

Original Article

Lifestyle Change Intervention with Modified Salt Substitution for Hypertension Patients: A Quasi-Experimental Study



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ABSTRACT

Background: Hypertension is a major global health problem. Lifestyle changes, including reducing sodium intake, are important strategies for managing hypertension. This study aims to evaluate the effectiveness of an integrated lifestyle intervention focusing on the use of salt substitutes in controlling blood pressure in patients with hypertension.

Methods: A quasi-experimental study design was used, involving 15 respondents. The study was conducted at the Singandaru Health Centre in Serang City, Banten. Participants were required to be over 40 years old, have a systolic blood pressure of over 40 years old, have a systolic blood pressure of over 140 mmHg and a diastolic blood pressure of over 90 mmHg, and have a history of hypertension. The respondent's blood pressure was measured before and after they underwent a 7-day course of modified low-sodium salt therapy. Analysis in the study using the t-test with a normality test first.

Results: The respondents with high blood pressure, 60% were male, with an average age of 62 years. In terms of education, most respondents had attended junior high school or high school. Before the salt substitute modification intervention, the average blood pressure of respondents was categorized as grade 2 hypertension. After the intervention, it was classified as grade 1 hypertension. There was an effect of low sodium salt consumption on systolic ($p < 0.001$) and diastolic blood pressure ($p = 0.045$).

Conclusion: Being disciplined in food choices and using low-sodium salt can significantly contribute to pressure reduction. Health professionals can provide structured education and counselling on low salt diets, appropriate use of salt substitutes, importance of physical activity, stress management, and other aspects of lifestyle change.

Keywords: Hypertensive diets; Low Sodium Salt; Lifestyle; Hypertension

Implications for Practice:

- Contributes to the reduction of systolic and diastolic blood pressure as an effective non-pharmacological strategy to help patients achieve their blood pressure targets.
- This intervention directly reduces the risk of serious cardiovascular events such as stroke, heart attack, and heart failure by lowering blood pressure.
- Replacing table salt with salt substitutes is much easier and more acceptable to patients than other drastic dietary changes. The taste of the food often does not change much, which improves patient compliance.

Introduction

Hypertension is the leading cause of death worldwide, with essential hypertension accounting for 90-95% of

cases. Based on the 2011-2021 Non-Communicable Disease (NCD) Cohort Study, hypertension is the fourth highest risk factor for death in Indonesia at 10.2%

([Kemenkes, 2023](#)). According to SKI 2023 data, about 59.1% of the causes of disability (vision, hearing, walking) in the population aged 15 years and over are acquired diseases, and 53.5% of these diseases are caused by non-communicable diseases, especially hypertension (22.2%) ([Tarmizi, 2024](#)). Based on data from the Health Office of Serang City in 2023, hypertension is the 10th most common disease with 123,266 patients ([Badan Pusat Statistik Kota Serang, 2024](#)).

Based on the results of research, the dominant risk factors for hypertension in Indonesia are physical activity, excess intake of sugar, salt, and fat. In addition, smoking and poor rest habits are also causes of hypertension ([Dewati et al., 2023](#)). One of the causes of hypertension is excessive salt consumption. The proportion of hypertension was found to be greater in abnormal salt intake patterns (35.3%) compared to normal salt intake patterns (19.7%). The results of the study indicate a relationship between salt consumption patterns and the incidence of hypertension ([M. H. Yunus et al., 2023](#)).

Implementing lifestyle interventions by reducing sodium intake in food is one of the lifestyle modifications to lower blood pressure in hypertension ([Hartati et al., 2025](#); [Widayati et al., 2024](#); [Widayati & Rachmania, 2024](#)). This is very important in addition to the use of antihypertensive drugs, namely by increasing patient compliance with a sodium intake restriction diet ([Shamsi et al., 2021](#)). An increase in the amount of sodium as a result of consuming excess salt will disrupt the fluid balance in the cells. If fluid enters the cells, it will cause the diameter of the blood vessels to dry out, causing the heart to pump excess blood.

This will cause an increase in blood pressure. Consuming excess salt can also disrupt the kidneys' work. The more salt consumed, the more blood volume will increase because the sodium content contained in salt has the property of binding much water. If the blood volume increases, it will cause blood vessels to dilate and make blood flow faster. So this will make blood pressure increase and is a risk factor for hypertension ([Zubaidah, 2022](#)).

Previous researchers have conducted research on low salt diets. Where there is a relationship between low salt dietary patterns and changes in blood pressure in hypertensive patients ([Niga et al., 2021](#)), the application of the use of salt substitutes in all foods and preservation without changing eating habits and lifestyles and reducing the amount of salt consumed by each family can help the successful implementation of a low salt diet. It can significantly reduce systolic and diastolic blood pressure ([Asri et al., 2022](#)).

