Effects of a Dietary Self-Management Program on Blood Pressure among Adults with Prehypertension in Nakhon Si Thammarat Province, Thailand

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Abstract

Prehypertension is a major risk factor for hypertension and cardiovascular diseases, and effective lifestyle modification is essential to prevent disease progression. This study aimed to evaluate the effects of a dietary self-management program on systolic blood pressure (SBP) and diastolic blood pressure (DBP) among adults with prehypertension in Nakhon Si Thammarat Province, Thailand. A quasi-experimental study with a two-group repeated-measures design was conducted among 70 adults aged 35 - 59 years with prehypertension. Participants were assigned to either an experimental group (n = 35) or a control group (n = 35). The experimental group participated in a 12-week dietary self-management program based on the Kanfer and Gaelick-Buys self-management framework, which incorporated goal selection, self-monitoring, self-evaluation, and self-reinforcement, while the control group received usual care. BP was assessed at baseline and at Weeks 4, 8, and 12. Data were analyzed using repeated-measures ANOVA, mixed repeated-measures ANOVA, and independent-samples t-tests. The results showed significant reductions in both SBP and DBP in the experimental group over time ($p < 0.001$). Mixed repeated-measures ANOVA revealed significant effects of time, group, and the time × group interaction on both SBP and DBP (all $p < 0.001$), indicating greater improvements in the experimental group compared with the control group. No significant differences in SBP or DBP were observed between groups at baseline; however, significant differences emerged at Weeks 4, 8, and 12 (all $p < 0.001$). By Week 12, mean SBP decreased from 128.86 ± 4.26 to 120.69 ± 3.76 mmHg, while mean DBP decreased from 81.46 ± 1.27 to 69.77 ± 2.21 mmHg in the experimental group. These findings suggest that the dietary self-management program is an effective approach for improving BP control among adults with prehypertension and may contribute to community-based strategies for preventing hypertension and reducing cardiovascular risk.

Keywords: Prehypertension, Dietary self-management, Blood pressure, Hypertension prevention, Community health

Introduction

Prehypertension is a highly prevalent condition that represents an early stage of pathophysiological changes that may progress to hypertension. This stage provides a critical opportunity for the prevention of non-communicable diseases (NCDs), particularly hypertension. Epidemiological evidence indicates considerable variation in the prevalence of prehypertension across regions worldwide. The reported prevalence ranges from 30.0% to 32.5% in South America, 25.5% to 40.7% in Asia, and approximately 42.8% in Africa (Hernández-Vásquez & Vargas-Fernández, 2022; Ismail et al., 2023; Endrias et al., 2024). In Thailand, the prevalence of prehypertension among adults aged 35 - 59 years has been reported at 51.74% (Glingasorn & Sornlorm, 2024), which is considerably higher than that reported in many other countries. At the provincial level, data from the Health Data Center (HDC) indicated that the prevalence of prehypertension in Nakhon Si Thammarat Province ranged from 6.9% to 22.4% in 2024. These findings highlight the substantial burden of prehypertension within the province and underscore the need for effective preventive interventions to reduce the risk of progression to hypertension and subsequent cardiovascular complications (Nakhon Si Thammarat Provincial Public Health Office, 2024).

If not appropriately managed, prehypertension may progress to hypertension within 2 - 8 years, with a reported progression risk of up to 64.1% (Li et al., 2023). This condition has significant consequences across multiple dimensions of health. Physiologically, prehypertension contributes to vascular and endothelial dysfunction, increasing the risk of cardiovascular diseases, stroke, and chronic kidney disease (Moftakhar et al., 2023). Psychologically, individuals with prehypertension may experience stress, anxiety, and concerns about their future health status, which can adversely affect health behaviors and disease management (Dhaval et al., 2022). Socially, the condition may limit participation in daily activities and social roles, potentially reducing quality of life and increasing social isolation (Sonthitham & Chamusri, 2020). Economically, the progression from prehypertension to hypertension imposes substantial healthcare expenditures associated with long-term treatment, monitoring, and the management of complications. These costs contribute significantly to the growing burden of non-communicable diseases, particularly cardiovascular diseases, stroke, and chronic kidney disease (Gheorghe et al., 2018).

Prehypertension is associated with both non-modifiable and modifiable risk factors. Non-modifiable factors include genetic predisposition, sex, and age, whereas modifiable factors encompass overweight and obesity, physical inactivity, unhealthy dietary patterns, smoking, and alcohol consumption. Overweight and obesity contribute to elevated BP through activation of the sympathetic nervous system and the renin–angiotensin–aldosterone system (RAAS), resulting in increased vascular resistance. Evidence indicates that a reduction of 1 kg in body weight is associated with decreases of approximately 1.1 mmHg in SBP and 0.9 mmHg in DBP (Neter et al., 2003). In addition, physical inactivity, excessive sodium intake, high-fat diets, smoking, and alcohol consumption have been consistently identified as major contributors to increased SBP and DBP (Meher et al., 2023; Sharma et al., 2023; World Health Organization [WHO], 2023; Poznyak et al., 2022; Visseren et al., 2021). Although these risk factors are largely modifiable, many health promotion programs primarily focus on increasing knowledge rather than developing the practical skills required for long-term behavior change. Consequently, effective self-management strategies are needed to empower individuals with prehypertension to monitor, regulate, and sustain healthy dietary behaviors, thereby reducing their risk of progression to hypertension and related cardiovascular complications.

