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Assessing the Effects of Nutritional Strategies on Blood Pressure Management in Perimenopausal Women: A Comparative Study

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ABSTRACT

Background: Perimenopausal women often experience increased cardiovascular risks, including elevated blood pressure (BP). This study, conducted in Ambala (Haryana), aimed to evaluate the impact of three nutritional interventions groups: Nutrition Education and Physical Activity Group (NEPAG), Supplementation Group (SUG) and Dietary Counselling Group (DCG) on systolic and diastolic BP among perimenopausal women.

Methods: A total of 180 perimenopausal women were enrolled and divided equally into a control group (N = 90) and an experimental group (N = 90). The experimental group was further subdivided into three intervention arms: NEPAG, SUG and DCG, each with 30 participants. BP measurements were recorded at three phases: baseline (0 days), mid-intervention (90 days), and post-intervention (180 days). ANOVA and descriptive statistics were used to analyze BP changes, while chi-square tests assessed socio demographic differences.

Results: Sociodemographic characteristics were evenly distributed across the groups, except for income, where the SUG showed a higher proportion of participants earning more than 10 lakhs annually ($p = 0.001$). In the control group, systolic and diastolic BP remained stable across all phases, with no significant differences detected ($p > 0.05$). In the experimental group, systolic BP decreased consistently, with the NEPAG showing the greatest reduction, reaching 134.97 mmHg after the intervention. Significant reductions in systolic and diastolic BP were observed across all intervention phases ($p < 0.05$), with NEPAG achieving the lowest diastolic BP of 87.88 mmHg post-intervention.

Conclusion: The study demonstrates the effectiveness of nutritional interventions, particularly NEPAG, in reducing systolic and diastolic BP among perimenopausal women. These interventions show promise for managing BP and reducing cardiovascular risks in this population.

Keywords: Systolic blood pressure, Nutritional interventions, Physical activity, Perimenopausal women, Cardiovascular diseases

INTRODUCTION

Blood pressure (BP) refers to the force of circulating blood on the walls of blood vessels, measured in systolic (when the heart beats) and diastolic (when the heart rests) values. Maintaining normal blood pressure is crucial, as elevated levels can lead to serious health issues such as heart disease and stroke. Regular monitoring and lifestyle modifications, including healthy eating and physical activity, are essential for managing or preventing hypertension (World Health Organization [WHO], 2023).

Perimenopause is the transitional phase leading to menopause, characterized by hormonal changes as the ovaries gradually decrease estrogen production. This phase typically begins in a woman's 40s and can last several years, presenting symptoms like irregular periods, hot flashes, and mood changes (Mayo Clinic, 2023; Patient.info, 2023). Cardiovascular diseases (CVDs) rank among the leading causes of death globally, with hypertension and hypercholesterolemia as key modifiable

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risk factors (World Health Organization, 2021). Perimenopausal women face an increased risk of developing these conditions due to hormonal changes, particularly the decline in estrogen, which adversely affects lipid metabolism and blood pressure regulation (Moghassemi and Marjani, 2014). The hormonal transition during perimenopause is linked to heightened blood pressure, unfavourable lipid profiles, and increased cardiovascular risks, underscoring the need for effective interventions (Roesch *et al.*, 2017).

Lifestyle interventions, including dietary modifications and physical activity, have shown efficacy in reducing blood pressure and improving lipid profiles (Whelton *et al.*, 2018). Targeted lifestyle strategies can significantly enhance the health of perimenopausal women by improving dietary habits, anthropometric measures and biochemical parameters (Vohra and Kaur, 2024). Whole grains, such as barley and oats, are rich in fiber and beta-glucan, which contribute to lowering cholesterol levels and managing cardiovascular risks (Fardet, 2010). Supplementing with multigrain flour further supports cardiovascular health by providing essential nutrients for metabolic function (Miller *et al.*, 2020). Additionally, personalized dietary counselling empowers individuals to make sustainable dietary changes tailored to their needs, leading to improved health outcomes (Greaves *et al*., 2011). Despite the benefits of these interventions, their effects on hypertensive perimenopausal women remain underexplored.

