

Effectiveness of Beetroot Juice as Adjuvant Therapy on Blood Pressure among Patients with Hypertension

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ABSTRACT

The present study was intended to assess the effectiveness of beetroot juice as adjuvant therapy on blood pressure among patients with hypertension attending Noncommunicable Disease Clinic, Ambalappuzha. Quasi experimental one group pre-test post-test design was adopted. A sample of 35 patients with hypertension was selected consecutively. The tool consisted of an interview schedule to determine the sociopersonal and clinical data and a standardized calibrated mercury sphygmomanometer and stethoscope to measure the blood pressure. 1 week apart, two pre-test blood pressure measurements were taken at patient's home. The researcher administered 200 ml of beetroot juice to the patients before breakfast for 14 consecutive days in addition to existing antihypertensive drug therapy. Post-test blood pressure measurements were taken on the 8th and 15th day of initiating the therapy at patient's home. It was found that the pre-test value of systolic BP, 148.13±5.36 mm Hg was reduced to 139.29±5.43 mm Hg and the pre-test value of diastolic BP, 92.52±3.05 mm Hg was reduced to 88.39±4.39 mm Hg after adjuvant therapy for 14 consecutive days. Paired-t test revealed a crucial difference in the level of blood pressure among patients with hypertension after adjuvant therapy with beetroot juice ($p < 0.001$). Chi-square analysis showed that there was no significant association between change in blood pressure and selected variables among patients with hypertension. The study concluded that beetroot juice as adjuvant therapy was effective in reducing blood pressure among patients with hypertension.

Keywords: *adjuvant therapy, beetroot juice, blood pressure, hypertension, systolic*

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INTRODUCTION

Hypertension is a silent killer. It is a long-term medical condition in which blood pressure in the arteries is persistently elevated [1]. High blood pressure usually does not cause any symptoms [2]. Prolonged hypertension is a major risk factor for coronary artery disease, stroke, heart failure, peripheral

vascular disease, loss of vision and chronic kidney disease [3].

The study conducted at Imperial College, London, revealed that the number of people in the world with raised blood pressure increased from 594 million in 1975 to 1.13 billion in 2015, with the increase largely in low-income and

middle-income countries [4]. Recent studies showed that with every person having hypertension there are two persons with either undiagnosed hypertension or pre-hypertension [5].

According to WHO Global status report on NCDs, every fourth individual in India aged above 18 years has raised blood pressure (hypertension) and the prevalence has increased by 10% from 2010 to 2014 [6]. Prevalence of hypertension is rapidly increasing among both urban and rural populations. In fact, hypertension is the most prevalent chronic disease in India [7]. The prevalence of hypertension ranges from 20 to 40% in urban adults and 12–17% among rural adults. The number of hypertensive patients is projected to increase from 118 million in 2000 to 2024 million in 2025, with nearly equal number of men and women [8].

It is dangerous to ignore high blood pressure, because this increases the chances of life-threatening complications [9]. The estimated direct and indirect cost of high blood pressure for 2011–2012 (annual average) was \$48.6 billion. Thus, controlling hypertension in all patients with cardiovascular diseases and stage 2 hypertension could be effective and cost-saving [10].

NEED AND SIGNIFICANCE OF THE STUDY

The World Health Statistics report showed that globally, cardiovascular disease accounts for approximately 17 million deaths a year, nearly one third of the total [11]. Of these, complications of hypertension account for 9.4 million deaths worldwide every year. Hypertension is responsible for at least 45% of deaths due to heart disease and 51% of deaths due to stroke [12].

Even a moderate reduction in systolic BP (SBP) of 10 mm Hg or diastolic blood

pressure (DBP) of 5 mm Hg has been found to decrease average risk of mortality from coronary heart disease and stroke by 22 and 41%, respectively [13]. Reducing blood pressure can decrease cardiovascular risk and this can be achieved by lifestyle measures in mild cases and it should be the commencing approach to manage hypertension in all cases. This mainly includes dietary modifications, weight reduction, exercise and smoking cessation. Dietary modifications include reducing salt, and increasing potassium and nitrate diet.

