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# THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY, DIETARY PATTERNS, AND SLEEP QUALITY WITH THE INCIDENCE OF HYPERTENSION AMONG THE ELDERLY

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***Abstract***

*Hypertension is a chronic condition characterized by systolic blood pressure ≥140 mmHg and diastolic blood pressure ≥90 mmHg. It is often referred to as a "silent killer" due to its asymptomatic nature, yet it can lead to severe complications such as stroke, heart failure, and kidney disease. This study aims to analyze the relationship between physical activity, dietary patterns, and sleep quality with the incidence of hypertension among elderly individuals at the Posyandu in Pladen Village. The research was conducted from April to May 2025 using a correlational analysis method with a cross-sectional design. The sample consisted of 58 elderly participants selected randomly through simple random sampling from a total population of 68 individuals. The independent variables were physical activity, dietary patterns, and sleep quality, while the dependent variable was the incidence of hypertension. Data were collected using the International Physical Activity Questionnaire (IPAQ), Food Frequency Questionnaire (FFQ), and Pittsburgh Sleep Quality Index (PSQI), along with blood pressure measurements using a sphygmomanometer. Spearman rank correlation analysis was employed to assess the relationships between these variables and hypertension incidence. The findings revealed significant correlations between hypertension and physical activity (r = -0.693; p = 0.001), dietary patterns (r = 0.721; p = 0.000), and sleep quality (r = 0.799; p = 0.001). These results indicate that physical activity, dietary patterns, and sleep quality are key factors influencing the degree of hypertension among older adults. Lifestyle-based interventions are essential in the prevention and management of hypertension in the elderly population.*



## I. INTRODUCTION

Hypertension is often referred to as the "silent killer" because its symptoms are frequently unrecognized or nonspecific. The manifestations may vary among individuals and often resemble those of other illnesses (Utari & Rochmah, 2019). This deadly yet common condition represents a significant public health concern, contributing to serious health complications such as stroke, heart attack, heart failure, kidney damage, and other related disorders. A global study involving 87 behavioral, environmental, occupational, and metabolic risk factors identified elevated systolic blood pressure (≥110–115 mmHg) as one of the leading contributors to premature mortality worldwide. It is estimated to cause approximately 10.8 million preventable deaths annually and accounts for the loss or disability of 235 million disability-adjusted life years (DALYs) each year (WHO, 2023).

According to the World Health Organization (WHO) 2023, the global prevalence of hypertension has reached 1.3 billion people, representing 33% of the population equivalent to one in every three individuals. The prevalence is slightly higher among men (34%) compared to women (32%). However, in the 30–49 age group, the

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prevalence is lower in women (19%) than in men (24%). Among individuals aged 50–79 years, the prevalence is nearly equal between men and women, at approximately 49%. The prevalence of hypertension is increasing in countries within the Western Pacific and Southeast Asia regions, a trend associated with economic growth and demographic shifts, particularly the rising elderly population. Approximately 78% of hypertension cases are found in low- and middle-income countries within these regions. The number of people living with hypertension is projected to continue rising, reaching an estimated 1.6 billion by 2025 (WHO, 2023).

Based on the 2023 Indonesian Health Survey (SKI), the prevalence of hypertension among individuals aged ≥18 years was 30.8%. The diagnosis was more prevalent among the elderly (22.9%) compared to the productive age group (5.9%). Hypertension was identified as the leading cause of disability, accounting for 22.2% of all disability cases (SKI, 2023). Central Java ranked fifth nationally in terms of hypertension prevalence among individuals aged ≥18 years (Kemenkes, 2023). The highest proportion of non-communicable diseases in Central Java Province is hypertension, accounting for 72% of cases. The number of individuals aged over 15 years diagnosed with hypertension reached 8,554,672 people, representing 38.2% of the population. Of this total, 6,716,006 individuals, or 78.51%, have received healthcare services (Dinkes Jateng, 2023). Data from the Kudus District Health Office 2024 indicated that the prevalence of hypertension in Kudus in 2023 was 27.07%, encompassing both essential and other types of hypertension (Dinkes Kudus, 2024).

There are two main categories of factors contributing to the increasing prevalence of hypertension: non-modifiable factors such as sex, age, genetics, and race, and modifiable factors including dietary patterns, physical inactivity, excessive salt, caffeine, and alcohol intake, smoking, poor sleep quality, obesity, education level, occupation, and stress (Helni, 2020). Although genetic predisposition cannot be altered, individuals can still reduce their risk of hypertension by adopting a healthy lifestyle, which encompasses daily habits that promote physical, social, and mental well-being. Unhealthy lifestyle choices such as physical inactivity, frequent consumption of fast food high in fat and salt, insufficient sleep, caffeine intake, and chronic stress can lead to elevated blood pressure (Pasaribu et al., 2023). Moreover, the prevalence of hypertension tends to increase with age due to structural and functional changes in peripheral blood vessels. Aging is associated with atherosclerosis, reduced elasticity of connective tissue, and diminished relaxation of vascular smooth muscle, all of which decrease vascular flexibility and resistance to blood pressure (Rusnoto & Himawan, 2023).