As one of the flavour enhancers in food, it is necessary to modify salt that is low in sodium. The 2018 European Society of Cardiology Hypertension Guidelines and the 2020 WHO statement recommend that. Sodium intake should be limited to < 2 g per day (equivalent to < 5 grams per day in the general population and hypertensive patients) ([Lubis et al., 2024](#)). As a salt substitute for hypertension, several studies have shown that there may be substantial benefits from using potassium-enriched salt with a composition of 75% sodium chloride and 25% potassium chloride more widely for hypertensive patients ([Xu et al., 2024](#)).

Research on low salt diets and salt modification has been done by many researchers before. However, not many

have conducted research by modifying salt substitutes that contain low sodium levels as an effort to lower blood pressure. So that researchers are interested in knowing the effect of Lifestyle Change Interventions with Modified Salt Substitutes on Hypertension Patients.

Methods

Study Design

This study was a quasi-experimental study with a 'one-group pretest-posttest' design.

Participants

This study was conducted in the Singandaru Health Centre Working Area in January-February 2025. A total of 15 respondents were selected through purposive sampling. The limited time of the researcher and the short duration of the research grant resulted in a small number of participants being collected. Based on the inclusion criteria: systolic blood pressure above 140 mmHg and diastolic blood pressure above 90 mmHg, willing to participate, no comorbidities, able to communicate, and a history of hypertension. While the exclusion criteria in this study are pregnant women, those who have chronic diseases, and are not willing to be respondents

Instruments

The Blood Pressure Measurement Instrument used in this study is an Automated Oscillometric Device. The measurement was carried out by ensuring that the respondent sat quietly for 5 minutes before measurement, the back was supported, the legs were not crossed, the arms were supported at heart level, the bladder was empty, and the respondent did not smoke/drink caffeine 30 minutes before. Measurements were taken at least 2-3 times with a break of 1-2 minutes, then the average of the last measurement was taken.

Measurement time is carried out consistently in the afternoon.

The intervention of providing low-sodium salt is carried out by replacing the salt that respondents usually consume with a type of salt that is low in sodium. meaning that respondents still use salt in cooking activities, it's just that the kind of salt and its dose are changed and adjusted. Previously, respondents were explained the use of salt that had been given, namely 5 grams per day for one week, in accordance with WHO recommendations in 2020. In addition, respondents were also given education about nutrition, always to reduce foods that could cause an increase in blood pressure

Intervention

The intervention in this study involved the administration of modified low-sodium salt, where the regular salt typically used by respondents was replaced with a type of salt containing reduced sodium content, at a dosage of 5 grams per day for one week, in accordance with WHO 2020 recommendations. Before the intervention, participants received education on how to use the provided salt and the importance of reducing the intake of high-sodium foods. The low-sodium salt was used in respondents' daily cooking activities, allowing them to maintain their usual eating habits while lowering sodium intake. Additional education was provided on balanced nutrition and foods that may contribute to increased blood pressure, aiming to enhance participants' understanding and adherence to healthy lifestyle changes.

Data Collection

Data collection began with an initial blood pressure measurement (pretest) at each respondent's home. Next, respondents were given low-sodium salt modification therapy to be consumed for one week. After one week, blood pressure measurements

(posttest) will be taken again to see any decrease in blood pressure.

Data Analysis

To analyse the difference in blood pressure between pretest and posttest, a t-test (bivariate t-test) was used in this study. Before conducting a bivariate analysis, a normality test was first performed. The normality test used was Shapiro-Wilk, with a significance value ($p = 0.78$)

Ethical Considerations

The Research Ethics Committee of Faletahan University has approved the research protocol with the number 172/KEPK.UF/V/2025

Results

Table 1 presents a comprehensive overview of respondent characteristics and the impact of the intervention using modified low-sodium salt on blood pressure. The majority of participants were male (60%) and had a moderate educational background, with 80% having completed junior or senior high school. This suggests a demographic that might have limited access to advanced health literacy, which could affect adherence to long-term dietary modifications—yet the observed positive outcomes indicate that simple and clear education can be effective even in populations with basic education levels.

The average age of participants was 62 years, within a high-risk age group for hypertension. This aligns with existing literature indicating that vascular stiffness and reduced baroreceptor sensitivity in older adults contribute significantly to elevated blood pressure. It is worth noting that the intervention was conducted on a population segment that is likely to have developed chronic hypertension, not just transient elevations.

Hypertension category classification before and after the intervention reveals a favorable shift: none of the participants

were normotensive at baseline, but one achieved normal blood pressure post-intervention. The most critical finding is the reduction in Grade 2 hypertension from 33.3% to 20%, and a corresponding increase in pre-hypertension and Grade 1 cases. This trend indicates not only a downward shift in mean blood pressure but also a redistribution toward milder categories, which has substantial clinical implications in terms of reducing cardiovascular risk.

