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Effectiveness of an 8-Week Meditation Intervention on Stress, Anxiety, and Sleep Quality in Older Adults: A Randomised Controlled Trial

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ABSTRACT

Background: Sleep disturbance, stress, and anxiety are highly prevalent among older adults and adversely affect physical health, cognitive function, and quality of life. Meditation is a safe, low-cost, non-pharmacological intervention that may improve these interrelated outcomes.

Objective: To evaluate the effect of an 8-week structured meditation programme on perceived stress, anxiety, and sleep quality in community-dwelling older adults, and to compare the relative efficacy of two meditation-based intervention protocols (Group A and Group B).

Methods: In this prospective interventional study, 58 older adults aged ≥60 years with mild-to-moderate stress, anxiety, or sleep disturbance were allocated to two intervention arms (Group A, n = 29; Group B, n = 29) and completed an 8-week structured meditation programme involving guided sessions of 30–45 minutes. Stress, anxiety, and sleep quality were assessed before and after the intervention using the Perceived Stress Scale (PSS), the Geriatric Anxiety Inventory (GAI), and the Pittsburgh Sleep Quality Index (PSQI), respectively. Within-group changes were analysed using paired-samples t-tests, between-group differences using independent-samples t-tests, and effect magnitude using Cohen's d. Statistical significance was set at $p < 0.05$.

Results: Groups were comparable for age ($p = 0.598$) and baseline PSS ($p = 0.636$); however, Group B had significantly higher baseline GAI scores ($p = 0.001$) and Group A had significantly higher baseline PSQI scores ($p = 0.045$). Both groups showed statistically significant and very large reductions in PSS (Group A: 44.4%, $d = 2.55$; Group B: 47.0%, $d = 3.34$; both $p < 0.001$) and PSQI (Group A: 40.2%, $d = 2.14$; Group B: 46.5%, $d = 2.03$; both $p < 0.001$), with no significant between-group difference in the magnitude of change (PSS $p = 0.286$; PSQI $p = 0.464$). For GAI, only Group B showed a statistically significant within-group reduction (46.5%, $d = 1.24$, $p < 0.001$), whereas Group A's change was non-significant (14.7%, $d = 0.24$, $p = 0.207$); the between-group difference significantly favoured Group B ($p < 0.001$, $d = 1.01$).

Conclusion: An 8-week meditation-based intervention produced clinically meaningful and statistically significant improvements in perceived stress and sleep quality in older adults, irrespective of protocol. The Group B protocol additionally conferred a significantly superior anxiolytic effect, suggesting that

meditation strategies should be selected according to the predominant symptom profile, particularly when anxiety is a primary concern.

Keywords: Meditation; Older adults; Perceived stress; Geriatric anxiety; Sleep quality; Mindfulness; Non-pharmacological intervention.

1. INTRODUCTION

Sleep is essential for physical health, psychological stability, cognitive performance, and quality of life.[1] Aging is associated with circadian alterations, sleep fragmentation, and reduced sleep efficiency, rendering older adults vulnerable to sleep disturbance, which often coexists with stress and anxiety.[1] Nearly 40–50% of adults aged ≥60 years report chronic sleep complaints,[1] yet this is frequently under recognized and dismissed as an inevitable consequence of aging.[2] Chronic sleep deficiency is linked to mood disorders, cognitive decline, cardiovascular disease, hypertension, diabetes, falls, and increased mortality, imposing a substantial healthcare and caregiver burden.[2–4]

Pharmacological agents remain first-line treatments for insomnia, but age-related pharmacokinetic changes and polypharmacy elevate risks of sedation, cognitive impairment, falls, and dependence in older adults.[5] Cognitive behavioural therapy for insomnia (CBT-I) is effective but limited by poor access, cost, and adherence challenges.[6–7] Chronic activation of the hypothalamic–pituitary–adrenal axis and elevated cortisol—often compounded by retirement, bereavement, and isolation in later life—disrupt sleep and heighten anxiety and depression risk, creating a bidirectional cycle of stress and poor sleep.[8,9]

Meditation, involving focused attention and present-moment awareness, reduces sympathetic activation and cortisol secretion while enhancing parasympathetic tone, reduces perceived stress, anxiety, and depressive symptoms, and is associated with neuroplastic changes in attention- and emotion-regulating brain regions.[10,11] Given its non-invasive, low-cost, and adaptable nature, meditation is a promising holistic intervention for stress, anxiety, and sleep impairment in older adults,[12–14] and validated tools such as the PSS, GAI, and PSQI permit standardized assessment of these outcomes. This study evaluated the effect of an 8-week structured meditation programme on stress, anxiety, and sleep quality in older adults, and compared two meditation-based protocols.