This study explores the effectiveness of targeted nutritional interventions in managing hypertension among perimenopausal women. By examining changes in systolic and diastolic blood pressure before, during and after a six-month intervention period, the research aims to offer insights into the role of dietary and lifestyle modifications in cardiovascular health.

Objectives of the Study:

1. To compare systolic and diastolic blood pressure levels among participants receiving the three nutritional interventions and those in the control group.
2. To evaluate the effectiveness of NEPAG, SUG and DCG in reducing blood pressure over the intervention period.
3. To explore the persistence of intervention effects on blood pressure after the completion of the interventions.

The findings aim to provide valuable insights into effective dietary and lifestyle strategies for managing hypertension in perimenopausal women, potentially contributing to the prevention of cardiovascular diseases.

METHODOLOGY

Study Design and Participants:

This study employed an experimental design to assess the impact of three nutritional interventions on the blood pressure (BP) of hypercholesterolemic and hypertensive perimenopausal women. A total of 180 participants were enrolled, with 90 allocated to the control group and 90 to the experimental group. The experimental group was further divided equally into three intervention arms: NEPAG, SUG and DCG (30 participants in each arm). The study spanned a period of six months, with BP measurements taken at three points: baseline (0 days), mid-intervention (90 days), and post-intervention (180 days).

Inclusion and Exclusion Criteria:

Participants were included if they were perimenopausal women aged 35–50 years with hypercholesterolemia and hypertension. Exclusion criteria included women with severe chronic illnesses, those on antihypertensive medication, and participants unwilling to follow the intervention protocols.

Interventions:

Nutrition Education and Physical Activity Group (NEPAG):

Participants in NEPAG attended educational sessions focused on dietary modifications and physical activities conducive to cardiovascular health. They were encouraged to engage in moderate exercise and adopt heart-healthy dietary practices.

Supplementation Group (SUG):

Participants in SUG received a blend of multigrain flours, including whole wheat, barley, chana, ragi, oats and sorghum. They were instructed to incorporate this flour blend into their daily meals throughout the intervention period.

Dietary Counselling Group (DCG):

Participants in DCG received individualized dietary counselling, including personalized diet charts. Recommendations focused on reducing sodium intake

and increasing the consumption of fruits, vegetables and whole grains.

The control group did not receive any interventions and continued their routine lifestyle without additional support.

Measurements:

Systolic and diastolic blood pressure were the primary outcome measures. BP was measured using a standardized sphygmomanometer at three intervals: before the intervention (baseline), during the intervention (90 days) and after the intervention (180 days). Sociodemographic data, including age, religion, education, occupation, marital status, family type and income, were collected using a structured questionnaire.

Statistical Analysis:

Data were analyzed using descriptive statistics to calculate means, standard deviations, and confidence intervals for systolic and diastolic BP at each time point. One-way analysis of variance (ANOVA) was employed to assess differences in BP between the intervention groups across the three phases. Chi-square tests were used to analyze the distribution of sociodemographic variables across groups. A significance level of $p < 0.05$ was set for all analyses.

RESULTS AND DISCUSSION

Table 1 presents a detailed summary of the sociodemographic characteristics of the control group respondents (N = 90), indicating that participants were evenly distributed across three interventions—NEPAG, SUG and DCG—each with 30 participants. In terms of age, most respondents fell between 36-49 years, with similar distributions across the three interventions. The majority identified as Hindu (53.3%), while the rest identified as Sikh (46.7%). Educationally, 57.8% were graduates, 22.2% had higher secondary education, and 20% held postgraduate degrees.

Regarding occupation, 65.6% were housewives, and the rest were working women (34.4%). Almost all participants were married (98.9%), with only one widow (1.1%). Family type was fairly balanced, with 56.7% living in nuclear families and 43.3% in joint families. In terms of annual income, half of the respondents (50%) reported earning between 5-10 lakhs, followed by 34.4% earning up to 5 lakhs, and 15.6% with 10-15 lakhs. Chi-square tests showed no statistically significant differences across groups for any of the variables ($p > 0.05$).

