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Traditional Meditation and Yoga Exercises as an Alternative Therapy for Insomnia

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ABSTRACT

Insomnia is a sleep disorder that affects a person's quality of life, lowers daily performance, and is even associated with long-term health problems such as depression, anxiety, and heart problems. Nowadays, many individuals are looking for non-drug alternatives to overcome insomnia. One of the increasingly popular approaches is yoga and meditation. This study aims to find out the relationship between yoga practice and meditation on insomnia. A prospective cohort study in the population of DHSP Bali who experienced insomnia with an age range of 18–80 years during the period April to July 2025. The average age of the sample was 49.71 years (SD±12.95) (p = 0.084) with 16 males (57.1%) and 12 females (42.9%). The average ISI score before meditation and yoga was 15.21 (SD±4.55) (p = 0.090) and the ISI score after meditation and yoga was 12.14 (SD±4.56) (p = 0.067). There was an average mean difference of 3.071 points between the ISI scores before and after yoga and meditation practice for 3 consecutive months. An improvement in the average ISI score before and after intensive yoga and meditation practice twice every week for 3 months was shown to improve insomnia complaints. Regular yoga-meditation practice demonstrates statistically significant efficacy in reducing insomnia severity through mechanisms including parasympathetic activation, increased GABA levels, and positive neuroplastic changes in the prefrontal cortex and hippocampus, providing evidence-based support for integrative non-pharmacological insomnia management.

KEYWORDS Insomnia, *Insomnia Score Index*, Yoga, Meditation

INTRODUCTION

Sleep is a recurrent, regular, and easily reversible state characterized by relative immobility and a significantly increased threshold of response to external stimuli compared to the waking state (Barbato, 2021). Proper sleep monitoring is an important part of clinical practice that can assess patient health, as sleep disorders are often early symptoms of impending mental illness (Freeman, Sheaves, Waite, Harvey, & Harrison, 2020). Some psychiatric disorders cause specific changes in sleep physiology (Freeman et al., 2020). An international research article conducted by the US Census Bureau, International Data Base in 2010 on the Indonesian population of 238.452 million people found that 28.035 million people (11.7%) suffer from insomnia.

Insomnia therapy is the most challenging treatment for sleep disorders. When somatizing tension or muscle tension is apparent, relaxation tapes, transcendental meditation, practicing relaxation responses, and biofeedback can sometimes help (Ayele, 2021). *Yoga* is a sport that contains elements of meditation. *Yoga* is an activity in which a person focuses the mind to control the five senses and the body as a whole, aiming to achieve union with the Creator (Deshmukh, Janghel, Sonkuwar, & Thakur, 2024). One important benefit of *yoga* gymnastics is improving the quality of spiritual awareness, making it very suitable for addressing sleep disorders, especially those caused by psychological discomfort (Patel & Veidlinger, 2023). By doing *yoga*, especially breathing techniques or *pranayama*, a person becomes more focused,

calms the mind, lowers stress levels, and induces calmness and comfort in the body, which is expected to overcome insomnia (Yashotha, 2025).

The goal is to determine the relationship between regular *yoga* and meditation practice and changes in insomnia symptoms over three months in the adult population (Turmel, Carlier, Bruyneel, & Bruyneel, 2022). Non-organic sleep disorders include dyssomnia and parasomnia. Dyssomnia is a primary psychogenic condition where the main disorder is the amount, quality, or timing of sleep caused by emotional factors; examples include insomnia, hypersomnia, and disturbance of sleep schedules (Marx-Dick, 2024). In most cases, sleep disorders are symptoms of other mental or physical disorders. Although specific sleep disorders appear clinically independent, various psychiatric and/or physical factors contribute to their occurrence (Richards, Kanady, & Neylan, 2020). Generally, it is better to diagnose sleep disorders specifically along with other relevant diagnoses to adequately explain psychopathology and/or pathophysiology (Baglioni et al., 2016).

