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Excessive Sodium and Insufficient Potassium Consumption Can Elevate the Risk of Developing Hypertension

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ABSTRACT

Introduction. Physiologically, there are setbacks and weaknesses in body functions in the elderly. This can cause inadequate food intake or eating imbalances in the elderly. Increased blood pressure is influenced by many factors such as sodium and potassium intake and less potassium intake can increase blood pressure. The purpose of this study was to determine the relationship of sodium and potassium intake from food with blood pressure in the elderly in the community dr. Mohammad Hoesin Hospital. **Methods**. An observational-analytic study was conducted on 120 elderly people using a cross-sectional research design conducted in the elderly community of dr. Mohammad Hoesin Hospital in October-November 2019. The sample of this study were members of the elderly community aged over 60 years, present when the study was conducted, willing to become a respondent and signed an informed consent. Data was obtained through filling out food record questionnaires, food recall interviews, personal data interviews, and direct measurement of blood pressure and nutritional status. To meet the research objectives, data were analyzed by Chi-square test. **Results**. In this study, there were 120 elderly people consisting of 3 men and 117 women. There was a significant relationship between sodium and potassium intake and blood pressure (p=0,003 and p=0,0001). **Conclusion**. There is a significant relationship between sodium and potassium intake with blood pressure in the elderly.

1. Introduction

Hypertension is a condition where systolic blood pressure exceeds 140 mmHg and diastolic blood pressure exceeds 90 mmHg in two consecutive measurements with a five-minute interval in a sufficiently rested/relaxed state. Data from WHO in 2015 indicates that approximately 1.13 billion people worldwide suffer from hypertension. Risk factors for hypertension are divided into controllable factors such as age, gender, and family history (genetics), and uncontrollable factors such as obesity, physical activity, smoking, alcohol consumption, coffee consumption, stress, high sodium intake, and low potassium intake. [1,2]

The elderly have a declining and weakening body function. One of these is a decline in the sense of taste and smell. Aging correlates negatively with the number of taste buds, making it difficult for them to enjoy the aroma and taste of food A 70% decrease in saliva production will also cause a relatively dry mouth, which disrupts taste This can lead to insufficient food intake or an imbalanced diet in the elderly.[3,4]

Sodium is a component commonly consumed in the form of table salt. If its intake increases, the kidneys respond by increasing salt excretion in the urine. If the effort to excrete sodium exceeds the capacity, the kidneys will retain water, leading to an increase in intravascular volume. An increase in intravascular volume causes an increase in blood pressure. Meanwhile, potassium increases its concentration within intracellular fluid, drawing fluid from the extracellular fluid and lowering blood pressure. Potassium can lower blood pressure by acting as a diuretic, increasing sodium and fluid excretion.[5,6]

There are still contradictions in studies seeking a relationship between sodium and potassium intake and blood pressure in the elderly. Atun's (2014) research suggests a significant relationship between the increased ratio of sodium and potassium intake and hypertension incidents in the Sleman primary

health care. Zainuddin and Yunawati's (2018) research in Kendari states a relationship between sodium intake and increased blood pressure incidents in the elderly. Wahyuni, Widajanti, and Pradigdo's (2016) study in Semarang also suggests that potassium sufficiency level is a risk factor for hypertension. However, Jannah's (2013) research states no relationship between sodium and potassium intake, and the sodium-potassium intake ratio, with blood pressure in the Minangkabau ethnic group in Padang. Afifah's (2016) research in Bantul also claims that sodium and potassium intake is not significantly related to hypertension.[5–9] The scarcity of data in Palembang discussing sodium and potassium consumption in elderly diets and its relation to blood pressure is the rationale for conducting this research.

2. Methods

This research design is a cross-sectional study. The study sample comprises elderly individuals who are part of Dr. Mohammad Hoesin Hospital's elderly community. Inclusion criteria consist of (1) elderly individuals present at the community event during the study period and (2) willing to participate in the study and sign the informed consent form. Meanwhile exclusion criteria for this study are elderly individuals who smoke, consume coffee, and consume alcohol. The sampling technique utilized in this study is consecutive sampling.

Variables collected from the elderly are blood pressure, sodium intake, and potassium intake. Data was collected by using questionnaires through interviews with respondents to ascertain the characteristics of the respondents under study. Nutritional status data are acquired by measuring weight and height using scales and a stadiometer. Sodium and potassium intake data from food are obtained using estimated food records forms over three days through questionnaire methods and reconfirmed using food recall through interview methods. Blood pressure status is determined by directly measuring respondents' blood pressure using a standard sphygmomanometer and stethoscope. Data obtained from the data collection process are converted into tables and percentages, then processed using Statistical Package for Social Science (SPSS) version 24 software. Statistical analysis employed to identify the relationship between sodium and potassium intake and blood pressure utilizes the chi-square test. This research has been deemed ethically appropriate and approved for implementation by the Research Ethics Committee of Mohammad Hoesin Hospital and the Faculty of Medicine, University of Sriwijaya (No. 421/kepkrsmhfkunsri/2019).

