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Obesity, dietary diversity, and hypertension among posyandu attended child-bearing age women in Bandung

Widya Astuti[1]*, As Syaffa Amalia Adha[2], Nuri Anggraeni[1]

Abstract

Purpose: This study explores the relationship between nutritional status and dietary diversity and the incidence of prehypertension and hypertension in women of reproductive age in Baleendah, Bandung Regency. **Methods:** The cross-sectional design, with primary data, was conducted from August to September 2023 in Baleendah Village, Bandung Regency, Indonesia. The study subjects were 50 women aged 15-49 years who registered at the Posyandu, had children aged 0-23 months, and had a history of hypertension, with the exclusion criteria being pregnant women. Nutritional status was measured using body weight with a digital scale and height with a SAGA multifunction tool. Food consumption data was collected through 24-hour dietary recall, and eating was assessed using a food frequency questionnaire (FFQ). Blood pressure was measured using a blood pressure monitor. The Minimum Dietary Diversity for Women (MDD-W) instrument measures dietary diversity diversity. The relationship between hypertension status and nutrient intake was analyzed using Spearman correlation tests applied due to non-normally distributed data. **Results:** There is a significant correlation between nutritional status and the incidence of prehypertension and hypertension in women of reproductive age (*p-value*=0.045). However, there is no significant correlation between dietary diversity and the incidence of prehypertension and hypertension in women of reproductive age (*p-value*=0.853). **Conclusion:** This study found a significant correlation between nutritional status, particularly obesity, and the incidence of prehypertension and hypertension in women of reproductive age, while dietary diversity showed no significant correlation. Economic and educational factors also played a role, with lower-income and less-educated respondents being more prone to hypertension. High consumption of fried snacks and high-sodium foods like salted fish and caffeine were associated with an increased risk of hypertension.

Keywords: dietary diversity; hypertension; nutrition education; posyandu; obesity; women of childbearing age

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[1]Nutrition Program, Faculty of Sport and Health Education, Universitas Pendidikan Indonesia, Bandung, Indonesia

[2]Community Nutrition Departement, Faculty of Human Ecology, IPB University, Bogor, Indonesia

***Correspondence:**
widyaastuti@upi.edu

INTRODUCTION

Hypertension is one of the significant causes of death worldwide, with over 9 million deaths associated with hypertension [1]. It is estimated that by 2025, the global population of hypertensive individuals will reach 1.5 billion. Southeast Asia is one of the regions with a high incidence of hypertension, with a prevalence of 36.6% in 2020 [2]. According to the data, in 2018, approximately one in three adults in Southeast Asia was diagnosed with hypertension, leading to an estimated 1.5 million hypertension-related deaths annually [3]. Indonesia is a country in Southeast Asia with a significantly high prevalence of hypertension. Based on the Riskesdas 2018 data, the prevalence of hypertension in Indonesia reached 34.1%, with West Java being the second-highest province at 39.6%. Other data also shows the average prevalence of women aged 15-49 years old who experience obesity and hypertension is 22.5% and 23.3%, respectively [4]. In 2020, the total number of hypertensive individuals in West Java was 1,956,417. In 2023, a total of 280.833 women aged ⩽15 years old in Bandung District suffered from hypertension [5].

Hypertension is a circulatory system disorder that causes an increase in blood pressure above typical values. Individuals are hypertensive if their systolic blood pressure is ≥ 140 mmHg and diastolic blood pressure is ≥ 90 mmHg [6]. Hypertension can occur in various demographic groups, including women of childbearing age. Riskesdas data shows that women above 18 years old in Indonesia had a hypertension prevalence of 36.9% in 2018. Several factors contribute to hypertension in women of childbearing age, including the use of hormonal contraceptives, which have been proven to increase the risk of hypertension [7]. Besides, family history can also increase the risk of hypertension in women of childbearing age. A study by [8] revealed that women with a family history of hypertension are 3.15 times more likely to have hypertension than those without a family history.

Additionally, obesity is a contributing factor; women with excess body weight are at a higher risk of hypertension than those with normal weight at the same age [9]. Obesity significantly increases the risk of hypertension among women aged 20-44. Women with obesity were 4-6 times more likely to develop hypertension compared to those with normal weight [10,11]. Other factors influencing hypertension in women of childbearing age include physical activity and diet quality [12].

According to research in 2021, there is a connection between dietary habits and hypertension [13]. Furthermore, another study shows that individuals with poor nutritional habits are 4.31 times more likely to develop hypertension than those with good dietary patterns [14]. One example is an unhealthy diet pattern, such as an unbalanced food intake. Excessive fat consumption can increase body fat levels, increasing weight gain and volume. This increased blood volume can also lead to elevated pressure in the blood vessels [15].

