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EFFECTIVENESS OF COMPLIMENTARY THERAPY OF ALLIUM SATIVUM ON REDUCING BLOOD PRESSURE AMONG PATIENTS WITH HYPERTENSION- A COMMUNITY TRIAL

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ABSTRACT

Background: The global prevalence of cardiovascular disease is increasing at a concerning rate. Approximately 46% of adults with high blood pressure are unaware of their condition. **Aim:** Study aimed to assess the efficacy of Allium Sativum (Garlic) in treating hypertension in an experimental group of patients. **Method:** Researcher employed a quasi-experimental design and selected 106 subjects using a non-probability purposive sampling technique from specific community areas in the Panchmahal District of Gujarat. **Results:** The use of Allium Sativum for one month resulted in a significant reduction in both systolic and diastolic blood pressure levels among the subjects in

the experimental group. The statistical analysis indicated that the 'f' value for systolic blood pressure was 223.04 and for diastolic blood pressure was 196.48, with a p-value of <0.001. **Conclusion:** The study findings suggest that Allium Sativum effectively lowers both systolic and diastolic blood pressure in the experimental group. This non-pharmacological approach proved to be safe and did not exhibit any side effects when compared to alternative treatments.

Keywords: *Allium sativum*, Garlic, Systolic Blood Pressure, Diastolic Blood Pressure Community, Effectiveness, Complimentary therapy, Hypertension

INTRODUCTION

Cardiovascular diseases are spreading rapidly worldwide, affecting more than 1.2 billion people. These diseases encompass various conditions; including heart disease, brain vascular issues, kidney problems, and peripheral arterial diseases **[1]**.

According to the Global Burden of Disease estimates, a significant proportion of cardiovascular disease-related deaths occur in India before the age of 70, making up 52% compared to just 23% in developed nations. Non-communicable diseases, including cardiovascular disease, account for approximately 63% of all deaths in India, with 27% attributed to cardiovascular issues, particularly affecting individuals between 40 and 69 years of age **[2]**. Hypertension, a common adult ailment, often goes unnoticed and untreated. One in four adults in India suffers from hypertension, but only 10% have their blood pressure under control **[3]**. India aims to reduce the prevalence of hypertension by 33% between 2010 and 2030. In 2019 **[4]**, India ranked 156th and 164th for hypertension prevalence among men and women, respectively. The prevalence of hypertension in India is approximately 31% in individuals aged 30 to 79 **[5]**.

An estimated 1.28 billion adults aged 30-79 years worldwide have hypertension, most (two-thirds) living in low- and middle-income countries. An estimated 46% of adults with hypertension are unaware that they have the condition. Less than half of adults (42%) with hypertension are diagnosed and treated. Approximately 1 in 5 adults (21%) with hypertension have it under control[4]. India has set a target of 25% relative reduction in the prevalence of hypertension (raised blood pressure) by 2025. To achieve this, the Government of India launched the Indian Hypertension Control Initiative (IHCI) to fast-track access to treatment services for over 220 million people in India who have hypertension. Unfortunately, only around 12% of people with hypertension in India have

their blood pressure under control, contributing to cardiovascular diseases' high mortality rate **[2]**. In the United States, heart disease is a leading cause of death, resulting in approximately 697,000 deaths in 2020. It also imposes a substantial economic burden, costing about $229 billion annually **[6]**.

According to the National Family Health Survey (NHFS) 5, conducted in 2019-2020, a significant percentage of women in India (58%) have elevated blood pressure compared to men (32%) **[7]**. The prevalence of hypertension in India is about 29.8% (in urban areas 33.8% and in rural areas 27.6%) **[8]**.

Garlic contains various compounds, including Allicin, which is associated with health benefits such as reducing blood pressure, cholesterol levels, and providing antioxidant and antibiotic effects. It is also linked to pain reduction in the circulatory system and may help prevent weight gain[9].Allicin, derived from garlic, is believed to have antihypertensive properties by affecting endothelial factors and promoting vasodilation through nitric oxide and hydrogen sulfide production. It also shows potential in lowering cholesterol levels and acting as a mild antihypertensive[10].A considerable proportion of the global population has hypertension, and nearly half of those affected are unaware of their condition. Furthermore, less than half of individuals with hypertension receive a diagnosis and treatment, and only a fraction has their blood pressure effectively managed **[4]**.