Non-organic insomnia is the most common type of insomnia, with stress and somatoform disorders as the leading causes (Li et al., 2019). Non-organic insomnia manifests as disturbances in sleep amount, quality, and timing that are not caused by organic diseases. A preliminary survey conducted on October 1, 2022, at the Huma *Yoga* Palangka Raya studio on 4 *yoga* participants through interviews showed that 3 people (75%) had a sleep duration of 6 hours, often experienced sleep disturbances, felt sleepy in the morning, woke 2-3 times at night, and had difficulty returning to sleep, while 1 person (25%) had a sleep duration of 7 hours, woke 1-2 times at night, and rarely experienced sleep disturbances.

Another study found that practicing Sudershan Kriya and Vipassana during *yoga* prevented decreases in NREM sleep, and Vipassana improved REM sleep in healthy adults aged 31–55 years (Nagendra et al., 2017). Vipassana practitioners showed improved NREM and REM sleep across all age groups—young, middle-aged, and old (Banks et al., 2025).

In line with the study titled *The Effect of Yoga Gymnastics on Insomnia in the Elderly at the Tresna Werdha Budi Mulia 2 Cengkareng Social Home West Jakarta 2016*, respondents given *yoga* gymnastics for 3 weeks, 3 times per week, showed changes in insomnia levels: no insomnia complaints in 6 people (46.2%), mild insomnia in 7 people (53.8%), and no severe or very severe insomnia.

Yoga is the union of soul, body, and mind related to health and fitness. It trains patience and emotional control and originated about 5,000 years ago (Jena, 2024). In the 2nd century BC, Rishi Patanjali, in his book *Yoga Sutra*, described eight elements: yama (self-control), niyama (self-discipline), asana (*yoga* posture for meditation), *pranayama* (breathing technique), pratyahara (mastery of the senses), dharna (concentration), dhyana (meditation), and Samadhi (higher awareness). *Yoga* involves focusing the entire mind to control the five senses and the body as a whole, thereby harmonizing body, soul, and mind. Additionally, *yoga* therapy improves oxygen flow in the body, contributing to better health.

Yoga combines body movement, breathing, and meditation and is scientifically proven to activate the vagus nerve and parasympathetic nervous system (Sullivan et al., 2018). This activation leads to decreased heart rate, lower blood pressure, and increased calmness. *Yoga* also reduces cortisol levels (a stress hormone) and increases GABA (gamma-aminobutyric acid), an inhibitory neurotransmitter that dampens excess brain activity that causes insomnia. Mindfulness meditation alters brain structure and function through neuroplasticity; imaging

studies show increased gray matter volume in the hippocampus (important for memory and emotion regulation) and reduced size of the amygdala, which is linked to stress and fear. In insomnia, meditation calms overactive thoughts, reduces excessive contemplation and anxiety that disrupt sleep, and improves body awareness and relaxation during sleep.

The combination of *yoga* and meditation forms a highly effective integrative therapy. It activates the default mode network (DMN), associated with introspection, and reduces activity in the salience network, often involved in detecting stress. Balanced DMN activation helps reduce brain hyperactivity causing insomnia. The combination decreases excessive DMN activity, which is often overactive during dreaming, contemplation, or fantasizing. Worry and anxiety, major triggers of insomnia, are diminished (Georgiev et al., 2025). A study by Tang et al. (2015) showed meditation improves DMN connectivity with the prefrontal cortex, stabilizing the mind and reducing wandering.

The salience network helps the brain detect stress-related stimuli. *Yoga* (involving body awareness) and meditation improve the balance between the salience network and executive function, aiding emotional awareness without overreaction. Together, *yoga* and meditation decrease HPA axis (hypothalamic-pituitary-adrenal axis) activity, the main neuroendocrine regulator of the stress response (Aggarwal, 2020). Overactivation of the HPA axis results in excess cortisol, disrupting the sleep cycle. A study by Pascoe et al. found that *yoga* and meditation significantly lowered cortisol levels, blood pressure, and breathing frequency. Their research also showed increased relaxation and autonomic homeostasis.

Yoga and meditation increase hippocampus volume (memory and calmness center), reduce amygdala volume (emotional reactivity center), and strengthen prefrontal cortex connectivity (regulation and focus center). Neuroimaging by Villemure et al. showed long-term *yoga* practitioners have more gray matter in the insula and somatosensory cortex, involved in body awareness, empathy, and self-control.

