RESEARCH PAPER

Effects of Structured Breathing Exercise on Blood Pressure and Sleep Quality in Older Adults with Hypertension: A Quasi-Experimental Study

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ABSTRACT

Background: Hypertension is a leading cause of morbidity and mortality among the elderly. Breathing exercise is a cost-effective, non-pharmacological intervention known to reduce blood pressure (BP) and improve sleep quality.

Objective: To assess the effectiveness of breathing exercise on blood pressure and quality of sleep among hypertensive clients residing in a selected old age home at Coimbatore.

Methods: A quasi-experimental time-series design was used. Sixty hypertensive clients (30 experimental, 30 control), aged 60–80 years, were selected by non-probability purposive sampling from Prabanja Amaithi Seva Ashramam, Coimbatore. Breathing exercise was administered for 15 minutes daily for 30 days to the experimental group. Blood pressure was assessed using a sphygmomanometer and sleep quality by the Pittsburgh Sleep Quality Index (PSQI) on Day 1, 10, 20, and 30. Data were analysed using repeated-measures ANOVA, unpaired t-test, and chi-square test. The conceptual framework was based on Roy's Adaptation Model.

Results: In the experimental group, mean systolic BP declined from 158.00±22.19 mmHg (Day 1) to 121.67±4.61 mmHg (Day 30) and mean diastolic BP from 84.33±8.58 mmHg to 76.00±7.24 mmHg, both statistically significant ($F=76.253$ and $F=6.583$, $P\leq0.01$). By Day 30, 80% of the experimental group achieved normal BP and 100% attained good sleep quality (mean PSQI: 9.90±2.25 to 2.50±0.73; $F=208.794$, $P\leq0.01$). No significant changes were observed in the control group. No significant association was found between BP stages and selected demographic variables.

Conclusion: Breathing exercise is a highly effective, low-cost non-pharmacological intervention for reducing blood pressure and improving sleep quality among elderly hypertensive clients in old age home settings.

Keywords: Breathing exercise, Hypertension, Blood pressure, Sleep quality, PSQI, Elderly, Old age home, Non-pharmacological intervention.

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1. INTRODUCTION

Globally, hypertension affects approximately 1.13 billion people, and is projected to rise to 1.5 billion by 2025 (WHO, 2015). In India, one in three adults has hypertension, with the majority undiagnosed or inadequately controlled (Indian Heart Journal, 2019). The elderly population, which is expected to reach 19% of India's total population by 2050 (UN DESA, 2017), is disproportionately affected due to age-related cardiovascular changes, including decreased aortic elasticity and increased peripheral vascular resistance.

Sleep disturbance is closely linked to hypertension in older adults. The National Sleep Foundation (2022) recommends 7–8 hours of sleep per night for individuals aged ≥65 years; however, nearly 78% of those above 65 years report poor sleep quality (Ombale Sneha, 2022). Poor sleep further elevates

sympathetic nervous system activity and blood pressure, creating a bidirectional relationship.

Pharmacological treatment, while effective, is associated with side effects and irregular adherence, particularly among elderly populations in low-resource settings. Non-pharmacological approaches such as breathing exercise—which activates the parasympathetic nervous system, reduces heart rate, dilates blood vessels, and promotes melatonin secretion—offer a practical, cost-effective, and side-effect-free alternative. Evidence from multiple studies confirms that slow, deep breathing significantly reduces systolic and diastolic BP and improves sleep quality in hypertensive elderly patients (Sandhiya B., 2019; Rubi Pradhan et al., 2020; Agussalim et al., 2021). The present study was undertaken to evaluate the effectiveness of a structured 30-day breathing exercise protocol on BP and sleep quality among elderly hypertensive residents of an old age home in Coimbatore.

2. MATERIALS AND METHODS

2.1 Study Design and Setting

A quasi-experimental time-series research design was adopted. The study was conducted at Prabanja Amaithi Seva Ashramam, Nallagoundampalayam, Coimbatore—a non-governmental organisation-run old age home housing 356 inmates, of whom 96 were aged 60–80 years. Ethical clearance was obtained from the institutional ethical committee and formal written permission from the home management prior to data collection.

