

Research Article

A Study on Effectiveness of Dietary Nitrate Supplementation with Beetroot Juice in Reduction of Blood Pressure among Essential Hypertensive Patients Admitted in General Hospital, Harihara Taluk, Davanagere District

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Abstract

Background: Hypertension is the leading risk factor for mortality. On a global level, hypertension is a greater problem with 13.5% of all deaths attributed to blood pressure related diseases. Hypertension the silent killer should be prevented and treated as early as possible to prevent stroke, cardio vascular dysfunction, renal dysfunction and multi organ failure. Increased intake of vegetables with a high dietary nitrate intake will help improving the blood pressure. Beetroot is the vegetable which contains nitrates, which is naturally found in soil and absorbed by the vegetables through the roots.

Objective: The main objective of the study was to determine the effect of beetroot juice on blood pressure among essential hypertensive patients.

Methods: The research design adopted was pretest and posttest control group design. The sample size was 50 patients with essential hypertension admitted in general hospital, Harihara taluk, Davanagere District. Purposive sampling technique was used in this study. Sphygmomanometer was used to assess blood pressure of patient. Questionnaire technique was adopted for collecting the patient data. Daily 250ml of beetroot juice was provided to patient under intervention group along with their medication, whereas in comparison group no juice was provided but was on their daily medication. Posttest assessment of blood pressure was carried out for 24 hours with BP recording at every 4 hour interval for both intervention and comparison group till the patient got discharged.

Major Findings: Difference in the systolic and diastolic blood pressure in the intervention group is 7.2 mmHg and 13.4 mmHg respectively, which is more than the table value 2.78 at 0.05 level of significance. This shows that there is a significant reduction in blood pressure among the intervention group. Systolic and diastolic blood pressure in the control group is 15.2 and 8.1 respectively, which is more than the table value 2.78 at 0.05 level of significance. This shows that there is a significant reduction in blood pressure among the control group.

Conclusion: The study highlights the usage of beetroot juice which is the best dietary nitrate supplementation for people who suffer from high blood pressure. In the present study beetroot juice administration showed the improvement in both systolic and diastolic blood pressure of patients within 24 hours of time period.

Keywords: Systolic Blood Pressure, Diastolic Blood Pressure, Hypertension, Beetroot Juice, Dietary Nitrate.

Introduction

Health is a precious aspect of all human beings, as it is an asset for an individual. The enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being. Health is maintained and improved not only through the advancement and application of health sciences, but also through the efforts and intelligent life style choices of individual and society like exercise, diet pattern, yoga and meditation practices¹. Hypertension is an important medical and public health issue. It exists worldwide at epidemic rates affecting as estimated 1 billion people. Two third of hypertensive patients do not have their blood pressure controlled². High blood pressure, also called hypertension, is elevated pressure of the blood in the arteries.

Hypertension results when the heart pumps blood with excessive force and when the body's smaller blood vessels (known as the arterioles) narrow, so that blood flow exerts more pressure against the vessels' walls. Such pressure can injure blood vessels in the heart, kidneys, the brain, and the eyes. The blood pressure is a persistent elevation of systolic pressure >140 mmHg and diastolic pressure >90 mmHg. The systolic pressure is the force that blood exerts on the artery walls as the heart contracts to pump out the blood.

High systolic pressure is now known to be a greater risk factor than diastolic pressure for brain, heart, kidney, and circulatory complications and for death, particularly in middle-aged and elderly adults. The diastolic pressure is the measurement of force as the heart relaxes to allow the blood to flow into the heart. High diastolic pressure is a strong predictor of heart attack and stroke in young adults. Health dangers from blood pressure may vary among different age groups and depending on whether systolic or diastolic pressure (or both) is elevated³.

There are considerable hurdles remains in overcoming hypertension. Below we are discussing the main four hurdles. First, the hypertension is frequently undiagnosed, and early detection prior to the development of end-organ damage remains a challenge. Second, many patients appropriately diagnosed with hypertension fail to achieve the treatment targets recommended by guidelines. This highlights the considerable challenges in implementing risk factor modification and appropriate adherence to antihypertensive therapies long term. Third, uncertainty remains as to the appropriate BP treatment target for high-risk patients. Fourth, even among patients who receive appropriate care, a proportion of patients remain resistant to treatment despite multiple medications. These patients with resistant hypertension carry substantial risk of adverse events⁴.