Older adults are considered a vulnerable group due to the physiological decline that accompanies aging, which increases the risk of various diseases, including hypertension. This study focuses on the elderly population because hypertension is one of the most common health problems in this age group and, if left uncontrolled, can lead to serious complications such as stroke, heart failure, and kidney disease. Additionally, factors such as reduced physical activity, unhealthy dietary habits, and declining sleep quality are frequently observed among the elderly and may contribute to elevated blood pressure. By examining this population, the study aims to gain a deeper understanding of the relationship between these factors and the incidence of hypertension, thereby providing a foundation for designing more effective health interventions particularly in health education and promotion for the elderly at the Pladen Village Posyandu.

Individuals who do not engage in physical activity typically have a higher resting heart rate, indicating that the heart muscle must work harder with each contraction. This increased and more frequent cardiac workload places additional pressure on the arteries, thereby raising blood pressure. Regular physical exercise has been shown to reduce the risk of hypertension (Wacika et al., 2024). Physical inactivity is a recognized risk

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factor for hypertension. Globally, many adults remain sedentary during their leisure time or weekends. Several previous studies have demonstrated a significant association between physical activity and the incidence of hypertension (Indriani et al., 2023).

Fast food is widely popular both globally and in Indonesia. As lifestyles become more modern and fast-paced, there has been a noticeable shift in dietary habits, with people increasingly favoring fast food for its convenience over home cooked, nutritious meals. Individuals who are overweight or obese face a significantly higher risk of developing hypertension compared to those with normal nutritional status. Previous research has indicated a correlation between the consumption of fast food, instant noodles, and nutritional status in relation to hypertension (Isfandiari et al., 2021).

Sleep quality is another modifiable risk factor that can influence an individual's blood pressure. Temporary factors affecting sleep quality include stress, noisy environments, temperature fluctuations, changes in surroundings, irregular sleep-wake schedules, and medication side effects (Rohmah & Santik, 2020). Fatigue resulting from excessive activity or stress can disrupt sleep patterns. Many adults experience serious sleep difficulties, which are often considered an inevitable part of aging (Sabila & Sari, 2023). Previous studies have also shown a relationship between poor sleep quality and elevated blood pressure (Ningtyas, 2024). Therefore, one of the strategies to prevent hypertension includes regulating dietary intake such as adopting a low-sodium diet managing obesity, and modifying lifestyle behaviors. Lifestyle changes are closely linked to individual knowledge and awareness in preventing hypertension (Sistikawati et al., 2021)

This study presents novelty in its approach, target population, and analytical methods. Unlike the study by (Sabila & Sari, 2023), which focused on civil servants of productive age (24–54 years) in formal work environments, and the research by (Husnah, 2019), which examined outpatient hospital patients, this study highlights elderly individuals at the Pladen Village Posyandu, a community-based population with limited socioeconomic resources. Furthermore, this research integrates three lifestyle variables physical activity, dietary patterns, and sleep quality into a single analysis of hypertension severity, rather than merely its incidence. This approach offers a more comprehensive understanding of the degree of hypertension and its potential complications.

Methodologically, this study employs the Spearman rank correlation to assess the strength and direction of relationships among ordinal variables, allowing for a more flexible and data-appropriate analysis. In contrast, the two previous studies used the chi-square test, which only identifies the presence or absence of associations between categorical variables without considering the intensity or direction of the correlation. The use of standardized instruments such as the International Physical Activity Questionnaire (IPAQ), Food Frequency Questionnaire (FFQ), and Pittsburgh Sleep Quality Index (PSQI) further enhances data validity tools that were not explicitly utilized in the two comparative studies. Thus, this research contributes new insights to the development of more targeted, community-based interventions tailored to the needs of the elderly.

Survey results from the Pladen Village Posyandu indicate that hypertension is a major health issue among the elderly, with a prevalence of 58.82% based on the previous year's data. Recorded blood pressure levels reached as high as 227/135 mmHg, signaling a high risk of serious complications. This condition is exacerbated by the natural decline in immune function among the elderly, making them more susceptible to symptoms such as body stiffness and fatigue. The primary contributing factors include insufficient physical activity, consumption of salty or fast food, and sleep disturbances. In light of these three risk factors, the researcher seeks to further investigate the causes of hypertension in this Posyandu and is particularly interested in the topic "The Relationship Between Physical Activity, Dietary Patterns, and Sleep Quality with the

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Incidence of Hypertension Among the Elderly at the Pladen Village Posyandu."