Aim of the Study

To evaluate the effectiveness of a structured meditation programme in reducing stress and anxiety and improving sleep quality in older adults, and to determine whether meditation can serve as a safe, affordable, non-pharmacological strategy for promoting mental health and well-being in this population.

Hypotheses

Alternative hypothesis (H_1): Older adults undergoing an 8-week structured meditation programme will demonstrate statistically significant reductions in stress and anxiety and improvement in sleep quality compared with baseline.

Null hypothesis (H_0): An 8-week structured meditation programme will produce no statistically significant change in stress, anxiety, or sleep quality among older adults.

2. MATERIALS AND METHODS

Study Design and Setting

A prospective, two-arm interventional study was conducted to evaluate the effect of an 8-week structured meditation programme on stress, anxiety, and sleep quality in older adults. Participants were recruited fr-

om community centres, physiotherapy outpatient clinics, and old-age homes in Kota, Rajasthan, India.

Participants

A total of 58 community-dwelling older adults aged ≥60 years with mild-to-moderate stress, anxiety, or sleep disturbance were enrolled and equally allocated to two intervention groups: Group A (n = 29) and Group B (n = 29).

Inclusion criteria: age ≥ 60 years; mild-to-moderate stress or anxiety on validated questionnaires; sleep disturbance (PSQI > 5); and ability to understand and follow meditation instructions.

Exclusion criteria: severe psychiatric disorders (e.g., major depression, psychosis); advanced dementia or cognitive impairment; chronic insomnia under heavy sedative medication; and severe hearing or visual impairment precluding participation.

Procedure

Following written informed consent, participants underwent a baseline assessment that recorded demographic data (age, gender, medical history, lifestyle factors) and completed the PSS, GAI, and PSQI. Participants were then allocated to Group A or Group B and completed an 8-week structured meditation programme comprising guided sessions of 30–45 minutes' duration. Outcome measures were re-administered at the end of the 8-week period to quantify change in stress, anxiety, and sleep quality.

Outcome Measures

Perceived stress was measured using the Perceived Stress Scale (PSS);[18] anxiety using the Geriatric Anxiety Inventory (GAI); and sleep quality using the Pittsburgh Sleep Quality Index (PSQI).[20]

Statistical Analysis

Data were coded and entered into Microsoft Excel and analysed using standard statistical methods. Continuous variables were expressed as mean ± standard deviation (SD); categorical variables as frequency and percentage. Paired-samples t-tests were used to compare pre- and post-intervention scores within each group, and independent-samples t-tests to compare mean differences between groups. Effect size was quantified using Cohen's d (small < 0.2; small–medium 0.2–0.5; medium 0.5–0.8; large 0.8–2.0; very large > 2.0). Normality of score distributions was assessed using the Shapiro–Wilk test; given the sample size of 29 per group (≥ 25–30), parametric tests were applied in accordance with the Central Limit Theorem, an approach further supported by the convergent direction of findings across all outcome measures. Statistical significance was set at $p < 0.05$.

3. RESULTS

A total of 58 older adults (Group A: mean age 66.9 ± 7.0 years; Group B: mean age 68.0 ± 8.7 years) completed the 8-week study. Age was statistically comparable between groups ($t = -0.530$, $p = 0.598$), confirming baseline demographic homogeneity (Table 1). Baseline PSS scores were also comparable (Group A: 18.17 ± 6.58; Group B: 18.93 ± 5.50; $p = 0.636$). However, Group B demonstrated significantly higher baseline GAI scores than Group A (5.41 ± 2.24 vs. 3.28 ± 2.31; $p = 0.001$), while Group A exhibited significantly higher (poorer) baseline PSQI scores than Group B (24.17 ± 10.58 vs. 19.07 ± 8.20; $p = 0.045$). These baseline differences were taken into account when interpreting post-intervention findings.

Table 1. Baseline Comparison — Pre-Intervention Scores (Group A vs. Group B)

Variable	Group A Mean ± SD	Group B Mean ± SD	t-value	p-value	Interpretation
Age (years)	66.9 ± 7.0	68.0 ± 8.7	−0.530	0.598	Not significant

Variable	Group A Mean ± SD	Group B Mean ± SD	t-value	p-value	Interpretation
PSS (pre)	18.17 ± 6.58	18.93 ± 5.50	−0.477	0.636	Not significant
GAI (pre)	3.28 ± 2.31	5.41 ± 2.24	−3.572	0.001***	Significant
PSQI (pre)	24.17 ± 10.58	19.07 ± 8.20	2.053	0.045*	Significant

*p < 0.05; ***p < 0.001.

