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SCAN ME

Effects of Relaxation Breathing Exercises on Cardiovascular Parameters among Hypertensive Patients

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ABSTRACT

Background: High blood pressure is a leading global risk factor for cardiovascular disease and premature mortality. Relaxation breathing exercises offer a promising approach to blood pressure management. **Objective:** To determine the effects of relaxation breathing exercises on cardiovascular parameters in hypertensive patients. **Methodology:** This randomized clinical trial was conducted at City Medical Complex and DHQ Hospital Faisalabad, Pakistan. Participant recruitment was done using a non-probability consecutive sampling method, with 82 hypertensive patients aged 20-50 years with essential or stage I hypertension enrolled in the study. The exclusion of patients with significant comorbidities, like angina, uncontrolled diabetes, stroke, and obesity, was made to minimize potential confounding factors. Standard lifestyle modifications, including the Dietary Approaches to Stop Hypertension diet, salt restriction, weight loss strategies, regular physical exercise, and smoking cessation counseling, were provided to the control group. The lifestyle modifications and supervised regimen of relaxation breathing exercises were given to the treatment group. Deep diaphragmatic breathing, pursed lip breathing, slow deep breathing, and alternate nostril breathing were some of the exercises included. The exercise was performed three times per week for 12 weeks with 10 repetitions in two sets per session. The primary outcomes measured were the systolic, and diastolic blood pressure, mean arterial pressure, pulse pressure, 6-minute walk test, and health-related quality of life assessed by the MINICHAL questionnaire. Data normality was confirmed by the Shapiro-Wilk test, and independent sample t-tests were performed to compare outcomes between groups at 6 and 12 weeks. Within-group changes were evaluated using repeated measures ANOVA. **Results:** The treatment group had significantly greater reductions in blood pressure, mean arterial, and pulse pressure compared to the control group. No significant differences were found in the 6-minute walk test and health-related quality of life between groups. **Conclusion:** Relaxation breathing exercises, combined with lifestyle modifications, effectively reduce blood pressure in hypertensive patients, offering a viable non-pharmacological intervention.

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INTRODUCTION

Hypertension, characterized by persistently elevated blood pressure, stands as a predominant global health challenge and a primary risk factor for cardiovascular diseases, including coronary artery disease, stroke, and renal failure.[1] According to the World Health Organization, about 1.28 billion adults aged 30–79 years worldwide are living with hypertension, and a large proportion of them live in low- and middle-income countries (World Health Organization).[2] In Pakistan, where this study was conducted, hypertension prevalence is notably high, with estimates indicating that up to 45% of adults, particularly in urban settings, may be affected.[3] The condition's asymptomatic nature often delays diagnosis, yet its untreated progression can lead to severe complications, contributing to its status as a leading cause of mortality and disability-adjusted life years globally.[4]

The management of hypertension traditionally relies on pharmacological interventions, such as diuretics, beta-blockers, and ACE inhibitors. However, these treatments frequently present challenges, including adverse side effects like fatigue, dizziness, or gastrointestinal issues, which can deter patient adherence.[5] A study highlighted that non-compliance with antihypertensive medications is prevalent due to these side effects and patients' lack of confidence in the drug's efficacy.[6] This has spurred a growing interest in non-pharmacological strategies that can either complement or serve as alternatives to medication, particularly for patients who experience intolerance or prefer non-drug approaches.