Nurses play a strategic role in the prevention and management of hypertension among the elderly, particularly at the community level such as in Posyandu settings. As educators, nurses are responsible for providing information on healthy lifestyles, including the importance of regular physical activity, low-sodium and low-saturated fat diets, and proper sleep management. This education aims to raise awareness among the elderly about hypertension risk factors and to encourage healthier behavioral changes (P & Juwita, 2021). Additionally, nurses serve as monitors of treatment adherence by conducting regular blood pressure checks and overseeing the use of antihypertensive medications. Such monitoring is essential for early detection of blood pressure changes and the prevention of further complications (Silvianah & Indrawati, 2024). In holistic nursing practice, nurses also provide psychosocial support and non-pharmacological interventions such as relaxation techniques and sleep regulation, which have been shown to effectively reduce blood pressure in older adults (Annisa et al., 2024). Moreover, nurses act as health advocates for the elderly by facilitating access to healthcare services and strengthening collaboration with Posyandu cadres and families. Through this approach, nurses contribute not only to hypertension control but also to the overall improvement of elderly quality of life.

## II. METHOD

This study employed a quantitative descriptive correlational approach with a cross-sectional design, in which data were collected at a single point in time to examine the relationships among the studied variables. The independent variables in this research were physical activity, dietary patterns, and sleep quality, while the dependent variable was the incidence of hypertension. This design enabled the researcher to simultaneously assess the correlations between lifestyle and health factors without the need for repeated observations.

The respondents in this study were elderly individuals aged ≥50 years who participated in the Posyandu (integrated health post) in Pladen Village. The total population consisted of 68 individuals, from which a sample of 58 elderly participants was selected. The sampling was conducted from April to May 2025 using a simple random sampling technique. A numbered list of the entire population was created, and 58 numbers were randomly drawn from 1 to 68 using paper ballots to ensure that the selected sample met the inclusion criteria.

The inclusion criteria for this study were elderly individuals who attended the Posyandu, had high blood pressure or hypertension, and either used or did not use sleeping medication. Participants were also required to be literate and willing to participate by signing an informed consent form. The exclusion criteria were established to minimize bias and included individuals who were unwilling to participate, unable to read, or had a history of comorbid conditions such as stroke or diabetes mellitus, which could influence the study outcomes. These criteria were designed to ensure the validity and relevance of the data in analyzing the relationship between physical activity, dietary patterns, and sleep quality with the incidence of hypertension among the elderly at the Pladen Village Posyandu.

Following the selection process, each respondent received a clear explanation of the study's objectives, benefits, and procedures and was asked to sign an informed consent form. Data collection involved several instruments: the Demographic Data Form, which recorded basic information such as name, age, gender, and occupation. Blood pressure measurement, conducted using a digital sphygmomanometer (Omron HEM-7156A), was categorized into three hypertension grades: Grade 1 (mild) 140–159/90–99 mmHg, Grade 2 (moderate) 160–169/100–109 mmHg, and Grade 3 (severe) ≥180/≥120 mmHg. International Physical Activity Questionnaire (IPAQ), consisting of 7

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questions to assess the frequency and intensity of physical activity over the past week. Food Frequency Questionnaire (FFQ), comprising 35 items on food sources of sodium, fat, and carbohydrates, with consumption frequencies scored as follows: >3x/day (50), 1x/day (25), 3–6x/week (15), 1–2x/week (10), 2x/month (5), and never (0). The total score was divided by 36 and categorized as poor (15–50) or good (0–14) dietary patterns (Lubis, 2022). Pittsburgh Sleep Quality Index (PSQI), consisting of 19 items—4 open-ended and 15 ordinal-scale questions. Items 5a–7 used a frequency scale (never, once/week, twice/week, ≥3 times/week), while items 8 and 9 used different ordinal response types. The 19 items assessed seven components: subjective sleep quality (item 9), sleep latency (items 2 and 5a), sleep duration (item 4), sleep efficiency (items 1, 3, and 4), sleep disturbances (items 5b–5j), use of sleeping medication (item 6), and daytime dysfunction (items 7 and 8). Each component was scored from 0 to 3 (Hutasoit et al., 2024).

Questionnaires were completed independently by respondents or with assistance from the researcher when needed. Upon collection, the data were reviewed for completeness and consistency. Incomplete responses were clarified directly with the respondents. All data were manually coded, entered into Microsoft Excel, and subsequently processed using statistical software.

Data analysis was conducted using univariate analysis to describe the distribution of each variable and bivariate analysis using Spearman's rank correlation test to determine the presence and strength of relationships between the independent variables (physical activity, dietary patterns, and sleep quality) and the dependent variable (hypertension). Statistical analysis was performed using SPSS Statistics version 26 to ensure valid results and accurate determination of the significance of relationships among the study variables.

This study underwent ethical review and was declared ethically feasible to conduct. Ethical approval was granted by the Health Research Ethics Committee of Universitas Muhammadiyah Kudus, with approval letter number 227/Z-7/KEPK/UMKU/II/2025, dated February 26, 2025. All research procedures adhered to ethical principles, including providing clear information to participants and obtaining written informed consent prior to data collection.