Descriptive Statistics: Pre-, Post-, and Change Scores

Both groups demonstrated substantial reductions in PSS and PSQI scores over the 8-week period. For GAI, the magnitude of change differed markedly between groups, with Group B showing a considerably larger reduction (2.52 points; 46.5%) than Group A (0.48 points; 14.7%) (Table 2).

Table 2. Descriptive Statistics — Pre, Post, and Change Scores by Group

Scale / Group	N	Pre Mean ± SD	Post Mean ± SD	Mean Change	% Improve
PSS — Group A	29	18.17 ± 6.58	10.10 ± 3.98	8.07	44.4%
PSS — Group B	29	18.93 ± 5.50	10.03 ± 4.02	8.90	47.0%
GAI — Group A	29	3.28 ± 2.31	2.79 ± 0.77	0.48	14.7%
GAI — Group B	29	5.41 ± 2.24	2.90 ± 0.86	2.52	46.5%
PSQI — Group A	29	24.17 ± 10.58	14.45 ± 7.02	9.72	40.2%
PSQI — Group B	29	19.07 ± 8.20	10.21 ± 4.76	8.86	46.5%

Within-Group Analysis (Paired-Samples t-Test)

Both groups showed highly significant and very large reductions in PSS (Group A: $t = 13.744$, $p < 0.001$, $d = 2.552$; Group B: $t = 17.985$, $p < 0.001$, $d = 3.340$) and PSQI (Group A: $t = 11.548$, $p < 0.001$, $d = 2.144$; Group B: $t = 10.913$, $p < 0.001$, $d = 2.027$). For GAI, Group A showed a small, non-significant reduction ($t = 1.293$, $p = 0.207$, $d = 0.240$), whereas Group B showed a large, highly significant reduction ($t = 6.682$, $p < 0.001$, $d = 1.241$) (Table 3).

Table 3. Within-Group Analysis — Paired-Samples t-Test (Pre vs. Post, 8 Weeks)

Scale	Group	Pre Mean ± SD	Post Mean ± SD	Δ Mean	t	p	Cohen's d
PSS	A	18.17 ± 6.58	10.10 ± 3.98	8.07	13.744	<0.001	2.552
PSS	B	18.93 ± 5.50	10.03 ± 4.02	8.90	17.985	<0.001	3.340
GAI	A	3.28 ± 2.31	2.79 ± 0.77	0.48	1.293	0.207	0.240
GAI	B	5.41 ± 2.24	2.90 ± 0.86	2.52	6.682	<0.001	1.241
PSQI	A	24.17 ± 10.58	14.45 ± 7.02	9.72	11.548	<0.001	2.144
PSQI	B	19.07 ± 8.20	10.21 ± 4.76	8.86	10.913	<0.001	2.027

Between-Group Analysis (Independent-Samples t-Test)

No significant between-group difference was observed for PSS change scores ($p = 0.286$, $d = 0.283$) or PSQI change scores ($p = 0.464$, $d = 0.194$), indicating equivalent efficacy of both protocols for stress and

sleep improvement. For GAI, a highly significant between-group difference favoured Group B ($t = -3.835$, $p < 0.001$, $d = 1.007$), reflecting a large effect. Although Group B's higher baseline GAI may have allowed greater scope for improvement, post-intervention GAI scores converged closely between groups (Group A: 2.79 ± 0.77; Group B: 2.90 ± 0.86; $p = 0.632$), and Group B's markedly larger within-group effect size ($d = 1.241$ vs. 0.240) supports a genuine, protocol-specific anxiolytic benefit rather than a baseline artefact alone. Group B also achieved a significantly lower absolute post-intervention PSQI score than Group A (10.21 vs. 14.45; $p = 0.009$), attributable to Group B's lower baseline sleep disturbance (Table 4).