The data aligns with previous findings by Shareef (2022), who reported that similar sociodemographic characteristics, such as age distribution, educational

Table 1: Sociodemographic data of respondents in the control group

		Groups								Chi-Square	p-value
		NEPAG		SUG		DCG		Total			
Age	36-40	11	36.7%	11	36.7%	13	43.3%	35	38.9%	.522	.971
	41-45	9	30.0%	10	33.3%	9	30.0%	28	31.1%		
	46-49	10	33.3%	9	30.0%	8	26.7%	27	30.0%		
Religion	Hindu	16	53.3%	17	56.7%	15	50.0%	48	53.3%	.268	.875
	Sikh	14	46.7%	13	43.3%	15	50.0%	42	46.7%		
Education	Higher secondary	8	26.7%	8	26.7%	4	13.3%	20	22.2%	6.741	.150
	Graduate	14	46.7%	15	50.0%	23	76.7%	52	57.8%		
	Postgraduate	8	26.7%	7	23.3%	3	10.0%	18	20.0%		
Occupation	Working women	11	36.7%	9	30.0%	11	36.7%	31	34.4%	.394	.821
	Housewife	19	63.3%	21	70.0%	19	63.3%	59	65.6%		
Marital	Married	30	100.0%	30	100.0%	29	96.7%	89	98.9%	2.022	0.364
Status	Widow	0	0.0%	0	0.0%	1	3.3%	1	1.1%		
	Divorced	0	0.0%	0	0.0%	0	0.0%	0	0.0%		
Type of	Nuclear	16	53.3%	15	50.0%	20	66.7%	51	56.7%	1.900	.387
family	Joint	14	46.7%	15	50.0%	10	33.3%	39	43.3%		
Annual	Upto 5 lakhs	11	36.7%	12	40.0%	8	26.7%	31	34.4%	2.696	0.61
Income	5-10 lakhs	15	50.0%	15	50.0%	15	50.0%	45	50.0%		
	10-15 lakhs	4	13.3%	3	10.0%	7	23.3%	14	15.6%		
	Total	30	100.0%	30	100.0%	30	100.0%	90	100.0%		

*Nutrition Education and Physical Activity Group (NEPAG), Supplementation Group (SUG) and Dietary Counselling Group (DCG)

attainment, and economic status, were observed in control groups for studies involving perimenopausal women.

Table 2 presents the sociodemographic data of the experimental group participants across the three interventions—NEPAG, SUG and DCG—showing similar distributions. Most participants were aged 36–45 years (80%), with 56.7% identifying as Hindu and 43.3% as Sikh. Educationally, 54.4% were graduates, 27.8% were postgraduates, and 17.8% had higher secondary education. Milton and Moncayo (2021) as well as Salwana *et al.* (2020) report result consistent with the findings of the current study.

While 60% were housewives, 40% were working women, and 94.4% were married. Family type was evenly split, with 53.3% in nuclear families and 46.7% in joint families.

Annual income varied significantly ($p = 0.001$), with 41.1% earning up to 5 lakhs, 43.3% earning 5–10 lakhs, and 15.6% earning 10–15 lakhs. Notably, 36.7% of the SUG had incomes in the highest range, while none in the NEG did. Overall, participants were well-matched across variables, except for income differences.

Table 3 presents the descriptive statistics for systolic blood pressure (BP) in the control group across the three interventions—NEPAG, SUG and DCG—showing minor variations over time. Before the intervention, the mean systolic BP ranged from 138.50 to 139.03 mmHg, with an overall mean of 138.77 mmHg. During the intervention, the mean ranged from 138.58 to 139.97 mmHg, with the SUG showing slightly higher readings. After the intervention, the overall mean was 138.75 mmHg, with individual group means ranging from 138.49 to 139.27 mmHg. Despite these subtle changes, systolic BP remained within a narrow range throughout the phases as shown in Fig. 1.