Self-management is a collaborative process in which individuals work with healthcare professionals to establish health goals, develop action plans, and implement sustainable behavioral changes to improve health outcomes According to the self-management framework proposed by Kanfer and Gaelick-Buys (1991), self-management is a self-regulatory process comprising four interrelated components: goal selection, self-monitoring, self-evaluation, and self-reinforcement. Through these processes, individuals actively participate in setting health-related goals, monitoring their behaviors, evaluating their progress, and reinforcing positive behavioral changes to achieve desired health outcomes. These components facilitate individuals' ability to regulate their behaviors and maintain long-term adherence to health-promoting practices. For individuals with prehypertension, self-management plays a crucial role in preventing the progression to hypertension, particularly through dietary modification. Evidence suggests that interventions incorporating goal setting and continuous self-monitoring can effectively reduce both SBP and DBP. However, many individuals with prehypertension possess limited health knowledge and insufficient self-management skills, which may hinder their ability to adopt and maintain healthy lifestyle behaviors. Therefore, structured self-management programs that promote practical behavioral changes-such as reducing sodium intake, increasing potassium-rich food consumption, monitoring dietary behaviors, and evaluating progress over time-are essential for improving BP control and reducing the risk of hypertension (Patil et al., 2024; Youngiam & Therawiwat, 2024).

The Self-Management program based on the framework of Kanfer and Gaelick-Buys (1991) includes goal selection self-monitoring self-evaluation and self-reinforcement. Most programs address holistic health behaviors but often lack emphasis on controlling sodium intake increasing potassium consumption and reducing fat intake alongside continuous behavior tracking. In southern Thailand high sodium consumption and limited health knowledge among individuals with prehypertension hinder effective SBP and DBP control. Therefore, it is essential to monitor SBP and DBP at 1, 4, 8 and 12 weeks to evaluate behavioral changes and inform strategies for preventing hypertension.

Although self-management interventions have demonstrated benefits in improving health behaviors and reducing BP, several knowledge gaps remain. First, most existing self-management programs focus on comprehensive lifestyle modification and do not specifically emphasize dietary behaviors that directly influence BP, such as reducing sodium intake, increasing potassium consumption, and limiting dietary fat. Second, evidence regarding the effectiveness of dietary self-management interventions among adults with prehypertension in southern Thailand remains limited, despite the region's high sodium consumption patterns and relatively low levels of health knowledge.

Third, previous studies have often evaluated outcomes only at baseline and post-intervention, providing limited information on the trajectory of BP changes during the intervention period. Consequently, it remains unclear how dietary self-management influences SBP and DBP over time. Addressing these gaps is essential for developing effective, context-specific interventions to prevent the progression from prehypertension to hypertension.

Research objectives

1. To compare the mean SBP and DBP before during and after participation in the dietary self-management program within the experimental and control groups.

2. To compare the mean SBP and DBP before during and after participation in the dietary self-management program between the experimental and control groups.

Methodology

Research design

This quasi-experimental study employed a two-group repeated-measures design to compare mean SBP and DBP at baseline, during the intervention (Weeks 4 and 8), and after the completion of a 12-week dietary self-management program among adults with prehypertension.

Population and sampling

A multistage probability sampling technique was employed. First, two districts in Nakhon Si Thammarat Province, namely Mueang Nakhon Si Thammarat and Tha Sala, were randomly selected. Subsequently, subdistricts and Subdistrict Health Promoting Hospitals were randomly selected from each district. In 2025, the total number of adults with elevated blood pressure registered within the catchment areas of the two participating SHPHs was 1,403 individuals.

The sample size was determined using an effect size of 0.95, a significance level (α) of 0.05, and a statistical power of 0.95, resulting in a minimum requirement of 25 participants per group (Islam et al., 2021). To account for a potential attrition rate during the 12-week follow-up period, the sample size was increased by 40%, yielding a final sample of 70 participants. Eligible adults aged 35 - 59 years with prehypertension were screened according to the inclusion and exclusion criteria. A total of 70 participants were recruited and assigned to either the experimental group (n = 35) or the control group (n = 35). To enhance baseline comparability between groups, participants were matched on sex, age, and body mass index (BMI) prior to group allocation.

Inclusion and exclusion criteria

Eligible participants were identified from non-communicable disease registries and screened according to the study's inclusion and exclusion criteria. Participants in the experimental and control groups were matched by sex, age, and BMI to ensure comparable baseline characteristics. The inclusion criteria were: (1) SBP of 120 - 139 mmHg and/or DBP of 80 - 89 mmHg; (2) age between 35 and 59 years; (3) ability to read and write Thai; and (4) willingness to participate in the study. The exclusion criteria were a diagnosis of hypertension, the presence of chronic diseases (e.g., diabetes mellitus, cardiovascular disease, chronic kidney disease, or stroke), pregnancy, and current smoking or alcohol consumption.

