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## Competitive Effect of Beetroot Juice and Allicin on Hypertensive Patients

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Levels of cardiovascular disease are increasing rapidly in the developing world including Hypertension. We performed this study to compare the therapeutic effect of beetroot juice and allicin in reducing the hypertension among mild to moderate hypertensive patients. 75 hypertensive patients were selected from two hospitals for 4 weeks. Patients were informed to record daily home BP twice a day with Sphygmomanometer. The anthropometric measurements and biochemical evaluation were also collected. The mean difference of Systolic Blood pressure of Group A having beetroot juice was  $18.14 \pm 9.347$  mmHg and in Group B taking allicin capsules were  $6.20 \pm 12.017$  mmHg ( $p = 0.000, 0.009$ ) respectively. The mean difference of Diastolic Blood pressure of Group A and B was  $15.46 \pm 10.807$  mmHg and  $4.29 \pm 11.297$  mmHg ( $p = 0.000, 0.056$ ) respectively. There is no statistically significant mean difference in change in BMI and hemoglobin among the patients of two study groups ( $p$ -value, 0.134 and 0.653). The trend of reduction in HDL and cholesterol was observed in both study groups, ( $p$ -value, 0.016, 0.019) respectively. There is no statistically significant mean difference in change in LDL and Triglycerides among the patients of two study groups ( $p$ -value, 0.702, 0.552) respectively. Group A showed more significant reduction in hypertension as compared to Group B. Beetroot juice exhibits remarkable hypertensive effectiveness.

**Keywords:** Allicin, Beetroot, Cardiovascular Diseases, Dietary Nitrate, Garlic, Hypertension

### INTRODUCTION

The prevalence of hypertension has increased in developing countries like Pakistan (Chong-Nguyen et al. 2020). Along with the medications of hypertension there are some organic components that helps to reduce hypertension such as beetroot and allicin, considered as highly acceptable with a high safety profile as an antihypertensive treatment. In the stomach wall dietary nitrate is absorbed (Hoffman 2020; Cui et

al. 2020). This dietary nitrate is reduced into nitrite ( $\text{NO}^-2$ ) in stomach wall and enter the entero-salivary circulation. ( $\text{NO}^-2$ ) is reduced to nitric oxide (NO) and again re-pass in the circulation to reach the acidic setting of the stomach. Various cardiovascular diseases are connected with NO bioactivity (Jones AM 2014). NO is expected to reduce aortic BP more than brachial BP (Chemla D and Millasseau S 2020). Ambulatory BP measurement over 24 h gives more accurate

results of CVD risk and total death or mortality than clinical management of BP (Kukadia et al. 2019). Garlic (*Allium sativum*) has been valued for its medicinal properties for centuries. that it may reduce the risk of heart disease and cancer (Tattelman 2005; Khanum et al.2004; Williams et al. 205). It is consumed as a medicinal supplement, with its antibacterial, anti-carcinogenic and antioxidant effect mainly produced by allicin (Wang et al. 2015). Allicin is not found in fresh garlic; it is derived through the enzymatic action of alliinase when the membranes of the garlic cloves are destroyed through Pressurized liquid extraction (PLE) technique (Farias-Campomanes et al. 2014). Antihypertensive properties of garlic have been associated to stimulation of intracellular NO and hydrogen-sulphide production, and blockage of angiotensin II production, which in turn helps in vasodilation and thereby lowers blood pressure (Ried et al. 2013). Therefore, the main purpose of the current study is to compare the therapeutic effect of beetroot and allicin in reducing hypertension.

## MATERIALS AND METHODS

### Data Collection Procedure:

It was a Randomized Single Blind Controlled trial. To meet the inclusive criteria of the study screening was done among 250 participants of which 70 participants were selected through the following Formula:

$$n_1 = \frac{(z_1 - \alpha/2 + z_1 - \beta)^2 [\sigma_1^2 + \sigma_2^2/r]}{2}$$

$r = n_2 / n_1, = \mu_1 - \mu_2$  where,  
 $\mu_1$  = Mean decrease of Systolic blood pressure in beetroot group = 1.0

$\mu_2$  = Mean decrease of Systolic blood pressure in allicin group= 8.7

$\sigma_1$  = Standard deviation decrease of systolic blood pressure in beetroot group = 8.4

$\sigma_2$  = Standard deviation decrease of systolic blood pressure in allicin group = 8.2

$\alpha = 0.01, \beta = 0.1$  Hence,

Sample size of Group A = 35, Sample size of Group B = 35

### Dose and Administration Details:

Volunteers in group A were randomized to receive 250ml of beetroot juice and group B received 80mg of Allicin Capsules for 4 weeks. Volunteers had BP measured twice a day with

Digital Blood pressure or sphygmomanometer. The follow ups for both groups were conducted twice a week. The anthropometric measurements and hypertension measurements was collected in each follow up. After 4 weeks the same protocol of baseline visit was conducted for both groups including blood pressure measurements, anthropometric measurements (weight, height, BMI), biochemical evaluation (Hemoglobin, lipid profile).