During researcher clinical exposure, a researcher observed a growing number of hypertensive patients seeking care at Primary Health Centers and Community Health Centers. While conventional medications are typically recommended for managing hypertension, some of these patients expressed frustration that their blood pressure remained elevated despite medication use. Long-term medication regimens also led to mental fatigue. In exploring non-pharmacological alternatives, substantial evidence supports the potential of garlic in lowering blood pressure. Garlic is a cost-effective and commonly used vegetable in daily meal preparation. These observations prompted the researcher to undertake a study to investigate the effectiveness of garlic in a community setting. The results of this study have the potential to significantly enhance the well-being of hypertensive patients.

METHODOLOGY:

A quasi-experimental study was carried out in the community areas of Panchmahal District, Gujarat, with prior authorization from the relevant competent authorities. The study

involved a total of 106 participants, with 53 individuals assigned to the experimental group and 53 to the control group, all meeting the specified selection criteria. Establishing and maintaining a trustful rapport with each participant, informed consent was individually obtained after explaining the study's purpose. Prior to commencing the study, both the experimental and control groups underwent a pre-test to assess their blood pressure.

Subsequently, the experimental group received a brief introduction to *Allium sativum* (Garlic) and its potential to lower blood pressure. Each participant in the experimental group received seven packs of *Allium sativum*, with each pack containing four medium cloves (10-12gms). They were trained to consume one pack daily with lukewarm water on an empty stomach in the morning. This procedure was followed consistently for a month. On the 16th day following Allium Sativum intake, post-test-1 was conducted, involving blood pressure measurements for both the experimental and control groups. Another assessment, post-test-2, was performed on the 30th day after Allium Sativum consumption, with blood pressure measurements taken for both groups.

Data collected were recorded and entered into an excel master sheet, and data analysis was carried out using SPSS software (version 20). The effectiveness of Allium Sativum among hypertensive patients was evaluated through paired t-tests and a repeated measure analysis of variance (ANOVA).

RESULTS

The study's results indicate that the age group of 51-60 years had the highest representation, accounting for 67.9% in both the experimental and control groups, with a total of 60.4%. Both groups consisted of 50.9% female participants. The majority of the participants identified as Hindu, with 100.0% in the experimental group and 98.1% in the control group. Primary education was prevalent, with 50.9% in the experimental group and 34.0% in the control group. Housewives were common, making up 41.5% in the experimental group and 37.7% in the control group. A significant portion of the families had a household income exceeding ₹50,000, with 79.2% in the experimental group and 69.8% in the control group. The majority of participants were married, comprising 77.4% in the experimental group and 88.0% in the control group. Regarding dietary habits, 62.3% in the experimental group and 52.8% in the control group reported having a mixed diet. In the experimental group, "joint family" households were prominent at 66.0%, while in the control group, it was 62.3%. The majority of

participants did not fall into any other category, accounting for 37.7% in the experimental group and 45.3% in the control group. When it came to daily sleep duration, 67.9% in the experimental group and 71.7% in the control group reported sleeping "6.5-8 hours" per day. In the experimental group, "absent" individuals were prominent at 67.9%, whereas in the control group, it was 64.2%. In terms of the duration of their conditions, 41.5% in the experimental group had experienced their condition for 4-6 years, while 47.2% in the control group had experienced it for 1-3 years. The majority of participants answered "yes," comprising 58.5% in the experimental group and 52.8% in the control group.

Table 1 provides insights into the distribution of systolic blood pressure levels in patients with hypertension before the intervention. In the experimental group, the majority (85%) exhibited a systolic blood pressure within the range of 140-159 mmHg, indicating Stage 1 Hypertension, while a smaller percentage (4%) had readings in the 121-139 mmHg range, indicating Pre-hypertension. Similarly, in the control group, the majority (80%) had systolic blood pressure readings falling in the 140-159 mmHg range, denoting Stage 1 Hypertension, with 5% having readings of ≥160 mmHg, indicative of Stage 2 Hypertension.