Research instruments and their validity and reliability testing

Data collection questionnaires

Three questionnaires were used to collect participants' demographic and health-related information. The first was a general information questionnaire that collected data on sex, age, religion, marital status, educational level, occupation, and monthly income. The second was a health status and BP–related factors questionnaire that assessed weight, height, BMI, family history of hypertension, physical activity behavior, and SBP and DBP levels. The content validity of both questionnaires was evaluated by five experts, yielding a Content Validity Index (CVI) of 1.00. The third instrument was the Thai version of the Depression Anxiety Stress Scale-21 (DASS-21), originally developed by Lovibond and Lovibond (1995). The Thai version was translated and culturally adapted by Sawang et al. and subsequently revised by Buathong and Pitthayaratstian to improve the appropriateness of wording and pronouns for community-based research. The DASS-21 consists of 21 items designed to assess three dimensions of psychological distress: Depression, anxiety, and stress. The internal consistency reliability (Cronbach's alpha coefficient) of the Thai version was reported as 0.82 for the depression subscale, 0.78 for the anxiety subscale, and 0.69 for the stress subscale. Each item is rated on a 4-point Likert scale ranging from 0 ("Did not apply to me at all") to 3 ("Applied to me very much or most of the time"). The depression subscale comprises Items 3, 5, 10, 13, 16, 17 and 21; the anxiety subscale includes Items 2, 4, 7, 9, 15, 19, and 20; and the stress subscale consists of Items 1, 6, 8, 11, 12, 14, and 18. Scores for each subscale are summed and multiplied by two to obtain the final score. For the depression subscale, scores are interpreted as normal (0 - 9), mild (10 - 13), moderate (14 - 20), severe (21 - 27), and extremely severe (≥ 28). For the anxiety subscale, scores are classified as normal (0 - 7), mild (8 - 9), moderate (10 - 14), severe (15 - 19), and extremely severe (≥ 20). For the stress subscale, scores are interpreted as normal (0 - 14), mild (15 - 18), moderate (19 - 25), severe (26 - 33), and extremely severe (≥ 34). Higher scores indicate greater levels of depression, anxiety, and stress (Chootong et al., 2019).

Intervention instruments

The intervention consisted of: (1) a 12-week Dietary Self-Management Program developed based on the self-management framework of Kanfer and Gaelick-Buys, and (2) a Self-Management Dietary Guide for Adults with Prehypertension. The Dietary Self-Management Program comprised four components: (1) goal selection, in which the researcher and participants collaboratively established dietary goals based on 24-hour dietary records and dietary behavior assessments; (2) self-monitoring, in which participants recorded their sodium, potassium, and fat intake using food diaries throughout the intervention period, with formal monitoring conducted at Weeks 4, 8, and 12; (3) self-evaluation, in which participants and the researcher reviewed dietary records and compared actual dietary intake with predetermined goals; and (4) self-reinforcement, in which participants received encouragement and positive reinforcement for achieving their dietary goals. The program demonstrated excellent content validity, with a CVI of 1.00. The Self-Management Dietary Guide for Adults with Prehypertension included: (1) educational content on prehypertension, its health consequences, and dietary strategies for preventing hypertension; and (2) a dietary intake recording section, including a 24-hour food diary for monitoring sodium, potassium, and fat consumption during both the intervention and home practice. The guide was reviewed by five experts and achieved a CVI of 1.00.

Health assessment instruments

BP was measured using a mercury sphygmomanometer and a calibrated stethoscope. Participants were instructed to rest for at least 15 min before measurement. Two BP readings were obtained from the same arm at 1-minute intervals, and the average value was used for analysis. BP measurements were performed at baseline (Week 1) and subsequently at Weeks 4, 8, and 12 throughout the study period. Body weight was measured using calibrated equipment by trained research assistants at Subdistrict Health Promoting Hospitals and participants' homes.

Data collection

Upon obtaining approval from the Committee on Human Rights Related to Research Involving Human Subjects, Walailak University, Thailand, the study was conducted according to the following procedures:

1. The researcher submitted formal requests for cooperation to the Nakhon Si Thammarat Provincial Administrative Organization and the selected Subdistrict Health Promoting Hospitals (SHPHs). Meetings were held with the directors of the participating SHPHs to explain the study objectives, procedures, and data collection process.

2. Research assistants were recruited from each participating healthcare facility, with one registered nurse assigned per site. Eligibility criteria for research assistants included: (1) possession of a valid nursing license, (2) experience in community health promotion, and (3) competency in standardized BP measurement. Prior to data collection, the researcher conducted a 1-hour training session to provide detailed instructions regarding the study protocol, administration of the data collection questionnaires, and standardized procedures for BP measurement, and body weight assessment. A pilot test involving five participants was subsequently conducted to evaluate the completeness of data recording and to refine assessment procedures, ensuring consistency and accuracy across all study sites.

3. Two Village Health Volunteers (VHVs) from each study area were invited to assist with participant recruitment, appointment scheduling, and preparation of data collection venues.

