

Dietary Patterns are Significantly Associated with Hypertension Among Older Adults

Eka SR Sihombing¹, Nur Masdalifah¹, Amanda Faradihita¹, Christian Rayando Butar-butur¹, Wandha¹

¹Faculty of Health, Universitas Efarina, Pematangsiantar, Indonesia

Correspondence: **Amanda Faradihita**: Jl. Sudirman No. 1, Pematangsiantar, Sumatera Utara, Indonesia; amandafaradhita829@gmail.com

ABSTRACT

Hypertension remains a major public health concern among older adults, particularly in low- and middle-income settings where lifestyle factors such as dietary patterns contribute substantially to disease burden. This study aimed to determine the relationship between dietary patterns and the occurrence of hypertension among older adults in the working area of BP Nauli Health Center, Pematangsiantar, in 2024. This study employed a quantitative analytic observational design using an ex post facto approach. The research was conducted from May to August 2024. A total of 2,813 older adults constituted the study population, from which 107 respondents were selected using purposive sampling. Dietary patterns were assessed based on frequency, type, and quantity of food consumed, while hypertension status was classified according to WHO criteria. Data were analyzed using descriptive statistics and Spearman's rho correlation test. More than half of the respondents (52.3%) exhibited poor dietary patterns. Hypertension Grade 2 was more prevalent (63.6%) than Grade 1 (36.4%). Cross-tabulation showed that respondents with poor dietary patterns had a higher proportion of Grade 2 hypertension (60.3%). Bivariate analysis using Spearman's rho revealed a significant relationship between dietary patterns and hypertension ($p = 0.03$; $\alpha = 0.05$), indicating that poorer dietary patterns were associated with higher hypertension severity. In conclusion, dietary patterns are significantly associated with hypertension among older adults. These findings highlight the importance of improving nutritional behavior as part of community-based hypertension prevention and control strategies.

Keywords: dietary pattern; hypertension; older adults

INTRODUCTION

Hypertension has emerged as one of the most pressing global health challenges, affecting populations across socioeconomic and demographic boundaries. The World Health Organization (WHO, 2023) defines hypertension as a persistent elevation of blood pressure, specifically systolic pressure equal to or exceeding 140 mmHg or diastolic pressure equal to or exceeding 90 mmHg. This chronic elevation forces the heart to exert greater effort in circulating blood throughout the body, gradually imposing strain on the cardiovascular system and increasing the likelihood of severe complications such as stroke, heart failure, and premature mortality [1].

Globally, hypertension continues to rise at an alarming rate. WHO estimates that 1.28 billion adults aged 30–79 years are currently living with hypertension, with the majority residing in low- and middle-income countries. A substantial proportion of these individuals remain undiagnosed, underscoring persistent gaps in screening, awareness, and access to care. Despite ongoing public health initiatives, four out of five people with hypertension still do not receive adequate treatment. WHO projects that if countries successfully expand hypertension care coverage, millions of deaths could be prevented over the coming decades. Several nations have demonstrated that structured, nationwide programs can significantly improve blood pressure control, offering a model for broader global implementation [1].

In Indonesia, hypertension has become increasingly prevalent and is now recognized as a major contributor to morbidity and mortality. The Ministry of Health reports that one in three Indonesians suffers from hypertension, with prevalence rising steadily each year. National health surveys indicate a marked increase from 25.8% in 2013 to 34.1% in 2021 [2]. In North Sumatra Province, more than three million individuals were recorded as having hypertension in 2022, yet only a fraction received appropriate health services. Pematangsiantar, the setting of this study, reported nearly ten thousand cases, reflecting a significant burden at the community level [30].

At the local health facility level, the upward trend is even more apparent. BP Nauli Health Center has documented a consistent increase in hypertension cases over the past four years, rising from 281 cases in 2020 to 937 cases in 2023. This pattern suggests that hypertension is not only a widespread national issue but also a growing concern within smaller communities, where early detection and preventive strategies are often limited.