3. Results

The total sample obtained from this study was 120 samples. The majority of respondents in this research were from the elderly population, predominantly female. with normal nutritional status and hypertension.

The daily sodium intake of respondents ranged from 106–6675 mg per day, with an average of 1225.55 mg/day. Table 2 shows that a significant number of respondents, specifically 56 (46.7%), consumed sodium in excess. On the other hand, the daily potassium intake of respondents ranged from 735–8403 mg per day, with an average of 3401.75 mg/day. The majority of respondents in this study consumed potassium below sufficiency levels (4700-5640 mg/day), totaling 75 respondents (62.5%).

This study indicates a significant association between high sodium intake and blood pressure in the elderly (p=0.003, Table 3). Excessive sodium consumption can increase the risk of hypertension by 1.05 times compared to adequate sodium intake (95% CI, 1.67-10.09)

Table 1. The distribution of respondent characteristics

Characteristics	Total (n)	Percentage (%)
Age (Years)		
Elderly (60-74 years)	109	90,8
Late Elderly (75-90 years)	11	9,2
Gender		
Male	3	2,5
Female	117	97,5
Nutritional Status		
Severely Underweight	1	0,8
Underweight	4	3,3
Normal	54	45,0
Overweight	23	19,2
Obesity	38	31,7
Blood Pressure		
Hypertension	86	71,7
Normotension	34	28,3
Total	120	100

Table 2. The distribution of respondent characteristics based on sodium and potassium intake

Intake	Total (n)	Percentage (%)
Natrium Intake		
Excessive	56	46,7
Adequate	5	53,3
Deficient	59	49,2
Potassium Intake		
Excessive	75	62,5
Adequate	10	8,3
Deficient	35	29,2
Total	120	100,0

Tabel 3. The relationship between sodium intake and blood pressure in the elderly

Natrium Intake	Blood Pressure				Total		*p*	Odds Ratio	Confidents Interval 95%
	Hypertension		Normotension						
	n	%	N	%	n	%			
Excessive	48	40,0	8	6,7	56	46,7	0,003	4,105	(1,67-10,09)
Adequate	38	31,7	26	21,7	64	53,3			
Total	86	71,7	34	28,3	120	100,0			

Tabel 4. The relationship between potassium intake and blood pressure in the elderly

Potassium Intake	Blood Pressure				Total		*p*	Odds Ratio	Confidence Interval 95%
	Normotension		Hypertension						
	n	%	n	%	n	%			
Excessive	20	16,7	15	12,5	35	29,2	0,0001	6,76	(2,80–16,32)
Adequate	14	11,7	71	59,2	85	70,8			
Total	34	28,3	86	71,7	120	100,0			

The analysis of the relationship between potassium intake and blood pressure in the elderly is presented in Table 4. The Chi-square analysis resulted in a p-value of 0.0001 with an OR of 6.76. This signifies a significant association between potassium intake and blood pressure in the elderly. Insufficient potassium consumption can increase the risk of hypertension by 6.76 times compared to adequate potassium intake

4. Discussion

The respondents in this study mainly comprised the elderly population, with a majority falling into the elderly group (60–74 years). The findings align with previous research conducted by Agustina, Sari & Savita (2014), Abdurrachim (2016), and Susanti (2017), where the majority of respondents were categorized as elderly, accounting for 83.9%, 86%, and 66.2%, respectively. Aging correlates with higher blood pressure due to changes in blood vessel structure, resulting in narrowing and stiffness of vessel walls, leading to increased systolic blood pressure (Kaplan, 2010). Additionally, aging causes an increase in diastolic blood pressure, although it might not be as prominent. The prevalence of hypertension increases with each decade of age groups.[10–12] Therefore, aging escalates the likelihood of developing hypertension.

Females comprised the largest proportion in this study. This study corroborates research by Fitri et al. (2017), Kurniasih, Pangestuti & Aruben (2017), Zaenurrohmah & Rachmayanti (2017), indicating that the majority of respondents were female, accounting for 73.3%, 77.5%, and 80%, respectively. The occurrence of hypertension in females is higher than in males. Women typically experience menopause around the age of 50, leading to decreased estrogen levels, which can cause blood vessel constriction and subsequently elevate blood pressure.[13–15] Therefore, in the elderly population, women have a higher likelihood of developing hypertension.