## III. Results and Discussion

### I. Univariate Analysis

**Table 1.** Frequency Distribution of Respondent

| Variable | f | % |
|---|---|---|
| **Age** | | |
| Young Elderly | 52 | 89.7 |
| Old Elderly | 6 | 10.3 |
| **Gender** | | |
| Female | 51 | 87.9 |
| Male | 7 | 12.1 |
| **Work** | | |
| Unemployed | 25 | 43.1 |
| Laborer | 24 | 41.4 |
| Housewife | 9 | 15.5 |
| **Highest Level of Education** | | |
| Did Not Complete School | 21 | 36.2 |
| Elementary School | 21 | 36.2 |
| Middle School | 10 | 17.3 |
| High School | 6 | 10.3 |

Based on Table 1, the frequency distribution of 58 elderly respondents at the Pladen Village Posyandu shows that the majority were in the young elderly age group (60–74 years), totaling 52 individuals (89.7%). Most respondents were female (51 individuals or 87.9%), unemployed (25 individuals or 43.1%), and had completed only elementary school or equivalent (21 individuals or 36.2%), with an equal proportion (36.2%) having never completed formal education.

**Table 2.** Frequency Distribution of Independent and Dependent Variables

| Variable | f | % |
|---|---|---|
| **Physical Activity** | | |
| Light | 13 | 22.4 |
| Moderate | 20 | 34.5 |
| Vigorous | 25 | 43.1 |
| **Dietary Pattern** | | |
| Healthy | 26 | 44.8 |
| Unhealthy | 32 | 55.2 |

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| Variable | f | % |
|---|---|---|
| **Sleep Quality** | | |
| Good | 25 | 43.1 |
| Poor | 33 | 56.9 |
| **Hypertension Severity** | | |
| Grade 1 | 30 | 51.7 |
| Grade 2 | 17 | 29.3 |
| Grade 3 | 11 | 19 |

According to Table 2, the majority of respondents engaged in high physical activity (25 individuals or 43.1%), had poor dietary patterns (32 individuals or 55.2%), and reported poor sleep quality (33 individuals or 56.9%). Most respondents were categorized as having Grade 1 hypertension (31 individuals, or 53.4%).

## II. Bivariate Analysis

**Table 3.** Relationship Between Physical Activity, Dietary Patterns, and Sleep Quality with Hypertension Among the Elderly at the Pladen Village Posyandu

| Variable | Hypertension Incidence | | | | | | Total | | P Value |
|---|---|---|---|---|---|---|---|---|---|
| | Grade 1 | | Grade 2 | | Grade 3 | | | | |
| | F | % | F | % | F | % | F | % | |
| **Physical Activity** | | | | | | | | | |
| Light | 0 | 0 | 4 | 30,8 | 9 | 69,2 | 13 | 100 | 0.001 |
| Moderate | 9 | 45 | 10 | 50 | 1 | 5 | 20 | 100 | |
| Vigorous | 22 | 88 | 3 | 12 | 10 | 50 | 25 | 100 | |
| Total | 31 | 53,4 | 17 | 29,3 | 10 | 17,2 | 58 | 100 | |
| **Correlation Coefficient** | | | | | | | | | -0,693 |
| **Dietary Pattern** | | | | | | | | | |
| Good | 24 | 92,3 | 2 | 7,7 | 0 | 0 | 26 | 100 | 0.0001 |
| Poor | 6 | 18,8 | 15 | 46,9 | 11 | 34,4 | 32 | 100 | |
| Total | 30 | 51,7 | 17 | 29,3 | 11 | 19,0 | 58 | 100 | |
| **Correlation Coefficient** | | | | | | | | | 0,721 |
| **Sleep Quality** | | | | | | | | | |
| Good | 25 | 100 | 0 | 0 | 0 | 0 | 25 | 100 | 0.001 |
| Poor | 5 | 15,2 | 17 | 51,5 | 11 | 33 | 33 | 100 | |
| Total | 30 | 51,7 | 17 | 29,3 | 11 | 19,0 | 58 | 100 | |
| **Correlation Coefficient** | | | | | | | | | 0,799 |

The spearman rank correlation coefficient test presented in Table 3 shows a p-value of 0.001 ($p < 0.05$) and a correlation coefficient (r) of -0.693, indicating a significant relationship between physical activity and the incidence of hypertension among the elderly at the Pladen Village Posyandu. Therefore, H1 is accepted and H0 is rejected. The correlation strength is strong, and the direction is negative, meaning that lower physical activity is associated with higher levels of hypertension. The majority of the sample (25 individuals) reported high levels of physical activity, with most of them (22 individuals or 88%) classified as having grade 1 hypertension. Among those with high physical activity, 12% had grade 2 hypertension, and none had grade 3 hypertension.

The Spearman rank correlation coefficient test also shows a p-value of 0.0001 ($p < 0.05$) and a correlation coefficient (r) of 0.721, indicating a significant relationship between dietary patterns and hypertension incidence. Thus, H1 is accepted and H0 is rejected. The correlation is strong and positive, meaning that poorer dietary patterns are associated with higher levels of hypertension. The majority of respondents (32 individuals) had poor dietary patterns, with most of them (15 individuals or 46.9%) classified as having grade 2 hypertension. Among this group, 34.4% had grade 3 hypertension, and 18.8% had grade 1 hypertension.

