



Effect of Pranayama on Sleep in Adults: A Narrative Review from a Neurophysiological and Behavioral Perspective

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Abstract : Sleep problems are common among adults and often lead to daytime tiredness, mood changes, and reduced quality of life. Conventional treatments like sleep medicines and CBT-I help many people, but they also have limitations, which is why pranayama is now receiving growing attention as a safe, simple, and low-cost method for improving sleep. This narrative review summarizes evidence from studies published between 2015 and 2025 that examined how pranayama, or yogic breathing, affects sleep in adults. Overall, most studies show that techniques such as slow breathing, alternate nostril breathing, diaphragmatic breathing, and Bhramari can improve sleep quality, reduce insomnia severity, and shorten sleep onset, both in healthy adults and in individuals with health conditions like hypertension or cancer. These benefits may be related to physiological and psychological mechanisms, including increased parasympathetic activity, reduced sympathetic arousal, lower stress and anxiety, and possible effects on hormones such as melatonin and cortisol. At the same time, the existing research has some limitations, including small sample sizes, varied breathing protocols, and a heavy reliance on self-reported sleep measures. Larger and more rigorous studies using objective assessments are needed to strengthen the evidence. Taken together, the findings suggest that pranayama represents a promising complementary approach for improving sleep in adults and may offer meaningful support for those seeking non-pharmacological options for better sleep.

Keywords: *Pranayama; Sleep quality; Insomnia; Yogic breathing; Mind-body intervention.*

I. INTRODUCTION

Sleep problems are very common among adults. Many people have trouble falling asleep, staying asleep, or feeling rested after sleep. Research shows that about 30% of adults experience some form of long-term sleep issue, and this rate tends to increase with age, affecting about 20–30% of older adults (Ohayon, 2002; Morin & Benca, 2012). These disturbances are often associated with daytime tiredness, mood problems, and a general decline in life satisfaction (Buysse, 2014).

Traditional treatments for insomnia usually depend on sleep medications, but these drugs have clear downsides. They are typically used only for short periods because of the risks of side effects, drug tolerance, and dependence (Glass et al., 2005). Psychological methods like Cognitive Behavioural Therapy for Insomnia (CBT-I) are often effective. Yet, they are not always easy to access, and some people do not get enough relief from them (Trauer et al., 2015). Because of these challenges, there is growing attention to complementary mind-body techniques—such as mindfulness or relaxation practices—as alternative ways to improve sleep quality (Black et al., 2015).

Pranayama, which means yogic breathing, is one of the techniques being studied for its effects on sleep. It involves consciously controlling the breath—by managing inhalation, exhalation, and sometimes breath-holding—and is considered a key element of yoga practice. The main idea behind using pranayama for better sleep is that it helps the body relax and is generally safe to practice (Jerath et al., 2006). Yogic breathing activates the parasympathetic nervous system and helps calm the mind, which may reduce stress and hyperarousal—two common factors that contribute to insomnia (Brown & Gerbarg, 2005).

Recent research provides growing support for this idea. Studies show that yoga-based programs that include breathing, relaxation, and mindfulness can improve sleep quality across diverse groups, including adults, older adults, and individuals with health conditions (Khalsa et al., 2009; Nagendra et al., 2012). The mindfulness component of pranayama may also help increase natural melatonin levels and reduce physiological stress responses, leading to deeper, more restful sleep (Harinath et al., 2004). Considering the limits of sleeping medications and the need for safe, holistic approaches, pranayama appears to be a promising technique to help adults manage sleep disturbances (Woodyard, 2011).

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II. METHODS

A structured literature search was conducted to identify relevant studies on pranayama and adult sleep outcomes published in the last 10 years (2015–2025). We searched two major databases – PubMed and Scopus – for peer-reviewed articles using keywords related to yogic breathing and sleep (e.g., pranayama, yogic breathing, breathing exercises, sleep quality, insomnia). The search was limited to studies involving human adult participants (age ≥ 18) and to articles indexed in the two databases to ensure broad coverage of biomedical and clinical research. We combined terms for pranayama with sleep-related terms using Boolean operators (for example: "pranayama" AND ("sleep quality" OR "insomnia")) and applied filters for publication year and language (English). Reference lists of relevant articles (including reviews) were also hand-searched to identify any additional studies.

