Efficacy of Beetroot Juice Supplementation on Lowering Blood Pressure in Hypertensive Patients – A Single Centre Study

Padmapriya. D[1], Prema.R[2], Suganya.M[3], Hemavathi.R[4], Sridevi[5]

[1]*AssistantProfessor, Department of obstetrics and Gynecological Nursing, Saveetha College Of Nursing, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University Thandalam*
[2]*BScNurisng 4thyear, Saveetha College of Nursing, SIMATS, Thandalam*
[3]*AssociateProfessor, Department of Sociology, Saveetha College of Nursing, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Thandalam, Chennai, Tamil Nadu, India*
[4]*Tutor, Department of obstetrics and Gynecological Nursing, Saveetha College of Nursing, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Thandalam, Chennai, Tamil Nadu, India*
[5]*Asst Professor, Department of Medical Surgical Nursing, Saveetha College of Nursing, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, Thandalam, Chennai, Tamil Nadu, India*

KEYWORDS
Beetroot juice ,Blood pressure, Hyperlipidemia, Hypertension.

ABSTRACT
I Background : Quasi -interventional pretest posttest research design was adopted to investigate beetroot juice supplementation on reduction of blood pressure and serum cholesterol levels among 60 hypertensive clients with hyperlipidemia using non probability purposive sampling technique Methodology: On Day-1: The demographic and clinical information was gathered by using a self-structured questionnaire . On Day - 2, the pretest level of hyperlipidemia was estimated and also, the pretest blood pressure level was assessed using sphygmomanometer. From Day-3, 200ml of beetroot juice was administered once a day for 30 days. On Day- 34 study participants were re-assessed to estimate the levels hyperlipidemia and blood pressure. Results: The study results concluded that, the pretest and posttest mean score with mean difference score of SBP and DBP in the Interventional Group was141.46±10.43,88.60±5.48 and 128.40±7.13 ,83.20±4.65 with mean difference score was13.06, 5.40 The calculated paired 't' test value of SDP and DBP t =12.558 , 5.964 was statistically significant at p<0.001 Level. The pretest and posttest with mean difference score of total cholesterol,LDL,HDL, triglyceride , cholesterol/HDLratio in the interventional group was 176.86±14.26,103.60±9.68,36.96±4.73,156.53±32.48, 4.45±0.82 and 170.10±15.37,92.96±9.20,41.96±6.08,138.83±26.48,4.00±0.75with mean difference score was 6.76,10.64,5.0,17.70, 0.45.The calculated Paired 't' test value of t =10.329,15.804, 7.816,10.652,14.879 was statistically significant at p<0.001 level.this clearly shows that after administered beetroot juice the blood pressure and serum cholesterol levels was significantly reduced in the Interventional group. Conclusion: administered Beetroot juice proved to be an effective intervention in reducing the blood pressure and serum cholesterol level among hypertensive patients with hyperlipidemia

1. Introduction

Hypertension is a major epidemiological issue in both developed and developing countries. Globally, 7.6 million deaths were ascribed to elevated blood pressure. It has been found that, hypertension has been cognated with elevated risk of coronary artery diseases, cardiovascular and cerebrovascular diseases. [1] Research studies have identified and reported that, in 2019, about 1 billion individuals from low income and middle income areas are affected with hypertension [2] Hypertension is defined as an unusual elevation of arterial blood pressure. According to JNC-7, when systolic blood pressure ≥ 140mmHg or diastolic blood pressure ≥ 90mmHg, is called as hypertension. Clinically, hypertension can be classified into two types, one is primary hypertension with unidentifiable cause secondary hypertension with identifiable causes.[3] The associated risk factors for hypertension includes BMI, physical activity, low literacy level, socio economic status, obesity, education , marital status, consumption of alcohol and tobacco etc.[4] Pathogenesis of hypertension is due to the impaired renal function, hormonal imbalances leading to altered renin angiotensin – aldosterone system or may due to the hyper activation of central nervous system.[5] The rise of systolic pressure may be due to inadequate elasticity of blood vessels, diminished vasodilatation elevated systemic vascular resistance and cardiac output. The clinical features includes left ventricular hypertrophy, myocardial ischemia, heart failure, transient ischemic attacks, chronic kidney disease and retinopathy [6].The pharmacological measures to treat hypertension includes mineralocorticoid receptors, sodium–glucose cotransporter-2 inhibitors [7], diuretics, calcium channel blockers.[8] The non- pharmacological treatment modalities includes life style modification mainly focusing on maintaining body weight, following healthy dietary habits comprising of less sodium and more potassium

intake, involving in regular physical activity and quitting from consuming alcohol, [7] Mindfulness–Based Stress-Reduction Program, Transcendental meditation, DASH diet, Mediterranean diet , use of coca, self - monitoring of blood pressure and use of personal air cleaners [9]

Consumption of beetroot juice is found to play a useful role reducing blood pressure level due to the significant presence of bioactive phytochemicals and antioxidants [10,11].

Therefore , the objectives of current study was to assess the effectiveness of beetroot juice consumption on level of blood pressure and serum lipid profile among hypertensive patients in both interventional and control group and to find out the association betweeen blood pressure and serum lipid profile among hypertensives with selected demographic variables.

2. Material and Methods

Study Design: Quasi-interventional pretest posttest control group research design was adopted to investigate the effectiveness of effectiveness of beetroot juice on reduction of blood pressure and hyperlipidemia among hypertensive patients.

Sampling Technique: The participants were recruited through non probability purposive sampling technique. 30 study participants in the interventional group and 30 study participants in the control group.

Study Setting: The current study was conducted for the duration of 6 months from November 2023 till April 2024 in the Hypertension Outpatient clinic of the host institution after obtaining ethical clearance from the Institutional Ethics Committee (702/2024/IEC/SCON) of Saveetha Institute Of Medical And Technical Sciences.

Study Participants: A total of 60 hypertensive patients who fulfilled the inclusion criteria were recruited as study participants. The purpose of study was explained clearly in-depth to each of the study participant and a written informed consent was obtained from them.

The present study included both genders and between the age group of 30-70 years, with a known case of hypertension and on regular treatment who were willing to participate in the study. When assessed the blood pressure according to American Heart Association [12] who comes under stage-I (Systolic -130-139 mmHg, diastolic Bp-80-89 mmHg) and stage-II (Systolic -140or higher mmHg, diastolic Bp-90 or higher mmHg) with presence of hyperlipidemia (Serum Total Cholesterol – 200-239mg/dl or above 240 mg/dl, Triglycerides above 150mg/dl, HDL- below 60mg/dl, LDL-above 130mg/dl) who are attending our Hypertension Clinic of the host institution were included in the current study. Individuals with history of diabetes, chronic renal disease and on dialysis treatment, allergic to beetroot, who has dysphagia, with history of severe co-morbidities and psychiatric illness, with history of consuming herbs or with alternative complementary therapies including acupressure, acupuncture or reflexology, Pregnant woman, lactation mothers and non-co-operative individuals were excluded.