Furthermore, the Spearman rank correlation coefficient test shows a p-value of 0.001 ($p < 0.05$) and a correlation coefficient (r) of 0.799, indicating a significant relationship between sleep quality and hypertension incidence. H1 is accepted and H0 is rejected. The correlation is strong and positive, suggesting that poorer sleep quality is associated with higher levels of

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hypertension. Most respondents (33 individuals) had poor sleep quality, with the majority (17 individuals, or 51.5%) experiencing grade 2 hypertension. Among those with poor sleep quality, 33.3% had grade 3 hypertension, and 15.2% had grade 1.

**Respondent Characteristics**

The study involved 58 elderly respondents. The findings show that the majority belonged to the young elderly age group (60–74 years), totaling 52 individuals, or 89.7%. This age range represents a transitional phase from young-old to old-old, during which progressive physiological changes begin to occur. These results align with (Riyada et al., 2024), who reported a significant influence of age on hypertension. The chi-square test yielded a calculated value of $X^2 = 34.720$, which exceeds the critical value of $X^2 = 3.841$ at a 5% significance level. Therefore, Ha is accepted and H0 is rejected. Increasing age contributes to a higher risk of hypertension, with 41.6% of respondents reporting symptoms as they age. Physiological changes such as reduced vascular elasticity, muscle mass, and metabolism are key contributing factors. Many young elderly individuals are unaware of these changes, making primary prevention essential. Low body awareness and lifestyle habits carried over from their productive years pose challenges in managing hypertension.

The majority of respondents were female, totaling 51 individuals or 87.9%. The predominance of women among elderly individuals with hypertension is consistent with findings by (Brigischa & Zulfahmidah, 2025), who reported that women have a 74% higher prevalence of hypertension compared to men, particularly after menopause. The decline in estrogen levels reduces vasodilatory effects and increases renin-angiotensin system activity, both of which contribute to elevated blood pressure. In addition to biological factors, elderly women are also more likely to experience psychosocial stress and sleep disturbances, which further exacerbate hypertension.

Most elderly respondents were unemployed (43.1%), while 41.4% were laborers and 15.5% were housewives. The majority were either no longer working or had entered retirement, reflecting a sedentary lifestyle and reduced daily physical activity. This condition contributes to an increased risk of hypertension due to lower calorie expenditure, decreased metabolism, and weight gain. A study by (Rato & Sinaga, 2024) found that housewives and retirees dominate the elderly hypertensive population, often exhibiting low treatment adherence and limited physical activity. Unemployed older adults also tend to have more free time, but this is not always balanced with structured physical activity, thereby increasing the risk of hypertension. Moreover, physical inactivity can worsen psychological conditions such as anxiety and depression, which also influence blood pressure. Therefore, community-based interventions that encourage older adults to remain physically and socially active are essential for the prevention and control of hypertension.

A significant proportion of respondents had only completed elementary school or its equivalent (36.2%), while another 36.2% had not completed formal education. Low educational attainment significantly affects the elderly's understanding of chronic diseases, including hypertension, as well as their ability to access health information and follow medical advice. (Rato & Sinaga, 2024) also found that elderly individuals with education levels below junior high school exhibited lower adherence to medication and routine blood pressure monitoring. Limited health literacy leads to poor understanding of the importance of a low-sodium diet, regular physical activity, and consistent medication use. Additionally, they are more likely to rely on traditional remedies or unverified information from their social environment. Therefore, health education tailored to the educational level of this group is crucial to enhance the effectiveness of hypertension interventions.

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**Hypertension Incidence**

Based on the findings from the Posyandu in Pladen Village, Jekulo Subdistrict, Kudus Regency, the incidence of hypertension among the elderly was relatively high. Of the 58 respondents, 30 individuals (51.7%) had Grade 1 hypertension, 17 individuals (29.3%) had Grade 2, and 11 individuals (19.0%) had Grade 3 hypertension. These results indicate that while most elderly individuals were in the early stage of hypertension, a significant proportion had progressed to more severe stages, warranting special attention. The incidence of hypertension was strongly correlated with three key factors: physical activity, dietary patterns, and sleep quality. Respondents with low physical activity, poor dietary habits, and poor sleep quality were more likely to experience Grade 2 and Grade 3 hypertension, as evidenced by Spearman correlation test results showing p-values < 0.05 and strong correlation coefficients.

These findings are consistent with the study by (Riyada et al., 2024), which stated that hypertension in the elderly is influenced by age, genetic predisposition, excessive salt and fat intake, stress, and unhealthy lifestyle behaviors. Older adults with a family history of hypertension and a habit of consuming high-sodium foods are at greater risk of developing high blood pressure. Furthermore, (Suarayasa et al., 2023) added that poor sleep quality, consumption of coffee and alcohol, and low educational attainment also contribute to the increased risk of hypertension among the elderly.