4. Potential participants with prehypertension were identified from the non-communicable disease registries and medical records of the two participating SHPHs. Eligible individuals were initially listed and stratified by sex and age. Subsequently, screening assessments were conducted at

the SHPHs or participants' homes to confirm eligibility according to the inclusion and exclusion criteria. Participants from the two study sites were then matched by sex, age, and BMI. A total of 70 eligible participants were enrolled, with 35 participants recruited from each SHPH.

5. After eligibility screening had been completed, eligible participants received a detailed explanation of the study objectives, procedures, potential benefits, and risks. Written informed consent was obtained from all participants prior to data collection. Participants in the experimental group subsequently enrolled in a 12-week Dietary Self-Management Program designed to promote healthy dietary behaviors related to sodium reduction, potassium enhancement, and fat control. The intervention was delivered through four face-to-face sessions conducted at Weeks 1, 4, 8, and 12.

Week 1 (Session 1: Goal selection)

Research assistants collected baseline data, including general information questionnaire, health status and BP–related factors questionnaire, BP, and psychological status. The researcher then provided education on prehypertension, its health consequences, and the importance of dietary management, particularly sodium reduction, potassium enhancement, and fat control. Individual dietary goals and target SBP and DBP levels were collaboratively established. Participants received the Self-Management Dietary Guide and were instructed on self-monitoring procedures. This session lasted approximately 20 - 30 min.

Week 4 (Session 2: Self-monitoring and feedback**)**

Research assistants measured participants' BP. The researcher reviewed participants' dietary records, monitored progress toward dietary goals, identified barriers to adherence, and provided individualized feedback and encouragement. This session lasted approximately 20 min.

Week 8 (Session 3: Self-evaluation and self-reinforcement)

Research assistants measured BP. The researcher evaluated participants' dietary behaviors related to sodium, potassium, and fat intake using the self-monitoring records. Participants were encouraged to reflect on their progress, identify challenges, and apply self-reinforcement strategies to maintain healthy dietary behaviors. This session lasted approximately 20 - 30 min.

Week 12 (Session 4: Outcome evaluation)

Research assistants measured BP, and the researcher conducted a final 24-hour dietary recall assessment to evaluate dietary behavior changes. Participants' progress was reviewed, and the intervention outcomes were summarized.

Participants in the control group received usual care provided by the SHPHs. Baseline assessments, including demographic information, psychological status, and BP measurements, were conducted at Week 1. Follow-up BP measurements were obtained at Weeks 4 and 8. During the study period, participants received routine health education and advice on hypertension prevention from healthcare personnel. At Week 12, a final BP assessment was conducted, after which participants were provided with the Self-Management Dietary Guide and educational recommendations for hypertension prevention.

Data analysis

1. Descriptive statistics were used to summarize participants' demographic characteristics and baseline study variables. Differences in baseline characteristics between the experimental and control groups were examined using the Chi-square test or Fisher's exact test for categorical variables and the independent-samples t-test for continuous variables.

2. Changes in SBP and DBP across the four measurement points (baseline, Week 4, Week 8, and Week 12) were analyzed separately within the experimental and control groups using repeated-measures analysis of variance (repeated-measures ANOVA).

3. Differences in SBP and DBP between the experimental and control groups over time were examined using mixed-design analysis of variance (mixed-design ANOVA), with group (experimental vs. control) as the between-subjects factor and time (baseline, Week 4, Week 8, and Week 12) as the within-subjects factor. This analysis was conducted to assess the main effects of group and time, as well as the group × time interaction effect on SBP and DBP. Independent-samples t-tests were additionally used to compare mean SBP and DBP values between groups at each measurement point

Prior to inferential analyses, the assumptions underlying repeated-measures ANOVA and mixed-design ANOVA were evaluated. The normality of SBP and DBP distributions at each measurement point was assessed using the Kolmogorov–Smirnov (K–S) test and the Shapiro–Wilk test. The assumption of sphericity was examined using Mauchly's test. When the sphericity assumption was violated, Greenhouse–Geisser corrections were applied. Statistical significance was established at $p < 0.05$ for all analyses.

Ethical consideration

This study was approved by the Committee on Human Rights Related to Research Involving Human Subjects, Walailak University, Thailand (Approval No. WUEC-25-176-01). Ethical approval was granted for the period from May 23, 2025 to May 22, 2026. Prior to participation, all participants were informed about the study objectives, procedures, potential benefits, and possible risks, and written informed consent was obtained. Participants were assured that all personal information would be kept confidential and used solely for research purposes. Participation was entirely voluntary, and participants had the right to withdraw from the study at any time without penalty or loss of benefits to which they were otherwise entitled. Any adverse events or unexpected effects occurring during the study were monitored and managed appropriately. If participant safety was deemed to be at risk, the intervention would be discontinued and appropriate assistance provided.

