

A Comparative Study on the Effect of Sleep Hygiene Education with Progressive Muscle Relaxation and Mindfulness-Based Sleep Training on Insomnia

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Abstract: *Insomnia is a common sleep disorder that affects physical health, psychological well-being, and daily functioning. This randomized comparative clinical study evaluated the effectiveness of Sleep Hygiene Education (SHE) combined with Progressive Muscle Relaxation (PMR) and SHE combined with Mindfulness-Based Sleep Training (MBST) in managing insomnia. Forty participants aged 18 to 60 years were randomly assigned to two groups of 20 each. Both groups received their respective interventions for 28 days, with assessments conducted at baseline, Day 30, and Day 45. Treatment outcomes were measured using the Insomnia Severity Index (ISI), WHO-5 Well-Being Index, and Sleep Efficiency (SE). In Group A, mean ISI scores decreased from 21.65 at baseline to 3.10 at follow-up, while Group B showed a reduction from 21.95 to 3.05. WHO-5 scores improved from 2.40 to 17.40 in Group A and from 2.20 to 16.80 in Group B. Sleep efficiency increased from 57.17% to 82.66% in Group A and from 54.66% to 82.89% in Group B. Although a statistically significant difference in sleep efficiency was observed at baseline ($p < 0.001$), no significant differences were found between the groups after treatment or at follow-up ($p > 0.05$). Both interventions were associated with improvements in sleep quality, insomnia severity, and psychological well-being, which continued through the final follow-up. The results support the use of PMR and mindfulness-based sleep training alongside sleep hygiene education as practical, non-pharmacological approaches to managing insomnia, with neither intervention demonstrating superior clinical outcomes.*

Keywords: Insomnia, Sleep Hygiene Education, Progressive Muscle Relaxation, Mindfulness-Based Sleep Training, Sleep Efficiency

1. Introduction

Sleep problems have become increasingly common in the general population due to lifestyle changes, work pressure, irregular schedules, and various personal challenges. These issues can disrupt the normal functioning of both individuals and their families, leading to reduced interest in family activities, decreased interaction among family members, increased economic burden due to frequent illness and absenteeism from work, and diminished quality time with loved ones as individuals often feel inadequately rested and constantly fatigued.

Features such as prolonged sleep latency, repeated awakenings during the night, extended periods of wakefulness after sleep onset, or frequent brief arousals are considered indicators of insomnia. Therefore, insomnia is regarded both as a subjective symptom and an observable sign. (Roth, 2007)

Population-based studies across various countries consistently indicate that about 30% of adults report at least one symptom of insomnia, such as difficulty falling asleep, trouble maintaining sleep, early morning awakening, or experiencing non-restorative, poor-quality sleep. Furthermore, conclusions from the NIH State-of-the-Science Conference held in June 2005 suggest that when an additional diagnostic criterion—namely, the presence of perceived daytime impairment or distress due to sleep difficulties—is included, the estimated prevalence of insomnia decreases to approximately 10%. (National Institutes of Health, 2005) When stricter diagnostic standards—such as those outlined in

the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV)* (American Psychiatric Association, 1994)—are applied, requiring that insomnia symptoms last for at least one month and are not solely attributable to another sleep disorder, mental condition, substance use, or medical illness, the estimated prevalence is reduced to around 6%. (Ohayon, 1997)

Pre-existing chronic insomnia has been identified as an independent risk factor for the development of depression, as demonstrated by numerous studies, along with the high rates of comorbidity between mental and physical health conditions. Furthermore, insufficient sleep can significantly impact children and their families, leading to poorer academic performance, increased irritability, reduced social and emotional stability, diminished attention, and a decreased ability to regulate behavior in the classroom. (Zendarski & Mulraney, 2019)

To prevent serious harm and the development of both physical and psychological diseases, it is imperative that we treat sleep disturbances, particularly insomnia, as soon as possible using the appropriate measures. Insomnia is commonly managed with medications; however, these treatments often provide only short-term relief. The benefits may decline after discontinuation, and they can be associated with adverse effects on daytime functioning as well as a risk of dependence.