Among non-pharmacological interventions, relaxation breathing exercises have gained attention for their simplicity, cost-effectiveness, and potential to modulate cardiovascular parameters through autonomic nervous system regulation.[7] These exercises, encompassing techniques such as deep diaphragmatic breathing, pursed lip breathing, slow deep breathing, and alternate nostril breathing, are believed to enhance parasympathetic activity while reducing sympathetic tone, thereby promoting vasodilation and lowering blood pressure.[8] The physiological mechanisms involve activating heart-lung mechanoreceptors, improving baroreflex sensitivity, and mitigating stress-related hormonal responses, which collectively contribute to blood pressure reduction.[9] A robust body of evidence supports the efficacy of breathing exercises in reducing blood pressure among hypertensive patients, with studies demonstrating significant improvements in systolic and diastolic pressures through various breathing techniques.[10]

This randomized clinical trial aimed to evaluate the effects of a structured program of relaxation breathing exercises, combined with lifestyle modifications, on cardiovascular parameters in hypertensive patients. The trial was of 82 patients aged 20–50 years with essential or stage I hypertension, randomized to a control group receiving standard lifestyle modifications like Dietary Approaches to Stop Hypertension (DASH) diet, exercise, and smoking cessation counseling or to a treatment group receiving standard lifestyle modifications plus relaxation breathing exercises. This research attempts to provide evidence on the integration of relaxation breathing exercises into comprehensive hypertension management protocols, especially in resource-constrained clinical settings, by comparing outcomes such as systolic and diastolic blood pressures, mean arterial pressure, pulse pressure, six-minute walk distance, and health-related quality of life.

METHODOLOGY

This randomized clinical trial was conducted at City Medical Complex and DHQ Hospital Faisalabad, Pakistan, and was registered at clinicaltrials.gov.pk (NCT06131528). Participant recruitment was done by using a non-probability consecutive sampling technique to ensure practical enrollment within the clinical setting. A total of 82 hypertensive patients aged 20-50 years with essential or stage I hypertension were enrolled in the study. The exclusion of patients with significant comorbidities, such as angina, uncontrolled diabetes, chronic renal failure, stroke, and obesity was made to minimize potential confounding factors. Participants were randomly assigned to one of two groups. Standard lifestyle modifications, including a DASH diet, salt restriction, weight loss strategies, regular physical exercise, and smoking cessation counseling, were provided to the control group. These interventions were delivered through structured counseling sessions to keep them consistent. The lifestyle modifications and supervised regimen of

relaxation breathing exercises were given to the treatment group. Deep diaphragmatic breathing, pursed lip breathing, slow deep breathing, and alternate nostril breathing were some of the exercises included in these. The exercise was performed three times per week for 12 weeks with 10 repetitions in two sets per session. Proper technique and adherence were ensured by supervision.

The primary outcomes measured were the systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), pulse pressure (PP), six-minute walk test (6MWD), and health-related quality of life (HRQOL) assessed by the MINICHAL questionnaire. Exercise capacity was assessed during the six-minute walk test in a standardized environment, whereas blood pressure was measured using a calibrated sphygmomanometer. Research staff administered the MINICHAL questionnaire to evaluate the impression of the quality of life caused by hypertension. Measurements were taken from baseline, 6^{th,} and 12th week to track changes over time. SPSS version 25 was used for data analysis. Data normality was confirmed by the Shapiro-Wilk test, and independent sample t-tests were performed to compare outcomes between groups at 6 and 12 weeks. Within-group changes were evaluated using repeated measures ANOVA. A p-value of less than 0.05 was considered statistically significant, indicating meaningful differences or changes in the measured outcomes.

RESULTS

The study comprised 82 participants with Stage 1 hypertension, randomized into a treatment group (n=41) and a control group (n=40). Demographic and clinical characteristics at baseline are summarized in Table 1. The mean age of participants in the treatment group was 36.73±13.33 vs. 28.10±8.31 years (p=0.472) and had a marginally higher BMI (22.04±2.42 vs. 20.63±1.73 (p=0.375). Gender distribution was balanced, with females constituting 53.7% of the treatment group and 50% of the control group. Baseline SBP was comparable between groups (139.26±9.89 vs. 141.94±14.9 mmHg; p=0.472). After six weeks, the treatment group showed a significant reduction to 121.7±9.75, whereas the control group reduced to 136.82±13.39 (p<0.001). At 12 weeks, SBP further declined to 122.58±7.84 (treatment) and 131.75±12.54 (control), with sustained between-group significance (p<0.001) (Table 2).