Preparation of Beetroot Juice: 50 grams of raw fresh beetroot was washed, cleaned, grinded along with 200 mL of water , made into a liquid form .

Pre-Assessment: On Day-1: The demographic and clinical information was gathered by using a self-structured questionnaire and the study participants were instructed to avoid food intake overnight for 10-12 hours on Day-1 and come for our laboratory in the next morning for giving the blood samples. On Day -2, the pretest level of hyperlipidemia was estimated and before withdrawing the blood, a tourniquet is tied around the study participants upper arm to increase the venous blood flow and the puncture site was cleansed with an alcohol swab. A syringe is pierced into the puncture site and about 2mL of blood is collected from the ante-cubital vein and the lipid levels are estimated directly using the process of ultracentrifugation. Also, the pretest blood pressure level was assessed using sphygmomanometer as per American Heart Association criteria. Intervention.

Intervention : From Day-3, 200ml of beetroot juice was administered orally in morning between 7.30-8.00 am in empty stomach before breakfast , once a day for 30 days for the intervention group while the control group received normal hospital care without beet root juice supplementation.

Post-Assessment: On Day- 34 study participants were re-assessed to estimate the levels hyperlipidemia and blood pressure.

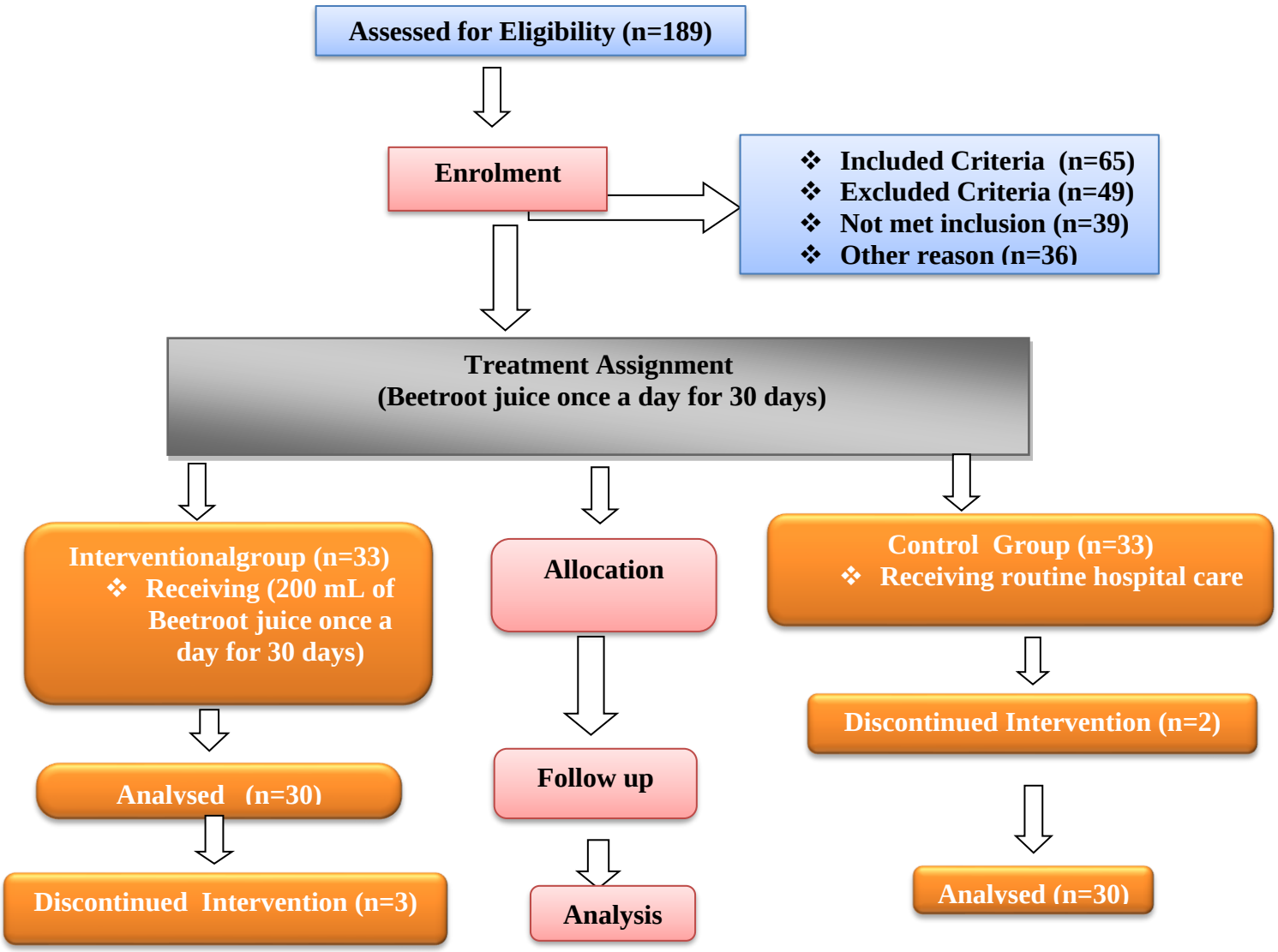

Figure :1 Consort Flowchart for The Patient's Recruitment Process

3. Results

Demographic Characteristics

In the interventional group most of the clients with type 2 diabetes mellitus, 12(40%) were aged between 41 – 50 years, 18(60%) were female, 25(83.3%) were Hindus, 9(30%) had primary school education, 12(40%) were unemployed, 30(100%) were residing in urban area, 27(90%) were married and 30(100%) belonged to middle class, whereas in the control group most of the clients with type 2 diabetes mellitus, 16(53.3%) were aged between 41 – 50 years, 21(70%) were female, 22(73.3%) were Hindus, 13(43.3%) were diploma holders / graduates, 16(53.3%) were private employees, 30(100%) were residing in urban area, 30(100%) were married and 30(100%) belonged to middle class.

Clinical Characteristics

In the interventional group most of the clients with type 2 diabetes mellitus, 30(100%) had type II diabetes mellitus, 15(50%) had type 2 diabetes mellitus for 3 – 5 years, 25(83.3%) had family history of type 2 diabetes mellitus, 12(40%) had hypertension, 25(83.4%) had moderate level of physical activity, 14(46.7%) had walking history of 1 kilometer, 29(96.7%) had clinical visits for 6 months once, 30(100%) had taken diabetes medications regularly, 21(70%) had no habits, 13(43.3%) had no diet restriction and no history of hypertension and 17(56.7%) had not regularly having hypertensive drugs whereas in the control group most of the clients with type 2 diabetes mellitus, 30(100%) had type II diabetes mellitus, 9(30%) had type 2 diabetes mellitus for above 7 years, 17(56.7%) had family history of type 2 diabetes mellitus, 14(46.7%) had hypertension, 23(76.7%) had

moderate level of physical activity, 16(53.3%) had walking history of more than 1 kilometer, 29(96.7%) had clinical visits for 6 months once, 30(100%) had taken diabetes medications regularly, 22(73.3%) had no habits, 14(46.7%) had no diet restriction, 11(36.7%) had no history of hypertension and 18(60%) had not regularly having hypertensive drugs.