Dietary patterns represent one of the most influential modifiable risk factors associated with hypertension. International and national data indicate that many individuals, including older adults, exhibit inadequate dietary habits; such as skipping meals, consuming excessive sodium and processed foods, and reducing portion sizes. In North Sumatra and Simalungun District, the prevalence of improper dietary patterns among adults and older adults remains notable. These behaviors, combined with modern dietary trends, contribute significantly to the rising incidence of hypertension. Observations at BP Nauli Health Center further reveal variations in nutritional status among older adults, alongside common practices such as skipping breakfast and reducing meal frequency, which may exacerbate vulnerability to hypertension.

Given the increasing burden of hypertension and the evident role of dietary patterns in shaping health outcomes, it becomes essential to explore how eating behaviors influence the occurrence of hypertension among older adults in this specific community setting. Understanding this relationship is expected to provide valuable insights for developing targeted interventions and strengthening preventive health strategies at the primary care level. Main objective of the study was to determine the relationship between dietary patterns and hypertension among older adults in the working area of BP Nauli Health Center, Pematangsiantar, in 2024.

METHODS

This study was conducted in the working area of BP Nauli Health Center, Pematangsiantar, a primary healthcare facility serving a diverse older-adult population. Data collection took place over a four-month period, from May to August 2024, allowing sufficient time for recruitment, assessment, and verification of respondent information. The research employed a quantitative analytic observational design using an ex post facto approach [4]. Ex post facto research is intended to identify potential causal relationships by examining phenomena that have already occurred, without manipulating the independent variable [5]. In this context, the study sought to explore how dietary patterns, already established among older adults were associated with the occurrence of hypertension. The design allowed simultaneous observation of the independent variable (dietary pattern) and the dependent variable (hypertension status) as they existed naturally within the population.

The study population consisted of 2,813 older adults residing in the working area of BP Nauli Health Center. Recruitment followed a purposive sampling technique, which selects participants based on predefined inclusion criteria relevant to the research objectives. Using the purposive sampling formula, the calculated sample size was 107 respondents, representing the minimum number required to ensure adequate analytical power. Eligible participants were approached through community health outreach activities and routine elderly health service sessions, where the researcher provided explanations regarding the study purpose, procedures, and voluntary participation.

The study involved two primary variables:

- 1) Independent variable: dietary pattern, operationalized through three components: (1) quantity of food consumed, (2) types of food consumed, and (3) frequency of food intake. these components were measured using a structured dietary assessment instrument adapted for older adults, capturing habitual eating behaviors over a defined period.
- 2) Dependent variable: hypertension status, determined through blood pressure measurements conducted by trained health personnel using standardized sphygmomanometers. Hypertension was classified according to WHO criteria (systolic ≥ 140 mmHg and/or diastolic ≥ 90 mmHg).

All instruments used in the study adhered to standard operational procedures to ensure accuracy and reliability. Collected data were processed through several stages: coding, tabulation, and entry into statistical software [4]. Descriptive statistics were used to summarize respondent characteristics and variable distributions [6,7]. Inferential analysis was then performed to examine the relationship between dietary patterns and hypertension [8,9].

RESULTS

The distribution in Table 1 shows that the largest proportion of respondents were aged 60–65 years (51.4%). Most respondents were male (56.1%). In terms of education, the highest proportion had completed elementary school (33.6%). Regarding occupation, the largest group were entrepreneurs (24.3%). Most respondents had an income below the regional minimum wage (UMR), accounting for 72.0%, with the UMR in Pematangsiantar being IDR 2,809,915.

Table 2 indicates that the highest number of older adults with hypertension were in the 60–65-year age group, particularly those with Grade 2 hypertension (41 respondents; 60.3%). Table 3 shows that hypertension was more prevalent among male respondents, with 38 men (55.9%) experiencing Grade 2 hypertension. Based on Table 4, the highest proportion of Grade 1 hypertension occurred among respondents who had completed elementary school (48.7%). Table 5 shows that the highest proportion of Grade 2 hypertension occurred among entrepreneurs (23.5%). Based on Table 6, respondents with income below the minimum wage had the highest proportion of Grade 2 hypertension (67.6%).