Baseline DBP was higher in the treatment group (90.41±7.53 vs. 87.62±4.51; p=0.047). At 6 weeks, the treatment group exhibited a greater reduction (82.92±4.71 vs. 85.05±3.69; p=0.027). By 12 weeks, DBP stabilized at 82.07±4.02 (treatment) and 83.55±3.90 (control), with no significant between-group difference (p=0.098). Baseline MAP was similar between groups (106.68±7.57 vs. 106.61±7.69; p=0.969). At 6 weeks, MAP decreased to 95.84±4.52 (treatment) vs. 102.29±6.13 (control; p<0.001). By 12 weeks, MAP further improved in the treatment group (95.56±3.5 vs. 99.6±6.21; p<0.001). The treatment group demonstrated significant PP reductions at 6 weeks (38.78±10.55 vs. 51.77±11.84; p<0.001) and 12 weeks (40.51±9.24 vs. 48.2±10.37; p<0.001), with no baseline difference (p=0.183). No significant between-group differences were observed at baseline (485.60±95.39 vs. 450.9±113.8; p=0.141), 6 weeks (511.5±104.5 vs. 472.02±114.5; p=0.109), or 12 weeks (494.3±121.1 vs. 494.3±121.1; p=0.233).

Both groups showed within-group improvements over time (p<0.001). No significant between-group differences were observed pre- (21.26±8.33 vs. 19.65±7.56; p=0.375) or post-intervention (20.17±10.23 vs. 23.90±10.13; p=0.103). However, the control group showed a significant within-group decline (p=0.043), while the treatment group remained stable (p=0.468). The intervention group demonstrated statistically significant reductions in SBP, DBP, MAP, and PP compared to controls, with sustained effects at 12 weeks. Functional capacity (6MWD) improved within both groups, but between-group differences were non-significant. The quality of

Table 1: Baseline demographics and clinical characteristics

Variables	Treatment group Mean±SD	Control group Mean±SD
Age (years)	36.73 ± 13.33	28.10 ± 8.31
Height	163.3 ± 7.717	165.1 ± 13.83
Weight	59.80 ± 7.47	20.63 ± 11.23
BMI	22.04 ± 2.42	20.63 ± 1.73

life remained unchanged in the treatment group, while the control group exhibited a paradoxical decline. These findings underscore the efficacy of RBEs in blood pressure management but highlight the need for longer-term studies to assess functional and quality-of-life outcomes.

DISCUSSION

The results of this randomized clinical trial indicate that relaxation breathing exercises, when combined with lifestyle modifications, significantly enhance the reduction of SBP, MAP, and PP in hypertensive patients compared to lifestyle modifications alone. These findings align with a substantial body of literature demonstrating the efficacy of breathing exercises in lowering blood pressure.[11] These benefits are underpinned by the physiological mechanisms of activation of the parasympathetic nervous system, improvement of baroreflex sensitivity, and the reduction of sympathetic activity, that promotes vasodilation and reduces blood pressure.[12] An example is slow breathing at 6–10 breaths per minute, which has been shown to reduce cardiovascular stress by optimizing oxygen flow and arterial dilatation.[13]

The greater reductions in SBP, MAP, and PP in the treatment group suggest that relaxation breathing exercises may be a valuable nonpharmacological adjunct in the treatment of hypertension. This is of particular interest because the literature is well-documented pharmacological treatments experiencing challenges like side effects and poor adherence.[14] Kalavati et al. (2019) noted that the non-compliance rates of antihypertensive medications are high due to the adverse effects, hence the need for alternative strategies such as breathing exercises.[15] These exercises are attractive to patients who are unwilling or unable to take medications, or to patients in settings