Sleep hygiene education (SHE) is a simple behavioral approach to managing insomnia and is often part of cognitive behavioral therapy for insomnia (CBT-I). It includes guidance

on habits such as caffeine use, exercise, consistent sleep timing, and environmental factors like light, noise, and temperature to improve sleep quality. These practices are taught to discourage sleep-disrupting behaviors and are supported by organizations like the National Sleep Foundation and CDC. SHE is easy to implement and is recommended as a first-line intervention, especially for high-risk groups such as shift workers and individuals with sleep disorders. (Irish et al., 2015)

Progressive Muscle Relaxation (PMR) is an intervention to increase relaxation to meet sleep needs. Relaxation therapy is the cheapest and most accessible, so it can be done anywhere and anytime to stretch tense muscles to reduce sleep disturbances and stress. (Apriany & Aljaberi, 2023)

Mindfulness Based Intervention corrects sequential cognitive and behavioral processes and can be a useful nonpharmaceutical intervention for insomnia. In many studies, MBI for insomnia has been proven with stability and efficacy. (Kim, 2021)

Therefore, the present study is designed with two distinct treatment groups, each integrating a different therapeutic modality along with sleep hygiene practices. The study aims to compare and evaluate the efficacy of Sleep Hygiene Education combined with Progressive Muscle Relaxation versus Sleep Hygiene Education combined with mindfulness-based sleep training in the management of insomnia

By simultaneously addressing cognitive, physiological, and somatic dimensions, this study has the potential to provide a comprehensive, safe, and effective approach to managing insomnia, thereby reducing disease burden and enhancing quality of life.

Objectives of the Study

Primary Objectives

- To evaluate the clinical efficacy of Sleep Hygiene Education combined with Progressive Muscle Relaxation in the management of Insomnia.
- To evaluate the clinical efficacy of Sleep Hygiene Education combined with mindfulness-based sleep training in the management of Insomnia
- To compare and evaluate clinical efficacies of both the groups.

Secondary Objectives

- To evaluate the overall wellbeing using WHO wellbeing index.

2. Material and Methods

Study Design and Settings

A randomized, comparative clinical study was conducted over a 45-day period to evaluate the efficacy of non-pharmacological interventions for insomnia. The study population was randomly selected from the outpatient department of the Agnivesh Ayurveda Clinic in Nagasandra, Bangalore, India.

Participant Selection

A total of 40 patients aged 18 to 60 years, of either gender, who met the diagnostic criteria for Insomnia Disorder according to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition, Text Revision (DSM-5-TR), were enrolled.

Inclusion Criteria:

- Males & Females aged 18-60 years.
- Able to give informed written consent.
- Symptoms of Insomnia Disorder as diagnosed by the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition criteria for Insomnia Disorder specifically: Difficulty initiating or maintaining sleep or waking up too early for at least 3 nights per week, for at least 3 months, with adequate opportunity and circumstances for sleep and at least one daytime impairment related to the sleep difficulty.
- Insomnia Severity Index scale scores of 15 or more
- Never previously treated with CBT-I or medications.

Exclusion Criteria:

- Insomnia Severity Index scale scores of 22 or more (severe).
- Known case of psychological conditions like Schizophrenia, Depression, Suicidal tendency, Psychotic illness or any severe cognitive dysfunction.
- Known cases of serious systemic illness such as; Asthma, COPD, IHD, Autoimmune conditions.
- Participants on hormone replacement therapy (HRT), Steroid therapy, Chemotherapy or Immunosuppressant therapy.
- Pregnancy or lactation.

The sample was randomized into two parallel arms with 20 participants assigned to each group:

- **Group A:** Received Sleep Hygiene Education (SHE) combined with Progressive Muscle Relaxation (PMR).
- **Group B:** Received Sleep Hygiene Education (SHE) combined with Mindfulness-Based Sleep Training (MBST).

3. Interventions

All therapeutic interventions were administered consistently over a active duration of 28 days.