Based on Table 7, rice was consumed daily by all respondents (100%). Eggs were the most frequently consumed protein source (39.3%). Fried snacks were the most frequently consumed fat source (20.6%). Vegetables were the most frequently consumed fiber source (42.1%). More than half of the respondents (52.3%) had poor dietary patterns (Table 8). Based on Table 9, grade 2 hypertension was more prevalent (63.6%) than Grade 1 (36.4%). Based on Table 10, respondents with poor dietary patterns had a higher proportion of grade 2 hypertension (60.3%).

Table 1. Distribution of demographic characteristics of respondents

Demographic characteristics	Frequency	Percentage
Age		
60–65 years	55	51.4
66–70 years	24	22.4
71–75 years	17	15.8
76–80 years	3	2.8
81–85 years	4	3.7
>85 years	4	3.7
Sex		
Male	60	56.1
Female	47	43.9
Education		
No schooling	1	0.9
Did not complete elementary school	10	9.3
Completed elementary school	36	33.6
Completed junior high school	22	20.6
Completed senior high school	18	16.8
Higher education	20	18.7
Occupation		
Unemployed	9	8.4
Housewife	15	14.0
Entrepreneur	26	24.3
Retired civil servant/military	15	14.0
Civil servant/employee	5	4.7
Farmer/laborer	24	22.4
Private employee	13	12.1
Income		
Above minimum wage	30	28.0
Below minimum wage	77	72.0

Table 2. Hypertension status by age group (n = 107)

Age group	Grade 1 hypertension	Grade 2 hypertension
60–65 years	14 (35.9%)	41 (60.3%)
66–70 years	8 (20.5%)	17 (25.0%)
71–75 years	10 (26.6%)	6
76–80 years	2 (5.1%)	–
81–85 years	2 (5.1%)	–
>85 years	3 (7.7%)	–

Table 3. Hypertension status by sex (n = 107)

Sex	Grade 1 hypertension	Grade 2 hypertension
Male	22 (56.4%)	38 (55.9%)
Female	17 (43.6%)	30 (44.1%)

Table 4. Hypertension status by educational level (n = 107)

Education Level	Grade 1 hypertension	Grade 2 hypertension
No schooling	0 (0.0%)	1 (1.5%)
Did not complete school	4 (10.3%)	6 (8.8%)
Completed elementary school	19 (48.7%)	17 (25.0%)
Completed junior high school	6 (15.4%)	16 (23.5%)
Completed senior high school	5 (12.8%)	13 (19.1%)
Higher education	5 (12.8%)	15 (22.1%)

Table 5. Hypertension status by occupation (n = 107)

Occupation	Grade 1 hypertension	Grade 2 hypertension
Unemployed	3 (7.7%)	6 (8.8%)
Housewife	6 (15.4%)	9 (13.2%)
Entrepreneur	10 (25.6%)	16 (23.5%)
Retired civil servant/military	4 (10.3%)	11 (16.2%)
Civil servant/employee	1 (2.6%)	4 (5.9%)
Farmer/laborer	12 (30.8%)	12 (17.6%)
Private employee	3 (7.7%)	10 (14.7%)

The Spearman's rho test ($p = 0.03 < \alpha = 0.05$) indicated a significant relationship between dietary patterns and hypertension among older adults in the working area of BP Nauli Health Center. Thus, H_0 was rejected, confirming that dietary patterns are statistically associated with hypertension status (Table 11).

Table 6. Hypertension status by income level (n = 107)

Income level	Grade 1 hypertension	Grade 2 hypertension
Above minimum wage	8 (20.5%)	22 (32.4%)
Below minimum wage	31 (79.5%)	46 (67.6%)

Table 7. Frequency of food consumption among older adults (n = 107)