Table 2: Variables at different follow-ups

Variables	Follow-up	Treatment Mean±SD	Control Mean±SD	Mean Difference	p-value
Systolic blood pressure	Pre-treatment	139.26±9.89	141.94±14.9	2.03	0.472
	6 weeks	121.7±9.75	136.82±13.39	15.11	<0.001
	12 weeks	122.58±7.84	131.75±12.54	9.16	<0.001
Diastolic blood pressure	Pre-treatment	90.41±7.53	87.62±4.51	-2.78	0.047
	6 weeks	82.92±4.71	85.05±3.69	2.12	0.027
	12 weeks	82.07±4.02	83.55±3.90	1.47	0.098
Mean Arterial Pressure	Pre-treatment	106.68±7.57	106.61±7.69	-0.06	0.969
	6 weeks	95.84±4.52	102.29±6.13	6.45	<0.001
	12 weeks	95.56±3.50	99.60±6.21	4.03	<0.001
Pulse pressure	Pre-treatment	48.81±7.68	52.00±12.81	3.14	0.183
	6 weeks	38.78±10.55	51.77±11.84	12.99	<0.001
	12 weeks	40.51±9.24	48.20±10.37	7.68	<0.001
Six-minute walk distance	Pre-treatment	485.60±95.39	450.9±113.8	-34.63	0.141
	6 weeks	511.5±104.5	472.02±114.5	-39.53	0.109
	12 weeks	494.3±121.1	494.3±121.1	-30.38	0.233
Health-related quality of life	Pre-treatment	21.26±8.33	19.65±7.56	1.63	0.375
	12 weeks	20.17±10.23	23.90±10.13	3.72	0.103

where pharmacological interventions are not available. However, there were no significant between-group differences in DBP, 6MWD and HRQOL. This may suggest that breathing exercises have a more significant effect on systolic pressure, perhaps because they affect arterial stiffness or vascular tone[16] and that the lack of a significant effect on DBP at 12 weeks (p=0.098) is because breathing exercises have a more pronounced effect on systolic pressure. Another possibility for this variability in DBP response could be due to unphysiological differences in variables with participants or measurement inconsistencies, which need to be investigated further. If 6MWD did not improve over the 12 weeks, then breathing exercises did not improve exercise capacity beyond the benefits of lifestyle modifications alone. This is in line with some studies that have shown that breathing exercises are more focused on autonomic regulation rather than aerobic capacity.[17]

The lack of improvement in HRQOL in the treatment group that was not seen in the control group (p=0.043) merits further exploration. It is possible that the MINICHAL questionnaire, which is used to assess HRQOL, was not sensitive enough to detect changes caused by breathing exercises, or that the 12 weeks of duration were not long enough for participants to feel improvements in quality of life.[18,19] Alternatively, the control group's HRQOL improvement could reflect the broader impact of lifestyle modifications, such as improved diet and physical activity, on perceived well-being, which may have overshadowed the specific effects of breathing exercises. This discrepancy highlights the need for longer-term studies to assess the sustained impact of breathing exercises on quality of life. These findings carry significant implications for clinical practice.

Healthcare providers, particularly physiotherapists and primary care clinicians, may consider integrating relaxation breathing exercises into treatment plans for hypertensive patients, especially those seeking non-pharmacological options. The exercises' ease of implementation, requiring no specialized equipment, makes them feasible for widespread adoption, potentially improving patient adherence and outcomes. In resource-constrained settings like Pakistan, where access to medications may be limited, such interventions could play a critical role in reducing the burden of hypertension. The study had the advantages of a randomized design, and diverse outcome measures, with supervision of the intervention delivery, resulting in adherence and consistency.

There are some limitations like 12 weeks may not have been long enough to observe long-term effects or changes in HRQOL. Although statistical adjustments were made, this age difference between groups (treatment group means age 36.73 years vs control group 28.10 years) may have influenced baseline cardiovascular parameters or responses to the intervention. However, participant compliance was a challenge as some patients found it difficult to adapt to breathing exercises because of competing risk factors or a lack of awareness of the benefits of breathing exercises. More specifically, the study size is small, and all of the patients have relatively few comorbidities, which makes the results applicable only to that subset of patients.

