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Effect of Device Guided Slow Breathing Exercise in Lowering the Blood Pressure Among Hypertensive Clients

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Abstract

Background: Device-guided slow breathing (DGSB) exercises are gaining attention as a potential non-invasive method to manage hypertension. This study evaluates the effectiveness of a DGSB intervention in reducing blood pressure among hypertensive clients in the Gajuwaka community, Visakhapatnam district, Andhra Pradesh.

Methods: This quasi-experimental study utilized a non-randomized control group design. Sixty hypertensive individuals, aged over 30 years, were selected using a non-probability purposive sampling technique. Participants were divided into Experimental (n=30) and Control (n=30) groups. The Experimental group underwent DGSB exercises using Kinetic RESPeRATE blood pressure lowering device for three days while the Control group received usual care. Demographic and lifestyle variables were recorded, and pre- and post-test blood pressure measurements were taken. Independent t Tests and Paired t Tests were used to analyze the data.

Results: Both groups were similar in age, gender, marital status, and income levels, but differed in religious composition and hypertension history. Pre-test systolic and diastolic blood pressures were comparable between groups. Post-test measurements revealed significant reductions in the Experimental group's mean systolic BP (from 151.0 to 126.0 mmHg) and diastolic BP (from 97.3 to 83.0 mmHg) compared to the Control group, whose BP changes were not significant. The Independent t Test showed significant differences in post-test systolic ($t=-5.894$, $p<0.001$) and diastolic BP ($t=-3.833$, $p<0.001$) between the groups. The Paired t Test confirmed significant reductions in both systolic ($t=15.903$, $p<0.001$) and diastolic BP ($t=10.785$, $p<0.001$) within the Experimental group, while the Control group showed no significant changes.

Discussion: The results demonstrate that DGSB exercises effectively reduce blood pressure in hypertensive individuals. These findings align with previous research by Wang et al., which highlighted the efficacy of DGSB in decreasing blood pressure and improving baroreflex sensitivity. However, our study did not measure inflammatory markers, limiting direct comparisons on this aspect.

Conclusion: This study provides strong evidence that DGSB exercises significantly reduce blood pressure, supporting their potential as a non-pharmacological intervention for hypertension management. Future research should explore long-term effects, mechanisms of action, and potential benefits of combining DGSB with other treatments to enhance cardiovascular health.

Keywords: Device-guided slow breathing, Hypertension management, Blood pressure reduction, non-pharmacological intervention, Cardiovascular health.

Background:

Device-guided slow breathing (DGSB) exercises are gaining attention as a potential non-invasive way to manage hypertension, a widespread health issue worldwide. DGSB typically involves using a device to help individuals control their breathing rate and depth, promoting relaxation and possibly lowering blood pressure. Various studies have examined DGSB's impact on blood pressure, using different devices and protocols. One study focused on a straightforward DGSB method with biofeedback for patients with high normal or treated essential hypertension (systolic BP >129 mmHg)(1). Participants used a mobile app to perform daily, unattended DGSB exercises for a set period. The app guided breathing exercises by visualizing the user's preset breathing rate, usually between six to eight cycles per minute. The researchers found that this DGSB method, using biofeedback based on pulse arrival time (PAT) or pulse wave velocity, significantly reduced self-measured systolic blood pressure. PAT, the time it takes for the blood pressure wave to travel from the heart to a peripheral site, indicates arterial stiffness. Since increased arterial stiffness is linked to hypertension, PAT is a useful measure for evaluating interventions like DGSB(1). The study showed a consistent decrease in systolic BP throughout the study period, suggesting that regular practice could lead to sustained BP reduction. Additionally, the reproducibility of these results over a week highlighted the reliability of this DGSB method. These findings suggest that this simple DGSB technique with biofeedback, using parameters like PAT, could help manage hypertension and deserves further research(2).

A systematic review and meta-analysis of randomized controlled trials on DGSB's effects on blood pressure painted a less clear picture. This analysis, which included 22 studies with a total of 17,214 participants, found that DGSB did not significantly reduce systolic or diastolic BP compared to usual care. The discrepancy between individual studies and the meta-analysis underscores the complexity of researching DGSB and its impact on blood pressure. Factors contributing to these varied results could include the heterogeneity of the studies in the meta-analysis, differences in device types, breathing protocols, participant characteristics, and study durations. The review also suggested considering non-device-guided slow breathing (NDGSB) as a possible alternative for managing hypertension(3). However, this suggestion was based on a limited number of studies, so more research is needed to determine NDGSB's effectiveness in lowering blood pressure. While some studies in the meta-analysis used DGSB as a standalone intervention, others combined it with therapies like lifestyle changes or medications, making it hard to isolate DGSB's specific effects(4). Although this combination reflects real-world clinical practice, it complicates interpreting the results. Despite these challenges, DGSB's potential as a non-invasive and accessible approach to managing hypertension should not be overlooked. More research is needed to understand DGSB's intricacies and its effect on blood pressure. Future studies should aim to standardize DGSB protocols, optimize device parameters, and conduct larger, well-designed trials with longer follow-up periods to provide clearer answers.