Food type	Often (>1 times/day)	Often (4-6 times/week)	Rarely (1-3 times/week)	Never
Carbohydrate sources				
Rice	107 (100%)	0	0	0
Cassava	5 (4.7%)	2 (1.9%)	29 (27.1%)	71 (66.4%)
Sweet potato	6 (5.6%)	0	14 (13.1%)	87 (81.3%)
Bread	14 (13.1%)	19 (17.8%)	0	74 (69.2%)
Corn	1 (0.9%)	5 (4.7%)	25 (23.4%)	76 (71.0%)
Noodles	7 (6.5%)	18 (16.8%)	51 (47.7%)	31 (29.0%)
Protein sources				
Beef	1 (0.9%)	0	7 (6.5%)	99 (92.5%)
Chicken	6 (5.6%)	23 (21.5%)	35 (32.7%)	43 (40.2%)
Goat meat	3 (2.8%)	12 (11.2%)	32 (29.9%)	60 (56.1%)
Eggs	42 (39.3%)	24 (22.4%)	30 (28.0%)	11 (10.3%)
Fresh fish	33 (30.8%)	12 (11.2%)	30 (28.0%)	32 (29.9%)
Tofu/tempeh	21 (19.6%)	13 (12.1%)	27 (25.2%)	46 (43.0%)
Nuts	11 (10.3%)	5 (4.7%)	41 (38.3%)	50 (46.7%)
Fat sources				
Full-cream milk	1 (0.9%)	1 (0.9%)	2 (1.9%)	103 (96.3%)
Cheese	0	0	1 (0.9%)	106 (99.1%)
Coconut milk	10 (9.3%)	14 (13.1%)	32 (29.9%)	51 (47.7%)
Fast food	12 (11.2%)	1 (0.9%)	29 (27.1%)	65 (60.7%)
Soft drinks	2 (1.9%)	0	9 (8.4%)	96 (89.7%)
Fried snacks	22 (20.6%)	7 (6.5%)	47 (43.9%)	31 (29.0%)
Fiber sources				
Vegetables	45 (42.1%)	10 (9.3%)	32 (29.9%)	20 (18.7%)
Fruits	16 (15.0%)	7 (6.5%)	33 (30.2%)	51 (47.7%)

DISCUSSION

Dietary patterns among older adults

The findings of this study demonstrate that most older adults in the working area of BP Nauli Health Center exhibit poor dietary patterns, with 56 respondents (52.3%) categorized as having inadequate eating behaviors, compared with 51 respondents (47.7%) who demonstrated good dietary patterns. As stated in the attached document, *"the majority of the findings indicate poor dietary patterns among older adults"*. This pattern reflects the high proportion of respondents whose dietary questionnaire scores fell within the "poor" category.

These results are consistent with Syahroni [2021], who reported that poor dietary patterns are associated with insufficient intake of carbohydrates, proteins, fats, and fiber, as well as limited knowledge and inadequate engagement in healthy behaviors [10]. Hamzah [2021] similarly found that 67.7% of respondents had poor dietary patterns, reinforcing the widespread nature of unhealthy eating habits among older adults [11].

Dietary pattern refers to a structured approach to healthy eating, encompassing the regulation of food quantity, food type, and meal timing to maintain health [12]. Dietary modification is recognized as a non-pharmacological strategy for managing hypertension, offering a safer alternative to long-term antihypertensive medication use, which may lead to dependency [13].

Food selection among hypertensive patients is influenced by several factors, including food type and portion size. Recommended dietary components include rice, vegetables, protein sources, fruits, and milk, while sodium-rich foods should be avoided. Elivia [2022] found that hypertension prevalence was higher among individuals who frequently consumed fatty foods [14]. Carsilah [2024] further emphasized that more than 80% of respondents were unaware of the importance of vegetables, fruits, unsaturated oils, and reduced daily food intake in preventing hypertension [15].