Nitrate, which is found in all vegetables and is particularly abundant in beetroot, has emerged as a possible mediating component for the cardiovascular health benefits associated with high vegetable consumption. Dietary nitrate is reduced to bioactive nitrite by facultative anaerobic bacteria in the saliva and further to nitric oxide via various pathways. Endothelium-derived nitric oxide is a potent vasodilator, governs systemic BP, retards atherogenesis and inhibits platelet aggregation [14].

To assess whether dietary nitrate might provide sustained BP lowering in patients with hypertension, a double-blind, placebo-controlled clinical trial was done among 68 patients with hypertension. Patients were randomly assigned to receive daily dietary supplementation for 4 weeks with either dietary nitrate (250 ml daily, as beetroot juice) or a placebo (250 ml daily, as nitrate-free beetroot juice). Daily supplementation with dietary nitrate was associated with reduction in blood pressure which was measured by three different methods. Mean reduction in clinic BP was 7.7/2.4 mm Hg, 24 h ambulatory BP was reduced by 7.7/5.2 mm Hg and home BP was reduced by 8.1/3.8 mm Hg [15].

Investigator from her field of experience and through extensive literature realized that most of the hypertensive patients are

not affordable for the high cost of antihypertensives that resulted in a nonadherence to the drugs. Thus, people ended up with complications of hypertension such as stroke, coronary artery disease, myocardial infarction, kidney failure, heart failure, hypertensive crisis (hypertensive urgency, hypertensive emergency, hypertensive encephalopathy) that affect their quality of life and decrease their longevity. Uncontrolled hypertension in patients those who are on single antihypertensive drug forces them to take multi-drug therapy of which all these drugs have many side effects like weakness, dizziness, fainting, headache and joint pain. The observed high incidence of complications even among those on treatment due to poor compliance and side effects explains the need to manage hypertension with a minimum cost and maximum effectiveness.

Hence, the investigator thought of doing a study to assess the effectiveness of beetroot juice as adjuvant therapy on blood pressure among patients with hypertension. Such interventions would assist the patients to manage hypertension appropriately. It would also assist the policy makers in developing context specific and relevant policies capable of improving the management of hypertension. Ultimately it is envisioned that the implementation of cost effective strategies would lead to increased levels of controlled blood pressure and reduced occurrence of complications.

STATEMENT OF THE PROBLEM

Effectiveness of beetroot juice as adjuvant therapy on blood pressure among patients with hypertension attending Noncommunicable Disease Clinic, Ambalappuzha.

Objectives

1. To find out the effectiveness of beetroot juice as adjuvant therapy on

blood pressure among patients with hypertension.

2. To find out the association between change in blood pressure and selected variables among patients with hypertension.

Operational Definitions

Effectiveness

Effectiveness refers to the difference in blood pressure among patients with hypertension before and after adjuvant therapy with beetroot juice.

Beetroot Juice

Beetroot juice refers to 200 ml of freshly prepared juice made of 50 g peeled slices of beetroot ground with 150 ml of boiled cooled water and filtered.

Adjuvant Therapy

Adjuvant therapy refers to the therapy with beetroot juice, administered every morning before breakfast for 14 consecutive days in addition to the antihypertensive drug therapy.

Patients with Hypertension

Patients with hypertension refers to those individuals clinically diagnosed to have stage I hypertension for more than 6 months and on antihypertensive medication with systolic and diastolic blood pressure of 140–159 or 90–99 mm Hg respectively, attending Noncommunicable Disease Clinic of Urban Health Training Centre (UHTC), Ambalappuzha.

Stage I Hypertension

Stage I hypertension refers to systolic blood pressure 140–159 mm Hg or diastolic blood pressure 90–99 mm Hg.

Hypotheses

- **H₁:** There is a significant difference in the level of blood pressure among patients with hypertension before and

after adjuvant therapy with beetroot juice.

- **H₂:** There is a significant association between change in blood pressure and selected variables among patients with hypertension.

METHODS AND MATERIALS

- **Research Approach:** Quantitative research approach.
- **Research Design:** Quasi experimental one group pretest posttest design.
- **Setting of the Study:** Noncommunicable Disease Clinic of Urban Health Training Centre (UHTC), Ambalappuzha and the field area under UHTC, Ambalappuzha.
- **Population:** Patients with hypertension.
- **Sample:** Patients clinically diagnosed to have stage I hypertension, attending Noncommunicable Disease Clinic of Urban Health Training Centre (UHTC), Ambalappuzha.
- **Sample Size:** 35 patients with hypertension.
- **Sampling Technique:** Samples fulfilling the inclusion criteria were selected consecutively.

