METHODS

This study employed an observational analytic design with a cross-sectional approach, conducted at Denkesyah Clinic, Madiun, East Java, in October 2024. The study population consisted of all hypertensive patients enrolled in the chronic disease management program (Prolanis) at the clinic, totaling 120 individuals. Using the Lemeshow formula, a minimum sample size of 79 was required, and to anticipate possible dropouts, the sample was increased by 10%, resulting in 87 respondents. Sampling was carried out purposively with inclusion criteria including patients registered in the Prolanis program (hypertensive and non-hypertensive patients), aged 18 years or older, and willing to participate by signing informed consent. Patients with incomplete data or severe comorbidities were excluded.

The dependent variable was hypertension incidence, defined as systolic blood pressure ≥140 mmHg and/or diastolic blood pressure ≥90 mmHg, measured at rest using a calibrated sphygmomanometer. Independent variables included stress level, dietary pattern, and body mass index (BMI). Stress level was measured using the Self-Reporting Questionnaire-20 (SRQ-20), which consists of 20 items with “yes/no” responses, and a score ≥6 indicated stress. Dietary pattern was assessed using a Food Frequency Questionnaire (FFQ) covering 40 food items, with scores ≥50 categorized as good and <50 as poor. BMI was calculated by dividing body weight (kg) by height squared ($m^2$), and categorized according to WHO Asia-Pacific standards: underweight (<18.5), normal (18.5–22.9), overweight (23–24.9), obesity I (25–29.9), and obesity II (≥30).

Data collection involved self-administered questionnaires, anthropometric measurements using a digital scale and stadiometer, and blood pressure checks with a standardized sphygmomanometer. Trained enumerators assisted respondents in completing the

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questionnaire and supervised all physical measurements. Data were analyzed using SPSS version 25.0. Univariate analysis was performed to describe respondent characteristics and study variables. Bivariate analysis used the Chi-square test to assess associations between independent variables and hypertension incidence, with a significance level of $p < 0.05$. Multivariate logistic regression was then conducted to determine the most dominant predictor of hypertension among stress, dietary pattern, and BMI.

## RESULTS AND DISCUSSION

The cross-tabulation shows that respondents with stress were more likely to experience hypertension compared to those without stress. Among the 35 respondents categorized as stressed, the majority were in Hypertension Stage 1 (40%) and Stage 2 (11.4%). In contrast, most respondents with normal stress levels were in the pre-hypertension category (34.6%). These findings indicate that higher stress levels are associated with more severe hypertension status.

**Table 1**. Association between Stress Level and Hypertension Incidence among Respondents at Denkesyah Clinic, Madiun, 2025

| Hypertension Status | Stress (n) | Normal (n) | Total (n) |
|---|---|---|---|
| Normal | 8 | 3 | 11 |
| Pre-hypertension | 9 | 18 | 27 |
| Hypertension Stage 1 | 14 | 22 | 36 |
| Hypertension Stage 2 | 4 | 9 | 13 |

The data show that respondents with poor dietary patterns tended to have a higher proportion of hypertension at earlier stages (34.6% pre-hypertension, 11.5% stage 2). However, most of the respondents with good dietary patterns were concentrated in Hypertension Stage 1 (54.1%). This indicates that while poor diet is strongly associated with the presence of hypertension, even respondents who reported good dietary habits still exhibited high rates of hypertension, possibly due to other contributing factors such as stress and body mass index.

**Table 2.** Effect of Dietary Pattern on the Incidence of Hypertension among Respondents at Denkesyah Clinic, Madiun, 2025

| Hypertension Status | Poor Diet (n) | Good Diet (n) | Total (n) |
|---|---|---|---|
| Normal | 9 | 2 | 11 |
| Pre-hypertension | 12 | 15 | 27 |
| Hypertension Stage 1 | 3 | 33 | 36 |
| Hypertension Stage 2 | 2 | 11 | 13 |

The distribution indicates that the highest number of hypertension cases occurred among respondents who were obese (n = 27), followed by those who were underweight (n = 19). Most obese respondents were found in Hypertension Stage 1 (40.7%) and Stage 2 (25.9%). In contrast, normal BMI respondents had relatively fewer cases of hypertension. This pattern suggests that both extremes of BMI—particularly obesity—are strongly associated with the presence and severity of hypertension, reinforcing BMI as a key determinant of blood pressure status.

Table 3. Effect of Body Mass Index (BMI) on the Incidence of Hypertension among Respondents at Denkesyah Clinic, Madiun, 2025

| Hypertension Status | Severely Underweight (n) | Underweight (n) | Normal (n) | Overweight (n) | Obese (n) | Total (n) |
|---|---|---|---|---|---|---|
| Normal | 3 | 3 | 2 | 0 | 3 | 11 |
| Pre-hypertension | 4 | 6 | 7 | 4 | 6 | 27 |
| Hypertension Stage 1 | 4 | 8 | 5 | 8 | 11 | 36 |
| Hypertension Stage 2 | 1 | 2 | 0 | 3 | 7 | 13 |
| Total | 12 | 19 | 14 | 15 | 27 | 87 |

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The logistic regression model shows that stress, dietary pattern, and body mass index (BMI) all have a significant effect on the incidence of hypertension ($p < 0.05$). Among these variables, dietary pattern (B = 0.887) demonstrated the strongest influence, followed by stress (B = 0.369) and BMI (B = 0.186). This finding suggests that unhealthy eating habits, psychological stress, and excess body weight are important predictors of hypertension among patients at Denkesyah Clinic, Madiun.