Results and discussion

Results

Most participants in both the experimental and control groups were female (77.14%), with mean ages of 48.94 ± 6.06 and 48.80 ± 6.20 years, respectively. The majority were married or living with a spouse (71.43% in the experimental group and 82.86% in the control group). Approximately half of the participants in both groups had completed secondary education (48.57%). Regarding occupation, the largest proportion of participants in the experimental group were self-employed or business owners (32.86%), followed by casual laborers (31.43%). In the control group, casual laborers constituted the largest occupational category (40.00%), followed by self-employed or business owners (31.43%). The mean monthly incomes were 7,285.71 ± 4,888.89 Thai Baht in the experimental group and 7,151.43 ± 5,127.06 Thai Baht in the control group. The mean BMI was 25.44 ± 4.04 kg/m² in the experimental group and 25.17 ± 4.00 kg/m² in the control group. A family history of hypertension was reported by 45.71% and 57.14% of participants in the experimental and control groups, respectively. Most participants reported no physical activity (80.00% and 88.57%, respectively). All participants in both groups had normal levels of depression, anxiety, and stress as assessed by the DASS-21.

No statistically significant differences were found between the experimental and control groups with respect to demographic characteristics, health status, physical activity, family history of hypertension, BMI, monthly income, or psychological status at baseline ($p > 0.05$). These findings indicate that the two groups were homogeneous and comparable prior to the implementation of the intervention. The demographic characteristics, health status, and psychological status of the participants are presented in **Table 1**.

Table 1 Demographic characteristics, health status, and psychological status of participants in the experimental and control groups.

Demographic Characteristics/ Health and Psychological Status	Total (n = 70)		Experimental (n = 35)		Control (n = 35)		Statistic	*p*-value
	n	%	n	%	n	%		
Gender							x^2 = 0.000	1.000
Women	54	77.14	27	77.14	27	77.14		
Men	16	22.86	8	22.86	8	22.86		
Age (year)	$\bar{x}$ = 48.87 ± 6.07 Min − Max = 35 − 59		$\bar{x}$ = 48.94 ± 6.06 Min − Max = 37 − 59		$\bar{x}$ = 48.80 ± 6.20 Min − Max = 35 − 58		t = 0.098	0.922
Age groups							FET = 0.356	1.000
35 - 39	6	8.57	3	8.57	3	8.57		
40 - 44	9	12.86	5	14.29	4	11.43		
45 - 49	25	35.71	12	34.28	13	37.14		
50 - 54	14	20.00	7	20.00	7	20.00		
55 - 59	16	22.86	8	22.86	8	22.86		

Demographic Characteristics/ Health and Psychological Status	Total (n = 70)		Experimental (n = 35)		Control (n = 35)		Statistic	*p*-value
	n	%	n	%	n	%		
Religion							FET -	0.259
Muslim	62	88.57	29	82.86	33	94.29		
Buddhism	8	11.43	6	17.14	2	5.71		
Marital status							FET = 2.746	0.272
Married / Living together	54	77.15	25	71.43	29	82.86		
Widowed / Divorced / Separated	11	15.71	8	22.86	3	8.57		
Single	5	7.14	2	5.71	3	8.57		
Education level							x^2 = 1.080	0.582
Primary education	23	32.86	10	28.57	13	37.14		
Secondary education	34	48.57	17	48.57	17	48.57		
Bachelor's degree or higher	13	18.57	8	22.86	5	14.29		
Occupation							FET = 3.616	0.476
Self-employed/ Business owner	23	32.86	12	34.29	11	31.42		
Unemployed/ Homemaker	17	24.29	9	25.71	8	22.86		
Casual laborer	22	31.43	8	22.86	14	40.00		
Farmer	4	5.71	3	8.57	1	2.86		
Company or government/private employee	4	5.71	3	8.57	1	2.86		
Income (THB/month)	$\bar{x}$ = 7,218.57 ± 4,973.42 Min – Max = 1,000 - 25,000		$\bar{x}$ = 7,285.71 ± 4,888.89 Min – Max = 1,500 - 20,000		$\bar{x}$ = 7,151.43 ± 5,127.06 Min – Max = 1,000 - 25,000		t = 0.112	0.911
Income group (THB/month)							x^2 = 0.633	0.729
≤ 5,000	33	47.14	18	51.43	15	42.86		
5,001 - 10,000	25	35.71	11	31.43	14	40.00		
> 10,000	12	17.15	6	17.14	6	17.14		
BMI (Kg/m^2)	$\bar{x}$ = 25.31 ± 3.99 Min – Max = 19.23 - 33.98		$\bar{x}$ = 25.44 ± 4.04 Min – Max = 19.38 - 33.98		$\bar{x}$ = 25.17 ± 4.00 Min – Max = 19.23 - 33.75		t = 0.285	0.776
BMI group							x^2 = 0.136	0.987
18.5 - 22.9	26	37.14	13	37.14	13	37.14		
23.0 - 24.9	14	20.00	7	20.00	7	20.00		