Criteria for Sample Selection:

Inclusion Criteria

Patients with stage I hypertension:

- in the age group of 35–65 years,
- duration of more than 6 months,
- on antihypertensive medication, and
- With systolic and diastolic blood pressure of 140–159 or 90–99 mm Hg respectively.

Exclusion Criteria

Patients with stage I hypertension:

- with diabetes mellitus,
- with secondary hypertension,
- with polycythaemia, and
- practicing any other complementary therapies.

DESCRIPTION OF TOOL

Tool 1: Interview Schedule to Assess the Socio-Personal and Clinical Data

- **Section A:** Include age, gender, education, occupation, monthly family income, marital status, type of family, supportive members, area of residence and unhealthy habits.
- **Section B:** Include body mass index, duration of hypertension, family history of hypertension, duration on antihypertensive medication treatment, regular intake of drugs, adherence to dietary modifications, performance of regular exercise, adequacy of sleep and presence of comorbidities.

Tool 2: Standardised Calibrated Mercury Sphygmomanometer and Stethoscope to Assess Blood Pressure

DATA COLLECTION PROCESS

After getting permission from Medical Officer of Urban Health Training Centre (UHTC), Ambalappuzha, 35 patients with hypertension attending Noncommunicable Disease Clinic of Urban Health Training Centre (UHTC), Ambalappuzha who fulfilled the criteria were selected consecutively. Established rapport explained the purpose of the study and then obtained informed consent from patients. Socio-personal and clinical data were collected using structured interview schedule of 10 min duration.

The blood pressure was assessed preferably in the upper arm using standardized calibrated mercury sphygmomanometer and stethoscope after a resting period of 5 min. Two more blood pressure measurements were taken 1 min apart and the mean of these three measurements were recorded as the blood pressure of the patient. On the 8th day (pre-test 1) and on the 15th day (pre-test 2), the investigator measured and recorded the blood pressure by the same method in

their home. The purpose of performing two pre-tests seven days apart by the investigator was to ensure the stability of the single group as the study did not have a control group.

On the 15th day of sample selection, patients or significant others were demonstrated to prepare 200 ml of beetroot juice (50 g peeled slices of fresh beetroot ground with 150 ml of boiled cooled water and filtered) by the investigator. The needed quantity of fresh beetroot (50 g) to prepare beetroot juice were peeled and weighed using standardized calibrated weighing scale in front of the patients or significant others and it was provided for the patient by the investigator. Then, the patients were instructed to drink 200 ml of beetroot juice before breakfast in the presence of investigator. The beetroot juice was prepared by the patients or significant others and patients were made to drink it in front of the investigator every morning between 6:15 AM and 9:00 AM before breakfast during the time of home visit for 14 consecutive days in addition to existing antihypertensive drug therapy.

Blood pressures of patients were again measured and recorded on the 8th and 15th day of initiating the therapy with beetroot juice by the investigator during the home visit. Patients were informed to continue their medications as ordered by the physician regularly and if they experience any discomforts, to report to the investigator or to their doctor in Urban Health Training Centre, Ambalappuzha.

Among the selected 35 samples, 4 patients were dropped out from the study for reasons as two of them were not present during the intervention and other two patients were not available during post-test.

DATA ANALYSIS AND INTERPRETATION

The data gathered were organized, tabulated and interpreted based on the objectives of the study using descriptive and inferential statistics.

Section I: Frequency and Percentage Distribution of Socio-demographic Variables among Patients with Hypertension

Table 1 shows that 60% of patients with hypertension belonged to the age group of 56–65 years and 14.3% of patients with hypertension belonged to the age group of 35–45 years.

Figure 1 shows that 42.9% of the patients with hypertension were males and 57.1% were females.

Table 1. Distribution of patients with hypertension based on age (n=35).