Two methods can be used to manage hypertension: pharmacological and non-pharmacological [16]. Non-pharmacological factors that can be changed include lifestyle components such as dietary patterns, sleep patterns, and smoking habits. Individuals with hypertension should pay attention to their dietary patterns, as diet quality is a controllable factor [17]. A good diet consisting of nutritionally balanced foods and sufficient vitamins and minerals has been proven to reduce the risk of hypertension [18].

Regarding the gaps and novelty of this research, among the gaps is the lack of integrated data; many studies have focused on only one factor, such as obesity or hypertension, without considering the holistic impact of dietary diversity. Other gaps related to this study are geographical and cultural context. Many studies focus on specific populations, particularly in developed countries. However, the results may not necessarily apply to populations in developing countries or those with different dietary patterns and food access. Research is scarce in regions with cultural diversity and limited food access. The novelty of this research is its focus on women of childbearing age. This research places a special emphasis on women of childbearing age, vulnerable groups in terms of both reproductive health and long-term well-being. By understanding the relationship between these three factors, the finding of this research can provide better guidance tailored specifically for women of childbearing age.

METHODS

The design of this research is a cross-sectional study using primary data. The research was conducted from August until September 2023 in Baleendah Village, Bandung Regency, Indonesia. The subjects in this study were women aged 15-49 (years). Subject inclusion criteria were registered as a member of Posyandu in Baleendah village, have children aged 0-23 (months), and have a history of hypertension. At the same time, subject exclusion criteria were not in a state of pregnancy. The number of samples was 50 subjects, based on inclusion and exclusion.

The calculation of the number of subjects is as follows. The data that describe the subject's characteristics are age, maternal education, job, and income. Data on body weight and height were taken to determine nutritional status. Body weight data was measured using a digital weight scale, and height was measured using the SAGA multifunction. Categorized nutritional status refers to MoH (2020), divided into four categories: underweight (<18.5), normal (18.5-22.9), overweight (23-25.9), and obese (25-29.9). Other data collected in this study was blood pressure. The data measured systolic and diastolic using an OMRON blood pressure monitor and divided into four categories: normal (systolic <120 mmHg; diastolic <80 mmHg), prehypertension (systolic<120-139 mmHg; diastolic 80-89 mmHg), hypertension stage 1 (systolic-140-159 mmHg; diastolic 90-99 mmHg), and hypertension stage II (systolic 160 mmHg; diastolic 100mmHg) refers to JNC-8.

The instrument for measuring dietary diversity is the Minimum Dietary Diversity for Women (MDDW) questionnaire which consists of 10 food group indicators including (1-Grains, white roots and tubers, and plantains, 2-Pulses, 3- Nuts and seeds, 4-Dairy, 5-Meat, poultry and fish, 6-Eggs, 7-Dark green leafy vegetables (DGLV), 8-Other vitamin A-rich fruits and vegetables, 9-Other vegetables, 10-Other fruits. It is calculated by giving one score for each food group consumed the previous day and summing them up to determine the number of groups consumed by women of childbearing age. The food is considered consumed and scored if it reaches the minimum consumption (15 grams). If the respondents consumed at least five of ten defined food groups, it was categorized as a diverse diet, while those who consumed less than five food groups were classified as a non-diverse diet.

Individual consumption was obtained through a 24-hour food recall. Meanwhile, eating habits were known through a food-frequency questionnaire (FFQ). The subject's blood pressure was measured using a blood pressure meter. The relationship test was carried out on hypertension status and nutrition intake using SPSS 26. The relationship test used was the Spearman correlation test because the data was not normally distributed. If the test results show a p-value <0.005, then it is stated that there is a significant relationship. Ethical approvals were issued by The Medical and Health Research Ethics Committee (Non-medical) Muhammadiyah University of Prof. Dr. Hamka.

RESULTS

Based on the research results, the average age of respondents was 26 years, and the majority were homemakers who did not work at 84%. Most (90%) have basic education or high school. More than 86% of respondents earned an income of less than IDR 3,000,000 per month.

Table 1. Characteristics of women childbearing age at Baleendah Village, Bandung District (n=50)

Characteristics subject	n	%
Age	26.9 ± 6.2	
Maternal education		
Basic education	45	90
Higher education	5	10
Job		
Does not work	42	8
Work	8	16
Income		
≥Rp3.000.000	7	14
≤Rp3.000.000	43	86

The average BMI of 50 subjects was 25.5 kg/m^2—meanwhile, average systolic and diastolic based on the results measured 118.2 mmHg and 81.4 mmHg, respectively. The results showed that the majority of WRA who were classified as pre-hypertensive had normal nutritional status (32%), followed by obesity at 10%, and the others were thin and overweight at 12%. Meanwhile, in the hypertension group, respondents were dominated by obese nutritional status (14%). The results of comparison tests using Mann Whitney showed a significant difference between the nutritional status of pre-hypertensive and hypertensive sufferers.