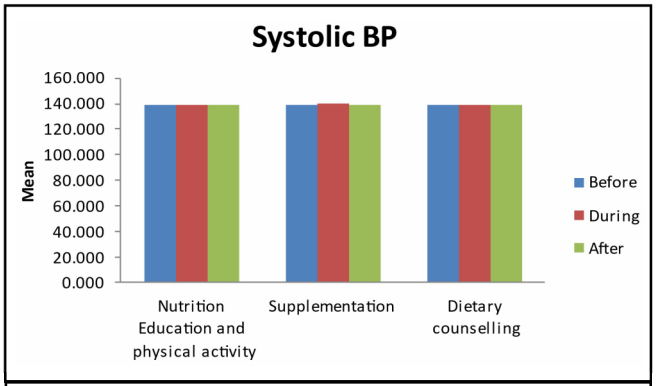

Fig. 1 : Mean change in Systolic BP of respondents in the control group

These findings align with those of Farras (2024) and Mohamed *et al.* (2024), who similarly reported minor variations in systolic BP within a narrow range of

Table 2 : Sociodemographic data of respondents in the experimental group

		Groups								Chi-Square	p-value
		NEPAG		SUG		DEC		Total			
Age	36-40	14	46.7%	10	33.3%	13	43.3%	37	41.1%	2.436	.656
	41-45	10	33.3%	12	40.0%	13	43.3%	35	38.9%		
	46-49	6	20.0%	8	26.7%	4	13.3%	18	20.0%		
Religion	Hindu	16	53.3%	15	50.0%	20	66.7%	51	56.7%	1.900	.387
	Sikh	14	46.7%	15	50.0%	10	33.3%	39	43.3%		
Education	Higher secondary	6	20.0%	8	26.7%	2	6.7%	16	17.8%	7.706	.103
	Graduate	18	60.0%	16	53.3%	15	50.0%	49	54.4%		
	Postgraduate	6	20.0%	6	20.0%	13	43.3%	25	27.8%		
Occupation	Working women	13	43.3%	14	46.7%	9	30.0%	36	40.0%	1.944	.378
	Housewife	17	56.7%	16	53.3%	21	70.0%	54	60.0%		
Marital Status	Married	27	90.0%	29	96.7%	29	96.7%	85	94.4%	3.094	0.542
	Widow	2	6.7%	0	0.0%	1	3.3%	3	3.3%		
	Divorced	1	3.3%	1	3.3%	0	0.0%	2	2.2%		
Type of family	Nuclear	19	63.3%	12	40.0%	17	56.7%	48	53.3%	3.482	.175
	Joint	11	36.7%	18	60.0%	13	43.3%	42	46.7%		
Annual Income	Upto 5 lakhs	18	60.0%	7	23.3%	12	40.0%	37	41.1%	19.238	.001**
	5-10 lakhs	12	40.0%	12	40.0%	15	50.0%	39	43.3%		
	10-15 lakhs	0	0.0%	11	36.7%	3	10.0%	14	15.6%		
	Total	30	100.0%	30	100.0%	30	100.0%	90	100.0%		

*Nutrition Education and Physical Activity Group (NEPAG), Supplementation Group (SUG) and Dietary Counselling Group (DCG)

approximately 138.50 to 139.97 mmHg across all intervention phases.

Table 4 presents the ANOVA results for systolic blood pressure (BP) across the three interventions—NEPAG, SUG and DCG—showing varied significance over time. At baseline, no significant differences were found (F = 0.455, p = 0.636), indicating comparable BP across groups. During the intervention, a significant difference emerged (F = 3.630, p = 0.031), suggesting that the intervention type influenced BP. However, post-intervention, the differences were no longer significant (F = 1.077, p = 0.345), indicating that BP levels across groups converged. These results suggest that the interventions temporarily impacted BP but did not sustain effects after the intervention ended.

Table 5 presents the descriptive statistics for systolic blood pressure (BP) in the experimental group, revealing distinct trends across the intervention phases. At baseline, the NEPAG had a mean BP of 137.13 mmHg, while the SUG and DCG recorded similar means of 139.13 mmHg and 139.14 mmHg, respectively. During the intervention, BP decreased, with the NEPAG showing the greatest reduction (135.97 mmHg). After the intervention, further declines were observed, with the NEPAG reaching 134.97 mmHg, followed by the SUG at 135.36 mmHg. DCG consistently maintained slightly higher BP levels, averaging 137.90 mmHg post-intervention.