2.2 Sample

Using non-probability purposive sampling, 60 hypertensive clients (30 experimental, 30 control) aged 60–80 years were selected. Inclusion criteria: diagnosed hypertension, medically fit for breathing exercise, able to comprehend Tamil or English, and willing to participate. Exclusion criteria: bed-ridden status, concurrent serious comorbidities (diabetes, CVD, renal disease, cancer, cerebrovascular accident), or mental illness. A pilot study (n=10) conducted at Bishop Old Age Home, Somanur, confirmed tool adequacy.

2.3 Intervention

The experimental group performed structured breathing exercise for 15 minutes daily (8:30–9:30 AM) for 30 consecutive days under investigator supervision. The protocol comprised four sequential steps (5 minutes total per cycle, repeated 3 times): (i) 30-second breathing (4-second inhalation, 6-second exhalation, 6 cycles); (ii) equal breathing (nasal inhalation and exhalation, counting to 4); (iii) diaphragmatic breathing (abdominal breathing with pursed-lip exhalation); and (iv) 4-7-8 technique (nasal inhalation for 4 counts, breath hold for 7 counts, oral exhalation for 8 counts). No intervention was administered to the control group.

2.4 Outcome Measures

Blood pressure was measured with a standard mercury sphygmomanometer and classified per the National High Blood Pressure Education Program (Lewis, 2018) as Normal (<120/<80 mmHg), Pre-hypertension (120–139/80–89 mmHg), Stage 1 (140–159/90–99 mmHg), and Stage 2 (≥160/≥100 mmHg). Sleep quality was assessed using the validated Pittsburgh Sleep Quality Index (PSQI); a global score ≥5 indicates poor sleep quality. Assessments were conducted on Day 1 (pre-intervention), Day 10, Day 20, and Day 30.

2.5 Statistical Analysis

Data were analysed using SPSS version 16.0. Descriptive statistics (frequency, percentage, mean, SD) summarised baseline characteristics and outcome variables. Repeated-measures ANOVA with Post Hoc analysis examined within-group changes over time. Unpaired t-test compared between-group differences at each time point. Chi-square test assessed associations between BP stages and demographic variables. Significance was set at $P \leq 0.05$.

3. RESULTS

3.1 Demographic Profile

In the experimental group, all participants (100%) were female, with the majority aged 65–70 years (60%), married (83.3%), and illiterate (43.3%). In the control group, most were aged >70 years (63.3%), female (73.3%), married (100%), and illiterate (63.3%). A majority in both groups had stayed in the old age home for >1 year and were irregular in anti-hypertensive medication intake (79.3% experimental; 62.9% control). None had been affected by COVID-19; all had received two vaccine doses.

3.2 Blood Pressure: Within-Group Changes

Table 1 presents systolic and diastolic BP changes in the experimental group. Mean systolic BP declined significantly from 158.00±22.19 mmHg (Day 1) to 121.67±4.61 mmHg (Day 30) ($F=76.253$, $P \leq 0.01$). Mean diastolic BP decreased from 84.33±8.58 to 76.00±7.24 mmHg ($F=6.583$, $P \leq 0.01$). Post hoc ANOVA confirmed significant pairwise differences at all time points. In the control group, systolic BP remained stable (151.67±11.17 to 150.67±10.15 mmHg; $F=1.183$, $P=0.318$, not significant).

Observation	Systolic BP Mean±SD (mmHg)	Diastolic BP Mean±SD (mmHg)

Day 1 (Pre-intervention)	158.00 ± 22.19	84.33 ± 8.58
Day 10	147.00 ± 13.17	78.33 ± 8.74
Day 20	134.00 ± 8.55	79.33 ± 8.28
Day 30 (Post-intervention)	121.67 ± 4.61	76.00 ± 7.24
F-value (ANOVA)	76.253**	6.583**
p-value	0.000	0.001

Table 1: Mean BP scores in the experimental group before and after intervention (**P≤0.01)

3.3 Blood Pressure: Between-Group Comparison

There was no significant difference between groups on Day 1 (t=1.396, P=0.168). Significant between-group differences emerged on Day 20 (systolic: t=7.249, P≤0.01; diastolic: t=2.038, P≤0.05) and Day 30 (systolic: t=4.250, P≤0.01; diastolic: t=4.599, P≤0.01), confirming hypothesis H2.