Dietary diversity was measured using the MDD-W (Minimum Dietary Diversity for Women) instrument. The two groups of prehypertension and hypertension are dominated by respondents whose food consumption is not diverse. The average score MDD-W in this study was 4.4. In prehypertension, 42% were classified as non-diverse, while 34% were classified as diverse. Meanwhile, for hypertension sufferers, food diversity is not much different between non-diversified and diverse, 14% and 10%. The tests showed no significant difference between the dietary diversity of prehypertension and hypertension sufferers, possibly due to the lower sample size.

Table 2. Results of comparison tests on nutritional status and dietary diversity score in the hypertension category

Variable	Women childbearing age		p-value*
	Prehypertension	Hypertension	
	n (%)	n (%)	
Nutritional status			
Thin	6 (12)	1 (2)	0.045
Normal	16 (32)	2 (4)	
Overweight	6 (12)	2 (4)	
Obese	10 (20)	7 (14)	
Dietary diversity score			
Non-diverse (MDD-W)	21 (42)	7 (14)	0.853
Diverse diet (MDD-W)	17 (34)	5 (10)	

*Mann-Whitney comparison test (significant if p-value<0.05)

The prehypertension group's most frequent staple food consumed in a month was rice, 72.6 and 75 times a month, respectively, or around 2 times per day. Generally, rice has become the leading staple food consumed by Indonesian people. The second most frequently consumed food was bread, followed by noodles. Sweet potato is a staple food that was rarely consumed (0.8 times/month) in prehypertensive women, while corn was consumed least frequently (1 time/month) in hypertensive sufferers. The egg was the most frequent animal-source food consumed by women with prehypertension and hypertension, 23.9 times/month and 22.6 times/month, respectively. Chicken meat was the second most frequently consumed by prehypertension sufferers (15 times/month).

On the other hand, hypertensive sufferers consume salted fish quite often (15.1 times/month), which is very different from pre-hypertensive sufferers, who only consume salted fish 4.3 times a month. The highest frequency of consumption of plant-based protein was tofu (21.9 times per month) in the prehypertension group.

Meanwhile, in the hypertension group, it was tempeh (32 times/month). Oncom (traditional fermented Indonesian food made with soybeans) was the most rarely consumed in both groups. We found that plant-based protein is consumed more often than animal-based protein. The snacks most frequently consumed by prehypertension sufferers were fried foods (12 times/month), meatballs (9.8 times/month), and *seblak* (5.2 times/month). In people with hypertension, fried food is also the snack most frequently consumed (21.8 times/month), followed by *seblak* (5.9 times/month) and meatballs (5.4 times/month). The highest frequency of drink consumption in a month is tea. The average tea consumption was higher in hypertension sufferers (31.7 times/month) compared to prehypertension (12.9 times/month). Coffee consumption was more significant (3.8 times/month) in the pre-hypertensive group than in the hypertensive group. In the pre-hypertensive group, carrots are the most frequently consumed vegetables (7.6 times/month), while in the hypertensive group, the average frequency consumption of cassava leaves is the highest, 8.8 times/month. Vegetables that are rarely consumed in both groups are eggplant and long beans. Papaya fruit is most often consumed by the hypertensive group (9.8 times/month), while for hypertension sufferers, it is bananas (6.2 times/month). Respondents rarely consume pineapples and strawberries, with the average consumption only being about once per month.

