ASTEEC Conference Proceeding: Applied Science
2nd International Conference on Obstetricians Participating in Training for Innovative Measures to Advance Leadership 2025 (OPTIMAL 2025)
24 January 2025 (Online)

Effectiveness of DASH Diet on Blood Pressure, Sodium, Potassium, Calcium, and Magnesium Intake in Hypertension Patients at RSUD Palangka Raya

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Abstract. Hypertension is a condition in which blood pressure increases and requires intervention in diet management. Recommendations for giving the DASH diet (Dietary Approaches to Stop Hypertension) at the RSUD Palangka Raya have never been made. The research aimed to determine the effectiveness of the DASH diet on blood pressure, sodium, potassium, calcium, and magnesium intake in hypertensive patients at RSUD Palangka Raya. The research design is a Quasi-Experimental Design with a plan Posttest Control Group Design with 24 respondents selected based on inclusion criteria. Blood pressure data is obtained from the patient's medical record status during treatment. Data on sodium, potassium, calcium, and magnesium intake are obtained from the average results Recall 24 hours-, and food weighing converted into grams and analyzed with Nutrisurvey. Based on sample characteristics, the majority are 51-60 years old (33.3%), female (66.7%), elementary school/equivalent education level (58.3%), and given amlodipine 10 mg (50%). The results showed that blood pressure and sodium intake are not significantly different (p-value>0.05) in the low sodium diet and DASH diet groups so the DASH diet is not effective in reducing blood pressure and sodium intake compared to the low sodium diet while the intake of potassium, calcium, and magnesium is significantly different (p-value<0.05) in the low sodium diet and DASH diet groups so The DASH diet is effective in increasing potassium, calcium, and magnesium intake compared to a low sodium diet.

Keywords: Hypertension, DASH Diet, Blood Pressure, Intake

INTRODUCTION

Hypertension is a condition in which blood pressure chronically increases beyond normal limits. This situation can last for years without the person experiencing it knowing. Hypertension is often referred to as a "silent killer" because many hypertension sufferers are not aware of their condition, considering that hypertension usually does not show clear signs or symptoms (1). Hypertension is a serious global health problem. This condition is a major risk factor for cardiovascular diseases such as heart attack, heart failure, stroke, and kidney disease.

In 2019, ischemic heart disease and stroke were recorded as the two biggest causes of death in the world (2). Hypertension has a major influence on public health and efforts to prevent and control hypertension are very important to reduce the risk of serious health complications (3). One of the interventions carried out in efforts to prevent and control hypertension is diet management. So far, at the RSUD Palangka Raya, diet implementation for hypertensive patients has relied on a low-salt diet. Generally, these settings focus on the level of sodium consumed by the patient, with the amount of salt given limited according to the patient's health condition and the type of food on the diet list. A low-salt diet aims to reduce the buildup of salt and water in body tissues and reduce blood pressure in hypertension sufferers-, but often does not pay attention to the adequacy of important minerals such as potassium, calcium, and magnesium. A low-salt

diet is intended to help reduce the buildup of salt and water in body tissues and reduce blood pressure in hypertensive patients, without paying attention to the adequacy of minerals such as potassium, calcium, and magnesium. The reduction in patient blood pressure is more influenced by the provision of drug therapy and a low-salt diet as support (4).

Apart from a low-sodium diet, the diet recommended for hypertension patients is the DASH diet (Dietary Approaches to Stop Hypertension). The DASH diet is a diet that emphasizes increasing the consumption of fruit, and vegetables and the consumption of processed/low-fat dairy products with a lower intake of saturated fat, total fat, and cholesterol. The importance of consuming whole grains, fish, poultry, and nuts, as well as reducing consumption of red meat, sweet foods containing simple sugars, and low-salt drinks are also emphasized in the DASH diet (5). These foods are rich in potassium, calcium, magnesium, protein, and fiber, and low in sodium (4).

Currently, efforts to reduce blood pressure are recommended not only to pay attention to the sodium composition but also to the mineral composition of potassium, calcium, and magnesium, so it is necessary to provide the DASH diet. According to, based on a literature review of several literatures, the DASH diet applied to hypertensive patients has been proven to be effective in helping reduce systolic and diastolic blood pressure. This diet recommends increasing the consumption of fruit, and vegetables, as well as milk and low-fat dairy products, as well as limiting the intake of saturated fat and cholesterol, which can improve the condition of hypertension as well as improving diet, such as increasing the consumption of fruit and vegetables. Compliance with a diet aimed at lowering blood pressure is influenced by understanding the benefits of the DASH diet. Therefore, education and counseling regarding the DASH diet needs to continue to be carried out to increase compliance and implementation of this diet, to reduce the incidence of hypertension, which is a risk factor for degenerative diseases.