3.4 Blood Pressure Distribution

In the experimental group, Day 1 showed 46.7% Stage 2 and 53.3% Stage 1 hypertension; by Day 30, 80.0% had normal BP and 20.0% pre-hypertension. The control group showed no meaningful change over the 30-day period.

3.5 Sleep Quality

All participants (100%) in both groups had poor sleep quality (PSQI ≥5) at baseline. In the experimental group, mean PSQI fell from 9.90±2.25 (Day 1) to 2.50±0.73 (Day 30) (F=208.794, P≤0.01), with 100% achieving good sleep by Day 30 (Table 2). In the control group, mean PSQI remained virtually unchanged from 7.47±2.06 to 7.67±2.14 (F=3.082, P=0.090, not significant). Significant between-group differences were found on Day 10 (t=3.657), Day 20 (t=10.129), and Day 30 (t=12.520), all P≤0.01, confirming hypothesis H4.

Observation	**Exp. Group Mean PSQI ± SD**	**Control Group Mean PSQI ± SD**	**t-value**	**p-value**
Day 1	9.90 ± 2.25	7.47 ± 2.06	4.367	0.000**
Day 10	5.57 ± 1.63	7.57 ± 2.14	3.657	0.001**
Day 20	3.57 ± 0.90	7.73 ± 2.07	10.129	0.000**
Day 30	2.50 ± 0.73	7.67 ± 2.14	12.520	0.000**

Table 2: Comparison of mean PSQI scores between groups (**P≤0.01)

3.6 Association between Demographic Variables and BP Stages

Chi-square analysis revealed no significant association between BP stages and personal characteristics (age, gender, education, marital status, family history, duration of stay: all P>0.05), dietary pattern (intake of meals, water, tea: all P>0.05), or personal habits (exercise, alcohol, tobacco: all P>0.05).

4. DISCUSSION

The present study demonstrates that a structured 30-day breathing exercise protocol significantly reduced both systolic and diastolic BP in elderly hypertensive clients, with 80% achieving normal BP by Day 30. These findings are consistent with Sandhiya B. (2019), who reported a reduction in mean systolic BP from 169.55±12.1 to 129.55±8.3 mmHg following abdominal deep breathing (P≤0.001). Similarly, Agussalim et al. (2021) reported significant BP reductions (P=0.000) following deep breathing in elderly hypertensive patients. Vinod Kathore and Vijay More (2019) demonstrated that slow deep breathing for one month significantly reduced both systolic and diastolic BP in essential hypertension (P=0.000). The mechanism underlying BP reduction involves parasympathetic activation, reduced peripheral vascular resistance, and enhanced baroreflex sensitivity through slow, paced respiration.

The improvement in sleep quality—from 100% poor sleep at baseline to 100% good sleep by Day 30 in the experimental group—is striking. This aligns with Rubi Pradhan et al. (2020), who found that deep breathing exercise significantly improved PSQI scores in geriatrics (pre-mean 13.56 to post-mean 2.60; P<0.0001). Nur Baharia Marasabessy et al. (2020) also confirmed that Benson's relaxation technique (a breathing-based therapy) improved elderly sleep quality (PSQI: 7.56 to 4.85; P=0.046). Breathing exercise promotes sleep by stimulating melatonin production, reducing cortisol levels, and inducing muscle relaxation.

The absence of significant demographic associations with BP stages suggests that breathing exercise is beneficial irrespective of age, gender, education, or lifestyle factors, supporting its broad applicability in geriatric care settings.

5. CONCLUSION

Breathing exercise is a simple, safe, cost-effective, and highly effective non-pharmacological intervention for reducing blood pressure and improving sleep quality in elderly hypertensive clients. Its ease of implementation, absence of adverse effects, and compatibility with pharmacological treatment make it an ideal complementary strategy in geriatric and community care settings. Nurses and caregivers in old age homes, hospitals, and community health centres should be trained to teach and supervise structured breathing exercise programmes. Future research with larger, multi-centre samples and long-term follow-up is recommended.