Investigating the combined effects of DGSB with other established therapies and considering individual responses to DGSB, taking into account factors like age, sex, and underlying health conditions, would offer a more comprehensive understanding of its potential benefits and limitations. This multifaceted approach could help define DGSB's role in hypertension management and potentially lead to personalized interventions(5).

Methods:

The methodology for this study adopts a quantitative approach, suitable for addressing the research objectives systematically. The research design chosen is a quasi-experimental, non-randomized control group design. The study was conducted in the community under the Gajuwaka Primary Health Centre in Visakhapatnam district, Andhra Pradesh. The target population comprises hypertensive clients within this community, and a sample of 60 individuals meeting the inclusion criteria has been selected. The non-probability purposive sampling technique was employed to ensure the selection of hypertensive clients residing in the community who were over 30 years old, without complications, willing to participate, and available during data collection. The exclusion criteria ruled out clients with heart disease, diabetes, stroke, kidney disease, those under 30 years of age, unwilling participants, and those unavailable during data collection. For the intervention, the Experimental group used the Kinetic RESPeRATE blood pressure lowering device for three days, with each session lasting 15 minutes, totaling 45 minutes in a week. The RESPeRATE device is designed to guide users through slow-paced breathing exercises, aimed at reducing blood pressure through relaxation and improved autonomic function. This structured approach ensures a representative sample and reliability in data collection for the study.

Results:

Table 1: Frequency and Percentage distribution of Demographic variables

N=60

S.No	Demographic Variables	Experimental		Control	
		Frequency	Percentage	Frequency	Percentage
1	Age				
	31-35 Years	4	13.3	2	6.7
	36-40 Years	6	20	4	13.3
	41-45 Years	3	10	4	13.3
	46 Years and above	17	56.7	20	66.7
2	Gender				
	Female	18	60	19	63.3
	Male	12	40	11	36.7
3	Religion				
	Christian	9	30	3	10
	Hindu	20	66.7	27	90
	Muslim	1	3.3	0	0
4	Educational Qualifications				
	Graduation	7	23.3	4	13.3
	Illiterate	9	30	11	36.7
	Primary education	8	26.7	7	23.3
	Secondary Education	4	13.3	8	26.7
	Others	2	6.7	0	0
5	Occupation				
	Employee	10	33.3	11	36.7
	Housewife	14	46.7	13	43.3
	Others	4	13.3	6	20
	Un-Employee	2	6.7	0	0

S.No	Demographic Variables	Experimental		Control	
		Frequency	Percentage	Frequency	Percentage
6	Marital status				
	Married	25	83.3	24	80
	Unmarried	1	3.3	1	3.3
	Widow/Widower	4	13.3	5	16.7
7	Type of family				
	Joint family	8	26.7	12	40
	Nuclear family	22	73.3	18	60
8	Family Income				
	< 10,000/-	12	40	11	36.7
	10,001-20,000/-	12	40	14	46.7
	20,001-30,000/-	3	10	3	10
	30,001/- and above	3	10	2	6.7
9	Nutritional Status				
	Non vegetarian	28	93.3	30	100
	Vegetarian	2	6.7	0	0
10	Life style habits				
	Alcoholism	2	6.7	3	10
	Cigarette smoking	1	3.3	2	6.7
	High fat intake	25	83.3	25	83.3
	Tobacco chewing	2	6.7	0	0
11	History of hypertension				
	< 1 year	14	46.7	5	16.7
	>2 years	12	40	21	70
	1-2 years	4	13.3	4	13.3
12	Management of hypertension				
	Dietary Modifications	11	36.7	2	6.7
	Pharmacological management	19	63.3	28	93.3
13	Aware of any other Device Guided Breathing				
	No	30	100	30	100

The comparative analysis of demographic and lifestyle variables between the Experimental (Experimental) and Control (Control) groups, each comprising 30 individuals, reveals notable similarities and differences. In terms of age, both groups predominantly consist of individuals aged 46 years and above, with 56.7% in Experimental and 66.7% in Control. Gender distribution is similar, with females constituting 60% in Experimental and 63.3% in Control. The majority religion is Hindu, comprising 66.7% in Experimental and 90% in Control. Educational qualifications show that 30% in Experimental and 36.7% in Control are illiterate. Occupationally, housewives are the largest category, with 46.7% in Experimental and 43.3% in Control. Most participants are married (83.3% in Experimental and 80% in Control), and nuclear families are more common in Experimental (73.3%) compared to Control (60%).

Family income shows that 40% in both groups earn between ₹10,001-20,000. Nutritional status indicates almost all are non-vegetarian, 93.3% in Experimental and 100% in Control. Lifestyle habits reveal high fat intake in 83.3% of both groups, with alcohol and cigarette use slightly more prevalent in Control. Hypertension history is more extended in Control, with 70% having over two years compared to 40% in Experimental. Hypertension management is primarily pharmacological, especially in Control (93.3%), while dietary modifications are more common in Experimental (36.7%). Awareness of other DGBs is absent in both groups, with 100% indicating no awareness. This data provides insights into the demographic and lifestyle characteristics of both groups.