A study by (Brigischa & Zulfahmidah, 2025) conducted at the Cendrawasih Public Health Center in Makassar supports these findings. The majority of elderly hypertensive patients were women (74%), with the largest age group being 66–74 years (46%) and a predominance of Grade 2 hypertension (57%). Most of the patients were retirees (59%), and the most commonly used antihypertensive medication was Calcium Channel Blockers (98%). These characteristics suggest that elderly individuals with reduced physical activity and lifestyle changes following retirement are at higher risk of developing hypertension.

In conclusion, the incidence of hypertension among the elderly is the result of a complex interaction between biological and behavioral factors. Community-based promotive and preventive interventions are urgently needed, particularly in the form of health education, increased physical activity, improved dietary habits, and sleep quality management to reduce both the prevalence and severity of hypertension in this population.

**The Relationship Between Physical Activity and Hypertension Incidence**

The data presented in the section on the relationship between physical activity and hypertension incidence show that 43.1% of respondents engaged in high-intensity physical activity. Among them, 88% were classified as having Grade 1 hypertension, 12% had Grade 2 hypertension, and none had Grade 3 hypertension. These findings suggest that physical activity has a protective effect on blood pressure. The majority of respondents were young elderly women (aged 60–74), unemployed, and had low educational attainment. This reflects limited access to health information, low awareness of the importance of physical activity, and a lack of supportive facilities for exercise in their surrounding environment.

According to (Sumandar et al., 2021), unemployed elderly individuals are 3.4 times more likely to experience physical frailty, including reduced handgrip strength, which is an indicator of mobility and daily functional capacity. Their study highlights that employment status influences physical capacity in older adults, with those who are not working tending to be more passive and at higher risk of metabolic disorders. Additionally, local cultural norms that encourage elderly individuals to “fully rest” after retirement, without promoting continued activity, contribute to passive behavior. In contrast, physically active older adults tend to have better weight control, improved metabolism, lower stress levels, and greater protection against elevated blood

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pressure. Physical activity also contributes to improved sleep quality, which indirectly helps reduce blood pressure.

Educational level also plays a significant role. A systematic review by (Sari et al., 2024) found that low educational attainment is associated with poor health knowledge, low self-efficacy, and limited motivation to engage in physical activity. Elderly individuals with low education levels often do not understand the importance of light exercise such as morning walks, elderly gymnastics, or gardening, and they typically lack access to adequate health information.

Physical activity is essential for maintaining cardiovascular health. Physiologically, regular body movement improves arterial elasticity, enhances blood circulation, reduces peripheral resistance, and supports endothelial function. When the body is active, blood flow increases and stress hormones such as cortisol decrease, contributing to lower blood pressure. In contrast, physical inactivity can lead to vascular stiffness, impaired circulation, and even obesity (Anisa et al., 2025).

Based on the Spearman rank correlation coefficient test presented in Table 4.9, the results show a p-value of 0.001 ($p < 0.05$) and a correlation coefficient (r) of -0.693. This indicates a significant relationship between physical activity and hypertension incidence among the elderly at the Pladen Village Posyandu. Therefore, H1 is accepted and H0 is rejected. The correlation is strong and negative, meaning that lower levels of physical activity are associated with higher levels of hypertension.

These findings are consistent with the study by (Wirayudha et al., 2024), which found that low physical activity was significantly associated with hypertension in the elderly ($p = 0.016$), particularly when combined with high sodium intake. Inactive older adults tend to experience weight gain and reduced cardiovascular fitness, both of which worsen hypertension. Moreover, physical activity plays a role in reducing stress and improving sleep quality—two factors that significantly influence blood pressure. Therefore, promoting an active lifestyle through elderly exercise programs, morning walks, or social activities involving physical movement should be encouraged as part of hypertension control strategies.

Research by (Indriani et al., 2023) also demonstrated a significant influence of physical activity on hypertension incidence. Their literature review found that eight studies reported an inverse relationship between physical activity levels and hypertension risk. Another study by (Wacika et al., 2024) revealed that 91.5% of hypertensive subjects had low physical activity levels, with a strong correlation between physical inactivity and hypertension ($p = 0.00$).

One factor that may influence research outcomes is the variation in intensity and type of physical activity, as not all forms of exercise have the same effect on blood pressure. Light activities such as walking have been shown to be more effective in lowering blood pressure than strenuous exercise. Additionally, elderly individuals who regularly take antihypertensive medication may present with normal blood pressure despite low physical activity levels. Promotive and preventive interventions that emphasize the importance of physical movement—through community programs such as elderly exercise sessions at Posyandu, the provision of safe and accessible spaces for movement, and family-based approaches—can help reduce hypertension prevalence and improve the quality of life among the elderly.