Table 3. Hypertension status and food types

Food types	Prehypertension	Hypertension
	Mean±SD	Mean±SD
Staple foods		
Rice	72.6±18.0	75.0±15.7
Potato	3.2±3.5	2.1±3.4
Cassava	4.4±15.2	8.5±25.7
Sweet potato	0.8±2.1	2.5±5.6
Corn	1.3±2.2	1.0±1.1
Noodle	8.9±11.0	6.8±8.0
Bread	10.4±11.5	12.5±16.9
Others	0.0±0.2	0.0±0.0
Animal-source protein		
Chicken	15.0±20.3	8.2±8.5
Beef	0.6±1.0	2.3±4.6
Goat meat	0.1±0.2	0.0±0.0
Marine fish	0.3±0.9	0.2±0.4
Fish brine	3.9±14.5	2.8±2.3
Freshwater fish	2.2±2.5	2.1±4.4
Salted fish	4.3±11.5	15.1±28.9
Milk	5.6±12.2	2.2±4.5
Egg	23.9±20.6	22.6±27.2
Sausage/nugget	7.1±14.6	1.0±1.4
Chicken liver/gizzard	3.3±4.6	2.3±2.5
Shrimp	0.4±1.5	0.2±0.4
Squid	0.4±1.0	0.5±0.7
Clam	0.2±0.7	0.4±1.2
Corned beef	0.5±2.0	0.1±0.3
Sardines	1.2±3.4	0.2±0.6
Plant-source protein		
Tofu	21.9±25.2	29.0±29.7
Tempe	19.3±25.9	32.0±33.7
Oncom	0.7±2.3	0.0±0.0
Nuts	0.9±1.6	3.4±8.7
Snacks		
Meatball	9.8±20.4	5.4±6.1
Chicken porridge	2.4±5.7	3.6±6.3
Gado-gado/ketoprak/ karedok [1]	0.7±1.3	1.1±2.3
Empek-empek [2]	0.3±1.4	0.1±0.3

Food types	Prehypertension	Hypertension
	Mean±SD	Mean±SD
Lontong sayur [3]	0.6±1.3	0.2±0.6
Dumplings	3.8±6.9	3.9±8.4
Chicken noodle	1.6±2.1	1.1±1.4
Fried food (tofu/tempe/banana /sweet potato/fritter)	12.4±17.0	21.8±27.5
Seblak[4]	5.2±8.2	5.9±8.7
Cilok/cireng/basreng[5]	4.7±8.2	2.6±3.1
Telur gulung[6]	2.6±8.2	1.0±3.5
Chips	4.1±7.1	4.7±5.9
Others		
Tea	12.9±26.5	1.7±52.8
Coffee	3.8±9.2	1.8±3.7
Carbonated water	0.1±0.3	2.5±8.7
Fruit flavored beverage	2.7±9.7	1.7±3.6
Powdered drink (pop ice, etc)	2.7±4.8	3.2±5.4
Vegetable		
Spinach	2.9±3.7	1.3±1.5
Water spinach	4.1±4.6	3.1±3.6
Pokcoy/caisim	2.9±5.9	2.2±4.5
Carrot	7.6±6.4	8.2±8.1
Cabbage	3.9±5.0	5.6±9.0
Chayote	1.2±2.5	3.5±8.4
Eggplant	0.9±2.1	0.4±0.8
Beans	2.6±4.3	1.7±2.1
Mung bean sprout	2.2±3.8	3.3±4.7
Cassava leaves	1.6±5.4	8.8±25.6
Yardlong bean	0.4±1.0	0.8±2.3
Broccoli	0.9±2.5	1.0±3.5
Fruits		
Guava	1.1±4.9	2.8±8.6
Papaya	5.6±7.9	9.8±10.9
Mango	2.3±5.9	2.8±4.2
Pineapple	0.2±0.7	0.1±0.3
Orange	4.0±6.6	4.0±3.7
Strawberry	0.6±2.0	1.0±2.5
Melon	4.6±7.9	5.8±11.4
Banana	6.2±11.4	8.8±13.0

1) vegetables with peanut sauce; 2) fish and flour-based; 3) rice and vegetables with coconut cream; 4) onion crackers with spicy sous); 5) snack base tapioca flour with chili powder; 6) rolled eggs filled with sauce

The intake of macronutrients, including energy, protein, fat, and carbohydrates, in hypertensive sufferers is higher than prehypertension. However, the Spearman correlation test results did not show any significant relationship between the intake of macro and micronutrients and the incidence of hypertension, where the p-value results for all nutrients were above 0.005. The energy adequacy rate was higher in the hypertension group (74.8%). Protein intake was adequate for pre-hypertensive and hypertensive groups, 81.2% and 96.6%, respectively. Intake of calcium was higher in the hypertensive group compared to pre-hypertensive group. However, the adequacy rates were far below the required need (41.4% in prehypertension and 43.3% in hypertension). The number of respondents consuming milk and other dairy foods that are primary calcium sources was low. On the contrary, iron intake was higher in the pre-hypertensive group (77.9%), and it can be said that it has already met the required rate. This also goes with Vitamin C, where the prehypertensive group consumed significantly higher food sources of Vitamin C with a rate of 93.6%, and the hypertension group was only 38.2% and considered a deficit. Sodium intake was higher in the hypertensive group (62.9%) than in the pre-hypertensive group (56.8%).