Table 2: Independent t Test to compare the Pre and Post test Blood pressure between the experimental and control group

N=60

Variable	Group	Mean	SD	t-Value	p-Value
Pre test Systolic BP	Experimental	151	15.4	0.366	0.716
	Control	149.7	12.7		
Pre test Diastolic BP	Experimental	97.3	9.4	1.692	0.096
	Control	93.7	7.2		
Post test Systolic BP	Experimental	126	13	-5.894	<0.001
	Control	148.7	16.6		
Post test Diastolic BP	Experimental	83	9.2	-3.833	<0.001
	Control	91.7	8.3		

The Independent t Test data reveals significant differences between the Experimental and Control groups in post-test systolic and diastolic blood pressure measurements. The mean pre-test systolic BP was similar for both groups (Experimental: 151.0, Control: 149.7), with no significant difference (t=0.366, p=0.716). The mean pre-test diastolic BP was slightly higher in the Experimental group (97.3) compared to the Control group (93.7), approaching significance (t=1.692, p=0.096). However, post-test measurements show marked differences:

the Experimental group's mean post-test systolic BP (126.0) was significantly lower than the Control group's (148.7), with a highly significant difference (t=-5.894, p= <0.001). Similarly, the mean post-test diastolic BP in the Experimental group (83.0) was significantly lower than in the Control group (91.7), also showing a significant difference (t=-3.833, p= <0.001). These results indicate that the intervention applied to the Experimental group effectively reduced both systolic and diastolic blood pressure compared to the Control group.

Table 3: Paired t Test to compare the Pre and Post test Blood pressure within the experimental and control group

N=60

Group	Variable	Mean	SD	t-Value	p-Value
Experimental	Pre test Systolic BP	151	15.4	15.903	<0.001
	Post test Systolic BP	126	13		
	Pre test Diastolic BP	97.3	9.4	10.785	<0.001
	Post test Diastolic BP	83	9.2		
Control	Pre test Systolic BP	149.7	12.7	0.474	0.639
	Post test Systolic BP	148.7	16.6		
	Pre test Diastolic BP	93.7	7.2	1.649	0.110
	Post test Diastolic BP	91.7	8.3		

The Paired t Test data shows significant reductions in both systolic and diastolic blood pressure in the Experimental group following the intervention. In the Experimental group, the mean pre-test systolic BP decreased from 151.0 to 126.0 post-test, with a highly significant t-value of 15.903 (p=0.000). Similarly, the mean pre-test diastolic BP dropped from 97.3 to 83.0 post-test, with a t-value of 10.785 (p=0.000). In contrast, the Control group exhibited no significant changes in blood pressure. The mean pre-test systolic BP of 149.7 slightly decreased to 148.7 post-test (t=0.474, p=0.639), and the mean pre-test diastolic BP of 93.7 reduced marginally to 91.7 post-test (t=1.649, p=0.110). These results suggest that the intervention was effective in significantly lowering both systolic and diastolic blood pressure in the Experimental group, while the Control group showed no significant changes.

Discussion:

This study aimed to evaluate the effectiveness of Device Guided Slow Breathing Exercise in reducing blood pressure among hypertensive clients in the Gajuwaka community, Visakhapatnam district, Andhra Pradesh. The results demonstrated significant reductions in both systolic and diastolic blood pressure in the Experimental group compared to the Control group, suggesting that the intervention was effective in managing hypertension. The demographic and lifestyle variables between the Experimental and Control groups showed similarities in age distribution, gender, marital status, and income levels. However, there were differences in religious composition, with a higher percentage of Hindus in the Control group, and in hypertension history, with the Control group having a longer duration of hypertension. These factors did not significantly influence the primary outcomes of the study, as both groups started with similar baseline systolic and diastolic blood pressures. The Independent t Test results indicated no significant differences in pre-test blood pressure measurements between the groups. However, post-test measurements showed that the Experimental group experienced significant reductions in both systolic and diastolic blood pressure compared to the Control group. The Paired t Test results further corroborated these findings, highlighting the substantial impact of the intervention on reducing blood pressure in the Experimental group, while the Control group showed no significant changes.

These findings align with the results from the study by Wang et al. (2021), which investigated the long-term effects of device-guided slow breathing (DGSB) on blood pressure regulation and chronic inflammation in hypertensive patients. Wang et al. found that DGSB significantly decreased blood pressure and improved baroreflex sensitivity, which is consistent with the significant reductions in blood pressure observed in our study's Experimental group. However, while Wang et al. also reported significant reductions in inflammatory markers such as TNF-α, our study did not measure these markers, limiting direct comparison on this aspect(6).

Conclusion:

This study provides strong evidence that the intervention applied to the Experimental group effectively reduced both systolic and diastolic blood pressure compared to the Control group. These results underscore the potential of non-pharmacological interventions in hypertension management and support further research to optimize and standardize such interventions. Future studies should explore the long-term effects, mechanisms of action, and potential benefits of combining these interventions with other lifestyle modifications or pharmacological treatments to enhance overall cardiovascular health

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