Assessment And Comparison Of Blood Pressure Among Hypertensive Clients In The Interventional And Control Group

The pretest mean score of SBP among hypertensive clients in the interventional group was 141.46±10.43 and the posttest mean score was 128.40±7.13. The mean difference score was 13.06. The calculated paired 't' test value of t = 12.558 was found to be statistically significant at p<0.001 level which clearly infers that there was reduction in the level of SBP after the administration of beetroot juice among hypertensive clients in the interventional group. The pretest mean score of SBP among hypertensive clients in the control group was 142.33±10.66 and the posttest mean score was 142.06±10.32. The mean difference score was 0.27. The calculated paired 't' test value of t = 0.103 was not found to be statistically significant which clearly infers that there was no significant reduction in the level of SBP among hypertensive clients. The calculated students independent 't' test value of t = 0.318 in the pretest between the interventional and control group was not found to be statistically significant. The calculated students independent 't' test value of t = 5.965 with mean difference score of 13.66 in the posttest between the interventional and control group was found to be statistically significant at p<0.001 level. This clearly infers that beetroot juice administered among the hypertensive clients in the interventional group was found to be effective in reduction in the SBP level than the hypertensive clients in the control group who had undergone hospital routine protocol. The pretest mean score of DBP among hypertensive clients in the interventional group was 88.60±5.48 and the posttest mean score was 83.20±4.65. The mean difference score was 5.40. The calculated paired 't' test value of t= 5.964 was found to be statistically significant at p<0.001 level which clearly infers that there was reduction in the level of DBP after the administration of beetroot juice among hypertensive clients in the interventional group. The pretest mean score of DBP among hypertensive clients in the control group was 89.60±5.95 and the posttest mean score was 89.40±5.73. The mean difference score was 0.20. The calculated paired 't' test value of t = 1.795 was not found to be statistically significant which clearly infers that there was no significant reduction in the level of DBP among hypertensive clients. The calculated students independent 't' test value of t = 0.677 in the pretest between the interventional and control group was not found to be statistically significant. The calculated students independent 't' test value of t = 4.598 with mean difference score of 6.20 in the post test between the interventional and control group was found to be statistically significant at p<0.001 level. This clearly infers that beetroot juice administered among the hypertensive clients in the interventional group was found to be effective in reduction in the DBP level than the hypertensive clients in the control group who had undergone hospital routine protocol (As depicted in Table:1 and figure:2 & Table:2 and figure:3)

Table 1: Comparison Of Systolic Blood Pressure Among Hypertensive Clients Within And Between The Interventional And Control Group

N = 60(30+30)

Systolic BP	Pretest		Post Test		Mean Difference Score	Paired 't' test value
	Mean	S.D	Mean	S.D		
Interventional Group	141.46	10.43	128.40	7.13	13.06	t = 12.558 p=0.0001 S***
Control Group	142.33	10.66	142.06	10.32	0.27	t = 1.682 p=0.103 N.S
Mean Difference Score	0.87		13.66		***p<0.001, **p<0.01, *p<0.05 S - Significant N.S – Not Significant	
Student Independent 't' test & p-value	t = 0.318 p=0.752, N.S		t = 5.965 p=0.0001, S***			

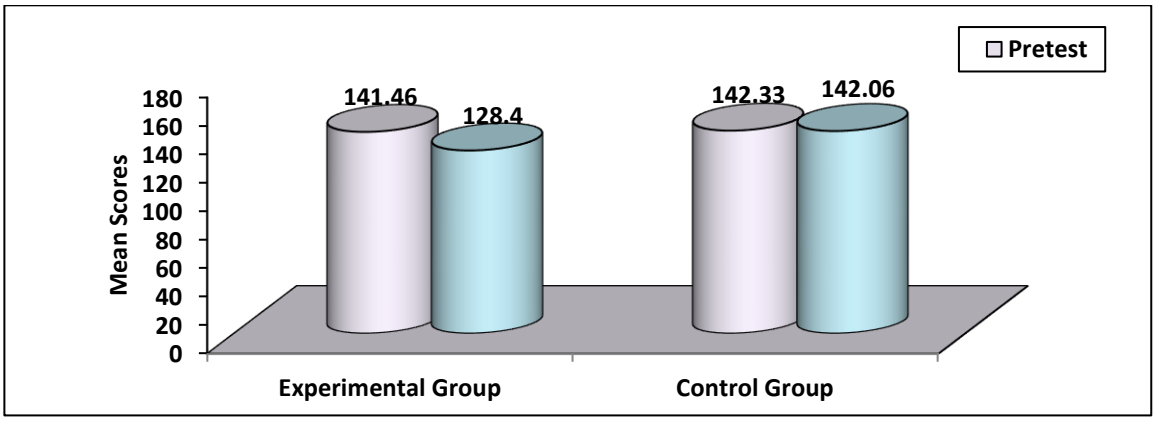

Figure :2 Comparison Of Systolic Blood Pressure Among Hypertensive Clients Within And Between The Interventional And Control Group

Table 2: Comparison Of Diastolic Blood Pressure Among Hypertensive Clients Within And Between The Interventional And Control Group

N = 60(30+30)

Diastolic BP	Pretest		Post Test		Mean Difference Score	Paired 't' test value
	Mean	S.D	Mean	S.D		
Interventional Group	88.60	5.48	83.20	4.65	5.40	t = 5.964 p=0.0001 S***
Control Group	89.60	5.95	89.40	5.73	0.20	t = 1.795 p=0.083 N.S
Mean Difference Score	1.00		6.20		***p<0.001, **p<0.01, *p<0.05 S - Significant N.S – Not Significant	
Student Independent 't' test & p-value	t = 0.677 p=0.501, N.S		t = 4.598 p=0.0001, S***			