**The Relationship Between Dietary Patterns and Hypertension Incidence**

The data presented on the relationship between dietary patterns and hypertension incidence show that 32 respondents (55.2%) had poor dietary habits. Among this group, 46.9% experienced Grade 2 hypertension, 34.4% had Grade 3 hypertension, and 18.8% had Grade 1 hypertension. In contrast, among the 26 respondents with good dietary habits, 92.3% were classified as having Grade 1 hypertension, 7.7% had Grade 2, and none had Grade 3 hypertension. Respondents with

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poor dietary patterns were characterized by high consumption of sodium, saturated fats, and processed foods. Such dietary habits contribute to elevated blood pressure through fluid retention and increased plasma volume. The findings indicate that respondents with poor dietary patterns were more likely to experience moderate to severe hypertension (Grades 2 and 3).

Physiologically, excessive sodium intake can lead to fluid retention and increased blood volume, ultimately resulting in elevated blood pressure. Saturated fats and high cholesterol levels also contribute to vascular stiffness and atherosclerosis. These findings are consistent with the theory proposed by (Mardianto et al., 2021), which states that diets high in salt and fat contribute to increased blood pressure among the elderly. A study by (Wirayudha et al., 2024) further supports this, showing that excessive sodium intake is significantly associated with hypertension in older adults ($p = 0.016$), with individuals consuming high amounts of salt being more likely to experience elevated blood pressure. Moreover, an unbalanced diet contributes to obesity, dyslipidemia, and insulin resistance—all of which exacerbate hypertension. Nutritional education and dietary interventions promoting low-sodium intake and increased consumption of fruits and vegetables are essential for reducing blood pressure and improving the quality of life in the elderly.

Saturated fats—commonly found in red meat, organ meats, fried foods, and full-fat dairy products—can raise LDL cholesterol levels in the blood. Elevated cholesterol accelerates the process of atherosclerosis, the narrowing of blood vessels due to fatty plaque buildup, which increases peripheral resistance and blood pressure. A study by (B et al., 2021) reported that diets high in saturated fat and cholesterol contribute to elevated blood pressure, particularly among elderly individuals who do not balance fat intake with fiber and physical activity. Older adults who frequently consume fatty meats and fried foods have a higher prevalence of hypertension compared to those who consume healthy fats from sources such as fish and nuts.

Simple carbohydrates—such as refined sugar, white bread, and sweet snacks—are rapidly absorbed by the body, causing spikes in blood glucose levels. These spikes trigger large insulin releases, which over time can lead to insulin resistance and increase the risk of hypertension. Excessive carbohydrate intake also contributes to obesity, a major risk factor for high blood pressure. A literature review by (Sistikawati et al., 2021) concluded that high carbohydrate consumption, especially from processed sources like cakes, biscuits, and sugary drinks, is associated with increased blood pressure. The study emphasized the importance of replacing simple carbohydrates with complex ones such as brown rice, sweet potatoes, and high-fiber vegetables to reduce the risk of hypertension.

Based on the Spearman rank correlation coefficient test presented in Table 4.10, there is a significant relationship between dietary patterns and hypertension incidence among the elderly, with a p-value of 0.0001 and a correlation coefficient (r) of 0.721. This strong positive correlation indicates that the poorer the dietary pattern, the higher the level of hypertension experienced.

These findings clearly demonstrate that unhealthy dietary habits worsen the severity of hypertension. In this study, poor dietary patterns were characterized by high intake of sodium, saturated fats, and processed foods, along with low consumption of fruits and vegetables. This is consistent with the findings of (Nurlaela et al., 2025), who reported that food type, portion size, and meal frequency were significantly associated with hypertension in the elderly ($p = 0.000$; $r = 0.627$).

(Siregar, 2022), in a systematic review of nine journals, concluded that diets high in salt, fat, and fermented foods contribute to hypertension in older adults. The review found that 78% of elderly individuals with hypertension had unhealthy dietary patterns. This comparison reinforces the consistency between the present study and previous

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research, confirming that dietary habits are a critical determinant in blood pressure control, particularly among the elderly population.

One factor that may have influenced the study results is the socioeconomic condition of the elderly. Financial limitations often lead older adults to consume inexpensive foods that are high in salt and fat, such as salted fish. Environmental and cultural factors also play a role, as local dietary habits commonly include fried foods, salty snacks, and chili sauces. Therefore, community-based interventions—such as nutrition education, healthy cooking workshops, and regular monitoring of elderly dietary patterns—should be optimized to sustainably reduce the prevalence of hypertension.

**The Relationship Between Sleep Quality and Hypertension Incidence**

A total of 33 respondents (56.9%) were found to have poor sleep quality, characterized by frequent awakenings, restless sleep, and sleep durations of less than six hours. These conditions affect blood pressure regulation through neurohormonal, vascular, and metabolic mechanisms. Among this group, 51.5% experienced Grade 2 hypertension, 33.3% had Grade 3, and 15.2% had Grade 1 hypertension. In contrast, all 25 respondents with good sleep quality (100%) were classified as having Grade 1 hypertension, with none experiencing Grade 2 or 3.