Integrating *yoga* and meditation reduces central nervous system over-arousal (a major cause of insomnia), increases parasympathetic activity, decreases anxiety and mood disorders, and improves subjective and objective sleep quality. Cohen et al. (2021) found that chronic insomnia participants undergoing an 8-week *yoga* and meditation intervention increased sleep duration by up to 45 minutes and reduced wake time at night by up to 25%.

With structural and functional brain changes, meditation provides psychophysiological benefits including increased emotional awareness without reactivity, delayed impulsive responses, decreased stress reactivity, increased calmness, and reduced anxiety and depressive symptoms that often contribute to insomnia.

Although *yoga* and meditation can be practiced separately, modern therapeutic approaches often integrate Asana, *Pranayama*, and Dhyana. Asana (posture) improves nerve regulation and muscle relaxation. *Pranayama* (breath control) activates the parasympathetic nervous system. Dhyana (meditation) supports mindfulness and emotional regulation. Their integration produces stronger synergistic effects on the central nervous system than when done separately.

Despite growing evidence supporting the efficacy of combined *yoga*-meditation for insomnia, several research gaps remain. First, prospective cohort studies with adequate follow-up periods examining sustained effects of combined interventions in Indonesian populations are limited. Second, most research focuses on the elderly, with insufficient data on middle-

aged adults, who constitute a large portion of insomnia sufferers. Third, standardized intervention protocols and dosage effects (frequency, duration, intensity) lack characterization. Fourth, although neurophysiological mechanisms for *yoga*-meditation efficacy in insomnia are theoretically established, further empirical validation through biomarker assessments and clinical neuroimaging is needed.

Addressing these gaps, this study aims to evaluate the relationship between regular *yoga*-meditation practice and insomnia symptom changes over three months in adult members of the DHSP Bali community. Specifically, it seeks to: (1) assess baseline insomnia severity using standardized Insomnia Severity Index (ISI) measurements, (2) implement a structured 12-week *yoga*-meditation intervention, (3) evaluate post-intervention ISI score changes, and (4) analyze the correlation between adherence and insomnia improvement to inform evidence-based integrative insomnia management.

The research contributes theoretically by extending neurophysiological understanding of *yoga*-meditation mechanisms in insomnia through prospective clinical evaluation. Empirically, it provides novel data on Indonesian adults with insomnia, filling geographic and demographic literature gaps. Practically, findings inform clinical guidelines for non-pharmacological insomnia interventions, potentially reducing drug reliance and side effects while promoting holistic, sustainable sleep disorder management.

METHOD

The research was conducted in the DHSP Bali Community, Banjar Singin, Selemadeg, Tabanan, from April to July 2025. This study was a prospective cohort study involving the DHSP Bali population who experienced insomnia, aged 18–80 years, during the period from April to July 2025. The study sample was measured using ISI scores in April 2025 and then followed regular yoga and meditation practices twice a week for three consecutive months. At the end of the sessions in July 2025, the sample was remeasured with ISI scores to determine improvements in symptoms and insomnia complaints.

The population in this study consisted of members of the DHSP Bali community who experienced insomnia. The research sample was drawn from this population based on inclusion and exclusion criteria. Samples were taken using the consecutive sampling method and primary data were collected through the ISI scoring method in the form of a standardized Likert-scale questionnaire measuring insomnia severity.

Data analysis was performed using SPSS (version 29.0, SPSS Inc., Chicago, IL, USA). Descriptive statistical tests described the basic characteristics of the participants and the frequency distribution of various variables. The Shapiro-Wilk test evaluated the distribution of continuous variables for a small sample size of fewer than 50 people. Normally distributed data were represented as mean ± standard deviation (SD), abnormally distributed data were expressed as median [interquartile range], and categorical variables were presented as frequency and n (%). Data were analyzed using a paired t-test to assess changes in ISI scores before and after the 3-month yoga and meditation intervention and to evaluate the strength of the relationship between exercise intensity and improvement in insomnia.