Based on the problems above, the author is interested in finding out the effectiveness of using the DASH diet on blood pressure, sodium, potassium, calcium, and magnesium intake in hypertensive patients at RSUD Palangka Raya.

METHODS

This research is conducted from August to October 2024 at RSUD Palangka Raya. This research is a quantitative experimental design as if experimental and uses the plan Post-test Control Group. Samples are taken by a technique of non-random sampling ie purposive sampling according to the researcher's criteria. Data on the number of hospitalized hypertensive patients is obtained from the RSUD Palangka Raya medical records. Data on diagnosis and drug therapy are obtained through medical record status. Sample characteristics including age, gender, education, and length of stay are obtained from the patient's medical record status. Blood pressure is obtained from the patient's medical record status during treatment. Blood pressure measurements are carried out by nurses in the room.

Data on sodium, potassium, calcium, and magnesium intake are the average amounts consumed in food, drinks, and infusions obtained from the results Recall 24 hours (for intake from outside the hospital) and food weighing (for intake from the hospital) while the patient is being treated.

Results data Recall 24 hours and food weighing converted into grams then analyzed by application Nutrisurvey, then averaged to determine the intake of sodium, potassium, calcium, and magnesium. If there are food ingredients that are not in the nutrisurvey application, the nutrients will be added manually using the food ingredient composition list, Fact Secret, or nutritional substances from the product label.

RESULTS AND DISCUSSION

Research on the effectiveness of giving the DASH diet on blood pressure, sodium, potassium, calcium, and magnesium intake in hypertensive patients at RSUD Palangka Raya with a total of 24 respondents, 12 people received a low sodium diet, and 12 people received the DASH diet. The data on the characteristics of respondents can be seen in the following table.

Table 1. Respondent Characteristics

Characteristics		Respondent			
		Low sodium Diet		Diet DASH	
		F	%	f	%
1.	**Age (years)**				
	31-40	-	-	2	16,7
	41-50	4	33,3	3	25
	51-60	5	41,7	4	33,3
	61-70	3	25	3	25
	Total	**12**	**100**	**12**	**100**
2.	**Gender**				
	Man	4	33,3	4	33,3
	Women	8	66,7	8	66,7
	Total	**12**	**100**		
3.	**Level of education**				
	Elementary School/Equivalent	2	16,7	7	58,3
	Middle School/Equivalent	-	-	1	8,3
	High School/Equivalent	8	66,7	3	25
	D3	1	8,3	1	8,3
	D4/S1	1	8,3	-	-
	Total	**12**	**100**		
4.	**Medication consumed**				
	Amlodipin 5 mg	5	41,7	2	16,7
	Amlodipin 10 mg	6	50	6	50
	Bisoprolol 2,5 mg	-	-	1	8,3
	Kandesartan 8 mg	1	8,3	2	16,7
	Kandesartan 16 mg	-		1	8,3
	Total	**12**	**100**	**12**	**100**
5.	**Long treatment days**				
	1 day	2	16,7	1	8,3
	2 days	3	25	2	16,7
	3 days	1	8,3	4	33,3
	4 days	3	25	4	33,3
	5 days	2	16,7	1	8,3
	6 days	1	8,3	-	-
	Total	**12**	**100**	**12**	**100**

Based on Table 1, the characteristics of the majority of respondents who received a low sodium diet are aged 51-60 years (41.7%) while the characteristics of the majority of respondents who received the DASH diet intervention are aged 51-60 years (33.3%). Elderly people are more susceptible to hypertension than young people. As you get older, body function will decrease. One of the changes that occurs is in the cardiovascular system, where hypertension is often found due to reduced elasticity of blood vessels, so blood vessels tend to narrow and cause an increase in blood pressure (7).

Based on Table 1, shows the characteristics of the majority of respondents who received a low sodium diet, namely female, 8 people (66.7%), as well as for the intervention with the DASH diet, the majority are female, 8 people (66.7%). This is in line with research conducted which states that there is a significant relationship between gender factors and the incidence of

hypertension in the elderly. Gender has a close relationship with the incidence of hypertension. In middle age, the prevalence of hypertension is higher in women, especially after menopause. Menopause is associated with an increase in blood pressure, which is caused by a decrease in levels of the hormone estrogen in women, even though this hormone previously played a role in protecting blood vessels from damage (9).