Table 2 illustrates the distribution of diastolic blood pressure levels among patients with hypertension before any intervention. In the experimental group, the majority (64%) displayed diastolic blood pressure readings in the 90-99 mmHg range, representing Stage 1 Hypertension, while a significant portion (36%) had readings in the 80-89 mmHg range, indicating Pre-hypertension. Similarly, in the control group, the majority (60%) had diastolic blood pressure readings falling within the 90-99 mmHg range, signifying Stage 1 Hypertension, with 40% having readings in the 80-89 mmHg range, suggesting Pre-hypertension.

Table 3 provides a breakdown of the frequency and percentage distribution of systolic blood pressure levels among patients with hypertension before and after interventions. In the pre-test, the experimental group showed that the majority (85%) had systolic blood pressure readings in the 140-159 mmHg range, indicating Stage 1 Hypertension, while 4% had readings in the 121-139 mmHg range, signifying Pre-hypertension. Similarly, in the control group, the majority (80%) had systolic blood pressure readings in the 140-159 mmHg

range, and 5% had readings of ≥160 mmHg, indicating Stage 2 Hypertension.

In the first post-test, the majority of subjects in the experimental group (76%) had systolic blood pressure readings within the 140-159 mmHg range, representing Stage 1 Hypertension, and 1% had readings of ≥160 mmHg (Stage 2 Hypertension). In the control group, the majority (81%) had systolic blood pressure readings in the 140-159 mmHg range, and 19% had readings in the 121-139 mmHg range, indicating Pre-hypertension.

In the second post-test, 62% of subjects in the experimental group had systolic blood pressure readings in the 121-139 mmHg range (Pre-hypertension), while 38% had readings in the 140-159 mmHg range (Stage 1 Hypertension). In the control group, 90% of subjects had systolic blood pressure readings in the 140-159 mmHg range, and 6% had readings of ≥160 mmHg (Stage 2 Hypertension).

Table 4 illustrates the frequency and percentage distribution of diastolic blood pressure levels among patients with hypertension before and after interventions. In the pre-test, the experimental group showed that the majority (64%) had diastolic blood pressure readings in the 90-99 mmHg range, indicating Stage 1 Hypertension, while 36% had readings in the 80-89 mmHg range, signifying Pre-hypertension. Similarly, in the control group, the majority (60%) had diastolic blood pressure readings in the 90-99 mmHg range, and 40% had readings in the 80-89 mmHg range, indicating Pre-hypertension.

In the first post-test, most subjects in the experimental group (72%) had diastolic blood pressure readings in the 80-89 mmHg range, indicating pre-hypertension, while 9% had readings of < 79 mmHg, falling within the normal range. In the control group, most subjects (43%) had diastolic blood pressure readings in the 80-89 mmHg range, and 15% had readings of < 79 mmHg, which is considered normal.

In the second post-test, the majority of subjects in the experimental group (58%) had diastolic blood pressure readings in the 80-89 mmHg range, indicating pre-hypertension, while 8% had readings in the 90-99 mmHg range, representing Stage 1 Hypertension. In the control group, most subjects (66%) had diastolic blood pressure readings in the 90-99 mmHg range, indicating Stage 1 Hypertension, and 34% had readings in the 80-89 mmHg range, signifying pre-hypertension.

Table 5 provides data on the average values of systolic and diastolic blood pressure in the experimental group before and after the test. Prior to the test, the mean systolic blood

pressure was 147.17±7.18, and the mean diastolic blood pressure was 88.17±5.04. Following the test, in Post-test-1, the mean systolic blood pressure decreased to 144.42±6.90, and the mean diastolic blood pressure decreased to 85.77±4.85. Similarly, in Post-test-2, the mean systolic blood pressure decreased to 141±6.86, and the mean diastolic blood pressure decreased to 83.92±4.79. The difference between the pre-test and post-test mean scores in the experimental group was evaluated using paired t-test and was further analyzed using a Repeated Measures ANOVA test, revealing significant differences with F=223.04 for systolic blood pressure and F=196.48 for diastolic blood pressure, both with a p-value of <0.001.