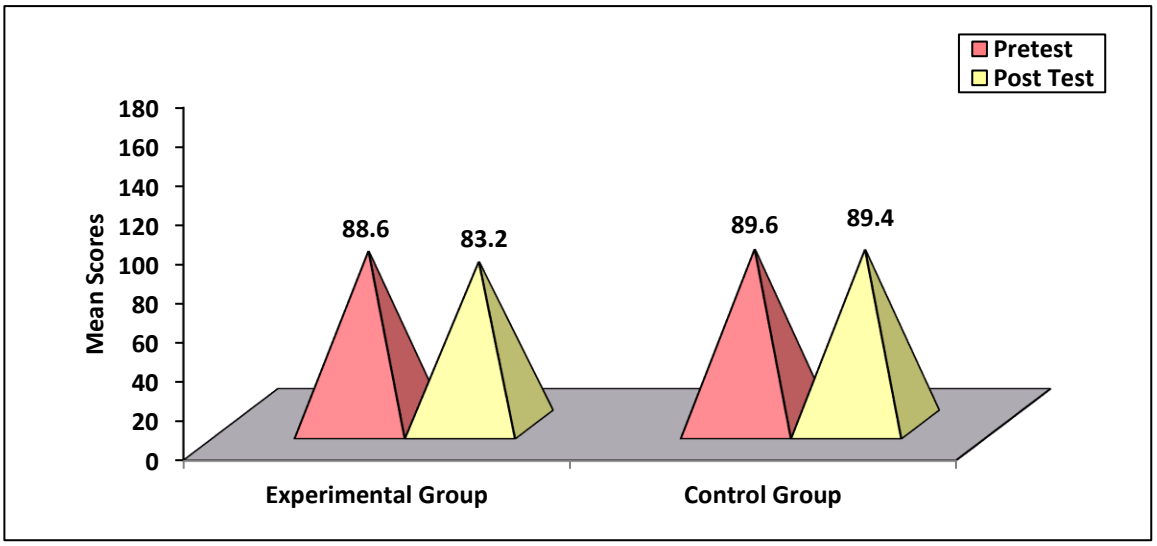

Figure :3 Comparison Of Diastolic Blood Pressure Among Hypertensive Clients Within And Between The Interventional And Control Group

A study was conducted among 20 healthy older adults aiming in investigating the effect of beetroot juice on reduction of blood pressure. The participants for the current study was randomly selected for both interventional and control group, the interventional group was administered with beetroot juice for about 28 days and the outcome of the study results concluded that, there was a significant reduction in the level of both systolic and diastolic blood pressure among the study participants.[10][13] A one group pretest posttest research was carried out among 60 hypertensive clients aiming in analyzing the impact of beetroot juice on reducing the blood pressure level and the results concluded that, there was a reduction in the level of blood pressure to some

extent.[11][14]

In our present study, we have recruited individuals who are diagnosed as hypertension as study participants, the reason for elevation in the level of blood pressure among these clients can be due to various factors, which the investigators failed to identify the reasons for the occurrence of hypertension. Similarly, in our study after administration of beetroot juice both systolic and diastolic blood pressure was significantly reduced among hypertensive clients (As depicted in Table:1 and figure:2 & Table:2 and figure:3). Beet root has an anti-oxidant property and also rich in nitrates, maintains the endothelial function thereby causing muscle relaxation over the endothelial layer and thereby reduces blood pressure. [12][15] The present study results and above supportive studies clearly highlighted that, administration of beetroot juice has proven to be effective in reducing the blood pressure.

Assessment And Comparison Of Serum Cholesterol Among Hypertensive Clients In The Interventional And Control Group

The pretest mean score of total cholesterol among hypertensive clients in the interventional group was 176.86±14.26 and the posttest mean score was 170.10±15.37. The mean difference score was 6.76. The calculated paired 't' test value of t = 10.329 was found to be statistically significant at p<0.001 level which clearly infers that there was reduction in the level of total cholesterol after the administration of beetroot juice among hypertensive clients in the interventional group. The pretest mean score of total cholesterol among hypertensive clients in the control group was 178.53±13.47 and the posttest mean score was 178.20±13.50. The mean difference score was 0.33. The calculated paired 't' test value of t = 1.836 was not found to be statistically significant which clearly infers that there was no significant reduction in the level of total cholesterol among clients with type 2 diabetes mellitus. The calculated students independent 't' test value of t = 0.465 in the pretest between the interventional and control group was not found to be statistically significant. The calculated students independent 't' test value of t = 2.168 with mean difference score of 8.10 in the post test between the interventional and control group was found to be statistically significant at p<0.01 level. This clearly infers that beetroot juice administered among the hypertensive clients in the interventional group was found to be effective in reduction in the total cholesterol level than the hypertensive clients in the control group who had undergone hospital routine protocol. (As depicted in Table:3 and figure:4)

Table 3: Comparison Of Total Cholesterol Among Hypertensive Clients Within And Between The Interventional And Control Group

N = 60(30+30)

Total Cholesterol	Pretest		Post Test		Mean Difference Score	Paired 't' test value
	Mean	S.D	Mean	S.D		
Interventional Group	176.86	14.26	170.10	15.37	6.76	t = 10.329 p=0.0001 S***
Control Group	178.53	13.47	178.20	13.50	0.33	t = 1.836 p=0.077 N.S
Mean Difference Score	1.67		8.10		***p<0.001, *p<0.05	
Student Independent 't' test & p-value	t = 0.465 p=0.644, N.S		t = 2.168 p=0.034, S*		S - Significant N.S – Not Significant	

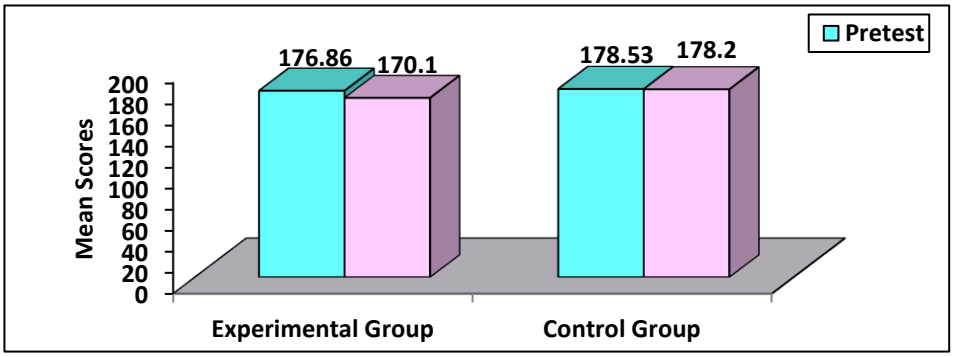

Figure:4 Comparison Of Total Cholesterol Among Hypertensive Clients Within And Between The Interventional And Control Group

The pretest mean score of LDL among hypertensive clients in the interventional group was 103.60±9.68 and the posttest mean score was 92.96±9.20. The mean difference score was 10.64. The calculated paired 't' test value of t = 15.804 was found to be statistically significant at p<0.001 level which clearly infers that there was reduction in the level of LDL after the administration of beetroot juice among hypertensive clients in the interventional group. The pretest mean score of LDL among hypertensive clients in the control group was 105.0±0.65 and the posttest mean score was 101.39±19.53. The mean difference score was 3.61. The calculated paired 't' test value of t = 1.063 was not found to be statistically significant which clearly infers that there was no significant reduction in the level of LDL among hypertensive clients. The calculated students independent 't' test value of t = 0.558 in the pretest between the interventional and control group was not found to be statistically significant. The calculated students independent 't' test value of t = 2.137 with mean difference score of 8.43 in the posttest between the interventional and control group was found to be statistically significant at p<0.05 level. This clearly infers that beetroot juice administered among the hypertensive clients in the interventional group was found to be effective in improvement in the LDL level than the hypertensive clients in the control group who had undergone hospital routine protocol. (As depicted in Table: 4 and figure:5)