Based on Table 1, the majority of respondents' characteristics based on education are given on a low sodium diet, namely high school/equivalent education, 8 people (66.7%), and the DASH diet, namely elementary school/ equivalent, 7 people (58.3%). This is in line with research. There is a correlation between education level and gender and the incidence of hypertension in Jagalan Village, which is within the working area of Pucang Sawit Health Center, Surakarta. Education level influences the incidence of hypertension. Someone with a low level of education is susceptible to hypertension due to a lack of health knowledge, making it difficult to control their health problems. The low level of education in hypertensive patients has a major impact on their disease condition- because a lack of insight into health causes a way of thinking that is less effective in responding to and maintaining their health.

Based on Table 1, the majority of respondents' characteristics based on the drugs consumed on a low sodium diet are 6 people (50%) who are given 10 mg amlodipine, while on the DASH diet, there are 6 people (50%) who are also given 10 mg amlodipine. Some respondents received other types of medication such as amlodipine 5 mg, bisoprolol 2.5 mg, candesartan 8 mg, and candesartan 16 mg. Antihypertensive drugs are given to control the incidence of disease, complications, and death due to hypertension. Various clinical studies show that timely administration of antihypertensive drugs can reduce the incidence of stroke by 35-40%, myocardial infarction by 20-25%, and heart failure by more than 50% (11).

Based on Table 1, the majority of respondents on the low sodium diet are treated for 2 days for as many as 3 people (25%) and 4 days for as many as 3 people (25%) while the majority of respondents on the DASH diet are treated for 3 days as many as 4 people (33.3%) and 4 days. as many as 4 people (33.3%). LOS (Length of stay) is the duration of a patient's stay in the hospital, calculated from the time they enter until they leave the hospital. This duration is influenced by factors such as age, comorbidities, diagnosis, type of surgery, hypermetabolism, failure to reduce salt intake, and nutritional deficiencies. In hospitalized patients with hypertension accompanied by complications of other diseases, the duration of treatment is longer (13).

Interview results: DASH diet respondents liked the menu served, got fruit for 3 meals, and got snacks and milk every day. The remaining food intake from staple foods, animal side dishes, vegetable side dishes, vegetables, fruit, and snacks in the low sodium diet group is greater than in the DASH diet group. Food recall results: The low sodium diet group consumed more food from outside than the DASH diet intervention group. Based on the results of interviews with respondents on a low sodium diet, the lack of food intake is caused by still feeling sick, lack of appetite, taste of bland food, and more desire to consume snacks from staple foods.

Table 2. Data on average blood pressure and intake in patients on a low sodium diet and the DASH diet

Data	**Mean**	
	Low sodium Diet	**Diet DASH**
Blood Pressure		
Systolic	135,85 mmHg	130,46 mmHg
Diastolic	83,45 mmHg	83,28 mmHg
Sodium Intake	6047,63 mg	5732,84 mg
Potassium Intake	2084,47 mg	4217,39 mg
Calcium Intake	413,44 mg	1276,51 mg
Magnesium Intake	291,44 mg	630,37 mg

The results of the respondents' blood pressure measurements are obtained from blood pressure measurements after being given a low sodium diet and the DASH diet and then averaged to become the final blood pressure (posttest). Systolic blood pressure from a low-salt diet is 5.39 mmHg higher than the DASH diet, while diastolic blood pressure from a low-salt diet is 0.16 mmHg higher than the DASH diet. The data from the average systolic blood pressure on a low sodium diet or the DASH diet is included in the classification of high normal blood pressure (130-139 mmHg) while data from the average diastolic blood pressure on a low sodium diet or the DASH diet is included in the normal blood pressure classification. (80-84 mmHg).

The total sodium intake from food, drinks, and infusions from the DASH diet is 314.79 mg lower than the low-sodium diet. The DASH diet and low sodium diet both reduced respondents' sodium intake. The average low-sodium diet provided with sodium intake from food and drinks is 803.81 mg and the DASH diet average is 745.02 mg. Meanwhile, the average low sodium diet received 5243.82 mg of sodium intake from infusion and the DASH diet average is 4987.82 mg. Of the low sodium diet respondents, 1 person (8.33%) is given a low sodium diet II, and 11 people are given a low sodium diet III (91.67%). One of the risk factors for hypertension is excessive sodium consumption. Sodium is an important mineral that plays a role in maintaining fluid balance, regulating nerve and muscle action, and helping the secretion and absorption of nutrients in digestion. Reducing sodium intake is often associated with reduced systolic and diastolic blood pressure. Sodium is usually consumed together with chloride in the form of salt (sodium chloride)(14).