Future research should look to address these limitations using larger, more diverse samples, including patients with coexisting conditions and longer follow-up periods to see how sustainable blood pressure reductions are and if the HRQOL can be delayed through the long term. The frequency, duration, and type of breathing exercises could be explored for the optimal frequency, and what would be fine for clinical practice.[20,21] Further probing how breathing exercises influence blood pressure would include an investigation of how they influence endothelial function or other features of arterial compliance.[22] Breathing exercises are still supported by recent studies, which show that even short daily sessions can result in significant blood pressure reduction.[23,24,25]

Relaxation breathing exercises supported by lifestyle changes are an effective non-pharmacological intervention for reducing blood pressure in hypertensive individuals. Despite not significantly improving exercise capacity or quality of life in this 12-week trial, the benefit of SBP, MAP, and PP suggests that the exercises have the potential as an important adjunct to hypertension management. These findings advocate for the inclusion of relaxation breathing exercises into overall hypertension management strategies and specifically indicate that such breathing exercises may be useful and well-

integrated into comprehensive hypertension management strategies in contexts where pharmacologic treatments represent an alternative to or are less available than usual.

CONCLUSION

This study provides evidence that relaxation breathing exercises, when used in combination with lifestyle changes, are effective in reducing blood pressure in hypertensive patients. Breathing exercises are suggested as a non-pharmacological therapy, as the treatment group showed significantly greater reductions in systolic, diastolic, pulse, and mean arterial pressures than the control group. In addition, exercise capacity and quality of life did not improve further with additional exercise benefits, but the effect on blood pressure indicates that breathing exercises may help improve cardiovascular health in this population. These findings highlight the potential role of relaxation breathing exercises in the total management of hypertension.

DECLARATIONS

Consent to participate: Written consent had been obtained from patients. All methods were performed following the relevant guidelines and regulations.

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REFERENCES

1. Crim MT, et al. National surveillance definitions for hypertension prevalence and control among adults. Circulation: Cardiovascular Quality and Outcomes. 2012;5(3):343-51.
2. World Health Organization. Hypertension. [Online]. Available: https://www.who.int/news-room/fact-sheets/detail/hypertension. Accessed May 5, 2025.
3. Burnier M, Egan BM. Adherence in Hypertension. Circulation Research. 2019;124(7):1124-1140.
4. Lim SS, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors in 21 regions, 1990–2010. The Lancet. 2012;380(9859):2224-60.
5. Unger T, et al. 2020 International Society of Hypertension global hypertension practice guidelines. J Hypertens. 2020;38(6):982-1004.
6. Butar SB, Gamayana Y, Yemina L. The Effect of Deep Breathing Relaxation on Changes of Blood Pressure on Hypertension Patients. Jurnal Keperawatan Komprehensif (Comprehensive Nursing Journal). 2022;8(4).
7. Herawati I, Mat Ludin AF, Ishak I, Farah NM. Breathing exercise for hypertensive patients: A scoping review. Frontiers in Physiology. 2023;14:70.
8. Kalaivani S, Kumari M, Pal G. Effect of alternate nostril breathing exercise on blood pressure, heart rate, and rate pressure product among patients with hypertension in JIPMER, Puducherry. Journal of Education and Health Promotion. 2019;8.
9. Genisa G, Yuliza E, Gunardi S. The Effect of Classical Music Therapy and Deep Breathing Relaxation Therapy on Lowering Blood Pressure in Hypertension Sufferers in RW 001 Samba Danum Village, Katingan Tengah District, Central Kalimantan Year 2022. Journal of Complementary Nursing. 2023;2(2):172-9.
10. Pakaya N, Nento AEP, editors. The Effectiveness of Diaphragmatic Breathing Exercise Slow Deep Breathing Musical Therapy and Foot Massage Therapy on Reducing High Blood Pressure in Hypertensive Patients. Proceedings of the International Conference on Nursing and Health Sciences; 2023.
11. El Shahat El Gammal W, Harfoush M, Mabrouk El Garhy S, Ibrahim Abdelkader Habiba A. Effect of Relaxation Technique on Blood Pressure, Stress and Quality of Life among Hypertensive Females in Damanhour City. Egyptian Journal of Health Care. 2023;14(1):870-87.
12. Zheng S, Zhang Q, Li S, Li S, Yao Q, Zheng X, et al. Effects of inspiratory muscle training in patients with hypertension: a meta-analysis. Frontiers in Cardiovascular Medicine. 2023;10:1113509.
13. Afify AM. Effect of Diaphragmatic Breathing Exercise on Cardiovascular Parameters Following Noise Exposure in Pre Hypertensive