The researcher assumes that poor dietary patterns among older adults in BP Nauli Health Center are largely due to unbalanced food intake. The document notes that *"respondents almost every day consumed only rice, noodles, and eggs because many older adults live alone or only"*

Table 8. Dietary patterns among older adults

Dietary pattern	Frequency	Percentage
Good	51	47.7
Poor	56	52.3

Table 9. Hypertension status among older adults

Hypertension status	Frequency	Percentage
Grade 1 hypertension	39	36.4
Grade 2 hypertension	68	63.6

Table 10. Cross-tabulation of dietary patterns and hypertension

Dietary pattern	Grade 1 hypertension	Grade 2 hypertension
Good	24 (61.5%)	27 (39.7%)
Poor	15 (38.5%)	41 (60.3%)

Table 11. Relationship between dietary patterns and hypertension

Variable	p-value	α (5%)	n
Dietary pattern vs. hypertension	0.03	0.05	107

with their spouse". Limited access to diverse food sources, particularly fats such as milk, cheese, coconut milk, fast food, and soft drinks, further contributes to inadequate dietary variety.

Blood pressure status among older adults

The study found that among 107 respondents, Grade 2 hypertension was more prevalent (68 respondents; 63.6%) than Grade 1 hypertension (39 respondents; 36.4%). As stated in the document, *"older adults most frequently experienced Grade 2 hypertension"*. Physiologically, blood pressure tends to increase with age due to arterial stiffness and reduced vascular elasticity, particularly in individuals with atherosclerosis. Fadillah [2020] noted that blood pressure is generally low during adolescence but increases significantly in adulthood and older age [16]. Latuamury [2020] added that arterial thickening and loss of elasticity contribute to elevated blood pressure [17].

Hypertension is a chronic condition requiring lifelong monitoring. Risk factors that cannot be modified include race, age, family history, and sex [18]. Latuamury [17] also identified age, heredity, education, and physical activity as contributors to hypertension. The researcher assumes that the high prevalence of Grade 2 hypertension in Puskesmas BP Nauli is influenced by demographic and socioeconomic factors such as age, sex, education, occupation, and income. The document states that *"most respondents had only completed elementary school and did not know the causes, symptoms, or management of hypertension"*. Additionally, many respondents reported limited financial capacity to purchase adequate food supplies, further exacerbating hypertension risk.

Relationship between dietary patterns and hypertension

Cross-tabulation analysis revealed that respondents with poor dietary patterns were more likely to experience Grade 2 hypertension (41 respondents; 60.3%). Conversely, those with good dietary patterns were more likely to have Grade 1 hypertension (24 respondents; 61.5%). As stated in the document, *"there is a relationship between dietary patterns and hypertension"*. The Spearman's rho test confirmed a statistically significant relationship between dietary patterns and hypertension ($p = 0.03 < \alpha = 0.05$), indicating that poorer dietary patterns are associated with higher hypertension severity.

These findings are consistent with Morika [2021], who reported a significant association between dietary patterns and hypertension ($p = 0.004$) [19]. Latuamury [17] also found that consumption of fatty and salty foods, such as meat, fried foods, salted fish, and coconut milk contributed to increased blood pressure. The Food Frequency Questionnaire (FFQ) used in this study is a semi-quantitative method that estimates nutrient intake based on consumption frequency and portion size [20]. FFQ is advantageous due to its simplicity, low cost, and ability to capture habitual dietary patterns [21].

The researcher assumes that poor dietary patterns among older adults in Puskesmas BP Nauli are influenced by irregular food intake, limited access to diverse food sources, and lack of physical activity. The document notes that *"most older adults did not engage in physical activity such as exercise; they only sat at home and drank coffee"*. This sedentary lifestyle likely contributes to increased blood pressure.

CONCLUSION

The study demonstrates that poor dietary patterns are common among older adults in the working area of Puskesmas BP Nauli and are significantly associated with higher severity of hypertension. Most respondents exhibited inadequate eating behaviors and a predominance of Grade 2 hypertension, indicating that unbalanced food intake, limited nutritional variety, and low physical activity contribute meaningfully to elevated blood pressure in this population.

Ethical consideration, competing interest and source of funding

- This study adhered to established ethical principles for research involving human participants. Prior to data collection, respondents were informed about the study objectives, procedures, potential risks, and their rights, including voluntary participation and confidentiality of personal information. Written informed consent was obtained from all participants. The study protocol was reviewed and approved by the relevant institutional ethics committee, ensuring compliance with ethical standards in public health research.
- There is no conflict of interest related to this publication.
- Source of funding is authors.

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