Table 4: Comparison of LDL Among Hypertensive Clients Within and Between The Interventional And Control Group

N = 60(30+30)

LDL	Pretest		Post Test		Mean Difference Score	Paired 't' test value
	Mean	S.D	Mean	S.D		
Interventional Group	103.60	9.68	92.96	9.20	10.64	t = 15.804 p=0.0001 S***
Control Group	105.00	0.65	101.39	19.53	3.61	t = 1.063 p=0.297 N.S
Mean Difference Score	1.40		8.43		***p<0.001, *p<0.05, *p<0.05	
Student Independent 't' test & p-value	t = 0.558 p=0.579, N.S		t = 2.137 p=0.039, S*		S - Significant N.S – Not Significant	

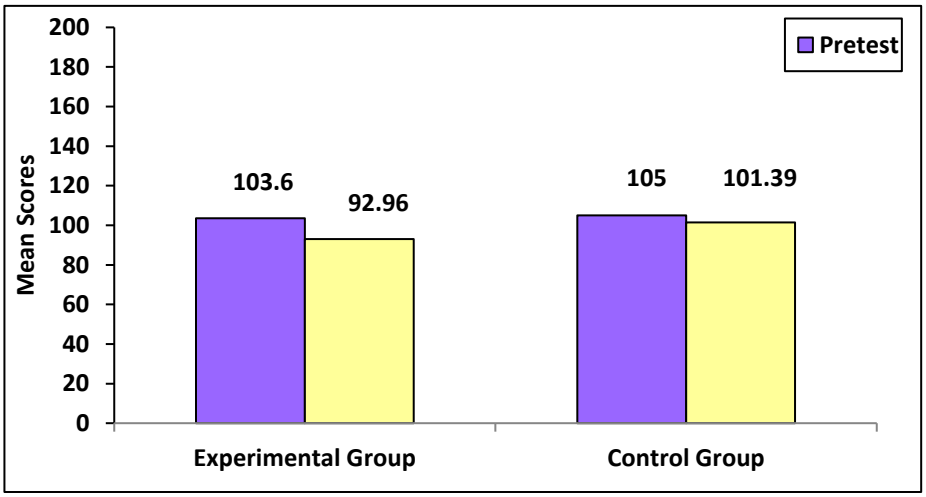

Figure:5 Comparison Of LDL Among Hypertensive Clients Within And Between The Interventional And Control Group

The pretest mean score of HDL among hypertensive clients in the interventional group was 36.96±4.73 and the posttest mean score was 41.96±6.08. The mean difference score was 5.0. The calculated paired 't' test value of t=7.816 was found to be statistically significant at p<0.001 level which clearly infers that there was improvement in the level of HDL after the administration of beetroot juice among hypertensive clients in the interventional group. The pretest mean score of HDL among hypertensive clients in the control group was 37.83±4.40 and the posttest mean score was 38.0±4.41. The mean difference score was 0.17. The calculated paired 't' test value of t = 1.223 was not found to be statistically significant which clearly infers that there was no significant improvement in the level of HDL among hypertensive clients. The calculated students independent 't' test value of t = 0.735 in the pretest between the interventional and control group was not found

to be statistically significant. The calculated students independent 't' test value of t = 2.888 with mean difference score of 3.96 in the posttest between the interventional and control group was found to be statistically significant at p<0.01 level. This clearly infers that beetroot juice administered among the hypertensive clients in the interventional group was found to be effective in improvement in the HDL level than the hypertensive clients in the control group who had undergone hospital routine protocol. (As depicted in Table: 5 and figure:6)

Table 5: Comparison Of HDL Among Hypertensive Clients Within And Between The Interventional And Control Group

N = 60(30+30)

HDL	Pretest		Post Test		Mean Difference Score	Paired 't' test value
	Mean	S.D	Mean	S.D		
Interventional Group	36.96	4.73	41.96	6.08	5.0	t = 7.816 p=0.0001 S***
Control Group	37.83	4.40	38.00	4.41	0.17	t = 1.223 p=0.231 N.S
Mean Difference Score	0.87		3.96		***p<0.001, **p<0.01 S - Significant N.S – Not Significant	
Student Independent 't' test & p-value	t = 0.735 p=0.466, N.S		t = 2.888 p=0.006, S**			

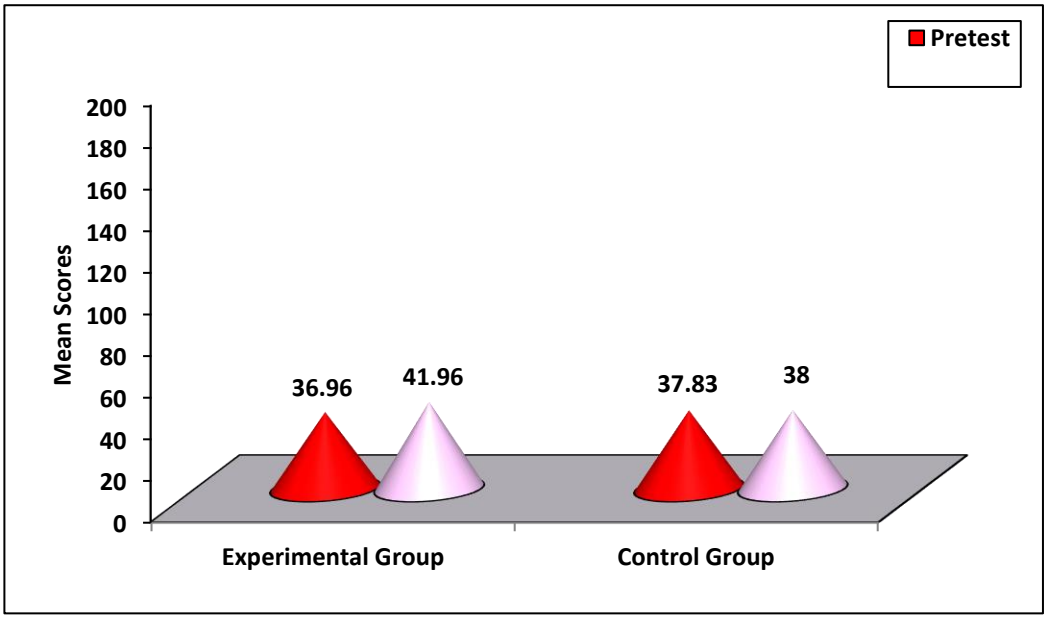

Figure:6 Comparison Of HDL Among Hypertensive Clients Within And Between The Interventional And Control Group