There are some natural ways to compare hypertension. The best way is to compare through the diet. Dietary modification requires active participation of individuals. Dietary factors have an important influence on blood pressure regulation in individuals with changing life styles. Increased intake of vegetables with a high dietary nitrate will help improving the blood pressure. Beetroot is the vegetable which contains nitrates, which is naturally found in soil and absorbed by the vegetables through the roots⁵.

Hence, hypertension the silent killer should be prevented and treated as early as possible to prevent stroke, cardio vascular dysfunction, renal dysfunction and multi organ failure. Taking lifelong medications can lead to various side effects, so as an alternative to organic medicine the inorganic medicine can be administered, which produces no harm or side effect to human body⁶. Therefore, the present situation demands a study on effectiveness of inorganic medicine to reduce hypertension, in this light investigator focus the study on beetroot juice which is a dietary nitrate helping in reduction of blood pressure among hypertensive clients.

Statement of the Problem

A Study on effectiveness of dietary nitrate supplementation with beetroot juice in reduction of blood pressure among essential hypertensive patients admitted in general hospital, Harihara taluk, Davanagere district.

Objectives

- 1) To assess the blood pressure among essential hypertensive patients in intervention and comparison group.
- 2) To determine the effect of beetroot juice on blood pressure among essential hypertensive patients.
- 3) To find out the association between the selected demographic variables and blood pressure among essential hypertensive patients.

Research Methodology

Research approach: In this study true intervention research approach was adopted.

Research design: The research design adopted was pretest and posttest control group design.

Research setting: General Hospital, Harihara taluk, Davanagere district.

Population

Target population: Essential hypertensive patients admitted in General Hospital, Harihara taluk, Davanagere district.

Accessible population: Hypertensive patients admitted in General Hospital, Harihara taluk, Davanagere district.

Sampling and Sampling Technique

Sample: Essential hypertensive patients admitted in General Hospital, Harihara taluk, Davanagere district.

Sampling technique: Non probability purposive sampling technique was used for this study.

Sample size: 50

Criteria for Sample Selection

Inclusion criteria

- ✓ Patients with essential hypertension ≥ 30 years of age.
- ✓ Patients who are conscious and stable.

Exclusion criteria

- ✓ Patients with diabetes mellitus.
- ✓ Patients on dialysis.
- ✓ Patients having allergy to beetroot.
- ✓ Patients having difficulty in swallowing.
- ✓ Pregnant women.

Description of the Instruments and Tool for Data Collection

The tool used was questionnaire to collect the baseline information, data on the dietary factors and information related to hypertension, and Sphygmomanometer was used to assess the blood pressure.

Sphygmomanometer

The standard instrument used to measure blood pressure is called as Sphygmomanometer. Measurements are given as units of mercury, which has filled the central column in standard sphygmomanometers for years. An inflatable cuff with a meter attached is placed around the patient's arm and the arm being used is around the level of the heart. The inflated cuff briefly interrupts the flow of blood in the artery, which then resumes as the cuff is slowly deflated.

The person taking the blood pressure listens through a stethoscope. The first pumping sound heard is recorded as the systolic pressure, and the last sound is the diastolic pressure. The lowest level in the scale is 0 and the highest level is 300 mm Hg.

Table 1. Blood pressure interpretation chart.

| Blood pressure interpretation | Systolic | Diastolic |
|-------------------------------|--------------|-----------|
| Pre hypertension | 120-139 mmHg | 80-89mmHg |
| Stage I | 140-159mmHg | 90-99mmHg |
| Stage II | >160mmHg | >100mmHg |

Steps of Intervention

- ✓ A moderate sized beetroot of 150 gm was taken; beetroot skin was peeled off and chopped into small pieces.
- ✓ These sliced pieces were put in to a mixer and 100ml of water was added to it. It was grinded for 1 whole minute, after grinding, from 150 gm of beetroot juice mixed with 100ml of water; to get 250 ml of beetroot juice.
- ✓ The juice was transferred from mixer to a clean flask. For intervention group pre assessment of blood pressure was done after two and half hours of regular intake of morning medication.
- ✓ As soon as after checking BP, using ounce glass 250 ml beetroot juice was collected from the flask and administered to the patients.
- ✓ Patient was advised to take beetroot juice within 30 minutes of time. After two hours of beetroot juice intake, posttest was done.
- ✓ Then every four hour interval posttest was continued until next day cycle starts. Same was continued for

Comparison group, but no beetroot juice was provided for patients. The study was continued till the patient got discharged.