Age (years)	Frequency	Percentage (%)
35–45	5	14.3
46–55	9	25.7
56–65	21	60.0

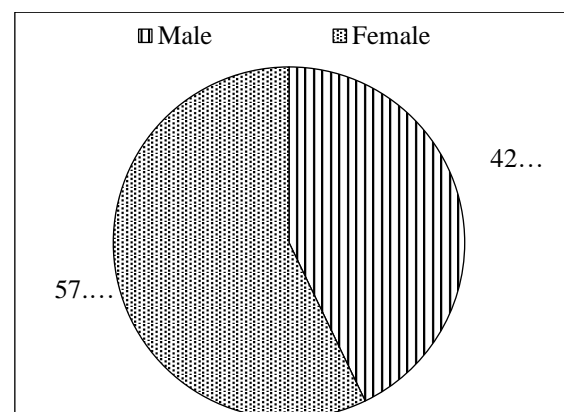


Fig. 1. Distribution of patients with hypertension based on gender (n=35).

Table 2 shows that 60% had BMI within normal range (18.50–22.99), 5.7% were underweight (<18.5) and 11.4% were obese (>27.50).

Among the selected 35 patients with hypertension, four patients were dropped

out from the study for reasons as two of them were not present during the intervention and other two patients were not available during post-test. Thus, analyses of the following sections were done in the data collected from the remaining 31 samples.

Table 2. Distribution of patients with hypertension based on body mass index ($n=35$).

Body Mass Index	Frequency	Percentage (%)
<18.5 (Underweight)	2	5.7
18.50–22.99 (Normal range)	21	60.0
23–27.49 (Overweight)	8	22.9
>27.50 (Obese)	4	11.4

Section II: Comparison of Blood Pressures of Pre-Test 1 and Pre-Test 2 before Adjuvant Therapy with Beetroot Juice

Table 3 shows that the 't' values obtained on statistical analysis were 2.03 and 1.43, which was not significant at 0.05 level. This denotes that there was no statistically significant difference in pre-interventional blood pressure values (pre-test 1 and pre-test 2) among patients with hypertension. The blood pressure values were remaining stable that ensures the stability of the one group.

Section III: Effectiveness of Beetroot Juice as Adjuvant Therapy on Blood Pressure among Patients with Hypertension

Effectiveness of Beetroot Juice as Adjuvant Therapy on Systolic Blood Pressure among Patients with Hypertension

Table 4 shows ± 5.12 mm Hg on 8th day of initiation of beetroot juice as adjuvant therapy and 139.29 ± 5.43 mm Hg after adjuvant therapy with beetroot juice for 14 consecutive days. The difference between the pre-test and post-test values was found to be statistically significant at 0.001 level. Thus, null hypothesis was not accepted

and it can be interpreted that beetroot juice as adjuvant therapy is effective in reducing systolic blood pressure among patients with hypertension.

Table 3. Mean, standard deviation and 't' value of two pre-test blood pressures before adjuvant therapy with beetroot juice among patients with hypertension ($n=31$).

S. No.	BP	Observation	Mean (mm Hg)	Standard Deviation	't' Value
1	Systolic BP	Pre-test 1	148.58	5.61	2.03
		Pre-test 2	148.13	5.36	
2	Diastolic BP	Pre-test 1	92.65	2.96	1.43
		Pre-test 2	92.52	3.05	

Table 4. Mean, standard deviation and 't' value of pre-test and post-test systolic blood pressure before and after adjuvant therapy with beetroot juice among patients with hypertension ($n=31$).

S. No.	Observation	Mean (mm Hg)	Standard Deviation	't' Value
1	Pre-Test 2	148.13	5.36	17.34***
2	Post-Test 1	142.39	5.12	
3	Pre-Test 2	148.13	5.36	21.43***
4	Post-Test 2	139.29	5.43	

*** Significant at 0.001 level.

Effectiveness of Beetroot Juice as Adjuvant Therapy on Diastolic Blood Pressure among Patients with Hypertension

Table 5 shows ± 4.07 mm Hg on 8th day of initiation of beetroot juice as adjuvant therapy and 88.39 ± 4.39 mm Hg after adjuvant therapy with beetroot juice for 14 consecutive days. The difference between the pre-test and post-test values was found to be statistically significant at 0.001 level. Thus, null hypothesis was not accepted and it can be interpreted that beetroot juice as adjuvant therapy is effective in reducing diastolic blood pressure among patients with hypertension.