Demographic Characteristics/ Health and Psychological Status	Total (n = 70)		Experimental (n = 35)		Control (n = 35)		Statistic	*p*-value
	n	%	n	%	n	%		
25.5 - 29.9	17	24.29	8	22.86	9	25.71		
> 29.9	13	18.57	7	20.00	6	17.15		
Family history of hypertension							x^2 = 0.915	0.339
No	34	48.57	19	54.29	15	42.86		
Yes	36	51.43	16	45.71	20	57.14		
Physical activity							x^2 = 1.870	0.172
No	60	85.71	28	80.00	31	88.66		
Yes	10	14.29	7	20.00	4	11.40		
Depression level								
Normal	70	100.00	35	100.00	35	100.00	-	-
Anxiety level								
Normal	70	100.00	35	100.00	35	100.00	-	-
Stress level								
Normal	70	100.00	35	100.00	35	100.00	-	-

x^2 = Chi-square test, FET = Fisher's exact test, t = independent t-test, $p < 0.05$

Mean SBP and DBP across measurement periods by group

The repeated-measures ANOVA revealed significant changes in both SBP and DBP over time in the experimental group. The mean SBP differed significantly across the four measurement points (F = 100.56, $p < 0.001$), and a similar pattern was observed for DBP (F = 302.63, $p < 0.001$). In contrast, no significant change in SBP was observed in the control group (F = 0.253, $p = 0.859$), whereas DBP showed a significant difference across time (F = 22.94, $p < 0.001$). These findings indicate that participants who received the dietary self-management program experienced significant improvements in both SBP and DBP throughout the intervention period, while participants in the control group showed no significant change in SBP. The results of the repeated-measures ANOVA are presented in **Table 2**.

Table 2 Repeated-measures ANOVA of mean SBP and DBP across measurement periods by group

Variable	SS	df	MS	F	*p*-value
Experimental					
SBP [a]					
Within subjects					
Time	1,280.54	2.19	584.31	100.56	**< 0.001*****
Error	432.96	74.51	5.81		
DBP[b]					
Within subjects					
Time	2,727.11	3	909.04	302.63	**< 0.001*****

Variable	SS	df	MS	F	*p*-value
Error	306.39	102	3.00		
Control					
SBP[a]					
Within subjects					
Time	3.34	3	1.11	.253	0.859
Error	447.41	102	4.39		
DBP[a]					
Within subjects					
Time	151.68	2.25	67.43	22.94	**< 0.001*****
Error	224.81	76.49	2.94		

[a] = Greenhouse-Geisser, [b] = Sphericity Assumed, $^{***}p < 0.001$

Pairwise comparisons using the Bonferroni adjustment revealed significant reductions in both SBP and DBP across the intervention period in the experimental group. For SBP, significant differences were observed between baseline and Week 4 (mean difference = 2.63 mmHg, $p < 0.01$), baseline and Week 8 (mean difference = 5.14 mmHg, $p < 0.01$), and baseline and Week 12 (mean difference = 8.17 mmHg, $p < 0.01$). Significant reductions were also found between Week 4 and Week 8 (mean difference = 2.51 mmHg, $p < 0.01$), Week 4 and Week 12 (mean difference = 5.54 mmHg, $p < 0.01$), and Week 8 and Week 12 (mean difference = 3.03 mmHg, $p < 0.01$).

Similarly, DBP decreased significantly throughout the intervention period. Significant differences were found between baseline and Week 4 (mean difference = 4.80 mmHg, $p < 0.01$), baseline and Week 8 (mean difference = 8.94 mmHg, $p < 0.01$), and baseline and Week 12 (mean difference = 11.69 mmHg, $p < 0.01$). Additional significant reductions were observed between Week 4 and Week 8 (mean difference = 4.14 mmHg, $p < 0.01$), Week 4 and Week 12 (mean difference = 6.89 mmHg, $p < 0.01$), and Week 8 and Week 12 (mean difference = 2.74 mmHg, $p < 0.01$).

In contrast, no significant differences in SBP were observed across any measurement periods in the control group ($p > 0.05$). However, DBP showed small but statistically significant reductions between baseline and Week 4 (mean difference = 1.63 mmHg, $p < 0.05$), baseline and Week 8 (mean difference = 2.34 mmHg, $p < 0.05$), baseline and Week 12 (mean difference = 2.71 mmHg, $p < 0.05$), and between Week 4 and Week 12 (mean difference = 1.09 mmHg, $p < 0.05$). The detailed results of the Bonferroni pairwise comparisons are presented in **Table 3**.

Table 3 Pairwise comparisons of Mean SBP and DBP within the experimental and control groups using Bonferroni adjustment.

Week	$\bar{x}$ ± SD	Week 1	Week 4	Week 8	Week 12
Experimental					
SBP					
1	128.86 ± 4.26	-	**2.63****	**5.14****	**8.17****
4	126.23 ± 4.29	-	-	**2.51****	**5.54****

Week	$\bar{x}$ ± SD	Week 1	Week 4	Week 8	Week 12
8	123.71 ± 4.34	-	-	-	**3.03****
12	120.69 ± 3.76	-	-	-	-
DBP					
1	81.46 ± 1.27	-	**4.80****	**8.94****	**11.69****
4	76.66 ± 2.67	-	**-**	**4.14****	**6.89****
8	72.51 ± 2.66	-	**-**	**-**	**2.74****
12	69.77 ± 2.21	-	-	-	-
Control					
SBP					
1	129.20 ± 4.55	-	0.29	0.37	0.06
4	129.49 ± 3.36	-	-	0.09	0.23
8	129.57 ± 2.45	-	-	-	0.31
12	129.26 ± 3.16	-	-	-	-
DBP					
1	82.00 ± 0.22	-	**1.63***	**2.34***	**2.71***
4	80.37 ± 0.22	-	-	0.71	**1.09***
8	79.66 ± 0.38	-	-	-	0.37
12	79.29 ± 0.30	-	-	-	-