### Statistical analysis:

Data was tabulated and analyzed with the help of SPSS version 22.0. The results were presented in the form of descriptive and inferential statistics. The quantitative variables were reported by using mean and standard deviation. Wilcoxon test was applied to see before and after mean differences with respect to each intervention, and for BMI paired sample t test was used for this purpose. Whereas, Mann Whitney U test was used to compare the difference of mean pre and post treatment values.

### Inclusion and Exclusion Criteria:

Only Stage 1 and stage 2 hypertensive patients were included. Patients who are already taking any supplement or medication of hypertension was excluded. Patients were excluded if they had secondary or white-coat hypertension or if they had known allergies to beetroot or garlic. Pregnant or nursing women were also not the part of experimental study.

## RESULTS AND DISCUSSION

Satisfactory blood pressure recordings, Hb and Lipid Profile were reported by both groups (Table 1,2) who completed the study and no adverse effects. Group A having beetroot juice showed significant reduction in hypertension as compared to allicin group. It exhibits remarkable hypertensive effectiveness. Levels of HDL in both groups were improved whereas Cholesterol levels among the patients of both study groups also showed significant reduction (p-value, 0.016 and 0.019). There is no statistically significant mean difference in change in LDL and triglycerides among the patients of both study groups (p-value, 0.702 and 0.552). Similarly, mean difference in change in BMI, Hb among the patients of both study groups was also not significant (p-value, 0.134 and 0.653).

It has been postulated that the inclusion of dietary nitrates in the form of beetroot-derived foods may be useful in the regulation of normal

BP due their high inorganic  $\text{NO}_3^-$  content. In the present study, beetroot juice and allicin capsules were prepared for the evaluation of effectiveness in the context of comparison in reducing hypertension among mild to moderate hypertensive patients.

The formulation of beetroot juice and allicin capsules were developed by following the similar work performed by two researchers on analyzing the potential of nitrate content in beetroot juice and allicin content in garlic for using it as a therapeutic agent in certain health conditions (Mathialagan et al. 2017; Coles LT and Clifton PM 2012).

The current study showed more positive result in reduction of blood pressure in beetroot group as compared to allicin group showing mean reduction in SBP as  $18.14 \pm 9.347$  and DBP as  $15.46 \pm 10.807$  whereas the mean reduction of SBP and DBP in allicin group was  $6.20 \pm 12.017$  and  $4.29 \pm 11.297$  respectively as mentioned in Table 1,2. A study has been reported to reduce blood pressure from beetroot juice in participants showing a peak reduction in SBP of  $5.4 \pm 1.5$  mmHg, whilst DBP changes were also significant (Retnaningsih R and Wijayanti TR 2020).

In our present study pre and post treatment of beetroot juice also shows statistically significant mean difference in SBP  $18.14 \pm 9.347$  and DBP  $15.46 \pm 10.807$ . A randomized, placebo-controlled, double-blind crossover trial in 2015 was conducted. The effect of 1-week intake of nitrate-rich beetroot juice was compared with 1-week intake of nitrate-depleted beetroot juice (placebo), showing a reduction in blood pressure ( $P < 0.001$ ) in nitrate beetroot juice group (Bondonno et al. 2015). In our present study there is also a mean reduction in SBP as well as in DBP  $18.14 \pm 9.347$  and  $15.46 \pm 10.807$  and ( $P=0.000$ ).

Our present study also showed decreased SBP and DBP with 250ml of beetroot juice for the duration of 4 weeks ( $P=0.000$ ), as mentioned in Table 1,2. In a randomized crossover study, a comparison of raw beet juice (RBJ) and cooked beet (CB) on BP was made to analyze its effect of hypertensive subject which showed that RBJ or CB decreased ( $P < 0.05$ ) systolic and diastolic BP (Asgary S et al. 2016). The obtained results were found to be similar to the mentioned studies working on beetroot. Therefore, it assures and reconfirms the effectiveness of beetroot on hypertensive patients. Our current study includes 35 individuals in group who consumed beetroot juice for 4 weeks and showed a reduction of

$15.46 \pm 10.807$  mmHg in Diastolic Blood pressure.

A similar study was conducted which was a double-blind crossover study to access the effects of sodium nitrate from beetroot juice on Blood Pressure (BP) in 17 healthy individuals for 10 days and described a significant reduction in diastolic BP 23.7 mmHg (Larsen F et al. 2016). So, the current study results were compatible with the previous study.