Table 4. The correlation between hypertension status and nutrition intake

Nutrition intakes	Prehypertension	Hypertension	*p-value	r
	Mean±SD (%)	Mean±SD (%)		
Energy (kcal)	1557 ± 596.9 (70.6)	1642 ± 687.4 (74.8)	0.75	0.04
Protein (g)	49.2 ± 24.1 (81.2)	58.1 ± 42.3 (96.6)	0.84	0.03
Fat (g)	41.2 ± 21.7 (63.7)	48.3 ± 35.6 (76.5)	0.94	0.01
Carbo-hydrate (g)	241.1 ± 95.9 (70.1)	245.1 ± 84.7 (71.0)	0.78	0.03
Calcium (mg)	418.28 ± 461.44 (41.4)	434.88 ± 344.77 (43.3)	0.96	-0.01
Iron (mg)	13.74 ± 12.06 (77.9)	12.57 ± 7.12 (70.6)	0.93	-0.01
Vitamin C (mg)	70.20 ± 261.99 (93.6)	28.69 ± 32.58 (38.2)	0.84	0.03
Sodium (mg)	855.01 ± 647.13 (56.8)	953.23 ± 963.55 (62.9)	0.87	-0.02

DISCUSSIONS

This study highlights the significant relationship between socioeconomic status, education level, and hypertension. A negative association between socioeconomic status and hypertension is observed in developed countries, whereas developing nations show the opposite trend [19]. Hypertension prevalence also varies based on regional economic conditions, with medium GDP per capita areas exhibiting the lowest prevalence [20]. Individuals with lower incomes often have limited purchasing power for diverse and nutritious food, potentially increasing their risk of hypertension [21,22]. Additionally, education plays a crucial role, as individuals with higher educational attainment demonstrate better health awareness and disease management capabilities [23,24]. In this study, 90% of participants had a basic education level, reinforcing the link between low education and hypertension risk.

From a public health perspective, the study underscores the importance of interventions to

improve dietary diversity and reduce obesity. Nutritional education, cooking workshops, and routine health screenings are essential to combat hypertension and obesity. Studies show educating women on dietary diversity can significantly lower obesity rates [25]. Cooking workshops encourage healthier food preparation, reducing reliance on processed foods known to contribute to hypertension [26]. Regular screenings at community health centers (Puskesmas) help monitor and prevent non-communicable diseases, supporting public health efforts [27]. Policy interventions, such as taxation on sugar-sweetened beverages and sodium reduction programs, have also effectively managed hypertension prevalence [28].

Understanding the relationship between dietary patterns and hypertension remains crucial for further research. While some studies found no significant association between dietary diversity and hypertension [29], others suggest a high-quality diet can lower disease risk [30]. This study shows that most respondents in both pre-hypertensive and hypertensive groups have a low Minimum Dietary Diversity for Women (MDD-W) score (≤ 5), suggesting nutrient deficiencies that may exacerbate hypertension risk [31]. Investigating specific dietary components, such as plant-based versus animal-based protein consumption, may provide deeper insights into effective dietary interventions [32]. Examining the role of staple food choices, including rice and high-sodium foods like salted fish, can enhance strategies for dietary improvements [33].

Raising awareness about choosing nutritious, diverse, and balanced meals is crucial, especially through educational media at Posyandu. To support this, community health cadres and nutrition extension workers (TPG) can create posters, flipcharts, and leaflets highlighting local foods that should be avoided. At the same time, collaboration between the health department and educational institutions is needed to involve students in mentoring activities. These students can assist cadres in educating the community on how to select healthy and balanced local food options.

The primary limitation of this study is the small sample size, which may not fully represent the broader population's prevalence of hypertension and obesity. Additionally, physical activity, a known risk factor for hypertension and obesity, was not included as a variable. Future research should explore the impact of food selection and processing methods on nutritional quality, particularly among women of reproductive age. Strengthening public health strategies through targeted nutritional education and intervention programs remains essential to improving dietary habits and preventing hypertension.

CONCLUSION

This study shows a significant correlation between nutritional status and the incidence of prehypertension and hypertension in women of reproductive age in Baleendah District, Bandung Regency. Women with obesity have a higher risk of developing hypertension. However, the study also found no significant relationship between dietary diversity and the incidence of prehypertension or hypertension. Most respondents in this study had a monotonous diet, with rice as the primary staple food, followed by bread and noodles. Economic and educational factors also influenced the incidence of hypertension, with low-income and basic-education respondents dominating the sample. Plant-based protein consumption was more frequent than animal-based protein. In addition, snacks such as fried foods and meatballs, as well as beverages like tea, were commonly consumed by the prehypertensive and hypertensive groups. High-sodium foods like salted fish and fried foods were identified as factors that could increase the risk of hypertension.

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