*$p < 0.05$, ** $p < 0.01$

Comparison of changes in SBP and DBP between the experimental and control groups over time

Mixed-design ANOVA was conducted to examine the effects of time, group, and the interaction between time and group on SBP and DBP. For SBP, significant main effects of time (F = 48.82, $p < 0.001$) and group (F = 31.07, $p < 0.001$) were observed. In addition, a significant time × group interaction effect was found (F = 50.34, $p < 0.001$), indicating that changes in SBP over time differed significantly between the experimental and control groups.

Similarly, for DBP, significant main effects of time (F = 264.84, $p < 0.001$) and group (F = 230.12, $p < 0.001$) were identified. A significant time × group interaction effect was also observed (F = 103.68, $p < 0.001$), suggesting that the pattern of change in DBP across the study period differed significantly between the two groups.

Overall, these findings indicate that the dietary self-management program had a significant effect on reducing both SBP and DBP among participants in the experimental group compared with those in the control group. The results of the mixed-design ANOVA are presented in **Table 4**.

Table 4 Mixed repeated-measures ANOVA of SBP and DBP across four measurement time points in the experimental and control groups.

Variable	SS	df	MS	F	*p*-value
SBP [a]					
Within subjects					
Time	632.09	2.40	263.21	48.82	**< 0.001*****
Time x Group	651.78	2.40	271.40	50.34	**< 0.001*****
Error time	880.37	163.30	5.39	-	-
Between subjects					
Group	1,422.00	1	1,422.00	31.07	**< 0.001*****
Error	3,112.37	68	45.77	-	-
DBP [b]					
Within subjects					
Time	2,068.89	3	689.63	264.84	**< 0.001*****
Time x Group	809.91	3	269.97	103.68	**< 0.001*****
Error time	531.20	204	2.60	-	-
Between subjects					
Group	1,913.66	1	1,913.66	230.12	**< 0.001*****
Error	565.49	68	8.32	-	-

[a] = Greenhouse-Geisser, [b] = Sphericity Assumed, ***$p < .001$.

Independent-samples t-tests were conducted to compare mean SBP and DBP between the experimental and control groups at each measurement time point. At baseline (Week 1), no significant differences were observed between the two groups in either SBP ($t = 0.33$, $p = 0.75$) or DBP ($t = 1.76$, $p = 0.08$), indicating that the groups were comparable prior to the intervention.

Following the implementation of the dietary self-management program, significant differences emerged between the groups. The experimental group demonstrated significantly lower mean SBP than the control group at Week 4 ($t = 3.54$, $p < 0.001$), Week 8 ($t = 6.95$, $p < p < 0.001$), and Week 12 ($t = 10.34$, $p < p < 0.001$). Similarly, the experimental group exhibited significantly lower mean DBP than the control group at Week 4 ($t = 7.42$, $p < p < 0.001$), Week 8 ($t = 12.16$, $p < p < 0.001$), and Week 12 ($t = 19.78$, $p < 0.001$).

These findings indicate that the dietary self-management program was effective in reducing both SBP and DBP among participants in the experimental group compared with those in the control group. The detailed results of the independent-samples t-tests are presented in **Table 5**.

Table 5 Comparison of Mean SBP and DBP Between the Experimental and Control Groups at Baseline, Week 4, Week 8, and Week 12.

Week	Experimental		Control		t	*p*-value
	$\overline{x}$	SD	$\overline{x}$	SD		
SBP						
1	128.86	4.26	129.20	4.55	0.33	.75
4	126.23	4.29	129.49	3.36	3.54	**< 0.001*****
8	123.71	4.34	129.57	2.45	6.95	**< 0.001*****
12	120.69	3.76	129.26	3.16	10.34	**< 0.001*****
DBP						
1	81.46	1.27	82.00	1.31	1.76	0.08
4	76.66	2.67	80.37	1.29	7.42	**< 0.001*****
8	72.51	2.66	79.66	2.24	12.16	**< 0.001*****
12	69.77	2.21	79.29	1.79	19.78	**< 0.001*****

***$p < 0.001$

Discussion

The findings of this study indicate that the dietary self-management program was effective in improving BP control among adults with prehypertension. At baseline, no significant differences were observed between the experimental and control groups in terms of demographic characteristics, health-related factors, psychological status, or BP levels, suggesting that the two groups were comparable prior to the intervention. Therefore, the observed changes in BP are likely attributable to the dietary self-management program rather than to pre-existing group differences. Participants in the experimental group demonstrated significant reductions in both SBP and DBP throughout the 12-week intervention period. From baseline to Week 12, mean SBP decreased by 8.17 mmHg, while mean DBP decreased by 11.69 mmHg. In contrast, participants in the control group showed no significant change in SBP and only a modest reduction in DBP over the same period. Furthermore, significant differences in both SBP and DBP were observed between the experimental and control groups at Weeks 4, 8, and 12, indicating a sustained intervention effect over time. These findings suggest that the dietary self-management program effectively promoted behavioral changes related to BP control and may serve as a practical community-based strategy for preventing the progression from prehypertension to hypertension.