The majority of the respondents in this study fell into the category of hypertension. This study supports research conducted by Manampiring (2009), Wahyuni, Siregar & Lubis (2014), and Zainuddin & Yunawati (2018), where the prevalence of hypertension was reported at 78.6%, 50.8%, and 60.9%, respectively. Elevated blood pressure

corresponds with increasing age due to changes in the structure of large blood vessels. In the elderly, collagen fibers in blood vessels and arteriolar walls increase, causing these vessels to harden and lose elasticity, resulting in increased blood pressure.[6,7,16]

Many respondents in this study consume an excessive amount of sodium. Excessive sodium intake can trigger the release of natriuretic hormones. If there's excessive water excretion from the body, it can lead to increased volume and blood pressure. The enzyme renin is secreted by kidney cells and activates a protein (angiotensinogen) in the blood, transforming it into its active form (angiotensin). Blood pressure rises due to the narrowing of blood vessels caused by angiotensin. Ten sodium-rich foods most commonly consumed by respondents in this study include salted fish, smoked fish, shrimp, squid, fishcake, fried foods, eggs, meat, seafood, and crackers.[17]

There's a significant relationship between sodium intake and blood pressure in the elderly. This aligns with studies conducted by Atun, Siswati & Kurdati (2013), Wahyuni, Laksmi & Pradigdo (2016), and Fitri et al. (2017), indicating that excessive sodium intake poses a risk of developing hypertension. Sodium is commonly consumed as table salt. When intake is excessive, the kidneys attempt to increase salt excretion through urine. However, if sodium excretion surpasses the kidney's capacity, the kidneys retain water, leading to an increase in intravascular volume and consequently raising blood pressure. Therefore, consuming high-sodium foods can escalate the risk of hypertension. Hence, sodium intake is a risk factor for hypertension in the elderly, where excessive sodium intake can increase the likelihood of hypertension by four times compared to adequate sodium intake. Physiologically, there is a decline and weakening of bodily functions in the elderly. One of these declines involves a reduced sense of taste and smell. Aging correlates negatively with the number of taste buds, affecting their ability to enjoy the aroma and taste of food. A 70% reduction in saliva production can cause relative dryness in the mouth, affecting the sense of taste. Consequently, the elderly might feel the need to add more salt to their food. This can be mitigated by cooking meals with various natural spices and herbs to enhance the taste of food without the need for excessive salt.[5–7,13]

This study indicates that respondents consume insufficient daily potassium. This finding aligns with research by Atun (2014), Immamudin (2015), and Etika & Kartini (2014), reporting that 80%, 97.2%, and 97.1% of the elderly population respectively consume inadequate levels of daily potassium. Adequate potassium intake can offer protection against hypertension. Consuming potassium increases the concentration within intracellular fluids, drawing fluids from extracellular spaces, and thereby lowering blood pressure. Potassium is a mineral commonly found in vegetables and fruits. The ten potassium-rich foods most frequently consumed by respondents in this study include milk, bananas, apples, papayas, oranges, sweet potatoes, spinach, yard long beans, and water spinach.[5,18,19]

This study demonstrates a significant association between potassium intake and blood pressure in the elderly. The World Health Organization (WHO) states that consuming an average of >3510 mg/day of potassium has a significant protective effect on the cardiovascular system. Potassium induces endothelial cell hyperpolarization by stimulating potassium channel opening and sodium pump activity, causing vasodilation. Increased natriuresis due to potassium activates baroreceptor sensitivity, reducing the vasoconstrictive sensitivity to angiotensin and norepinephrine, resulting in decreased blood pressure. The hypertensive group consumes lower levels of potassium compared to the normotensive group, hindering the expected effects of natriuresis and vasodilation on lowering blood pressure. Additionally, respondents' inadequate knowledge about dietary patterns and potassium sources in their food intake could contribute to this scenario. Therefore, insufficient potassium intake is a risk factor for hypertension in the elderly, where inadequate potassium intake can increase the likelihood of hypertension by six times compared to adequate potassium intake.[20,21]

The limitation of this study lies in the method used, which relies on self-recording of food intake, thus depending on the accuracy of respondents in documenting the food and beverages consumed, potentially causing reporting bias. Efforts to mitigate this methodological weakness were undertaken by cross-verifying the recorded food intake results through the food recall method. In this approach, the researcher reconfirmed the data on food intake that respondents had previously recorded.

5. Conclusion

The study conducted on the elderly within the Dr. Mohammad Hoesin Hospital community shows that almost the majority of respondents have a pattern of excessive sodium intake and insufficient potassium intake. Excessive sodium and insufficient potassium consumption can elevate the risk of developing hypertension. Further research could delve deeper into exploring respondents' medication intake, including the type, duration, and adherence to hypertension medication.

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