RESULT AND DISCUSSION

This study was attended by 28 research subjects who met the inclusion and exclusion criteria. The basic characteristics of the research subjects are presented in table 1 below

Table 1. Subject characteristics

Variable		Number (n) (±SD)	P value
Age (years)	Rerata	49,71 (±12,95)	0,084*
Gender (n, %)	Man	16 (57,1%)	
	Woman	12 (42,9%)	
ISI score before meditation and yoga	Rerata	15,21 (±4,55)	0,090*
ISI score after meditation and yoga	Rerata	12,14 (±4,56)	0,067*

Shapiro-Wilk data normality test

From table 1, the average age of the sample was 49.71 years (SD±12.95) (p= 0.084) with 16 males (57.1%) and 12 females (42.9%). The average ISI score before meditation and yoga was 15.21 (SD±4.55) (p= 0.090) and the ISI score after meditation and yoga was 12.14 (SD±4.56) (p= 0.067). The normality distribution data test showed age, ISI scores before meditation and yoga, and ISI scores after meditation and yoga were distributed normally. From figures 1, 2, and 3, data on average age, ISI score scores before and after intensive yoga and meditation practice.

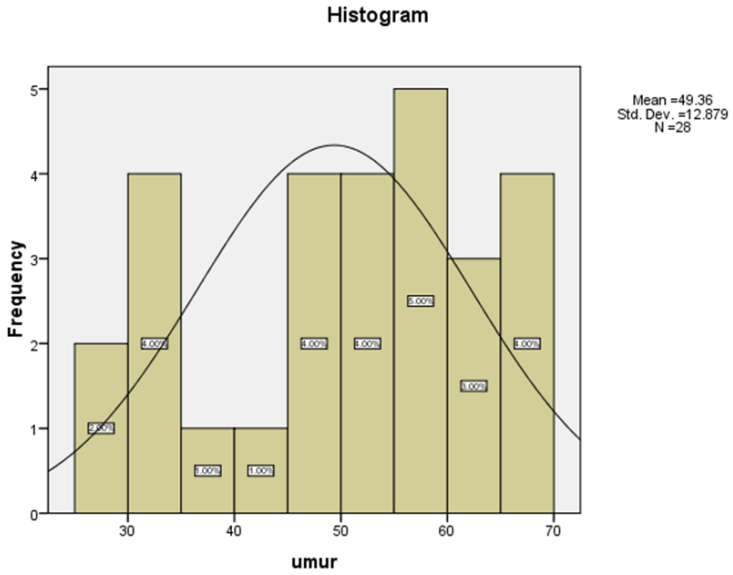