Biochemical tests including Lipid profile and Hb were also carried out in both study groups. The effect of administered beetroot juice and allicin capsules were analyzed onto the hemoglobin and Lipid profile which involve the testing of the levels of Total Cholesterol, LDL, HDL and Triglycerides. The relevant tests were performed for the determination of change caused by consumption of beetroot juice and allicin capsules in the hypertensive patients. There is no statistically significant mean difference in change in BMI, Hb among the patients of two study groups (p-value, 0.134 and 0.653). Similarly, there is no statistically significant mean difference in change in LDL and triglycerides among the patients of both of the study groups (p-value, 0.702 and 0.552). Whereas, both groups showed statistically significant difference in HDL and Cholesterol in pre and post treatments. Beetroot juice group showed more statistically significant difference in HDL, cholesterol as compared to allicin group and the recorded data is mentioned in Table 1,2. The obtained results were found to be similar to the studies that had been performed previously by working on beetroot juice and allicin (Jajja et al. 2014; Lotfi et al. 2019; Elkayam et al. 2003; Hosseini A and Hosseinzadeh H2015). Therefore, it reassures and reconfirms the effectiveness of beetroot juice which helps in reducing hypertension among mild to moderate hypertensive patients.

**Table 1: Comparison of average SBP, DBP, BMI, Hb, LDL, HDL, Cholesterol and Triglycerides level pre and post treatment in Beetroot juice group and Allicin Group**

Groups		SBP	DBP	BMI	Hb	LDL	HDL	Cholesterol	Triglycerides
Beetroot Juice	Pre	137.60±10.71	99.03±8.287	26.13± 2.846	12.991±2.4911	130.51±33.436	41.86±4.506	178.00±44.094	182.49±53.084
	Post	119.46±8.651	84.00±8.117	25.634± 3.0462	13.537±1.8854	117.69±29.989	40.57±5.473	177.03±22.914	171.03±46.524
Allicin Capsules	Pre	135.09±13.868	94±12.238	26.66± 3.388	12.717±1.7940	130.94±31.880	45.20±6.820	183.54±22.148	180.57±70.832
	Post	128.86±9.000	89.71±9.070	26.574± 3.3611	13.043±1.4803	121.17±27.079	46.97±7.426	177.26±15.151	169.31±50.520

\*SBP: Systolic Blood pressure, DBP: Diastolic Blood Pressure, BMI: Body Mass Index, Hb: Hemoglobin, LDL: Low-Density Lipoprotein, HDL: High-Density Lipoprotein

**Table 2: Comparison of average SBP, DBP, BMI, Hb, LDL, HDL, Cholesterol and Triglycerides level treatment in among two study groups**

Groups	SBP	DBP	BMI	Hb	LDL	HDL	Cholesterol	Triglycerides
Beetroot Juice	18.14±9.347	15.46±10.807	0.600±0.946	0.500±0.9375	9.97±13.049	1.29±4.663	0.69±27.186	11.57±15.230
Allicin	6.20±12.017	4.29±11.297	0.169±0.4549	0.320±0.7112	9.77±13.77	1.54±5.078	6.00±15.303	11.49±25.880

\*SBP: Systolic Blood pressure, DBP: Diastolic Blood Pressure, BMI: Body Mass Index, Hb: Hemoglobin, LDL: Low-Density Lipoprotein, HDL: High-Density Lipoprotein

## CONCLUSION

After a diligent and detailed inspection of our results it is concluded that beetroot juice is more effective in reducing hypertension than allicin in hypertensive patients. The present study provides the insight data to explore the systolic and diastolic blood pressure of the hypertensive patients. The current research project also showed improvement in levels of H. and reduction in Cholesterol levels.

## CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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## AUTHOR CONTRIBUTIONS

MS designed and planned the research and also wrote the manuscript. SB and TA analyzed and interpret the experimental data. SAG helped in drafting the article. MMQ critically revised the data and AB helped in statistical part of experimental data. All authors read and approved the final version.