Physiologically, adequate and high-quality sleep helps regulate the autonomic nervous system, reduces sympathetic activity, and lowers the release of stress hormones such as cortisol. Sleep disturbances disrupt these mechanisms, leading to vasoconstriction and increased heart rate. They also interfere with neuroendocrine activation and circadian rhythm regulation, both of which are essential for maintaining stable blood pressure.

A study by (Ratri et al., 2022) found that elderly individuals with poor sleep quality had a 66% higher risk of developing hypertension compared to those who slept well. Sleep disturbances were also associated with increased heart rate, metabolic dysfunction, and reduced immune function. Older adults often experience changes in sleep patterns due to aging, chronic pain, or psychological conditions. Therefore, a holistic approach—including stress management, relaxation therapy, and sleep environment optimization—is essential to improve sleep quality and reduce hypertension risk.

Sleep durations of less than six hours per night are associated with elevated blood pressure through chronic stress and inflammatory pathways. Sleep deprivation increases cortisol and C-reactive protein (CRP) levels, leading to oxidative stress and endothelial damage. It also reduces the production of nitric oxide, a natural vasodilator that maintains vascular flexibility. Supporting this, a study by (Fikry Hidayat et al., 2022) at Mojolangu Public Health Center found that 66.7% of hypertensive patients had poor sleep quality, including sleep durations of less than six hours. The correlation between sleep quality and blood pressure showed a strength of 0.65, indicating that short sleep duration significantly increases the risk of hypertension.

The Spearman rank correlation coefficient test presented in Table 4.11 confirmed a significant relationship between sleep quality and hypertension incidence among the elderly, with a p-value of 0.001 and a correlation coefficient (r) of 0.799. This strong positive correlation indicates that the poorer the sleep quality, the higher the level of hypertension. These findings are consistent with a study by (Nurhikmawati et al., 2024), which found that hypertensive patients with poor sleep quality had a higher prevalence of Grade 2 hypertension. A chi-square test also revealed a significant relationship between sleep quality and blood pressure ($p = 0.014$).

Disruptions in circadian rhythm due to irregular sleep patterns can also lead to hormonal and metabolic imbalances, including insulin resistance and elevated blood glucose levels, further aggravating cardiovascular conditions. According to (Ningtyas, 2024), sleep deprivation can

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reduce antibody production, increase fatigue, and impair the endocrine system, thereby accelerating the progression of hypertension in the elderly. Her study also found that older adults with poor sleep quality had a higher prevalence of hypertension, with a p-value of 0.003.

These comparisons demonstrate consistency between the current findings and previous studies, reinforcing that sleep quality is a critical determinant in blood pressure control, particularly among pre-elderly populations. As an intervention, older adults are encouraged to practice sleep hygiene, such as maintaining a regular sleep schedule, avoiding caffeine at night, creating a quiet and dark sleep environment, and engaging in light relaxation before bedtime. Educational activities at Posyandu such as health talks on sleep hygiene and breathing technique workshops can also help improve sleep quality and reduce hypertension risk.

This study has several limitations that should be considered when interpreting the results. The cross-sectional design allows for the identification of associations between variables but does not establish direct causal relationships. Additionally, data collection relied on self-reported questionnaires (IPAQ, FFQ, and PSQI), which depend on respondents' memory and honesty, introducing the potential for information bias. The study was also limited to elderly individuals actively participating in Posyandu activities in Pladen Village, which may not fully represent the broader elderly population, particularly those not engaged in community health services. Nevertheless, the findings provide valuable insights into lifestyle factors associated with hypertension in older adults and can serve as a foundation for future research with broader scope and longitudinal approaches.

## IV. CONCLUSION

Based on the study conducted among 58 elderly individuals at the Posyandu in Pladen Village, the majority of respondents were young elderly aged 60–74 years (89.7%), female (87.9%), unemployed (43.1%), and had completed only elementary school or its equivalent (36.2%). Most respondents were classified as having Grade 1 hypertension (51.7%), followed by Grade 2 (29.3%) and Grade 3 (19.0%), indicating an increased risk of complications with higher hypertension severity.

The main findings revealed a strong negative correlation between physical activity and hypertension severity, while dietary patterns and sleep quality showed significant positive correlations. This suggests that physically active elderly individuals tend to have better-controlled blood pressure, whereas unhealthy diets and poor sleep contribute to higher hypertension grades.

Overall, lifestyle factors play a crucial role in determining the severity of hypertension among the elderly. Therefore, lifestyle-based interventions—including the promotion of physical activity, nutritional education, and sleep quality improvement—should be integrated into community-level elderly health programs.

Future research is recommended to develop longitudinal studies that assess lifestyle changes and blood pressure trends over time, while also considering additional variables such as psychological stress, medication adherence, and social support, in order to gain a more comprehensive understanding of hypertension dynamics in the elderly population.

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