Potassium intake from food, drinks, and infusions on the DASH diet is 2132.92 mg greater than on a low-sodium diet. The average low-salt diet provided with potassium intake from food and drinks is 2032.41 mg and the DASH diet average is 4303.98 mg. Meanwhile, the average low-salt diet received 19.55 mg of potassium intake from infusion and the DASH diet average is 29.32 mg. High potassium intake can help lower blood pressure because it relieves tension in the walls of blood vessels which causes high blood pressure. By eliminating excess sodium through urine, consuming potassium from food also helps overcome the problem of high salt levels in the body (15).

Calcium intake from the DASH diet is 863.07 mg greater than the low-sodium diet. The average low sodium diet provided calcium intake from food and drinks of 405.92 mg and the average DASH diet provided 1265.24 mg. Meanwhile, the average low-salt diet received 7.52 mg of calcium intake from infusion and the DASH diet average is 11.27 mg. Calcium intake is found in many dairy products, eggs, meat, fish, as well as several types of vegetables and fruit. Calcium has a role in regulating blood pressure, including reducing the activity of the renin-angiotensin system, improving sodium and potassium balance, and inhibiting blood vessel constriction. If calcium intake is less than what the body needs, the parathyroid hormone will stimulate the release of calcium from the bones into the blood to maintain calcium balance in the blood (Nurmayanti and Kaswari, 2022).

Magnesium intake from the DASH diet is 338.93 mg greater than the low sodium diet. The recommended adequacy rate for the mineral magnesium for Indonesian people according to Indonesian Minister of Health Regulation no. 28 of 2019 for ages 30-80 years, both men and women, ranges from 320-360 mg/day. From the results, the average magnesium intake of respondents given the DASH diet met the recommended daily requirement, namely 630.37 mg. Magnesium can be found abundantly in foods such as grains, nuts, and green leafy vegetables, while meat, fruit, and dairy products have moderate magnesium content (Rahmawati et al., 2013).

Data Normality Test

Table 3. Normality Test

Variable		*Shapiro-Wilk Sig.*	Information
Systolic Blood Pressure	Low sodium Diet	0,894	Normal Distribution
	Diet DASH	0,297	Normal Distribution
Diastolic Blood Pressure	Low sodium Diet	0,126	Normal Distribution
	Diet DASH	0,466	Normal Distribution
Sodium Intake	Low sodium Diet	0,376	Normal Distribution
	Diet DASH	0,000	Non-Normal Distribution
Potassium Intake	Low sodium Diet	0,631	Normal Distribution
	Diet DASH	0,009	Non-Normal Distribution
Calcium Intake	Low sodium Diet	0,707	Normal Distribution
	Diet DASH	0,000	Non-Normal Distribution
Magnesium Intake	Low sodium Diet	0,281	Normal Distribution
	Diet DASH	0,378	Normal Distribution

3.1 Analysis of The Effectiveness of The DASH Diet on Blood Pressure

Test results T-test Independent on systolic blood pressure shows a p-value of 0.318 (>0.05). This shows that there is no difference in systolic blood pressure between the treatment group that is given additional DASH diet intervention and the control group that is only given low sodium diet intervention.

The tendency for systolic blood pressure to continue to increase until the age of 70-80 years, while diastolic blood pressure increases until the age of 50-60 years and then tends to stabilize or decrease slightly (Ramayulis 2010). Most of the decrease in blood pressure in patients is caused by various factors, such as the use of medication, reduced sodium intake due to recommended restrictions, and increased consumption of potassium, calcium, and magnesium. Other factors, such as stress levels, also affect blood pressure. Blood pressure can increase significantly during stress, but the effect is only temporary (Sutomo, 2009).

In line with the research results, shows that implementing the DASH diet can reduce blood pressure, which means that the DASH diet is useful for hypertension sufferers to regulate their diet so that it is more controlled and avoid complications that might occur if they do not follow a healthy diet.

Test results T-test Independent of diastolic blood pressure produces a p-value of 0.957 (>0.05). This shows that there is no difference in diastolic blood pressure between the group given additional intervention in the form of the DASH diet and the control group which is only given intervention in the form of a low-sodium diet.