Adults. Journal of Population Therapeutics and Clinical Pharmacology. 2023;30(7):79-86.
14. Tanna D, Bose N, Patel T. Effect of relaxation therapy on pre-induction blood pressure and anxiety in hypertensive patients: A randomized controlled study. Bali Journal of Anesthesiology. 2022;6(1):54.
15. de Freitas Gonçalves KS, Daniel ACQG, Lamas JLT, Oliveira HC, Silveira RC, Cloutier L, et al. Device-and nondevice-guided slow breathing to reduce blood pressure in patients with hypertension: protocol for a systematic review and meta-analysis. JMIR Research Protocols. 2022;11(3):e33579.
16. Ibrahim SS, Ebeid IAE-S, El-Aty A, Mostafa E. Efficacy of Benson relaxation technique on physiological parameters, anxiety and sleep quality among gestational hypertensive women. Assiut Scientific Nursing Journal. 2022;10(29):14-25.
17. Roshan P, Niranjan Meenar S. Effectiveness of diaphragmatic breathing exercise and Jacobson's progressive muscle relaxation on cardiopulmonary parameters in pre-hypertensive patients. International Journal of Physical Education, Sports and Health. 2021;8(6):01-5.
18. Ghati N, Killa AK, Sharma G, Karunakaran B, Agarwal A, Mohanty S, et al. A randomized trial of the immediate effect of bee-humming breathing exercise on blood pressure and heart rate variability in patients with essential hypertension. EXPLORE. 2021;17(4):312-9.
19. Mulyati L, Hendriana Y, Padilah EN, editors. Effectiveness of Progressive Muscle Relaxation and Meditation Relaxation Treatment of Reduction of Blood Pressure in Hypertension Patients in the Village of Sindangagung Kuningan District. 1st Paris Van Java International Seminar on Health, Economics, Social Science and Humanities (PVJ-ISHESSH 2020); 2021: Atlantis Press.
20. Carter JR, et al. Deep breathing exercise at work: Potential applications and impact. Frontiers in Physiology. 2023;14:1040091.
21. Herawati I, et al. Effect of breathing exercises on blood pressure and heart rate: A systematic review and meta-analysis. Frontiers in Cardiovascular Medicine. 2023;10:10765252.
22. Joseph CN, et al. Slow breathing improves arterial baroreflex sensitivity and decreases blood pressure in essential hypertension. Hypertension. 2005;46(4):714-8.
23. Ismail AMA, et al. Effect of alternate nostril breathing exercise on autonomic functions, ocular hypertension, and quality of life in elderly with systemic hypertension and high-tension primary open-angle glaucoma. Geriatric Nursing. 2023;52:91-7.
24. Yun R, et al. How breathing exercises influence on respiratory muscles and quality of life among patients with COPD? A systematic review and meta-analysis. Canadian Respiratory Journal. 2021;2021:1-12.
25. Ramzan A, Nasir T, Shafi S. Effects of Jacobson's Progressive Muscle Relaxation and Deep Breathing Exercises on Quality of Life among Lecturers of Faisalabad: Jacobson's Progressive Muscle Relaxation and Deep Breathing Exercises among Lecturers. The Healer Journal of Physiotherapy and Rehabilitation Sciences. 2024 Sep 30;4(5):10-4.