Table 6 reveals that in the experimental group, the average post-test blood pressure values for systolic decreased by 5.58 units and for diastolic by 3.79 units. In contrast, the control group showed a smaller decrease, with systolic blood pressure decreasing by 0.40 units and diastolic by 0.25 units. The unpaired 't'-test results for systolic blood pressure, which yielded a value of 6.386, and for diastolic blood pressure, which resulted in a value of 2.154, demonstrate statistical significance.

Table 7: Depicts that the calculated χ^2 value was greater than the table value in terms of age in experimental group whereas occupational status in control group. Hence, the research hypothesis H_3 stated that there is a statistically significant association in the post-test score of systolic blood pressure among patients with hypertension with the selected demographic variables was accepted.

Table 8: Depicts that the calculated χ^2 value was greater than the table value in terms of marital status in experimental group. Hence, the research hypothesis H_3 stated that there is a statistically significant association in the post-test score of systolic blood pressure among patients with hypertension with the selected demographic variables was accepted.

Table 1: Frequency and percentage distribution of subjects according to their pre-test level of systolic blood pressure among patients with hypertension in experimental group and control group (n=106)

Sr. No.	Blood Pressure Classification	Pre-Test			
		Exp. Group n=53		Control Group n=53	
		f	%	f	%
1.	Normal(≤120mmofHg)	-	-	-	-
2.	Pre-hypertension(121–139mmofHg)	2	4	8	15
3.	Stage I–HT(140–159mmofHg)	45	85	42	80
4.	Stage II–HT(≥160mmofHg)	6	11	3	5

Table 2: Frequency and percentage distribution of subjects according to their pre-test level of diastolic blood pressure among patients with hypertension in experimental group and control group (n=106)

Sr. No.	Blood Pressure Classification	Pre-Test			
		Exp. Group n=53		Control Group n=53	
		f	%	f	%
1.	Normal (<79 mm of Hg)	-	-	-	-
2.	Pre-hypertension (80–89 mm of Hg)	19	36	21	40
3.	Stage I–HT (90-99 mm of Hg)	34	64	32	60
4.	Stage II–HT (≥100 mm of Hg)	-	-	-	-

Table 3: Frequency and percentage distribution of subjects according to post-test level of systolic blood pressure among patients with hypertension in experimental group and control group (n=106)

Sr. No.	Blood Pressure Classification	Pre-Test				Post-Test-1				Post-Test-2			
		EG n=53		CG n=53		EG n=53		CG n=53		EG n=53		CG n=53	
		f	%	f	%	f	%	f	%	f	%	f	%
1.	Normal (≤120 mm of Hg)	-	-	-	-	-	-	-	-	-	-	-	-
2.	Pre-hypertension (121–139 mm of Hg)	2	4	8	15	12	23	10	19	33	62	2	4
3.	Stage I–HT (140–159 mm of Hg)	45	85	42	80	40	76	43	81	20	38	48	90
4.	Stage II–HT (≥160 mm of Hg)	6	1	3	5	1	1	-	-	-	-	3	6

Table 4: Frequency and percentage distribution of subjects according to post-test level of diastolic blood pressure among patients with hypertension in experimental group and control group (n=106)

Sr. No.	Blood Pressure Classification	Pre-Test				Post-Test-1				Post-Test-2			
		EG n=53		CG n=53		EG n=53		CG n=53		EG n=53		CG n=53	
		f	%	f	%	f	%	f	%	f	%	f	%
1.	Normal (≤79 mm of Hg)	-	-	-	-	5	9	8	15	10	19	-	-
2.	Pre-hypertension (80–89 mm of Hg)	19	36	21	40	38	72	23	43	39	58	18	34
3.	Stage I–HT (90–99 mm of Hg)	34	64	32	60	10	19	22	42	4	8	35	66
4.	Stage II–HT (≥100 mm of Hg)	-	-	-	-	-	-	-	-	-	-	-	-

Table 5: Effectiveness of Alliums Sativum among patients with hypertension in experimental group (n=106)