Overall, all interventions led to BP reductions, with NEPAG demonstrating the most consistent improvement across phases as shown in Fig. 2. The present findings align with previous studies conducted by Reyhannot Farras (2024) and Mohamed *et al.* (2024).

Table 6 presents the ANOVA results for systolic blood pressure (BP) across the three interventions—NEPAG, SUG and DCG—showing significant differences at all phases. At baseline, the groups differed significantly (F = 8.848, p = 0.0001), indicating variations in initial BP levels. During the intervention, these differences became

Table 3 : Efficacy of nutritional interventions on Systolic blood pressure of respondents in the control group

Descriptives									
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Systolic BP-Before	NEPAG	30	139.029	±1.967	0.359	138.294	139.764	134.23	141.85
	SUG	30	138.498	±2.290	0.418	137.643	139.353	134.23	141.85
	DCG	30	138.780	±2.202	0.402	137.958	139.602	134.23	141.85
	Total	90	138.769	±2.144	0.226	138.320	139.218	134.23	141.85
During	NEPAG	30	138.862	±1.883	0.344	138.159	139.565	134.23	141.85
	SUG	30	139.967	±1.790	0.327	139.299	140.636	134.23	141.85
	DCG	30	138.584	±2.555	0.467	137.630	139.538	132.02	141.85
	Total	90	139.138	±2.165	0.228	138.684	139.591	132.02	141.85
After	NEPAG	30	138.496	±2.329	0.425	137.626	139.365	132.57	141.85
	SUG	30	139.271	±2.292	0.418	138.415	140.126	134.23	141.85
	DCG	30	138.494	±2.465	0.450	137.574	139.415	133.45	141.85
	Total	90	138.754	±2.365	0.249	138.258	139.249	132.57	141.85

*Nutrition Education and Physical Activity Group (NEPAG), Supplementation Group (SUG) and Dietary Counselling Group (DCG)

Table 4 : Analysis of variance for systolic blood pressure before, during and after the nutritional intervention among respondents in the control group

ANOVA						
		Sum of Squares	df	Mean Square	F-value	p-value
Systolic BP-Before	Between Groups	4.235	2	2.117	.455	.636
	Within Groups	404.945	87	4.655		
	Total	409.180	89			
During	Between Groups	32.132	2	16.066	3.630	.031*
	Within Groups	385.081	87	4.426		
	Total	417.213	89			
After	Between Groups	12.033	2	6.017	1.077	.345
	Within Groups	485.834	87	5.584		
	Total	497.868	89			

Table 5: Efficacy of nutritional interventions on Systolic blood pressure of respondents in the experimental group

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Systolic BP-Before	NEPAG	30	137.133	±2.156	0.394	136.328	137.938	132.54	141.02
	SUG	30	139.127	±2.184	0.399	138.312	139.942	134.23	141.85
	DCG	30	139.137	±2.032	0.371	138.379	139.896	134.23	141.85
	Total	90	138.466	±2.305	0.243	137.983	138.949	132.54	141.85
During	NEPAG	30	135.967	±1.995	0.364	135.222	136.711	131.54	139.54
	SUG	30	137.159	±2.426	0.443	136.253	138.065	133.23	141.42
	DCG	30	138.890	±2.328	0.425	138.021	139.759	134.23	141.85
	Total	90	137.339	±2.537	0.267	136.807	137.870	131.54	141.85
After	NEPAG	30	134.967	±2.558	0.467	134.011	135.922	130.54	140.51
	SUG	30	135.356	±2.036	0.372	134.596	136.116	132.51	139.61
	DCG	30	137.898	±3.079	0.562	136.748	139.047	132.15	141.56
	Total	90	136.073	±2.878	0.303	135.471	136.676	130.54	141.56