Based on clinical research results, there is a reduction in blood pressure after being given the DASH diet intervention. Blood pressure can also be influenced by food intake, especially those related to potassium, sodium, fat, and cholesterol (Ramadani et al., 2017). This is in line with the nutritional composition based on the DASH diet recommendations which focus on reducing salt and saturated fat intake, as well as increasing consumption of foods rich in potassium, calcium, magnesium, and high fiber which can reduce blood pressure in hypertensive patients (NIH, 2006).

3.2 Analysis Of The Effectiveness Of The DASH Diet On Sodium Intake

Test results Mann Whitney on potassium intake produces a p-value of 0.419 (>0.05). This shows that there is no significant difference in sodium intake between the group given additional DASH diet intervention and the control group which is only given low sodium diet intervention. This research is in line with research conducted by those who conducted the test independent t-test The average sodium intake is around 2 weeks given the low sodium diet intervention and the

DASH diet in respondents aged between 40 - 80 years. The results showed that there is no significant difference between sodium intake before and after the intervention between the low-sodium diet group and the group given the DASH diet.

3.3 Analysis Of The Effectiveness Of Giving The DASH Diet On Potassium Intake

Test results Mann Whitney for potassium intake shows a p-value of 0.000 (<0.05). This means that there is a significant difference in potassium intake between the group that is given additional DASH diet intervention and the control group that is only given low sodium diet intervention. This research is in line with research, namely that there is a relationship between the habit of consuming foods high in sodium and foods high in potassium and blood pressure in elderly respondents. Potassium is a mineral that is useful for lowering or controlling blood pressure. Potassium also plays an important role in triggering the work of muscles and nerve nodes. In addition, high potassium levels can facilitate oxygen delivery to the brain and help balance fluids in the body. The ideal potassium intake is 4700 mg/day. Foods rich in potassium can be obtained from fruits and vegetables. Fruit such as bananas, oranges, melons, papaya, and vegetables such as spinach, kale, broccoli, carrots, potatoes, tomatoes, and sweet potatoes. This is under the nutritional recommendations of the DASH diet so that respondents who receive the DASH diet intervention will have their potassium intake fulfilled.

3.4 Analysis Of The Effectiveness Of The DASH Diet On Calcium Intake

Test results from Mann Whitney for calcium intake indicate a p-value of 0.000 (<0.05). This indicates that there is a significant difference in calcium intake between the group that received additional intervention in the form of the DASH diet and the control group that was only given intervention in the form of a low-sodium diet.

The results of this study are also in line with research and state that the structure of the DASH diet encourages the consumption of whole foods that naturally contain higher levels of calcium, such as green leafy vegetables and dairy products, compared to more restrictive low-salt diets that may not emphasize this food group.

3.5 Analysis Of The Effectiveness Of The DASH Diet On Magnesium Intake

Test results T-test Independent for magnesium intake produces a p-value of 0.000 (<0.05). This showed a significant difference in magnesium intake between the group that received additional DASH diet intervention and the control group that only received low sodium diet intervention.

These results are in line with research conducted by Etika and Apoina (2014) that there is a significant relationship between magnesium intake and the incidence of hypertension. Magnesium has been studied and found to be associated with hypertension due to its effect on vascular smooth muscle relaxation as well as its interaction with calcium. In addition, epidemiological studies show that intake of calcium, magnesium, fat, and alcohol contributes to increased blood pressure(26).

CONCLUSIONS

The Dietary Approaches to Stop Hypertension (DASH) diet has been shown to effectively increase the intake of essential minerals such as potassium, calcium, and magnesium, which play a crucial role in cardiovascular health and blood pressure regulation. However, when compared to a low-sodium diet, the DASH diet alone may not be as effective in significantly reducing blood pressure and sodium intake. This suggests that while the DASH diet offers numerous nutritional benefits, its impact on blood pressure control may be enhanced when combined with stricter sodium restriction. Future studies should further investigate the long-term effects of the DASH diet in different populations, explore strategies to optimize sodium reduction within the DASH framework, and assess its overall effectiveness in managing hypertension when integrated with other dietary and lifestyle interventions.

ACKNOWLEDGMENTS

The author would like to express his thanks to the Director of RSUD Palangka Raya who has given research permission, the health workers and nutritionists of RSUD Palangka Raya as well as all respondents who cooperated in this research.

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