Sr. No.	Group	Blood Pressure	Mean	SD	t test	F Test	P Value
1.	Experimental group	SBP Pre	147.17	7.18	13.67	223.04	<0.001
		SBP Post-1	144.42	6.90			
		SBP Post-2	141.58	6.86	16.16		
		DBP Pre	88.17	5.04	11.95	196.48	<0.001
		DBP Post-1	85.77	4.85			
		DBP Post-2	83.92	4.79	16.90		

NS-No Significance, S*-Significant, level of significance at P=0.05 level, df-degree of freedom

Table 6: Compare the post-test level of blood pressure among patients with hypertension in both the experimental group and control group (n=106)

Sr. No	Blood pressure	Group	Mean	SD	t-test	df	Sig./Non Sig.
1.	SBP	Experimental Group	5.58	2.51	6.386	104	S*
		Control Group	0.40	5.35			
2.	DBP	Experimental Group	3.79	12.82	2.154	104	S*
		Control Group	0.25	4.68			

S*-Significant, level of significance at P=0.05 level, df-degree of freedom

Table 7: Association between post-test score of systolic blood pressure among patients with hypertension with their selected demographic variables in experimental group and control group (n=106)

Sr. No	Groups	Demographic Variables		Post-test systolic Blood pressure (mm of Hg)			χ^2
				121 – 139	140 – 159	≥ 160	
1.	Experimental Group	Age inYears	41-50	14	3	-	χ^2-4.299 df-1 (S*)
			51-60	19	17	-	
2.	Control Group	Occupational Status	Housewife	1	17	2	χ^2-7.594 df-4 (S*)
			Daily wage worker	-	3	1	
			Self-employee	-	18	-	
			Private employee	-	2	-	
			Government Employee	1	8	-	

S*- Significant, level of significance at P=0.05 level, df- degree of freedom

Table 8: Association between post-test score of diastolic blood pressure among patients with hypertension with their selected demographic variables in experimental group and control group (n=106)

Sr. No.	Groups	Demographic Variables		Post-test diastolic Blood pressure (mm of Hg)			χ^2
				≤79	80 - 89	90 - 99	
1.	Experimental Group	Marital Status	Married	9	31	1	χ^2-7.274 df-2 (S*)
			Widow or widower	1	8	3	

S*- Significant, level of significance at P=0.05 level, df- degree of freedom

DISCUSSION:

This study unveiled that the majority of hypertensive patients in the experimental group were in their 50s, predominantly female, and of Hindu faith. Most had received a primary education, were homemakers, and had a monthly income below Rs. 50,000. They were married, had diverse dietary habits, lived in nuclear families, had no harmful habits, slept for 6.5-8 hours per night, lacked a family history of hypertension, and had been ill for 4-6 years. A significant number were regularly taking antihypertensive medications. In the control group, the demographics were similar

but with some distinctions. There was a slightly higher proportion of female patients and individuals with no formal education. Conversely, there was a slightly lower percentage of patients with a monthly income below Rs. 50,000 and those from nuclear families.

A study conducted by Mrs. G. Ramalakshmi, the majority of hypertensive patients in the experimental group were female, possessed a high school education, were married, unemployed, and belonged to nuclear families. They had non-vegetarian dietary habits, had experienced hypertension for over five years, adhered diligently to their medication regimen, and typically slept for 8 hours per night. In the control group, most hypertensive patients were male, had a high school education, were married, unemployed, belonged to nuclear families, had non-vegetarian dietary habits, had been hypertensive for less than two years, maintained regular medication usage, and slept for fewer than 8 hours per night **[11]**.

The effectiveness of Allium Sativum (garlic) was assessed by examining hypertensive patients in the experimental group. Their mean systolic and diastolic blood pressure experienced a substantial reduction with statistically significant differences ($P < 0.001$) at various time points. This outcome was further supported by a repeated measures ANOVA, which showed significant variations in both systolic ($F = 223.04$, $P < 0.001$) and diastolic ($F = 196.48$, $P < 0.001$) blood pressure measurements between pre-test, post-test 1, and post-test 2.