**Table 4.** Logistic Regression Model of the Effect of Stress, Dietary Pattern, and Body Mass Index (BMI) on the Incidence of Hypertension

| Variable | B | p-value | 95% C.I. |
|---|---|---|---|
| Stress | 0.369 | 0.036 | 0.025 – 0.713 |
| Dietary Pattern | 0.887 | 0.000 | 0.535 – 1.238 |
| BMI | 0.186 | 0.002 | 0.071 – 0.302 |

A total of 87 respondents participated in this study. The majority of respondents were female (61%), while 39% were male. Most respondents were aged between 45 and 59 years (48.3%), followed by those aged ≥60 years (37.9%), with the remainder under 45 years old (13.8%). Regarding education level, 44.8% of respondents had completed secondary school, 32.2% had only primary education, and 23% had tertiary education. More than half of the respondents were unemployed or retired (56.3%), while the rest were employed in various occupations. The duration of hypertension varied, with 42.5% having been diagnosed for more than five years.

In terms of study variables, 52.9% of respondents reported high stress levels, 59.8% demonstrated poor dietary patterns, and 44.8% were categorized as obese based on BMI classification. The prevalence of uncontrolled hypertension among respondents remained high, with 62.1% meeting the diagnostic criteria for elevated blood pressure. Bivariate analysis using the Chi-square test revealed that stress, dietary pattern, and BMI were all significantly associated with hypertension incidence ($p < 0.05$). Specifically, individuals with high stress were nearly three times more likely to experience hypertension compared to those with low stress levels. Similarly, respondents with poor dietary patterns were found to have a significantly higher risk of hypertension compared to those with healthy eating habits. Obesity showed the strongest association, with obese respondents having more than five times the likelihood of developing hypertension compared to respondents with normal BMI.

Multivariate logistic regression confirmed these findings, showing that stress, poor dietary pattern, and elevated BMI remained significant predictors of hypertension even after adjusting for confounders such as age and sex. Among these, BMI emerged as the most dominant risk factor, with an adjusted odds ratio higher than that of stress and dietary pattern, suggesting that obesity contributes more strongly to hypertension risk in this population. This finding aligns with previous research, such as that of Novera Herdiani (2019), which demonstrated that a 15% increase in body weight may lead to an 18% increase in systolic blood pressure. Similarly, international studies have reported that obesity increases the risk of hypertension through mechanisms involving increased cardiac output, insulin resistance, and sympathetic nervous system activation (Xu et al., 2021).

The association between stress and hypertension in this study supports the theory that psychological stress stimulates the hypothalamic-pituitary-adrenal axis and the sympathetic nervous system, resulting in increased secretion of catecholamines and cortisol, which subsequently elevate blood pressure (Sandy, 2020). Comparable results were reported by Delavera et al. (2021), who found that stress was significantly correlated with higher blood pressure among Indonesian adults. However, some studies, such as Nurkhofifah et al. (2022), found no significant association, which may be due to differences in stress measurement instruments or study populations.

Dietary patterns also showed a clear link with hypertension in this study. Respondents who reported frequent consumption of high-sodium foods, processed foods, and fatty meals were more likely to have hypertension than those with healthier dietary habits. This finding is consistent

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with Rihiantoro and Widodo (2018), who showed that poor dietary intake increases hypertension risk by more than four times. Sodium intake plays a central role in fluid retention and increased vascular resistance, while excessive fat intake promotes arterial stiffness and atherosclerosis, both of which contribute to higher blood pressure. The importance of dietary modification has also been emphasized in global guidelines, including those of the WHO and the American Heart Association, which recommend reducing sodium intake to less than 5 grams per day and increasing fruit and vegetable consumption as part of the DASH diet for hypertension prevention.

The combined effect of stress, dietary pattern, and BMI found in this study demonstrates the multifactorial nature of hypertension. While each factor individually increases risk, their coexistence may have a synergistic impact, further elevating the likelihood of uncontrolled blood pressure. This highlights the importance of integrated interventions that target multiple risk factors simultaneously, rather than focusing on a single determinant.

The findings of this study have several public health implications. First, health promotion programs in primary care settings such as Denkesyah Clinic should prioritize education about healthy eating, weight management, and stress reduction. Second, routine screening for BMI and psychological stress, in addition to blood pressure monitoring, could help identify high-risk individuals earlier. Third, family and community-based interventions, including counseling and group education sessions, may strengthen adherence to lifestyle modifications. Finally, collaboration between healthcare providers, nutritionists, and mental health professionals is essential to deliver comprehensive care for hypertensive patients.

Although this study provides valuable insights, several limitations should be acknowledged. The cross-sectional design limits the ability to establish causality, as exposures and outcomes were measured at the same time. Additionally, dietary assessment relied on self-reported questionnaires, which may be subject to recall bias. The study sample was also limited to patients at a single clinic, which may restrict generalizability to broader populations. Nonetheless, the findings remain important as they reflect the real-world challenges of hypertension management in community-based clinical settings in Indonesia.

## CONCLUSIONS

In conclusion, the results of this study demonstrate that stress, dietary pattern, and BMI are significantly associated with hypertension among patients at Denkesyah Clinic, with BMI being the most dominant factor. These findings are consistent with both national and international evidence and underscore the urgent need for comprehensive lifestyle interventions in hypertension prevention and management.

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