Findings of the Study

Section A: Demographic Profile

Table 2. Frequency and percentage distribution of hypertensive patients in intervention and comparison group according to their demographic variables (n=50).

| Demographic variables | Intervention group n=25 | | Comparison group n=25 | |
|-----------------------|----------------------------|----------------|--------------------------|----------------|
| | Frequency | Percentage (%) | Frequency | Percentage (%) |
| Age (Years) | | | | |
| 30-40 | 1 | 4 | 0 | 0 |
| 41-50 | 6 | 24 | 7 | 28 |
| 51-60 | 6 | 24 | 4 | 16 |
| 61-70 | 5 | 20 | 8 | 32 |
| 71-80 | 6 | 24 | 6 | 24 |
| 81-90 | 1 | 4 | 0 | 0 |
| Gender | | | | |
| Male | 13 | 52 | 15 | 60 |
| Female | 12 | 48 | 10 | 40 |
| Height (Cm's) | | | | |
| 140-150 | 1 | 4 | 3 | 12 |
| 151-160 | 9 | 36 | 6 | 24 |
| 161-170 | 7 | 28 | 12 | 48 |
| 171-180 | 7 | 28 | 4 | 16 |
| 181-190 | 1 | 4 | 0 | 0 |
| Weight (Kg) | | | | |
| 40-50 | 3 | 12 | 5 | 20 |
| 51-60 | 5 | 20 | 5 | 20 |
| 61-70 | 8 | 32 | 10 | 40 |
| 71-80 | 4 | 16 | 1 | 4 |
| 81-90 | 3 | 12 | 0 | 0 |
| 91-100 | 2 | 8 | 4 | 16 |
| Occupation | | | | |
| Sedentary work | 15 | 60 | 13 | 52 |
| Moderate work | 2 | 8 | 2 | 8 |
| Heavy worker | 8 | 32 | 10 | 40 |

Frequency and percentage distribution of hypertensive patients according to demographic variable had been shown in table 2. There are 50 essential hypertensive samples selected, out of which 25 under intervention group and 25 under comparison group. The selected age groups ranged from 30 to 90, out of which 25 under intervention group and 25 under comparison group. In the intervention group 6(24%) patients belongs to 41-50, 51-60, 71-80 years of age group category respectively. In comparison group 8(32%) patients were in 61-70 years of age group.

Among selected gender group, both in the intervention group as well in comparison group 13(52%) and 15(60%) of the respondents were males.

In height group category of hypertensive patients, under intervention group, 9(36%) samples come under 151-160 cm of height category. In the comparison group 12(48%) samples were in 161-170 cm of height category.

For weight category relation to hypertension, under intervention group 8(32%) samples come under 61-70 kg of weight group. In the comparison group 10(40%) samples were in 61-70 kg weight group category.

As represented under the occupation category, in the intervention group 15(60%) of respondents were sedentary workers. In comparison group 13(52%) of respondents were sedentary worker.

Section B: Dietary Factors

Table 3. Frequency and percentage distribution of hypertensive patients in intervention and comparison group according to their dietary factors (n=50).

| Dietary factors | Intervention group n=25 | | Comparison group n=25 | |
|---|----------------------------|----------------|--------------------------|----------------|
| | Frequency | Percentage (%) | Frequency | Percentage (%) |
| Daily salt intake | | | | |
| <5 gms | 5 | 20 | 2 | 8 |
| 5-6 gms | 11 | 44 | 8 | 32 |
| 7-8 gms | 6 | 24 | 11 | 44 |
| >8 gms | 3 | 12 | 4 | 16 |
| Habit of drinking coffee | | | | |
| Yes | 13 | 52 | 17 | 68 |
| No | 12 | 48 | 8 | 32 |
| Habit of drinking tea | | | | |
| Yes | 20 | 80 | 19 | 76 |
| No | 5 | 20 | 6 | 24 |
| Habit of taking snacks | | | | |
| Yes | 12 | 48 | 12 | 48 |
| No | 13 | 52 | 13 | 52 |
| Quantity of oil used by person per month | | | | |
| <500 ml | 10 | 40 | 11 | 44 |
| 501-1000 ml | 13 | 52 | 14 | 56 |
| 1001-1500 ml | 2 | 8 | 0 | 0 |
| >1500 ml | 0 | 0 | 0 | 0 |
| Kind of oil used | | | | |
| Refined | 23 | 92 | 18 | 72 |
| Unrefined | 2 | 8 | 7 | 28 |

