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Short-Term Effects of an 11-Day Structured Pranayama Protocol on Insomnia Severity in Women: A Pilot Observational Study

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Abstract

***Background**: Insomnia is associated with persistent physiological and cognitive hyperarousal. Breathing-based interventions may influence autonomic regulation; however, short-term effects of structured pranayama delivered online remain insufficiently studied. **Objective**: To examine short-term changes in insomnia severity following an 11-day structured pranayama protocol in adult women. **Methods**: This pilot study employed a prospective single-arm pre–post design. Fourteen women enrolled in an online guided pranayama program. The intervention consisted of a daily sequence progressing from activating to slower, exhalation-focused breathing techniques over 11 days. Insomnia severity was assessed using the Insomnia Severity Index (ISI) at baseline and Day 11. Per-protocol analysis included participants completing ≥50% of sessions with paired ISI data. **Results**: Five participants met inclusion criteria. Baseline ISI ranged from 5 to 25 (mean 14.2). After 11 days, mean ISI decreased to 9.8 (mean change −4.4). Four participants (80%) demonstrated improvement, one (20%) achieved clinically meaningful reduction (≥7 points), and one (20%) demonstrated worsening. **Conclusions**: Short-term structured pranayama delivered online was associated with heterogeneous changes in insomnia severity. Larger controlled studies are required to determine efficacy and clarify mechanisms.*

Key Words: Pranayama, Insomnia, Breathing exercises, Autonomic regulation, Hyperarousal.

1. INTRODUCTION

Insomnia is a prevalent sleep disorder characterized by difficulty initiating or maintaining sleep and impaired daytime functioning. It has been associated with reduced quality of life and psychosocial burden [1,2]. Contemporary models conceptualize insomnia as a disorder of hyperarousal involving sustained activation of stress-related systems and altered autonomic regulation [4,7].

Breathing-based interventions have gained interest as accessible non-pharmacological approaches targeting autonomic balance. Because respiration can be voluntarily regulated, structured breathing practices may influence autonomic activity and stress-related responses [3–7]. Pranayama has been described as a form of self-directed neuromodulation capable of influencing respiratory–autonomic coupling [4].

Evidence from respiratory-autonomic training approaches, including heart rate variability biofeedback, demonstrates small to moderate effects across emotional and physical outcomes, with smaller but significant effects on sleep measures [8]. However, short-term structured pranayama interventions delivered online remain insufficiently characterized. This pilot study aimed to examine short-term changes in insomnia severity following an 11-day structured pranayama protocol delivered through daily online guided sessions. It was hypothesized that participation would be associated with changes in Insomnia Severity Index (ISI) scores.

2. MATERIALS AND METHODS

2.1 Study Design

This pilot study employed a prospective single-arm pre–post design. Participants were assessed at baseline (Day 1) and after completion of the 11-day intervention (Day 11).

2.2 Participants

Fourteen adult women voluntarily enrolled in the program. Seven did not attend the instructional session and were excluded. Five participants completed ≥50% of sessions and provided paired ISI data, constituting the per-protocol sample.

2.3 Intervention

Participants completed a daily ~45-minute structured pranayama sequence delivered through supervised online sessions: Bhastrika (5 min), Kapalabhati (10 min), Ujjayee (5 min), Anuloma Viloma (15 min), Bhramari (10 repetitions), Udgeetha (5 min), and Pranava (5 min). The sequence progressed from activating techniques toward slower, exhalation-focused practices.

2.4 Outcome Measures and Analysis

Insomnia severity was assessed using the ISI (0–28) at baseline and Day 11. Analyses were descriptive due to small sample size.

3. RESULTS

Five participants met per-protocol criteria. Baseline ISI ranged from 5 to 25 (mean 14.2). After 11 days, mean ISI decreased to 9.8 (mean change −4.4). Four participants (80%) demonstrated improvement, one participant (20%) achieved clinically meaningful reduction (≥7 points), and one participant (20%) demonstrated worsening.