Table 4. Between-Group Analysis — Independent-Samples t-Test (Change Scores and Post Scores)

Scale	Comparison	Mean A	Mean B	t	p	Cohen's d	Sig.
PSS	Change score	8.07	8.90	−1.078	0.286	0.283	ns
PSS	Post score	10.10	10.03	0.066	0.948	—	ns
GAI	Change score	0.48	2.52	−3.835	<0.001	1.007	***
GAI	Post score	2.79	2.90	−0.482	0.632	—	ns
PSQI	Change score	9.72	8.86	0.737	0.464	0.194	ns
PSQI	Post score	14.45	10.21	2.693	0.009	—	**

**p < 0.01; ***p < 0.001; ns = not significant.

Effect Size Summary

Within-group effect sizes for PSS and PSQI were uniformly very large in both groups (all $d > 2.0$), confirming clinically meaningful change irrespective of protocol. For GAI, the within-group effect size for Group B ($d = 1.241$, large) substantially exceeded that of Group A ($d = 0.240$, small), and the corresponding between-group effect size ($d = 1.007$) was the single largest between-group effect observed in this study, indicating that the average Group B participant experienced greater anxiety reduction than approximately 84% of Group A participants (Table 5).

Table 5. Effect Size Summary (Cohen's d) — All Comparisons

Scale	Comparison	Group	Cohen's d	Magnitude
PSS	Within-group	A	2.552	Very large
PSS	Within-group	B	3.340	Very large
PSS	Between-group	A vs. B	0.283	Small
GAI	Within-group	A	0.240	Small
GAI	Within-group	B	1.241	Large
GAI	Between-group	A vs. B	1.007	Large
PSQI	Within-group	A	2.144	Very large
PSQI	Within-group	B	2.027	Very large
PSQI	Between-group	A vs. B	0.194	Small

Summary of Findings

Both intervention groups demonstrated statistically significant and very large within-group improvements in perceived stress and sleep quality ($p < 0.001$, $d > 2.0$), with no significant between-group differences, indicating equivalent efficacy for these outcomes regardless of the specific meditation protocol applied. Anxiety reduction was the principal differentiating outcome: Group B achieved a statistically and clinically significant improvement, while Group A did not, and the between-group comparison robustly favoured Group B ($p < 0.001$, $d = 1.007$).

4. DISCUSSION

This study evaluated the effect of an 8-week structured meditation programme on perceived stress, anxiety, and sleep quality in older adults. Both groups showed significant, clinically meaningful improvements in stress and sleep quality, while only Group B showed significant anxiety reduction, with a robust between-group advantage favouring Group B.

These findings align with Goyal et al. (2014), who reported that mindfulness meditation produces consistent reductions in psychological stress, anxiety, and emotional distress in adult populations through meditation-induced relaxation and reduced psychological arousal.[15] The present study extends this evidence specifically to older adults using standardized, validated measures within a controlled 8-week framework, addressing unique geriatric vulnerabilities such as HPA-axis dysregulation, polypharmacy, and psychosocial stressors (bereavement, isolation) that may modify treatment response.[8,9] The present findings thus provide direct, intervention-based evidence reinforcing Goyal et al.'s broader conclusions within a geriatric population.

The differential anxiolytic response is clinically notable. Group B's significantly greater GAI reduction, despite a higher anxiety burden at baseline, suggests its protocol may more effectively engage anxiety-relevant mechanisms such as reduced rumination or enhanced parasympathetic activation. Near-identical post-intervention GAI scores between groups indicate that Group B participants effectively 'caught up' to Group A's lower anxiety levels, while Group A's low baseline GAI may have produced a floor effect limiting further improvement.

The equivalent, large improvements in PSS and PSQI across both groups reinforce existing literature indicating that meditation reliably reduces stress and improves sleep quality in older adults regardless of specific technique, [16–20] broadening the practical options available to clinicians. Overall, these findings support meditation as a simple, safe, cost-effective intervention for healthy aging, with protocol selection potentially optimized according to a patient's predominant symptom profile—particularly favouring Group B's approach when anxiety management is a primary goal.

Limitations

Limitations include the modest single-centre sample ($n = 58$), pre-existing baseline differences in GAI and PSQI between groups, absence of a true non-intervention or attention-matched control arm, reliance on self-reported questionnaires without physiological corroboration (e.g., cortisol), and lack of long-term follow-up. Future studies should employ larger multi-centre samples, attention-matched controls, objective biomarkers, and extended follow-up.

5. CONCLUSION

An 8-week structured meditation programme produced statistically significant and clinically meaningful improvements in perceived stress and sleep quality among older adults, with both intervention protocols

showing equivalent, very large effects. For anxiety, however, Group B's protocol demonstrated a significantly superior anxiolytic effect, with a large between-group effect size (d = 1.007) favouring Group B over Group A. These findings support meditation as a safe, accessible, and effective non-pharmacological strategy for promoting psychological well-being and sleep health in ageing populations, and suggest that clinicians may consider protocol selection based on the predominant symptom profile, particularly favouring Group B's approach when anxiety reduction is a primary clinical goal.

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