Frequency and percentage distribution of hypertensive patients according to diet intake had been shown in table 3. There are 50 essential hypertensive samples selected, out of which 25 under intervention group and 25 under comparison group. With regard to daily salt intake, under intervention group 11(44%) of the respondents take 5-6 gms of salt. In comparison group 11(44%) of the respondents take 7-8 gms of salt. Among coffee intake of selected hypertensive samples, under intervention group 13(52%) of respondents have the habit of drinking coffee on daily basis, whereas in comparison group 17(68%) of respondents have the habit of drinking coffee. Among tea intake of selected hypertensive samples, in intervention and comparison groups, majority of samples 20(80%) and 19(76%) have the habit of drinking tea respectively.

Similarly snacks intake of the samples are verified, in intervention and comparison group, half of the samples 13(52%) do not take snacks on daily basis. With reference to oil intake, 13(52%) and 14(56%) of the respondents consume 500-1000ml of oil per month respectively for both in intervention and comparison group. Among refined and unrefined oil kind, 23(92%) of samples in intervention group used refined oil and 2(8%) used unrefined oil. Whereas in comparison group 18(72%) of samples used refined oil and 7(28%) used unrefined oil in their daily diet.

Section C

This section includes frequency and percentage distribution of level of systolic and diastolic blood pressure among hypertensive patients in intervention and comparison group, also the level of systolic and diastolic blood pressure for 24 hours in both intervention and comparison group.

The initial assessment of systolic blood pressure showed that among intervention group 17(68%) samples were in stage I hypertension and 8(32%) samples were in stage II hypertension. Whereas in comparison group 17(68%) samples were in stage I hypertension and 8(32%) samples in stage II hypertension. After administration of beetroot juice in the intervention group, 17(68%) samples in stage I have moved to pre hypertension stage and 8(32%) samples in the stage II have moved to stage I. In the comparison group out of 17(68%) samples from stage I, 16(64%) samples have moved to pre hypertension stage after post-test and 1(4%) stayed in stage II and out of 8(32%) samples in stage II in pre-test moved to stage I after post-test

analysis. The initial assessment of diastolic blood pressure assessment showed 2(8%) samples in intervention group is having pre hypertension, 19(76%) samples in stage I and 4(16%) samples in the stage II hypertension. Whereas in the comparison group 5(20%) samples are in pre hypertension, 14(56%) samples in stage I and 6(24%) samples in stage II.

After administration of beetroot juice, in the intervention group majority of samples 24(96%) have moved to pre hypertension and 1(4%) in stage I and in comparison group majority of samples 23(92%) have moved to pre hypertension and 2(8%) in stage I.

Table 4. Frequency and percentage distribution of level of systolic and diastolic blood pressure among hypertensive patients in intervention and comparison group.

| Level of BP | | Intervention | | | | Comparison | | | |
|-------------|----------|--------------|----|-----------|----|------------|----|-----------|----|
| | | Pre-test | | Post-test | | Pre-test | | Post-test | |
| | | f | % | f | % | f | % | f | % |
| Systolic | Pre HT | 0 | 0 | 17 | 68 | 0 | 0 | 16 | 64 |
| | Stage I | 17 | 68 | 8 | 32 | 17 | 68 | 8 | 32 |
| | Stage II | 8 | 32 | 0 | 0 | 8 | 32 | 1 | 4 |
| Diastolic | Pre HT | 2 | 8 | 24 | 96 | 5 | 20 | 23 | 92 |
| | Stage I | 19 | 76 | 1 | 4 | 14 | 56 | 2 | 8 |
| | Stage II | 4 | 16 | 0 | 0 | 6 | 24 | 0 | 0 |

Section D

The analysis under this section denotes the comparison of systolic and diastolic blood pressure of patient between intervention and comparison group through paired t-test.