The findings of the present study are consistent with both national and international evidence supporting the effectiveness of self-management and lifestyle modification interventions for BP control. In Thailand, Youngiam and Therawiwat (2024) reported that a health literacy intervention using the “I Watch Sodium” application significantly improved sodium-related health behaviors and contributed to reductions in BP among individuals with prehypertension. Likewise, Athikamanon et al. (2024) demonstrated that a quasi-experimental self-management program incorporating group process–based learning significantly reduced systolic BP among newly diagnosed patients with hypertension by enhancing self-management skills and promoting healthy lifestyle behaviors.

International evidence provides further support for these findings. Patil et al. (2024) found that self-monitoring combined with lifestyle education improved hypertension control in primary care settings by enhancing adherence to recommended health behaviors. Similarly, Villafuerte et al. (2024) reported that a randomized controlled trial incorporating self-monitoring, medication self-management, dietary modification (including a low-sodium, hypocaloric diet), and increased physical activity resulted in significant reductions in both SBP and DBP among patients with uncontrolled hypertension. Such interventions may represent a practical and effective approach for preventing the progression from prehypertension to hypertension and reducing future cardiovascular risk in community settings.

Several physiological mechanisms may explain the significant reductions in SBP and DBP observed among participants in the experimental group. Reduced sodium intake is known to decrease extracellular fluid volume and suppress activation of the renin–angiotensin–aldosterone system, thereby lowering vascular resistance and BP. At the same time, increased potassium consumption promotes natriuresis, improves sodium excretion, and enhances vasodilation, which further contributes to BP reduction. In addition, limiting dietary fat intake, particularly saturated fat, may improve endothelial function and reduce arterial stiffness, both of which are associated with lower SBP and DBP. Consistent with these mechanisms, recent evidence has demonstrated that dietary interventions emphasizing sodium reduction, increased potassium intake, and overall improvement in dietary quality are effective strategies for BP control and cardiovascular disease prevention (Maniero et al., 2023; Patil et al., 2024).

Beyond the physiological effects of dietary modification, the self-management process itself likely contributed to the observed improvements. The program was based on the principles of goal selection, self-monitoring, self-evaluation, and self-reinforcement, which encouraged participants to actively engage in managing their own health behaviors. Regular recording of dietary intake and continuous follow-up throughout the intervention period may have increased participants' awareness of their eating habits, facilitate self-reflection, and strengthen adherence to dietary goals. These findings are consistent with those reported by Chansree et al. (2020), who found that continuous self-monitoring and follow-up not only enhanced awareness of personal health behaviors but also served as important mechanisms for promoting successful and sustainable lifestyle modification.

Importantly, the reductions observed in this study were not only statistically significant but also clinically meaningful. Participants in the experimental group achieved reductions of 8.17 mmHg in SBP and 11.69 mmHg in DBP over the 12-week intervention period. Previous evidence suggests that even modest reductions in BP can substantially decrease the risk of cardiovascular disease, stroke, heart failure, and chronic kidney disease. Consistent with the 2021 European Society of Cardiology Guidelines for Cardiovascular Disease Prevention and WHO recommendations, lifestyle modification remains the cornerstone of prevention and early intervention for individuals with elevated BP and prehypertension. In particular, dietary improvement, sodium reduction, weight management, regular physical activity, and self-management strategies are strongly recommended as first-line approaches for BP control (Visseren et al., 2021; WHO, 2023). Therefore, the magnitude of

BP reduction observed in the present study suggests that the dietary self-management program may have important clinical implications for reducing future cardiovascular risk and preventing the progression from prehypertension to hypertension.

Although a slight reduction in DBP was observed among participants in the control group, the magnitude of change was considerably smaller than that observed in the experimental group. This improvement may be attributable to routine healthcare services provided by the Subdistrict Health Promoting Hospitals, as well as increased awareness of healthy behaviors resulting from repeated BP assessments and participation in the study. Nevertheless, the significantly greater reductions in both SBP and DBP among participants receiving the dietary self-management program indicate that the intervention provided benefits beyond those achieved through routine care alone.

Conclusions

The dietary self-management program significantly reduced systolic and diastolic blood pressure among adults with prehypertension. The findings support the effectiveness of self-management strategies focused on dietary modification, including sodium reduction, increased potassium intake, and fat control. Integrating such interventions into community health services may help prevent the progression to hypertension and contribute to the reduction of cardiovascular risk in high-risk populations.

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Declaration on AI

The authors used ChatGPT (OpenAI) solely for language editing and improvement of manuscript readability. All outputs were reviewed, revised, and verified by the authors, who take full responsibility for the content of this manuscript. AI tools were not used to generate data, perform analyses, or draw scientific conclusions.

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