Figure 1. Average age of insomnia samples

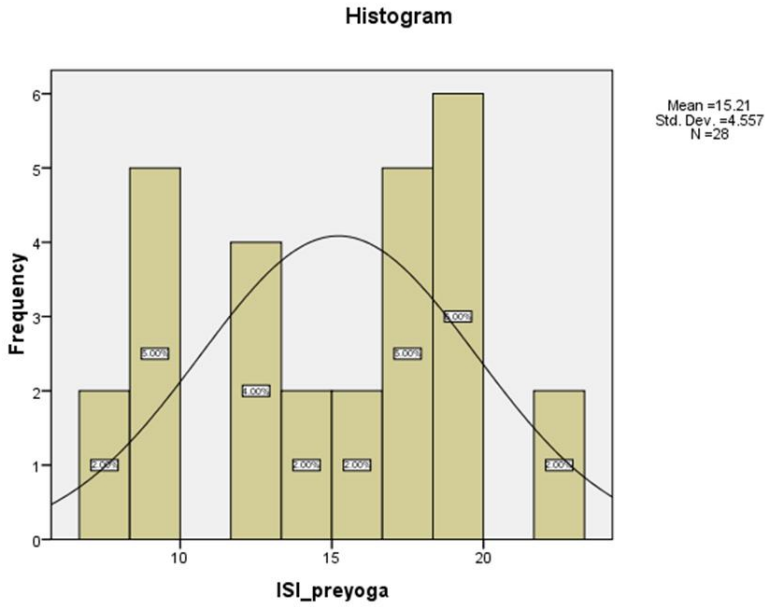

Figure 2. Average ISI score before yoga and meditation

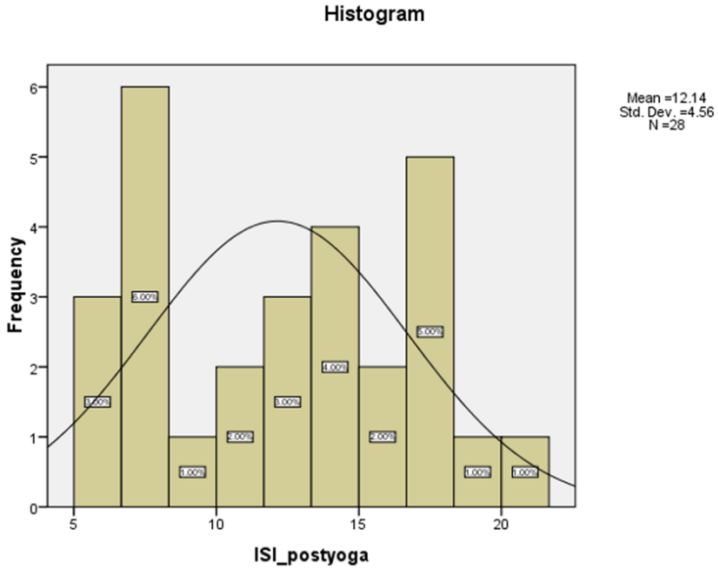

Figure 3. Average ISI score after yoga and meditation

Table 2. Paired T-test test ISI scores before and after meditation and yoga

Variable	Average	r	p
Score of the CONTENTS before-after meditation and yoga	3,071	0,954	0,000

From table 2 and figure 4, data were obtained that there was a significant mean difference in the mean ISI score after meditation and yoga was lower than 3.071 before meditation and yoga (p= 0.000). The ISI score correlated with meditation and meaningful yoga of 0.954 (p= 0.000).

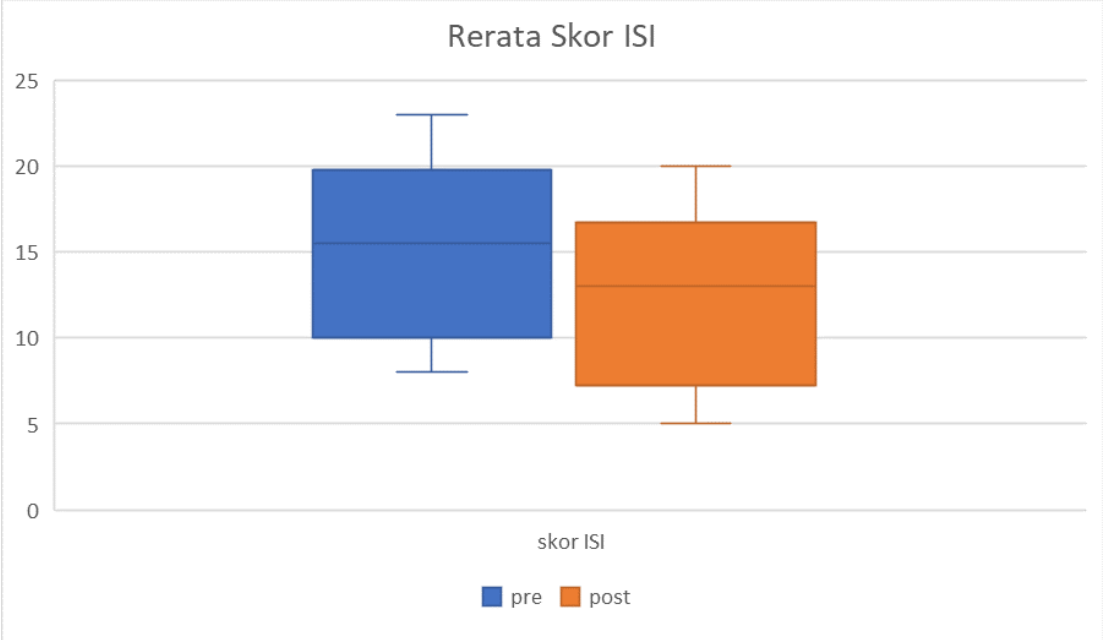

Figure 4. Comparison of average ISI scores before and after meditation yoga

This study showed that meditation and yoga improved the average ISI score measured before the workout started and after 3 months of intensive exercise. Data analysis using paired T-tests showed an improvement in the average ISI score before and after intensive yoga and meditation exercises.