*Nutrition Education and Physical Activity Group (NEPAG), Supplementation Group (SUG) and Dietary Counselling Group (DCG)

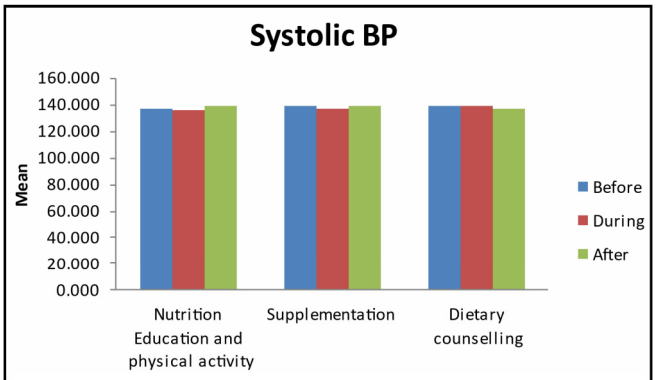

Fig. 2 : Mean change in Systolic BP of respondents in the experimental group

more pronounced (F = 12.725, p = 0.0001), highlighting the interventions' impact on BP. Post-intervention, the differences remained significant (F = 11.306, p = 0.0001), suggesting the sustained influence of the interventions.

These results emphasize the distinct effects of each intervention on systolic BP, underscoring the importance of intervention type in managing BP outcomes effectively.

Table 7 presents the descriptive statistics for diastolic blood pressure (BP) in the control group across the three interventions—NEPAG, SUG and DCG—showing minimal variation across the three phases. Before the intervention, the total mean diastolic BP was 90.41 mmHg (SD = 0.97). During the intervention, it remained stable at 90.40 mmHg (SD = ±1.37), and after the intervention, the total mean slightly decreased to 90.19 mmHg (SD = ±1.53).

The 95% confidence intervals for diastolic BP ranged narrowly, from 90.21 to 90.61 mmHg at baseline, 90.11 to 90.68 mmHg during, and 89.87 to 90.51 mmHg post-intervention. These results indicate that diastolic BP remained consistent across all phases, suggesting no significant impact of the interventions within the control groups as shown in Fig. 3. The current findings are consistent with those reported by Farras, 2024; Mats,

Table 6 : Analysis of variance for systolic blood pressure before, during and after the nutritional intervention among respondents in the experimental group

ANOVA

		Sum of Squares	df	Mean Square	F-value	p-value
Systolic BP-Before	Between Groups	79.908	2	39.954	8.848	.0001**
	Within Groups	392.866	87	4.516		
	Total	472.774	89			
During	Between Groups	129.639	2	64.819	12.725	.0001**
	Within Groups	443.152	87	5.094		
	Total	572.791	89			
After	Between Groups	152.024	2	76.012	11.306	.0001**
	Within Groups	584.899	87	6.723		
	Total	736.923	89			

Table 7 : Efficacy of nutritional interventions on Disystolic blood pressure of respondents in the control group

Descriptives									
		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Disystolic BP-Before	NEPAG	30	90.290	±0.982	0.179	89.924	90.657	88.14	92.56
	SUG	30	90.191	±0.881	0.161	89.862	90.520	88.14	92.56
	DCG	30	90.741	±0.982	0.179	90.374	91.108	89.48	92.58
	Total	90	90.408	±0.969	0.102	90.205	90.611	88.14	92.58
During	NEPAG	30	90.111	±1.909	0.349	89.398	90.824	86.51	92.58
	SUG	30	90.248	±0.894	0.163	89.914	90.581	88.14	92.56
	DCG	30	90.827	±0.994	0.181	90.456	91.198	89.48	92.58
	Total	90	90.395	±1.367	0.144	90.109	90.681	86.51	92.58
After	NEPAG	30	90.086	±1.105	0.202	89.674	90.498	87.45	92.56
	SUG	30	90.263	±0.999	0.182	89.890	90.636	88.14	92.56
	DCG	30	90.208	±2.228	0.407	89.376	91.040	82.45	92.58
	Total	90	90.185	±1.532	0.161	89.865	90.506	82.45	92.58