Null Hypothesis (H₀₁): There will not be a significant difference between level of blood pressure before and after administration of beetroot juice in the intervention and comparison group.

Table 5. Comparison of mean and standard deviation of systolic blood pressure of patients between intervention and comparison with ‘t’ value and table value.

| Systolic blood pressure | Pre-test | | Post-test | | ‘t’ value | Table value | Level of significance |
|-------------------------|----------|-------|-----------|-------|-----------|-------------|-----------------------|
| | Mean | SD | Mean | SD | | | |
| Intervention group | 146.2 | 10.43 | 135.7 | 9.59 | 7.2 | 2.78 | p < 0.05 |
| Comparison group | 146.8 | 9.98 | 136.8 | 11.38 | 15.2 | 2.78 | p < 0.05 |

The calculated value of intervention group is 7.2, which is more than the table value of 2.78 at 0.05 level of significance. This indicates there is significant difference in the systolic blood pressure among the intervention group after administration of beetroot juice. Null hypothesis is rejected and research hypothesis is accepted.

The calculated value of comparison group is 15.2, which is more than the table value of 2.78 at 0.05 level of significance. This indicates there is a significant difference in the pretest and posttest systolic blood pressure among the comparison group. Null hypothesis is rejected and research hypothesis is accepted.

Table 6. Comparison of mean and standard deviation of diastolic blood pressure of patients between intervention and comparison with ‘t’ value and table value.

| Diastolic blood pressure | Pre-test | | Post-test | | ‘t’ value | Table value | Level of significance |
|--------------------------|----------|------|-----------|------|-----------|-------------|-----------------------|
| | Mean | SD | Mean | SD | | | |
| Intervention group | 89.6 | 4.06 | 82.49 | 3.05 | 13.4 | 2.78 | p < 0.05 |
| Comparison group | 89.2 | 5.53 | 83.4 | 3.87 | 8.1 | 2.78 | p < 0.05 |

The calculated value of intervention group is 13.4, which is more than the table value 2.78 at 0.05 level of significance. This indicates there is a significant difference in the diastolic blood pressure among the intervention group after administration of beetroot juice. Null hypothesis is rejected and research hypothesis is accepted. The calculated value of comparison group is 8.1, which is more than the table value 2.78 at 0.05 level of significance. This indicates there is a significant difference in the pretest and posttest diastolic blood pressure among the comparison group. Null hypothesis is rejected and research hypothesis is accepted.

Conclusion

The study highlights the usage of beetroot juice which is the best dietary nitrate supplementation for people who suffer from high blood pressure. Modern medical science treats the blood pressure with too expensive medications and regular medical checkups which seems to be challenging. Thus, a better compliment for this health problem is through the diet, i.e., by the daily intake of beetroot juice. Complimentary therapies like dietary therapy are better in the treatment of hypertension along with anti-hypertensive medications, which in turn prevents the hypertension as one of the major burdens of disease in developing and developed countries. This study review showed that beetroot juice was one of the most effective methods for the reduction of blood pressure. This result can potentially be employed as non-pharmacologic therapy in the management of essential hypertension.

Nursing Implications

Nursing practice

Nursing includes preventive, promotive, curative and rehabilitative services to the population. A clinical nurse plays a major role in all those aspects of health care. Nurses in clinical and community settings have a key role in observing, finding out the hypertensive patients and administering beetroot juice in the form of dietary nitrate as an effective nursing care. Nurses also involve in educating hypertensive patients and their families on the importance of beetroot juice intake. Nurses should provide support and motivation to the hypertensive patients to add beetroot as a dietary intake in their daily diet for better health and reduction of blood pressure.

Limitations

- ✓ The study was conducted only in General Hospital, Harihara taluk, Davanagere district.
- ✓ Findings cannot be generalized to all population due to small sample size.

Recommendations

- ✓ A similar study can be replicated in a larger sample.
- ✓ A similar study can be performed in community settings.
- ✓ A similar study can be tried with other nitrate rich foods.
- ✓ A similar study can be done with the increase in the amount of beetroot juice of 500 ml.

Declarations

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