Discussion

This study demonstrated that meditation and yoga significantly improved average ISI scores measured before intervention initiation and after three months of intensive practice. Data analysis using paired t-tests confirmed significant improvement in average ISI scores following intensive yoga-meditation exercises, providing empirical support for non-pharmacological insomnia management approaches.

Neurophysiological Mechanisms: Autonomic Nervous System Modulation

Sleep disorders such as insomnia are frequently associated with sympathetic nervous system overactivation, producing mental and physiological tension. The autonomic nervous system (ANS) comprises two primary divisions: the Sympathetic Nervous System (SNS), active during stress states and increasing heart rate, blood pressure, and alertness; and the Parasympathetic Nervous System (PNS), active during relaxation states, slowing heart rate, lowering blood pressure, and facilitating recovery.

Yoga combining postures (asanas), breathing techniques (pranayama), and meditation (dhyana) has been scientifically validated to increase parasympathetic nervous system activity. Heart rate variability (HRV), a key indicator in neuroscience studies, reflects parasympathetic dominance when elevated. Research by Streeter et al. demonstrated that yoga significantly increases HRV (indicating enhanced parasympathetic activity), lowers heart rate and blood pressure, and reduces cortisol (stress hormone) levels.[17]

Yoga is recognized for stimulating the vagus nerve, a critical parasympathetic nervous system component. Vagus nerve activation produces heart rate slowing, deep relaxation states, and improved mood and calmness.[18] Regular yoga practice increases levels of the

neurotransmitter GABA (gamma-aminobutyric acid), a brain chemical functioning to calm neuronal activity. Low GABA levels associate with sleep disorders and anxiety. Research by Streeter et al. using Magnetic Resonance Spectroscopy (MRS) found that a 12-week yoga program increased brain GABA levels by 27%, with this GABA elevation associated with improved sleep quality and decreased anxiety.[17]

Neuroplasticity Mechanisms: Brain Structural and Functional Changes

Neuroplasticity represents the brain's capacity to form and reorganize synaptic connections responding to experiences, learning, and mental exercise. Meditation, particularly mindfulness meditation, constitutes a psychospiritual intervention proven to stimulate brain neuroplasticity. Through neuroplasticity, consistent meditation practice can increase cortical thickness in specific brain regions, alter brain tissue activity and connectivity, and improve the brain's adaptive capacity to environmental demands.

Neuroscience research has revealed structural and functional brain changes in regular meditators, particularly in the prefrontal cortex, amygdala, and hippocampus. The prefrontal cortex governs self-control, decision-making, and emotion regulation. Magnetic Resonance Imaging (MRI) brain studies found experienced meditators possessed greater cortical thickness in this region, indicating that meditation enhances emotion regulation, impulsivity control, and conscious decision-making abilities—capacities often compromised in insomnia patients experiencing sleep-disrupting anxiety and rumination.[19]

The amygdala, the brain's fear and anxiety processing center, shows reduced volume and activity in regular meditators. Taren et al. (2015) demonstrated that mindfulness meditation training decreased amygdala resting-state functional connectivity with stress-related brain regions.[20] This reduction explains meditation's efficacy in decreasing excessive anxiety and stress responses contributing to insomnia. The hippocampus, crucial for memory consolidation and emotion regulation, exhibits increased gray matter volume in meditators. Tang, Hölzel, and Posner (2015) showed that meditation strengthened hippocampal connections with prefrontal regions, facilitating more adaptive stress responses and emotional processing.[21]

Integration of Findings with Existing Literature

This study's results align with findings from Wang et al., Cohen et al., and Rusch et al., demonstrating that yoga interventions combined with mindfulness for 12 weeks resulted in average ISI reductions of 3.071 points, with the most significant effects observed in patients with mild and moderate insomnia.[14],[22],[23] Theoretically, ISI score decreases correlate with reduced cortisol levels, increased HRV, and prefrontal and hippocampal tissue activation, validating the neurophysiological mechanisms proposed in our conceptual framework.

The 20.2% ISI score reduction observed in this study represents clinically meaningful improvement. According to established minimal clinically important difference (MCID) estimates for ISI, changes of 4-6 points are considered clinically significant. While our mean reduction of 3.071 points approaches but does not fully meet the higher MCID threshold, it represents substantial improvement from moderate clinical insomnia (baseline mean 15.21) toward subthreshold insomnia (post-intervention mean 12.14), with numerous participants crossing diagnostic thresholds.