*Nutrition Education and Physical Activity Group (NEPAG), Supplementation Group (SUG) and Dietary Counselling Group (DCG)

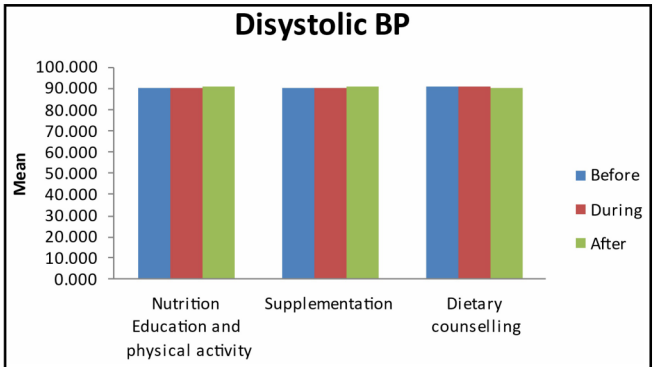

Fig. 3 : Mean change in Disystolic BP of respondents in the control group

2023; Kundapur *et al.,* 2022).

Table 8 presents the ANOVA results for diastolic blood pressure (BP) across the three intervention groups, showing no statistically significant differences at any phase. Before the intervention, the F-value was 2.855 (p = 0.063), indicating non-significant differences, though close to significance. During the intervention, the F-value was 2.398 (p = 0.097), remaining non-significant but approaching relevance. After the intervention, the F-value dropped to 0.102 (p = 0.903), confirming no meaningful differences. While some variations were noted over time, the results suggest that the interventions had no statistically significant impact on diastolic BP.

Table 9 presents the descriptive statistics for diastolic blood pressure (BP) in the experimental group—NEPAG, SUG and DCG—showing a decreasing trend over three phases: before, during, and after the intervention. Before the intervention, the mean diastolic BP was 90.65 mmHg for the NEPAG, 89.91 mmHg for the SUG, and 90.20 mmHg for the DCG, with an overall mean of 90.25 mmHg. During the intervention, mean values dropped to 89.58 mmHg, 88.98 mmHg, and 89.97 mmHg, respectively, resulting in an overall mean of 89.51 mmHg. After the intervention, the NEPAG recorded the

Table 8 : Analysis of variance for disystolic blood pressure before, during and after the nutritional intervention among respondents in the control group

ANOVA						
		Sum of Squares	Df	Mean Square	F-value	p-value
Disystolic BP-Before	Between Groups	5.150	2	2.575	2.855	.063
	Within Groups	78.471	87	.902		
	Total	83.622	89			
During	Between Groups	8.684	2	4.342	2.398	.097
	Within Groups	157.526	87	1.811		
	Total	166.210	89			
After	Between Groups	.490	2	.245	.102	.903
	Within Groups	208.261	87	2.394		
	Total	208.751	89			

Table 9 : Efficacy of nutritional interventions on Disystolic blood pressure of respondents in the experimental group

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
Disystolic BP-Before	NEPAG	30	90.647	0.951	0.174	90.292	91.002	89.48	92.58
	SUG	30	89.908	0.921	0.168	89.564	90.252	87.51	92.56
	DCG	30	90.199	0.875	0.160	89.872	90.526	88.14	92.56
	Total	90	90.251	0.956	0.101	90.051	90.452	87.51	92.58
During	NEPAG	30	89.580	0.993	0.181	89.210	89.951	87.56	91.58
	SUG	30	88.975	1.131	0.207	88.552	89.397	86.51	92.56
	DCG	30	89.971	1.467	0.268	89.424	90.519	84.91	92.58
	Total	90	89.509	1.269	0.134	89.243	89.774	84.91	92.58
After	NEPAG	30	87.883	1.532	0.280	87.311	88.455	84.36	90.58
	SUG	30	88.141	2.786	0.509	87.101	89.182	82.21	91.52
	DCG	30	89.302	2.153	0.393	88.498	90.106	83.62	92.56
	Total	90	88.442	2.278	0.240	87.965	88.919	82.21	92.56

* Nutrition Education and Physical Activity Group (NEPAG), Supplementation Group (SUG) and Dietary Counselling Group (DCG)

lowest mean at 87.88 mmHg, while the SUG and DCG reported means of 88.14 mmHg and 89.30 mmHg, respectively as shown in Fig. 4. The overall mean post-intervention was 88.44 mmHg, highlighting a consistent reduction in diastolic BP, particularly in the NEPAG.