The pretest mean score of triglyceride among hypertensive clients in the interventional group was 156.53±32.48 and the posttest mean score was 138.83±26.77. The mean difference score was 17.70. The calculated paired 't' test value of t = 10.652 was found to be statistically significant at p<0.01 level which clearly infers that there was reduction in the level of triglyceride after the administration of beet root juice among hypertensive clients in the interventional group. The pretest mean score of triglyceride among hypertensive clients in the control group was 155.30±33.61 and the posttest mean score was 155.16±33.55. The mean difference score was 0.14. The calculated paired 't' test value of t = 1.682 was not found to be statistically significant which clearly infers that there was no significant reduction in the level of triglyceride among hypertensive clients. The calculated students independent 't' test value of t = 0.145 in the pretest between the interventional and control group was not found to be statistically significant. The calculated students independent 't' test value of t = 2.084 with mean difference score of 16.33 in the post test between the interventional and control group was found to be statistically significant at p<0.001 level. This clearly infers that beetroot juice administered among the clients in the interventional group was found to be effective in reduction in the triglyceride level than the hypertensive clients in the control group who had undergone hospital routine protocol. (As depicted in Table: 6 and figure: 7)

Table 6: Comparison Of Triglyceride Among Hypertensive Clients Within And Between The interventional And Control Group

N = 60(30+30)

Triglyceride	Pretest		Post Test		Mean Difference Score	Paired 't' test value
	Mean	S.D	Mean	S.D		
Interventional Group	156.53	32.48	138.83	26.77	17.70	t = 10.652 p=0.0001 S***
Control Group	155.30	33.61	155.16	33.55	0.14	t = 1.682 p=0.103 N.S
Mean Difference Score	1.23		16.33		***p<0.001, *p<0.05	
Student Independent 't' test & p-value	t = 0.145 p=0.886, N.S		t = 2.084 p=0.042, S*		S - Significant N.S – Not Significant	

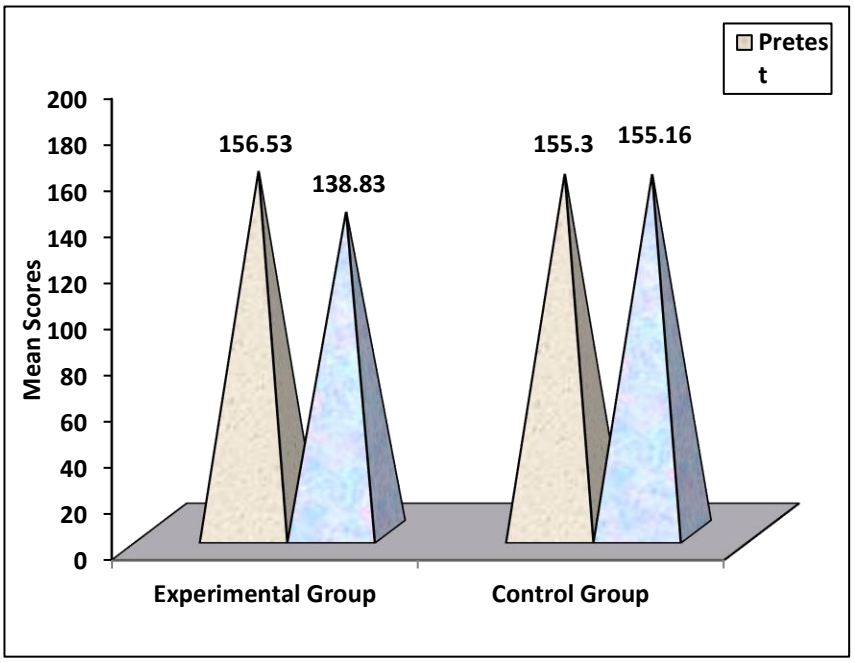

Figure: 7 Comparison Of Triglyceride Among Hypertensive Clients Within And Between The interventional And Control Group

The pretest mean score of cholesterol / HDL Ratio among hypertensive clients in the interventional group was 4.45±0.82 and the posttest mean score was 4.00±0.75. The mean difference score was 0.45. The calculated paired 't' test value of t = 14.879 was found to be statistically significant at p<0.001 level which clearly infers that there was reduction in the level of cholesterol / HDL Ratio after the administration of beet root juice among hypertensive clients in the interventional group. The pretest mean score of cholesterol / HDL Ratio among hypertensive clients in the control group was 4.56±0.79 and the posttest mean score was 4.48±0.6. The mean difference score was 0.08. The calculated paired 't' test value of t=1.742 was not found to be statistically significant which clearly infers that there was no significant reduction in the level of cholesterol / HDL Ratio among hypertensive clients. The calculated students independent 't' test value of t = 0.562 in the pretest between the interventional and control group was not found to be statistically significant. The calculated students independent 't' test value of t = 2.597 with mean difference score of 0.48 in the post test between the interventional and control group was found to be statistically significant at p<0.05 level. This clearly infers that beetroot juice administered among the clients in the interventional group was found to be effective in reduction in the cholesterol / HDL Ratio than the hypertensive clients in the control group who had undergone hospital routine protocol. (As depicted in Table: 7 and figure: 8)

Table 7: Comparison of Cholesterol / HDL Ratio Among Hypertensive Clients Within And Between The interventional And Control Group

N = 60(30+30)

Cholesterol / HDL Ratio	Pretest		Post Test		Mean Difference Score	Paired 't' test value
	Mean	S.D	Mean	S.D		
Interventional Group	4.45	0.82	4.00	0.75	0.45	t = 14.879 p=0.0001 S***
Control Group	4.56	0.79	4.48	0.66	0.08	t = 1.742 p=0.092 N.S
Mean Difference Score	0.11		0.48		***p<0.001, *p<0.05 S - Significant N.S – Not Significant	
Student Independent 't' test & p-value	t = 0.562 p=0.576, N.S		t = 2.597 p=0.012, S*			