Participant ID	Baseline ISI	Day 11 ISI	Change (Δ)	Interpretation
PRA.I-001	5	8	+3	Worsening (None → Mild)
PRA.I-004	25	12	−13	Clinically meaningful improvement (Severe → Mild)
PRA.I-006	10	4	−6	Moderate improvement (Moderate → None)
PRA.I-008	13	9	−4	Mild improvement
PRA.I-014	18	16	−2	Minimal improvement

Table 1. Individual Changes in ISI Scores from Baseline to Day 11 (Per-Protocol Sample, n = 5). *Negative values indicate improvement in insomnia severity; positive values indicate worsening.*

4. DISCUSSION

This pilot observational study examined short-term changes in insomnia severity following an 11-day structured pranayama protocol delivered through daily online guided sessions. In the per-protocol sample (n=5), 80% of participants demonstrated some degree of improvement, with a mean ISI reduction of −4.4 points, and one participant (20%) achieving a clinically meaningful decrease (≥7 points). One participant demonstrated worsening. These findings suggest that short-term structured breathing interventions may be associated with measurable changes in insomnia severity, although responses appear heterogeneous. Insomnia is commonly conceptualized as a disorder of hyperarousal involving sustained physiological and cognitive activation with altered autonomic regulation [1–4]. Because respiration can be voluntarily regulated, structured breathing practices represent a plausible means of influencing autonomic balance [3,4,6,7]. Pranayama has been described as a

form of self-directed neuromodulation affecting respiratory–autonomic coupling [4]. Although autonomic markers were not measured here, these mechanisms provide a theoretical framework for the observed changes.

The structure of the intervention was intentionally sequential. The protocol began with relatively activating techniques (Bhastrika and Kapalabhati), characterized by rapid respiratory patterns. Within traditional and contemporary frameworks, these practices are described as stimulating and may enhance interoceptive awareness and attentional engagement [4,7]. The sequence then transitioned to slower and more regulated breathing patterns (Ujjayee and Anuloma Viloma), which have been associated in prior literature with improved autonomic balance and parasympathetic engagement [3,4,6,7]. The final practices (Bhramari, Udgeetha, and Pranava) emphasized prolonged exhalation and vocalized breathing. Exhalation-dominant breathing has been associated with parasympathetic activation and modulation of autonomic tone in experimental contexts [3,4,6,7].

This progression was designed to support gradual autonomic downregulation rather than abrupt relaxation. Conceptually, the initial activation may facilitate attentional stabilization and respiratory control, while subsequent slower and exhalation-focused phases may promote physiological recovery. However, in the absence of physiological measurements such as heart rate variability or baroreflex sensitivity, these mechanisms remain theoretical in the context of this pilot study.

Evidence from heart rate variability biofeedback (HRVB) research further supports the broader relevance of respiratory–autonomic training. A systematic review and meta-analysis reported small to moderate effect sizes across emotional and physical health outcomes, with smaller but significant effects observed for sleep-related measures [8]. Although HRVB differs from pranayama in its use of real-time physiological feedback, both approaches involve intentional modulation of breathing patterns to influence autonomic processes. The magnitude of change observed in the present study (mean −4.4 ISI points) is consistent with the expectation that sleep outcomes may improve modestly over short durations, particularly in the absence of multimodal behavioral components.

The short duration of the intervention (11 days) may partly explain the variability in response. Autonomic recalibration and behavioral sleep adjustments may require longer exposure to produce stable changes. Prior research on breathing-based interventions often includes longer training periods or structured feedback [3,8]. Therefore, changes observed here may represent early adaptation rather than consolidated physiological restructuring.

Response heterogeneity was notable and may not be explained solely by baseline severity. Observationally, participants who completed follow-up assessments reported greater environmental feasibility, including protected time and fewer interruptions during online sessions. In contrast, inconsistent participation was associated with competing demands or environmental instability. These findings suggest that contextual readiness and environmental stability may moderate engagement and perceived benefit in online breathing interventions.

It is also plausible that structured daily breathing practice may initially be experienced as cognitively effortful, particularly in individuals with elevated baseline stress or hypervigilance. For some participants, dedicating focused time to structured practice could transiently increase perceived cognitive load before autonomic adaptation occurs. Such dynamics may contribute to short-term symptom fluctuation rather than immediate improvement and warrant further investigation.

Adherence remains a central feasibility consideration. Although five participants met per-protocol criteria, half of enrolled individuals did not attend the instructional session. This highlights the importance of structured onboarding, expectation setting, and potentially hybrid delivery models to enhance engagement.

Several limitations must be acknowledged. The small sample size limits generalizability and precludes inferential analysis, and the absence of a control group prevents differentiation between intervention effects and natural symptom variability. Outcomes were self-reported, no physiological markers of autonomic regulation were collected, and variability in baseline severity complicates interpretation. Despite these constraints, the findings provide preliminary evidence that a structured online pranayama protocol may be associated with short-term reductions in insomnia severity in some participants. Larger

randomized controlled trials incorporating objective autonomic measures and longer follow-up are needed to clarify efficacy and identify moderators of response.

5. CONCLUSIONS

Short-term structured pranayama delivered online was associated with diverse changes in insomnia severity in this pilot sample. While most participants demonstrated some improvement, findings should be interpreted carefully. Larger controlled studies are required.

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