Table 10 presents the ANOVA results for diastolic blood pressure (BP) among the experimental groups—NEPAG, SUG and DCG—indicating significant differences at all three time points: before, during, and after the intervention. Before the intervention, there was a significant difference in diastolic BP among the groups ($F(2, 87) = 4.955$, $p = 0.009$), suggesting that baseline BP varied significantly across the interventions. During the intervention, the analysis also revealed significant differences ($F(2, 87) = 5.138$, $p = 0.008$), indicating a pronounced impact of the interventions on diastolic BP. After the intervention, significant differences persisted ($F(2, 87) = 3.488$, $p = 0.035$), demonstrating that the effects of the interventions continued post-treatment.

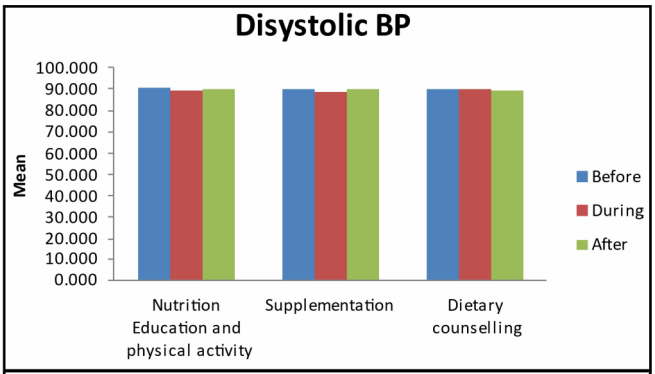

Fig. 4 : Mean change in Disystolic BP of respondents in the experimental group

Overall, these findings highlight the effectiveness of nutritional interventions in managing diastolic BP among the experimental groups at all measured time points, emphasizing their potential role in blood pressure management for perimenopausal women.

Table 10: Analysis of variance for disystolic blood pressure before, during and after the nutritional intervention among respondents in the experimental group

ANOVA

		Sum of Squares	df	Mean Square	F-value	p-value
Disystolic BP-Before	Between Groups	8.315	2	4.158	4.955	.009**
	Within Groups	73.002	87	.839		
	Total	81.317	89			
During	Between Groups	15.131	2	7.565	5.138	.008**
	Within Groups	128.093	87	1.472		
	Total	143.223	89			
After	Between Groups	34.274	2	17.137	3.488	.035*
	Within Groups	427.466	87	4.913		
	Total	461.741	89			

Conclusion:

This study, conducted in Ambala (Haryana), highlights the significant role of nutritional interventions in managing blood pressure (BP) among perimenopausal women, a group at increased cardiovascular risk due to hormonal changes. The experimental group undergoing NEPAG, SUG and DCG showed notable reductions in both systolic and diastolic BP throughout the intervention phases, with the NEPAG demonstrating the most consistent improvements. The sustained reduction in BP underscores the effectiveness of lifestyle changes for long-term cardiovascular benefits.

While the SUG and DCG also exhibited reductions, their impact was less pronounced. Notably, systolic BP reductions were significant during the intervention but became non-significant post-intervention, indicating the necessity for continuous support to maintain benefits. Diastolic BP improvements were more stable, with significant differences observed across phases.

The control group showed no significant changes in BP, reinforcing the importance of active interventions in managing cardiovascular risks. This study emphasizes that targeted nutritional strategies can play a pivotal role in BP management for perimenopausal women in Ambala, potentially reducing the risk of hypertension and related cardiovascular conditions. Future research should explore the long-term sustainability of these interventions and their effectiveness in diverse populations.

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