Hence, it is concluded that beetroot juice as adjuvant therapy is effective in reducing blood pressure among patients with hypertension.

Table 5. Mean, standard deviation and ‘t’ value of pre-test and post-test diastolic blood pressure before and after adjuvant therapy with beetroot juice among patients with hypertension (n=31).

S. No.	Observation	Mean (mm Hg)	Standard Deviation	‘t’ Value
1	Pre-test 2	92.52	3.05	8.97***
2	Post-test 1	89.42	4.07	
3	Pre-test 2	92.52	3.05	8.27***
4	Post-test 2	88.39	4.39	

*** Significant at 0.001 level.

Section IV: Association between Change in Blood Pressure and Selected Variables among Patients with Hypertension

Chi-square analysis indicated that there was no statistically significant association between change in blood pressure and selected variables among patients with hypertension.

RESULTS AND DISCUSSION

The present study investigated the effectiveness of beetroot juice as adjuvant therapy on blood pressure among patients with hypertension and found that the systolic blood pressure was reduced by 8.84±0.14 mm Hg and diastolic blood pressure was reduced by 4.13±0.49 mm Hg after adjuvant therapy with 200 ml of beetroot juice for 14 consecutive days. A double-blind, placebo-controlled clinical trial conducted at Queen Mary University of London, to assess whether dietary nitrate provide sustained blood pressure lowering in patients with hypertension among 68 participants strongly supports this finding by illustrating that daily supplementation with 250 ml of beetroot juice for 4 weeks reduced systolic blood pressure and diastolic blood pressure by 8.1/3.8 mm Hg [16].

The present study results showed that beetroot juice as adjuvant therapy significantly reduced the systolic blood pressure after 2 weeks of intervention (8.84±0.14 mm Hg). This was supported

by the findings of a study done at Newcastle upon Tyne in the North-East of England which showed that beetroot juice concentrate reduced daily systolic blood pressure after 3 weeks (7.3±5.9 mm Hg). However, the effect was not maintained after the interruption of the supplementation (week 4, 2.8±6.1 mm Hg, p=0.09) [17].

The findings of the present study highlight that there was a significant reduction in blood pressure after consumption of 200 ml of beetroot juice (50 g peeled slices of fresh beetroot ground with 150 ml of boiled cooled water and filtered) for a period of 14 days and there was no statistically significant association between change in blood pressure and selected variables. This finding was consistent with a similar community based quasi experimental study conducted in Nellore, Andhra Pradesh, India which revealed that there was a significant reduction in blood pressure after consumption of 400 ml of beetroot juice (50 g beetroot mixed with 350 ml water) for a period of 7 days and there was no statistically significant association between post-test blood pressure scores with their selected socio-demographic variables [18].

LIMITATIONS

- The study was limited to a particular geographical area (Noncommunicable Disease Clinic of Urban Health Training Centre (UHTC), Ambalappuzha.) which imposes limits on generalization.
- Small size was very small to generalize the findings.
- Samples were selected consecutively.
- The study used one group pre-test and post-test design, considered as a weak design to establish causal relationship between independent and dependent. Thus, using control group could have given more strength to the study

findings and made the design more strong.

- Immediate effect of the intervention could not be assessed in the present study.

RECOMMENDATIONS

- A separate Nurse-run hypertension clinic in the outpatient department can be started to identify hypertensive patients and to provide health education and counselling services for patients and families.
- A special nursing unit for implementing and analysing the use of adjuvant therapy in the management of various disease conditions including beetroot juice for hypertension can be organized in each institution.
- Long term efficacy of beetroot juice needs to be tested in people at higher cardiovascular risk, together with an assessment of the tolerance, safety, compliance and cost effectiveness of the intervention.
- A follow up study can be conducted to find out whether the positive effects of the intervention are persisting or not.

CONCLUSION

In the present study, it was found that the beetroot juice as adjuvant therapy was effective in reducing blood pressure among patients with hypertension. It is simple, cost effective and can be added to the management protocol for hypertensive patients in addition to the existing treatments.

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