The mean systolic blood pressure decreased significantly from 161.5 mmHg to 149.1 mmHg ($p < 0.001$), and the diastolic from 90.9 mmHg to 82.1 mmHg ($p = 0.045$). These changes are statistically significant and clinically meaningful, supporting the hypothesis that even short-term dietary salt modification can produce measurable improvements in blood pressure. The highly substantial p -value for systolic pressure suggests that it was more responsive to sodium reduction than diastolic pressure, which is consistent with patterns observed in salt-sensitive hypertensive populations.

However, several critical considerations must be addressed. First, the sample size is small ($n=15$), which limits the generalizability of the findings. While the intervention shows promise, it may not represent the effect in a more heterogeneous population. Second, the study duration was only seven days; longer-term adherence and sustained impacts remain unknown. Lastly, the potential influence of other lifestyle variables (e.g., physical activity, medication use, psychological stress) was not controlled or measured in this quasi-experimental design, which may confound the observed effects.

In conclusion, the table not only demonstrates statistically significant outcomes but also suggests that low-sodium salt substitution is a viable and practical non-pharmacological intervention. Nevertheless, to solidify its effectiveness as

a public health strategy, larger and longer-term randomized controlled trials are

necessary to account for potential confounders and adherence variability.

Table 1. Characteristics of Respondents and Blood Pressure Before and After Intervention (n = 15)

Variable	Category	Frequency (n)	Percentage (%)	Mean $\pm$ SD	Min-Max	Pre-Intervention n (%)	Post-Intervention n (%)
Gender	Male	9	60				
	Female	6	40				
Education Level	Junior High School	6	40				
	Senior High School	6	40				
	University	3	20				
Age (years)				62.0 $\pm$ 7.70	44–75		
Hypertension Category	Normal					0 (0.0%)	1 (6.7%)
	Pre-Hypertension					2 (13.3%)	5 (33.3%)
	Grade 1 Hypertension					8 (53.3%)	6 (40.0%)
	Grade 2 Hypertension					5 (33.3%)	3 (20.0%)
Systolic Blood Pressure (mmHg)				161.50 $\pm$ 27.77			149.14 $\pm$ 26.66
Diastolic Blood Pressure (mmHg)				90.93 $\pm$ 15.56			82.14 $\pm$ 9.41
Statistical Test (p-value)	Systolic						<0.001**
	Diastolic						0.045*

Notes: SD: Standard Deviation; Min-Max: Minimum-Maximum; *p < 0.05 = significant; *p < 0.001 = highly significant.

Discussion

Characteristics of respondents based on gender found that men are more affected by hypertension than women. The risk of high blood pressure in men can be influenced by a family history of hypertension, the type of food consumed, and inherited genetic factors ([Siregar et al., 2023](#)). In addition, from the education factor, it was found that the higher the level of education, the less respondents were affected by hypertension. This is because higher levels of education often correlate with the ease of obtaining health information from various sources such as the media, the internet, and health facilities, making it easier to understand and manage hypertension ([Agusri et al., 2024](#)). One of the factors that can affect knowledge is a person's level of education. The higher

the level of education, the higher the knowledge ([Dhirisma & Moerdhanti, 2022](#)).

Meanwhile, from the characteristics of age, it was found that the older the age, the greater the risk of hypertension. This result is in accordance with previous research where there is a relationship between age and the incidence of hypertension ([M. Yunus et al., 2021](#)). Increasing age causes changes in the heart, blood vessels, and hormones that naturally occur in the body. In old age, the regulation of blood pressure contained in the baroreceptor reflex will decrease in action. So that causes the increasing age, the blood pressure also increases ([Sarfika & Saifudin, 2024](#)).

Age tends to be a very strong risk factor. The incidence of hypertension in young people is around 2- 3%, while the

prevalence of hypertension in the elderly is around 65% or more. Blood pressure tends to rise with age, and the risk of increasing Hypertension will also be higher with age (Syamsu et al., 2021).. In addition, with age, the cardiovascular system in older people changes, such as thickening and stiffness of the heart valves, decreased blood pumping ability (contraction and volume), reduced elasticity of blood vessels, and increased peripheral vascular resistance, resulting in increased blood pressure (Niga et al., 2021).

The results of blood pressure measurements in this study found that the average blood pressure before being given the salt substitute modification intervention was in the category of grade 2 hypertension, while after the intervention, the average blood pressure of respondents was in the category of grade 1 hypertension. So, in this study, it can be concluded that there is an effect of salt substitute modification on reducing systolic and diastolic blood pressure in hypertensive patients. Studies show that a diet with low salt content has a significant blood pressure-lowering effect on hypertensive patients. After a two-week low-salt diet intervention, there was a statistically significant decrease in blood pressure numbers ($p < 0.05$) (Niga et al., 2021).