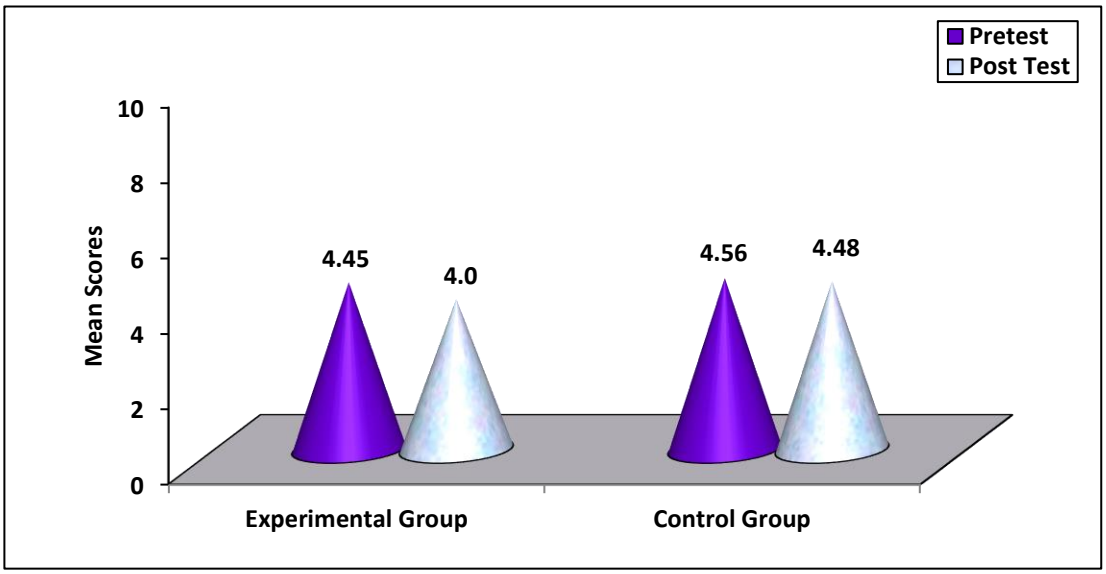

Figure: 8 Comparison Of TCH/HDL Ratio Among Hypertensive Clients Within And Between The interventional And Control Group

As no literatures related to beetroot juice on reducing the serum cholesterol level among hypertensive clients are unavailable. As our current study proves to have a positive effect on improving the serum cholesterol level, further studies are need to be conducted to assess the impact of our present intervention in future.

Association Of Level Of Blood Pressure And Serum Cholesterol Among Hypertensive Clients With Selected Demographic Variables

The demographic variables did not show statistically significant association with post test scores of systolic blood pressure, serum cholesterol and LDL among hypertensive clients at $p<0.05$ level in the interventional group. The demographic variables occupational status ($F=3.147$, $p=0.042$) and habits ($t=3.238$, $p=0.009$) had shown statistically significant association with posttest level of diastolic blood pressure among hypertensive clients at $p<0.05$ and $p<0.01$ level respectively and the other demographic variables had not shown statistically significant association with posttest level of diastolic blood pressure among hypertensive clients at $p<0.05$ level in the interventional group.

Association Of Post Test Level Of HDL, Triglycerides And Cholesterol/HDL Ratio Among Hypertensive Clients With Their Selected Demographic Variables In The Interventional Group

The demographic variables did not show statistically significant association with post test scores of HDL and TCH/HDL ratio among hypertensive clients at $p<0.05$ level in the interventional group. The demographic variable habits ($t=2.505$, $p=0.019$) had shown statistically significant association with posttest level of TCH/HDL ratio among hypertensive clients at $p<0.05$ level and the other demographic variables had not shown statistically significant association with posttest level of TCH/HDL ratio among hypertensive clients at $p<0.05$ level in the interventional group.

Association Of Post Test Level Of Blood Pressure, Total Cholesterol And LDL Among Hypertensive Clients With Their Selected Clinical Variables In The Interventional Group

The clinical variables did not show statistically significant association with post test scores of SBP, DBP, TCH, LDL among hypertensive clients at $p<0.05$ level in the interventional group

Association Of Post Test Level Of HDL, Triglycerides And TCH/HDL Ratio Among Hypertensive Clients With Their Selected Clinical Variables In The Interventional Group

The clinical variables did not show statistically significant association with post test scores of HDL, Triglyceride and TCH/HDL Ratio among hypertensive clients at $p<0.05$ level in the interventional group.

4. Discussion

Hypertension is known to be a silent killer. Many risk factors like age, gender, family history, diet, obesity,tobacco usage as well as tooth loss are associated with hypertensive prognosis. [16] Hypertension is known to induce changes in inflammatory biomarkers, autonomic functions and affect sleep quality. [17,18] Though advancement in drugs for managing hypertension is plenty, there exist few effective natural interventions [19] like yoga, vestibular stimulation and nutritional supplementation which have found to be effective in reducing blood pressure and lipid levels [20,21]

Beetroot contains numerous bioactive phytochemicals, having innumerable health benefits . Energy drinks enriched with beetroot were shown to have elevated antioxidant capacity compared to flavored milk. Many nutraceutical products containing beetroot are used for oral consumption along with adequate amount of proteins, fats, carbohydrates and total energy content. [11]. In addition it is proven to be protective against diseases like cancer and atherosclerosis. Beetroot has various therapeutic applications, having antioxidant, antibacterial, antiviral, and analgesic effect. Beetroot is noted to be functional food as it is rich in minerals, amino acids, phenolic acid, flavonoid, betaxanthin, and betacyanin. [10]

Systematic review studies have shown that beetroot juice is an effective supplementation for hypertension having the ability to reduce both systolic and diastolic blood pressure in prehypertensive as well as hypertensive patients. The blood pressure lowering effect observed in our study could be due to the mechanism invloving the $NO_3^-/NO_2^-/NO$ pathway, although more studies are needed to prove if other secondary metabolites , like betalains, present in beetroot juice could synthesize the effect [22,23,24] .A minimum of two weeks of beet root juice administration was recommended in previous studies for blood pressure lowering efficacy, whereas our supplementation was for thirty days making its effect significantly antihypertensive. Thus, beetroot juice supplementation could be an easy, side effect free, cost-effective method to reduce blood pressure.[25,26]

5. Conclusion

Based on the findings of the current study, it was evident that administration of beetroot juice had significant effect on reducing the blood pressure and serum cholesterol level among hypertensive clients. So, beetroot juice administration can be implemented as a part of nursing intervention and health education awareness programs can be created to patients with hypertension as beetroot juice is safe, economical and effective intervention with no evidence of side effects.

LIMITATIONS

However, the study has its limitations as the sample size was small and it was done in a single centre. Larger multicentric studies with longitudinal follow up will produce more insightful results on the long-term beneficial effect of beet root juice supplementation in hypertensive individuals.

STUDY IMPACT

Beet root juice supplementation induced reduction in blood pressure could lead to reduced mortality related to cardiovascular as well as cerebrovascular diseases which may ultimately help in diminishing the economic burden of public health expenditure.

AUTHORS CONTRIBUTION

Padma Priya developed the study concept and design, Prema collected the clinical data, Padma Priya performed the statistical analysis and interpretation of data, study supervision, critical revision of the manuscript for the intellectual content and drafting of the manuscript. All authors read and approved the final manuscript.

CONFLICT OF INTEREST AND FUNDING SUPPORT

The authors for the current project did not receive funding support and declare no conflict of interest

References

[1] Kishore, J., Gupta, N., Kohli, C., & Kumar, N. (2016). Prevalence of hypertension and determination of its risk factors in rural Delhi. International journal of hypertension, 2016.

[2] Bernotienė, G., Dulskienė, V., Klumbienė, J., Kriaučionienė, V., Kučienė, R., Lukšienė, D., ... & Tamošiūnas, A. (2021). Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants. Lancet. London: Lancet Publishing Group, 2021, vol. 398, no. 10304.