1) Sleep Hygiene Education (SHE) (Groups A & B)

Participants in both groups received identical guidance on sleep optimization techniques:

- **Scheduling:** Maintenance of a strict, regular sleep-wake schedule.
- **Relaxation Routine:** Adoption of pre-bedtime rituals (e.g., warm baths, warm milk, gentle stretching, or calming music) to mitigate stress.
- **Environment:** Optimization of the sleeping space using dim lighting, quiet surroundings, and soothing aromatherapy.
- **Stimulant Avoidance:** Restriction of electronic device usage and consumption of central nervous system stimulants (caffeine and alcohol) within two hours of bedtime.

2) Progressive Muscle Relaxation (PMR) (Group A)

Group A participants practiced PMR daily for 15 minutes in a comfortable, supine position within a quiet environment. The procedure followed a systematic caudal-to-cephalic sequence (feet to head). Muscle groups were isolated, tensed for approximately 5 seconds during inhalation, and abruptly released during exhalation. Each group was targeted 2–3 times with decreasing intensity to heighten contrast

awareness. Participants mentally anchored the word “relax” during the release phase, maintained uninhibited respiration, and adjusted intensity to avoid physical discomfort.

3) Mindfulness-Based Sleep Training (MBST) (Group B)

Group B underwent a structured multi-component mindfulness protocol as detailed in **Table 1**.

Table 1: Operational Protocol for Mindfulness-Based Sleep Training (MBST)

Step No.	Procedure	Description	Frequency	Time Required
1	Psychoeducation	Education on insomnia, hyperarousal, and mindfulness principles	One-time (initial session)	60–90 min
2	Mindful Breathing	Focus on natural breathing; redirect attention when distracted	Daily	10–15 min
3	Body Scan Meditation	Sequential awareness of body parts to reduce physical tension	Daily (before bedtime)	15–20 min
4	Observation of Thoughts	Non-judgmental awareness of intrusive thoughts	Daily	10–15 min
5	Acceptance Training	Accept wakefulness; avoid forcing sleep	Daily (bedtime)	Integrated practice
6	Bedtime Practice	Apply breathing/body scan while lying in bed	Nightly	Until sleep onset
7	Managing Awakenings	Use mindfulness; leave bed if awake >15–20 min	As needed	10–20 min
8	Daytime Mindfulness	Mindful walking/eating to reduce stress	Daily	10–20 min

Outcome Assessments and Timeline

Clinical efficacy was systematically measured using subjective and objective metrics across three scheduled milestones: **Day 0** (Baseline / pre-therapy), **Day 30** (First follow-up / immediately post-therapy), and **Day 45** (Final follow-up / monitoring sustainability). No therapeutic interventions were administered between Day 29 and Day 45.

- **Subjective Metrics:** Changes in sleep metrics were evaluated via the *Insomnia Severity Index (ISI)* scale, while broader psychosocial outcomes were tracked using the *WHO Well-Being Index*.
- **Objective Metrics:** Quantitative baseline physiological sleep parameters were measured through calculated *Sleep Efficiency* percentages.

Statistical Package for the Social Sciences (SPSS) version 27. Descriptive statistics were used to summarize the study variables, with results presented as means and percentages, as appropriate. The Mann–Whitney U test was used to compare differences between Group A and Group B, while the Friedman test was employed to assess differences in repeated measurements within each group. These non-parametric tests were used to evaluate differences between independent groups and across repeated measurements, respectively. A p-value of less than 0.05 was considered statistically significant.

4. Results

Subjective parameter – Insomnia Severity Index (ISI): Between the Group

Statistical Analysis

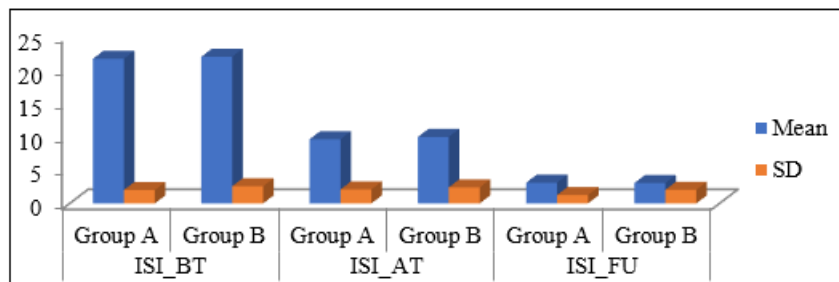
The data collected for the study were entered into a Microsoft Excel spreadsheet and subsequently analyzed using the