Hypertension sufferers urgently need to modify or adjust their diet. The main goal of a diet for hypertension is to adopt a healthy diet that is effective in controlling high blood pressure and reducing the risk of diseases of the heart and blood vessels. Four types of diets are important for maintaining blood pressure, namely a low-salt diet, a low-cholesterol diet, a diet with limited fat and high fibre, and a low-calorie diet if body weight exceeds normal limits. To successfully change eating habits, a positive mentality is needed in dealing with various problems associated with hypertension (Pebriani, 2023).

The risk of hypertension in respondents with high salt consumption is 2.47 times

that of those who consume salt within normal limits (Jingga & Indarjo, 2022). High salt intake forces the kidneys to work extra hard to process it and results in more fluid retention. This fluid build-up increases blood volume, so blood vessels carry more fluid. As a result, the load on the blood vessels increases, which causes blood pressure to rise on the blood vessel walls (Nisa et al., 2024).

The results of interviews with respondents found that hypertension occurred due to their habit of consuming foods that are high in salt, such as salted fish. The habit of often consuming high-sodium foods is more common in the group of respondents who have hypertension (95%) compared to the group of hypertensive respondents who rarely consume these foods (53.6%) (Octarini et al., 2023). The risk of hypertension may be increased by a diet that is high in sodium and low in potassium. Too much sodium in salt can cause blood pressure to rise. The main sources of sodium in our diet are processed products and restaurant meals. In addition, deficient potassium intake can also contribute to increased blood pressure. Potassium is abundant in bananas, potatoes, beans, and yoghurt (Syamsu et al., 2021).

Patient compliance is key to the success of the intervention in this study. Without compliance, the intervention will not be effective. Adherence in the survey was related to taste acceptance, where the change in taste of the food due to the use of low-sodium salt could be a major deterrent. If the flavour is unacceptable, compliance will be very low. So this was anticipated by educating on how to use other herbs and spices to enhance flavour. In addition, social and family support is very important in supporting the use of low-sodium salt in the hope that dietary and lifestyle habits can support gradual and sustainable change.

The Lifestyle Change intervention in this study, apart from the use of low-sodium salt instead of regular salt in daily cooking,

also involved education and support for healthy behaviours such as a balanced diet (generally the DASH diet) and increased physical activity. At the same time, many other studies may focus on one of these aspects only.

This study also encouraged respondents to use low-sodium salt in their daily lives. This makes it different from other studies related to the Common Low Salt Diet, which only advocate salt reduction without specification of the type of salt substitute. In addition, providing low-sodium salt substitution is a very practical and immediate intervention for respondents who may not always be the focus of other lifestyle change studies. The results are also easier to apply directly to public health programmes as they are conducted under conditions similar to everyday life.

Relevance to Clinical Practice

This study highlights the practical and impactful role of using modified low-sodium salt as part of a lifestyle intervention to reduce blood pressure in hypertensive patients. The findings support the clinical recommendation to limit sodium intake as a first-line, non-pharmacological strategy for managing hypertension, especially among elderly patients and those with low health literacy. The intervention's simplicity—replacing regular table salt with a measured amount of low-sodium salt (5 grams/day)—makes it feasible for integration into routine patient counseling and dietary education, even in primary healthcare settings with limited resources.

Furthermore, the study reinforces the importance of combining salt modification with basic nutritional education to enhance patient compliance. Since the intervention did not drastically alter patients' usual food habits, it increases the likelihood of long-term adherence, a common challenge in dietary management. Clinicians and nurses

can apply this approach in community health centers by providing clear, culturally relevant education and supplying accessible alternatives such as potassium-enriched salts.

Implementing this strategy may significantly reduce the burden of uncontrolled hypertension and its complications—stroke, heart failure, and renal damage—particularly in low-to-middle-income populations. Thus, promoting salt substitution alongside lifestyle counseling should be considered an essential component of hypertension management protocols in clinical and public health practice.

Conclusion

Based on the results of the study, the average measurement of respondents' blood pressure before the low-sodium salt substitute modification intervention was included in the grade 2 hypertension category. However, after the intervention, the average blood pressure of respondents decreased to the grade 1 hypertension category. So that modification of the use of low-sodium salt can be used as an alternative effort in reducing systolic and diastolic blood pressure in hypertensive patients.

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CrediT Authorship Contributions Statement

Trio Gustin Rahayu: Conceptualization, Methodology, Supervision, Writing - Original Draft

Ernawati: Investigation, Resources, Data Curation, Project Administration

Dwi Agung Riyanto: Software, Validation, Formal Analysis, Writing - Review & Editing

Conflicts Of Interest

The authors declare that they have no competing financial interests or personal relationships that could influence the work reported in this paper.

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