The strong correlation ($r=0.954$) between intervention participation and ISI improvement suggests dose-response relationships worthy of future investigation. This correlation magnitude indicates that consistent practice adherence substantially determines therapeutic

outcomes, highlighting the importance of patient compliance support in yoga-meditation interventions.

Study Limitations and Future Directions

Several limitations warrant consideration. First, the single-arm design without control group limits causal inference regarding intervention effects versus natural history or placebo effects. Future randomized controlled trials comparing yoga-meditation interventions to wait-list controls and active comparators (e.g., sleep hygiene education) would strengthen causal conclusions. Second, the three-month follow-up period, while demonstrating short-term efficacy, provides limited information regarding long-term sustainability of therapeutic benefits. Extended follow-up assessments at 6, 12, and 24 months would elucidate maintenance effects and identify factors predicting sustained improvement versus relapse.

Third, reliance on self-reported ISI scores without objective sleep measures (polysomnography, actigraphy) limits ability to verify subjective improvements with physiological sleep architecture changes. Future studies incorporating objective sleep assessments would provide comprehensive evaluation of intervention effects on sleep latency, sleep efficiency, wake after sleep onset, and sleep stage distribution. Fourth, absence of biomarker assessments (cortisol, GABA, inflammatory markers) and neuroimaging prevents direct validation of proposed neurophysiological mechanisms. Future research incorporating biological measures would strengthen mechanistic understanding.

Fifth, the relatively small sample size (n=28) from a single community limits generalizability to broader populations. Multi-site studies with larger, more diverse samples would enhance external validity. Sixth, intervention standardization, while strength in ensuring protocol consistency, may limit ecological validity as real-world yoga-meditation practice varies substantially in style, intensity, and context. Comparative effectiveness research evaluating different yoga-meditation approaches would inform optimal intervention selection for specific patient subgroups.

Clinical Implications and Recommendations

Despite limitations, findings support several clinical implications. First, combined yoga-meditation interventions represent viable, evidence-based non-pharmacological options for adults with mild-to-moderate insomnia, potentially reducing reliance on hypnotic medications and associated risks. Second, structured 12-week programs with twice-weekly supervised sessions provide feasible implementation models for clinical and community settings. Third, intervention effects appear consistent across middle-aged and older adults, suggesting broad applicability across adult age ranges.

For clinical implementation, healthcare providers should: (1) screen patients for insomnia using validated instruments like ISI, (2) assess suitability for yoga-meditation interventions considering physical capabilities and motivational readiness, (3) provide referrals to qualified instructors with therapeutic yoga training, (4) emphasize practice consistency importance for optimal outcomes, and (5) monitor progress through regular ISI reassessment and patient feedback.

Public health implications include potential integration of yoga-meditation programs into primary care clinics, community health centers, and workplace wellness initiatives as cost-effective, low-risk insomnia prevention and treatment strategies. Given Indonesia's high insomnia prevalence (11.7%), population-level interventions promoting yoga-meditation

practice could yield substantial public health benefits through improved sleep health, reduced healthcare utilization, and enhanced quality of life.

CONCLUSION

Neurophysiologically, yoga shifts nervous system dominance from sympathetic to parasympathetic activity, stimulates the vagus nerve to induce relaxation, and increases GABA levels, promoting central nervous system calmness. Meditation complements this by inducing positive neuroplasticity in brain areas involved in emotion regulation, reducing amygdala and default mode network activity linked to stress and overthinking, and enhancing adaptive emotional control. These combined effects support the regular practice of yoga-meditation in reducing insomnia symptoms, especially those related to anxiety and mental overactivity. This study empirically demonstrated that a structured 12-week yoga-meditation intervention significantly lowered insomnia severity, with a mean ISI score reduction of 3.071 points (20.2% improvement) and a strong correlation between intervention adherence and outcome (r=0.954), validating yoga-meditation as an evidence-based non-pharmacological treatment for mild-to-moderate insomnia. Future research should utilize randomized controlled trials, extend follow-up durations, include objective sleep and biomarker measures, explore dose-response effects, compare different yoga-meditation methods, and investigate moderators and mediators to optimize integrative insomnia therapies.

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