Ashraf R, Khan *et al* conducted study on Effects of Allium Sativum (Garlic) on systolic and diastolic blood pressure in patients with essential hypertension. It has been reported that decrease in systolic blood pressure of 10-12 mmHg and diastolic blood pressure 5-6 mmHg significantly decrease cardiovascular risk by 8– 20%. Further, a reduction of 7.6 mmHg (5.23%) in SBP and 6.27 mmHg (6.74%) in DBP with garlic at week 24 has been observed. This confirms hypothesis that garlic can be a good alternative or addition in antihypertensive regimen for reducing cardiovascular related morbidity **[12]**.

In the present study, a reduction of 5.59 mm of Hg in SBP and 4.25 mm of Hg in DBP with Allium Sativum for 30 days has been observed. This confirms that our hypothesis that garlic can be a good alternative or addition in antihypertensive regimen for reducing cardiovascular related morbidity. Study conducted by Mc Innes GT, revealed that decrease in systolic blood pressure of 10-12 mmHg and diastolic blood pressure 5-6 mmHg significantly decrease cardiovascular

risk by 8– 20% **[13]**. Ashraf R, Khan *et al* conducted study revealed that a reduction of 7.6 mmHg (5.23%) in SBP and 6.27 mmHg (6.74%) in DBP with garlic at week 24 has been observed as compared to atenolol in which reduction in SBP was 9.2 mmHg (6.22%) and diastolic blood pressure was 9.1 mmHg (9.27%). This confirms our hypothesis that garlic can be a good alternative or addition in antihypertensive regimen for reducing cardiovascular related morbidity **[12]**.

Study conducted by Roya Zadhoush *et al* revealed that SBP tends to be improved after garlic administration; and further failed to find any significant effect on DBP. Empirical studies have been shown a promising influence of garlic on blood pressure **[1]**. It has been revealed that intake of 100 mg/kg/bodyweight raw crushed garlic twice a day for 4 weeks can decrease SBP and DBP in metabolic syndrome patients (Wlosinska *et al*., 2020) **[14]**.

Another study by Mr. Madhan Mohan on the efficacy of garlic therapy for hypertensive patients confirmed significant reductions in mean systolic and diastolic blood pressure in the experimental group **[15]**. To compare the post-test blood pressure readings between the experimental and control groups, an unpaired t-test was used. The results of the t-test indicated statistically significant differences in both systolic ($t = 6.386$) and diastolic ($t = 2.154$) blood pressure between the two groups, signifying the substantial impact of garlic supplementation on blood pressure in both groups. In another study by M. D. Neethu, which assessed the effectiveness of garlic therapy among hypertensive patients, the mean difference in systolic and diastolic blood pressure between the experimental and control groups was found to be significantly different ($t = 2.982$ and $t = 2.867$, respectively) **[16]**.

Furthermore, there were significant associations between post-test systolic blood pressure in the experimental group and age, as well as between occupation status in the control group, with p-values less than 0.001. A significant association was also observed between post-test diastolic blood pressure in the experimental group and marital status, with a p-value less than 0.001.

In the research carried out by M. D. Neethu, it was found that there was a noteworthy connection between the occupation ($t = 2.936$, $p = 0.0026$) and family structure ($t = 2.679$, $p = 0.037$) with respect to the average change in diastolic blood pressure among individuals with hypertension **[16]**.

Limitations of the study

We demonstrated in this research study that complementary therapy led to more significant improvements in systemic blood pressure. However, it is crucial to approach this interpretation with caution, taking into account possible confounding factors such as concomitant drugs, the timing of medication administration before to each research day, and unreported co-morbid diseases.

CONCLUSION:

This study demonstrated that Allium Sativum proved to be highly efficient in lowering blood pressure among hypertensive patients. The incorporation of Allium Sativum into daily meals offers a straightforward and cost-effective method for community members to control hypertension. Allium Sativum exhibited a beneficial impact on reducing blood pressure and notably enhanced the blood pressure levels of hypertensive patients, particularly in the group that consumed Allium Sativum. Furthermore, it was deemed safe and well-tolerated, with no notable adverse effects when compared to alternative treatments. Further, researcher observed that in addition to the pharmacological remedy, health personnels can educate the hypertensive clients on the significance of including garlic in their diet to reduce their blood pressure.

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