6. LIMITATIONS

- Single-centre study; findings may not be generalisable to all old age home populations.
- Small sample size (n=60) due to time constraints.
- Non-probability sampling technique limits randomisation.
- Self-reported sleep data may introduce recall bias.

Conflict of Interest: The authors declare no conflict of interest.

Funding: This study received no external funding.

Ethical Approval: Ethical clearance was obtained from the institutional ethical committee prior to data collection.

REFERENCES

1. Agussalim, et al. (2021). Effectiveness of deep breathing on blood pressure among elderly people with hypertension. Gowa Regency, Indonesia.

2. Bana Manishaa Reddy, et al. (2017). Hypertension and its correlates in the oldest old population (80+ years) in Urban South India. Cross-sectional study, Hyderabad.

3. Chalise Radhika Dilaram, et al. (2017). Effectiveness of breathing exercise on bio-physiological parameters among hypertensive patients. Quantitative quasi-experimental study, Pune.

4. Dr. Eman Elsayed Hussein Mohammad, et al. (2018). Effectiveness of breathing exercise in lowering high blood pressure among hypertensive patients. International Journal of Science and Healthcare Research, 3(3).

5. Elavarasi R. (2018). Effectiveness of abdominal breathing exercise on regulation of blood pressure among hypertensive patients, Pillaiyarkuppam, Puducherry.

6. Indian Heart Journal. (2019). Great India Blood Pressure Survey. Prevalence of hypertension among Indian adults.

7. Izabella Uchmanowicz. (2019). Relationship between sleep disturbances and quality of life in elderly patients with hypertension. Cross-sectional study.

8. Kamalesh K. Gulia, Velayudhan Mohan Kumar. (2018). Sleep disorders in the elderly: A growing challenge. 18(3):155–165.

9. Lewis S. (2018). Medical Surgical Nursing. 2nd edition. New Delhi: Elsevier Publication.

10. Lina Safarina, et al. (2022). Effect of slow deep breathing on blood pressure in elderly patients with hypertension: A systematic review. PubMed, Google Scholar.

11. Mrs. Joshi Rashmi, et al. (2017). Effectiveness of breathing exercises on the quality of sleep among patients with dyspnoea. Quasi-experimental study, Bangalore.

12. Neha Jain, et al. (2021). Sleep quality and quality of life in hypertensive subjects. Observational cross-sectional study, Uttarakhand.

13. Novian Mahayu Adiutama, et al. (2022). Deep breathing relaxation technique and reduction of blood pressure in the elderly. 15 minutes, 3 times/day, 3 months.

14. Nur Baharia Marasabessy, et al. (2020). Benson's relaxation therapy and sleep quality among elderly at a social institution in Inakaka, Indonesia. Quasi-experimental study.

15. Ombale Sneha. (2022). Quality of sleep among old age: A cross-sectional study. Tertiary care hospital, Karad. PSQI used; 78% poor sleep quality.

16. Rodriguez, et al. (2016). Epidemiologic study: Sleep problems in approximately 50% of older adults.

17. Roopa Shivashankar, et al. (2017). Sleep duration, disturbances and hypertension in metropolitan cities of South Asia. CARRS study cross-sectional analysis.

18. Rubi Pradhan, et al. (2020). Deep breathing exercise and quality of sleep among geriatrics. European Journal of Molecular & Clinical Medicine, 7(8).

19. Sandhiya B. (2019). Effectiveness of abdominal deep breathing exercise to reduce blood pressure among hypertensive patients. One group pretest post-test design, Erode.

20. Soni Patriot Wira Atmanegara. (2021). Progressive muscle relaxation and its effect on blood pressure and sleep quality in elderly with hypertension.

21. UN Department of Economic and Social Affairs. (2017). World Population Ageing report.

22. Vinod Kathore, Vijay More. (2019). Effect of slow and deep breathing exercise on blood pressure among

patients with essential hypertension. MedPulse International Journal of Physiology, 12(2):24–28.

23. Vinod Kumar. (2021). How to live well in old age: Deep breathing, anxiety, blood pressure, and pain.

24. Wei Zhang, et al. (2020). Systematic review and meta-analysis: Exercise to improve sleep quality in older adults. PubMed, Embase, Cochrane.

25. WHO. (2015). Global report on hypertension.