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## REFERENCES

- Asgary, S., Afshani, M. R., Sahebkar, A., Keshvari, M., Taheri, M., Jahanian, E., ... & Sarrafzadegan, N. (2016). Improvement of hypertension, endothelial function and systemic inflammation following short-term supplementation with red beet (*Beta vulgaris* L.) juice: a randomized crossover pilot study. *Journal of human hypertension*, 30(10), 627-632.
- Bondonno, C. P., Liu, A. H., Croft, K. D., Ward, N. C., Shinde, S., Moodley, Y., ... & Hodgson, J. M. (2015). Absence of an effect of high nitrate intake from beetroot juice on blood pressure in treated hypertensive individuals: a randomized controlled trial. *The American journal of clinical nutrition*, 102(2), 368-375.
- Chemla, D., & Millasseau, S. (2020). A systematic review of invasive, high-fidelity pressure studies documenting the amplification of blood pressure from the aorta to the brachial and radial arteries. *Journal of Clinical Monitoring and Computing*, 1-8.
- Chong-Nguyen, C., Stalens, C., Goursot, Y., Bougouin, W., Stojkovic, T., Béhin, A., ... & Wahbi, K. (2020). A high prevalence of arterial hypertension in patients with mitochondrial diseases. *Journal of inherited metabolic disease*, 43(3), 478-485.
- Coles, L. T., & Clifton, P. M. (2012). Effect of beetroot juice on lowering blood pressure in free-living, disease-free adults: a randomized, placebo-controlled trial. *Nutrition journal*, 11(1), 1-6.
- Cui, T., Liu, W., Chen, S., Yu, C., Li, Y., & Zhang, J. Y. (2020). Antihypertensive effects of allicin on spontaneously hypertensive rats via vasorelaxation and hydrogen sulfide mechanisms. *Biomedicine & Pharmacotherapy*, 128, 110240.
- Elkayam, A., Mirelman, D., Peleg, E., Wilchek, M., Miron, T., Rabinkov, A., ... & Rosenthal, T. (2003). The effects of allicin on weight in fructose-induced hyperinsulinemic, hyperlipidemic, hypertensive rats. *American journal of hypertension*, 16(12), 1053-1056.
- Fariás-Campomanes, A. M., Horita, C. N., Pollonio, M. A., & Meireles, M. A. A. (2014). Allicin-rich extract obtained from garlic by pressurized liquid extraction: Quantitative determination of allicin in garlic samples. *Food and Public Health*, 4(6), 272-278.
- Hoffman, D. J. (2020). Use of beetroot juice extract for hypertension treatment in low-and middle-income countries. *The Journal of Nutrition*, 150(9), 2233-2234.
- Jajja, A., Sutjarjoko, A., Lara, J., Rennie, K., Brandt, K., Qadir, O., & Siervo, M. (2014). Beetroot supplementation lowers daily systolic blood pressure in older, overweight

- subjects. *Nutrition research*, 34(10), 868-875.
- Jones, A. M. (2014). Dietary nitrate supplementation and exercise performance. *Sports medicine*, 44(1), 35-45.
- Khanum, F., Anilakumar, K. R., & Viswanathan, K. R. (2004). Anticarcinogenic properties of garlic: a review. *Critical reviews in food science and nutrition*, 44(6), 479-488.
- Kukadia, S., Dehbi, H. M., Tillin, T., Coady, E., Chaturvedi, N., & Hughes, A. D. (2019). A Double-blind placebo-controlled crossover study of the effect of beetroot juice containing dietary nitrate on aortic and brachial blood pressure over 24 h. *Frontiers in physiology*, 10, 47.
- Larsen, F., Ekblom, B., Sahlin, K., Weitzberg, E., & Lundberg, J. (2006). Effects of dietary nitrate on blood pressure in healthy volunteers. *New England Journal of Medicine*, 28(355 (26)), 2792-3.
- Lofli, M., Azizi, M., Tahmasebi, W., & Bashiri, P. (2019). Acute Beetroot Juice Intake: Hematological, Antioxidant and Lipid Parameters in Female Athletes. *Research in Molecular Medicine*, 7(1), 42-50.
- Mathialagan, R., Mansor, N., Shamsuddin, M. R., Uemura, Y., & Majeed, Z. (2017). Optimisation of Ultrasonic-Assisted Extraction (UAE) of Allicin from Garlic (*Allium sativum* L.). *Chemical Engineering Transactions*, 56, 1747-1752.
- Retnaningsih, R., & Wijayanti, T. R. A. (2020). The Effect Of Beetroot Juice (*Beta Vulgaris* L) And Star Fruit (*Averrhoa Carambola* L) On The Reduction Of Blood Pressure In Second Trimester Pregnant Women With Gestational Hypertension. *Journal of Islamic Medicine*, 4(2), 106-114.
- Ried, K., Frank, O. R., & Stocks, N. P. (2013). Aged garlic extract reduces blood pressure in hypertensives: a dose-response trial. *European Journal of Clinical Nutrition*, 67(1), 64-70.
- Tattelman, E. (2005). Health effects of garlic. *American family physician*, 72(1), 103-106.
- Wang, H.P., Yang, J., Qin, L.Q. and Yang, X.J., 2015. Effect of garlic on blood pressure: A meta-analysis. *The Journal of Clinical Hypertension*, 17(3), pp.223-231.
- Williams, M. J., Sutherland, W. H., McCormick, M. P., Yeoman, D. J., & de Jong, S. A. (2005). Aged garlic extract improves endothelial function in men with coronary artery disease. *Phytotherapy Research: An International Journal Devoted to Pharmacological and Toxicological Evaluation of Natural Product Derivatives*, 19(4), 314-319.