[3] Harrison, D. G., Coffman, T. M., & Wilcox, C. S. (2021). Pathophysiology of hypertension: the mosaic theory and beyond. Circulation research, 128(7), 847-863.

[4] 4.Singh, S., Shankar, R., & Singh, G. P. (2017). Prevalence and associated risk factors of hypertension: a cross-sectional study in urban Varanasi. International journal of hypertension, 2017.

[5] Hall, M. E., & Jones, D. W. Pathophysiology of Hypertension-John E. Hall/Joey P. Granger.

[6] Unger, T., Borghi, C., Charchar, F., Khan, N. A., Poulter, N. R., Prabhakaran, D., ... & Schutte, A. E. (2020). 2020 International Society of Hypertension global hypertension practice guidelines. Hypertension, 75(6), 1334-1357.

[7] . Mogi, M., Maruhashi, T., Higashi, Y., Masuda, T., Nagata, D., Nagai, M., ... & Kario, K. (2022). Update on hypertension research in 2021. Hypertension Research, 45(8), 1276-1297.

[8] 8.Carey, R. M., Moran, A. E., & Whelton, P. K. (2022). Treatment of hypertension: a review. Jama, 328(18), 1849-1861..

[9] Verma, N., Rastogi, S., Chia, Y. C., Siddique, S., Turana, Y., Cheng, H. M., ... & Kario, K. (2021). Non-pharmacological management of hypertension. The Journal of Clinical Hypertension, 23(7), 1275-1283.

[10] Thiruvengadam, M., Chung, I. M., Samynathan, R., Chandar, S. R. H., Venkidasamy, B., Sarkar, T., Rebezov, M., Gorelik, O.,Shariati M A., Simal-Gandara, J. (2022). A comprehensive review of beetroot (Beta vulgaris L.) bioactive components in the food and pharmaceutical industries. Critical Reviews in Food Science and Nutrition, 64(3), 708–739. https://doi.org/10.1080/10408398.2022.2108367

[11] Ashraf S, Sayeed SA, Ali R, Vohra F, Ahmed N, Alam MK. Assessment of Potential Benefits of Functional Food Characteristics of Beetroot Energy Drink and Flavored Milk. Biomed Res Int. 2022 Mar 15;2022:1971018. doi: 10.1155/2022/1971018. PMID: 35342761; PMCID: PMC8947884.

[12] American Heart Association guidelines https://www.heart.org/en/health-topics/high-blood-pressure accessed on 3rd October 2024

[13] Jones, T., Dunn, E. L., Macdonald, J. H., Kubis, H. P., McMahon, N., & Sandoo, A. (2019). The effects of beetroot juice on blood pressure, microvascular function and large-vessel endothelial function: a randomized, double-blind, control-controlled pilot study in healthy older adults. Nutrients, 11(8), 1792.

[14] Cynosure sharma, B., Girija Bhaskaran, Hemavathy,V., (2019) . A study to assess the effectiveness of beetroot juice in reducing blood pressure among the hypertension patients. International Journal of Current Advanced Research, 8 (5), 18879-18880.

[15] Benjamim, C. J. R., Porto, A. A., Valenti, V. E., Sobrinho, A. C. D. S., Garner, D. M., Gualano, B., & Bueno Junior, C. R. (2022). Nitrate derived from beetroot juice lowers blood pressure in patients with arterial hypertension: a systematic review and meta-analysis. Frontiers in nutrition, 9, 823039.

[16] Vignesh, Dr Shilpa Shyam. "ASSOCIATION OF TOOTH LOSS WITH HYPERTENSION-A retrospective study." Obstetrics and Gynaecology Forum. Vol. 34. No. 3s. 2024.

[17] 17.K.Anjana,R. Archana , J.K.Mukkadan ,Jidhu.G, Changes in inflammatory biomarkers in hypertensive subjects due to om chanting - a randomized controlled trial , NeuroQuantology 2022; 20(8): 3321-3326,

[18] 18.Archana Rajagopalan, Anjana Krishna, Joseph Kurian Mukkadan Effect of Om chanting and Yoga Nidra on depression anxiety stress, sleep quality and autonomic functions of hypertensive subjects – a randomized controlled trial J Basic Clin Physiol Pharmacol 2022 (6) ,

[19] Ojha U, Ruddaraju S, Sabapathy N, Ravindran V, Worapongsatitaya P, Haq J, Mohammed R, Patel V. Current and Emerging Classes of Pharmacological Agents for the Management of Hypertension. Am J Cardiovasc Drugs. 2022 May;22(3):271-285. doi: 10.1007/s40256-021-00510-9. Epub 2021 Dec 8. PMID: 34878631; PMCID: PMC8651502.

[20] K.Anjana, R. Archana , J.K.Mukkadan .Effect of Om chanting and yoga nidra on blood pressure and lipid profile in hypertension – a randomized controlled trial. Journal of Ayurveda and Integrative medicine, 2022 (13) : 100657

[21] Neethu N.Sadanandan, Archana R, Kumar Sai Sailesh, Mukkadan J K. Antony N.J. Antihyperlipidemic effect of

vestibular stimulation in wistar albino rats. Int.J.Res.Ayurveda Pharm. 2015; 6(4): 509-512

[22] Bonilla Ocampo DA, Paipilla AF, Marín E, Vargas-Molina S, Petro JL, Pérez-Idárraga A. Dietary Nitrate from Beetroot Juice for Hypertension: A Systematic Review. Biomolecules. 2018 Nov 2;8(4):134. doi: 10.3390/biom8040134. PMID: 30400267; PMCID: PMC6316347.

[23] Lara J., Ashor A.W., Oggioni C., Ahluwalia A., Mathers J.C., Siervo M. Effects of inorganic nitrate and beetroot supplementation on endothelial function: A systematic review and meta-analysis. Eur. J. Nutr. 2016;55:451–459. doi: 10.1007/s00394-015-0872-7.

[24] Bahadoran Z., Mirmiran P., Kabir A., Azizi F., Ghasemi A. The nitrate-independent blood pressure–lowering effect of beetroot juice: A systematic review and meta-analysis. Adv. Nutr. Int. Rev. J. 2017;8:830–838. doi: 10.3945/an.117.016717.

[25] Gilchrist M., Winyard P.G., Fulford J., Anning C., Shore A.C., Benjamin N. Dietary nitrate supplementation improves reaction time in type 2 diabetes: Development and application of a novel nitrate-depleted beetroot juice control. Nitric Oxide Biol. Chem. 2014;40:67–74. doi: 10.1016/j.niox.2014.05.003.

[26] Jajja A., Sutyarjoko A., Lara J., Rennie K., Brandt K., Qadir O., Siervo M. Beetroot supplementation lowers daily systolic blood pressure in older, overweight subjects. Nutr. Res. 2014;34:868–875. doi: 10.1016/j.nutres.2014.09.007.