Table 2: Results On Subjective parameter- Insomnia Severity Index (ISI): Between the Group

Variables	Group	N	Mean	SD	Mann-Whitenu U test value	p-value	Remarks
ISI_BT	Group A	20	21.65	2.007	191.5	0.827	Not Significant
	Group B	20	21.95	2.564			
ISI_AT	Group A	20	9.6	2.088	185	0.69	Not Significant
	Group B	20	9.95	2.395			
ISI_FU	Group A	20	3.1	1.252	204.5	0.912	Not Significant
	Group B	20	3.05	2.038			

The mean ISI score in Group A decreased from 21.65 at baseline (BT) to 9.60 after treatment (AT) and further to 3.10 at follow-up (FU). Similarly, Group B showed a reduction from 21.95 at BT to 9.95 at AT and 3.05 at FU. The Mann–Whitney U test revealed no statistically significant difference between the groups at baseline ($p = 0.827$), after treatment

($p = 0.690$) or at follow-up ($p = 0.912$). These findings indicate that both groups demonstrated substantial improvement in insomnia severity, with no statistically significant difference between the interventions at any assessment point.



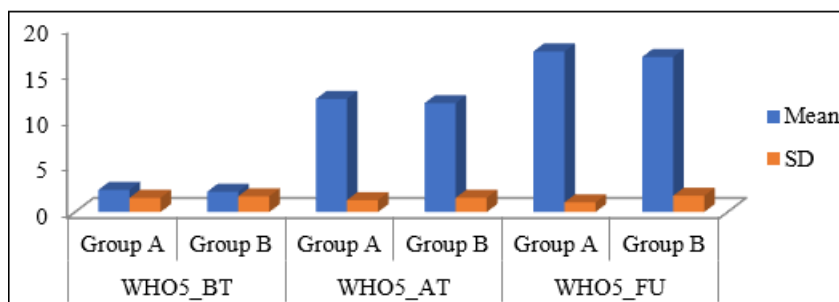
Graph 1: Results On Subjective parameter- Insomnia Severity Index (ISI): Between the group

Table 3: Results On Subjective parameter- WHO Well Being Index: Between the Group

Variables	Group	N	Mean	SD	Mann-Whitenu U test value	p-value	Remarks
WHO5_BT	Group A	20	2.4	1.536	0.69	0.69	Not Significant
	Group B	20	2.2	1.704			
WHO5_AT	Group A	20	12.25	1.293	244	0.227	Not Significant
	Group B	20	11.8	1.542			
WHO5_FU	Group A	20	17.4	1.046	246	0.205	Not Significant
	Group B	20	16.8	1.765			

The mean WHO-5 score in Group A increased from 2.40 at BT to 12.25 at AT and 17.40 at FU. In Group B, the mean score increased from 2.20 to 11.80 and 16.80, respectively. The between-group comparison revealed no statistically significant difference at baseline ($p = 0.690$), after treatment

($p = 0.227$) or at follow-up ($p = 0.205$). These results suggest that psychological well-being improved in both groups, with neither intervention demonstrating statistically significant superiority over the other.



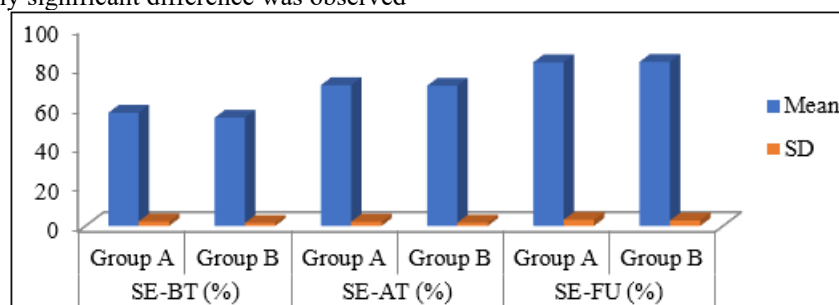
Graph 2: Results On Subjective parameter – WHO Well Being Index: Between the Group

Table 4: Results on Objective Parameter – Sleep Efficiency (SE)

Variables	Group	N	Mean	SD	Mann-Whitenu U test value	p-value	Remarks
SE-BT (%)	Group A	20	57.17	2.27	327.5	<0.001	Significant
	Group B	20	54.66	1.505			
SE-AT (%)	Group A	20	71.09	2.148	238	0.308	Not Significant
	Group B	20	70.79	1.664			
SE-FU (%)	Group A	20	82.66	3.096	187	0.733	Not Significant
	Group B	20	82.89	2.707			

The mean sleep efficiency in Group A increased from 57.17% at BT to 71.09% at AT and 82.66% at FU. Group B showed an increase from 54.66% to 70.79% and 82.89%, respectively. The Mann–Whitney U test revealed a statistically significant difference between the groups at baseline ($p < 0.001$). However, no statistically significant difference was observed

after treatment ($p = 0.308$) or at follow-up ($p = 0.733$). Thus, although the groups differed significantly in sleep efficiency at baseline, their mean sleep efficiency was comparable after treatment and at follow-up.



Graph 3: Results on Objective Parameter – Sleep Efficiency (SE)

5. Discussion

The present study evaluated the comparative efficacy of Sleep Hygiene Education (SHE) combined with either Progressive Muscle Relaxation (PMR; Group A) or a Mindfulness-Based Intervention (MBI; Group B) for the management of insomnia. The findings demonstrated robust, progressive improvements in both subjective metrics (ISI, WHO-5) and objective parameters (TIB, TST, SE) across the 45-day evaluation period. Notably, no statistically significant between-group differences were observed post-treatment or at the final follow-up, indicating that both integrative protocols were highly and comparably effective at reversing clinical insomnia and enhancing psychological well-being. The remarkable reduction of mean ISI scores to sub-clinical thresholds (<8) and the progressive rise in WHO-5 indexes highlight the reciprocal relationship between improved sleep architecture and psychological health. SHE likely acted as a crucial foundational primer across both cohorts by regularizing circadian rhythms and eliminating ambient sleep disruptors. The equivalent clinical success of both groups can be attributed to their distinct yet complementary pathways of downregulating clinical hyperarousal:

- **Somatic De-escalation (Group A):** PMR directly addresses peripheral autonomic arousal. By systematically tensing and relaxing major muscle groups, it reduces somatic tension, lowers heart rate, and shifts the autonomic nervous system toward a parasympathetic dominant state favorable for sleep onset.
- **Cognitive De-escalation (Group B):** Conversely, MBI targets central cognitive arousal. Through non-judgmental awareness, mindful breathing, and acceptance training, participants learned to observe intrusive, sleep-related anxieties without automatic emotional reactivity, effectively breaking the paradoxical cycle of trying to force sleep.

The objective parameters mirror this therapeutic success. The uniform increase in Total Time in Bed (TIB) suggests that participants adhered well to structured behavioral sleep schedules. Crucially, this expansion of bedtime was accompanied by a marked increase in Total Sleep Time (TST)- culminating in an optimal mean of 480 minutes (8 hours) in both groups- and a commensurate surge in Sleep Efficiency (SE) past 82%.

While Group A displayed a significantly superior SE at baseline ($p < 0.001$), this variance was entirely resolved post-intervention ($p = 0.308$). This neutralization demonstrates that MBI enabled Group B to bridge a steeper initial deficit, matching the therapeutic trajectory of the PMR cohort. Furthermore, the sustained improvements observed at Day 45 (17 days post-intervention) indicate that both behavioral skill sets are easily internalized and offer lasting therapeutic durability without the risk of dependence or tolerance associated with pharmacotherapy.

6. Conclusion

Both PMR and MBI, when paired with comprehensive Sleep Hygiene Education, serve as equally viable, durable, and effective non-pharmacological interventions for moderate insomnia. Clinical selection between these two modalities can

comfortably be guided by patient preference, targeting somatic tension with PMR or cognitive hyperarousal with MBI

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