2.1 Inclusion criteria: We included randomized controlled trials (RCTs), quasi-experimental studies, observational studies (e.g. cohort or pre-post designs), and systematic or scoping reviews that examined the effect of pranayama (as the primary intervention or as a key component of a multi-modal intervention) on sleep outcomes in adults. Sleep outcomes of interest encompassed subjective measures like sleep quality (e.g., Pittsburgh Sleep Quality Index, PSQI), insomnia severity (e.g., Insomnia Severity Index, ISI), sleep latency/duration, and objective measures if available. We required that studies report at least one quantitative sleep-related outcome. Both healthy populations with sleep complaints and clinical populations with sleep disturbances (e.g., patients with medical or psychiatric conditions) were eligible, as long as the intervention involved a form of pranayama or yogic breathing practice.

2.2 Exclusion criteria: We excluded studies focusing on children or adolescents, since the target population was adults. We also excluded studies where the breathing practice was confounded with multiple other interventions (unless pranayama was a significant component) – for example, a full yoga program with postures, unless the study highlighted the breathing component. Case reports, expert opinion pieces, and non-English articles were excluded. Where multiple publications reported on the same trial, we included the most comprehensive report.

The search and screening process followed principles of narrative and scoping reviews rather than a formal PRISMA systematic review, given the anticipated heterogeneity of interventions and study designs. Data were extracted on study design, population characteristics, pranayama technique(s) used, intervention duration/frequency, and key sleep outcomes. The findings from the included studies were then synthesized qualitatively in a narrative format, organized by thematic content.

III. RESULTS AND DISCUSSION

3.1 Overview of included studies: Our search identified several recent studies (2015–2025) that evaluated pranayama-based interventions for improving sleep in adults. The evidence consists primarily of small-to-moderate-sized RCTs and a few quasi-experimental trials, along with one or two broader reviews. The majority of these studies report positive effects of pranayama or yogic breathing techniques on subjective sleep outcomes, although the magnitude of benefit varies and a few trials found no significant effect. Notably, the pranayama interventions and study populations were diverse – ranging from healthy adults with mild sleep complaints to clinical groups such as older hypertensive patients and cancer patients undergoing therapy. Across this body of literature, common sleep measures included the Pittsburgh Sleep Quality Index (PSQI) for overall sleep quality, the Insomnia Severity Index (ISI) for insomnia symptoms, and occasionally objective metrics (e.g., actigraphy or polysomnography, though these were seldom used).

3.2 Sleep quality improvements: Multiple trials have documented improvements in sleep quality with pranayama practice. For example, a recent randomized controlled trial in 105 older adults (mean age ~ 65) with hypertension examined a 24-week home-based program of daily pranayama and meditation (Akshita et al., 2025a). The intervention consisted of 40 minutes each morning of guided breathing exercises – including Sheetali (cooling breath), Ujjayi (psychic breath), Nadi Shodhana (alternate-nostril breathing), and Bhramari (humming bee breath) – followed by a short yoga nidra relaxation and meditation (Akshita et al., 2025a). After 24 weeks, participants who practiced these pranayama techniques showed a significant improvement in sleep quality compared to the control group receiving standard care (Akshita et al., 2025a). Specifically, the intervention group's PSQI scores improved by an average of 2.6 points (indicating better sleep), versus a negligible 0.7-point improvement in the control group (a statistically significant between-group difference, $p < 0.001$) (Akshita et al., 2025a). This finding suggests that a sustained pranayama-based routine can meaningfully enhance subjective sleep quality in older adults, even when added to usual medical care.

Another study focused on elderly individuals with hypertension combined pranayama with a mindfulness program and found similar benefits. In a controlled trial by Noventi et al. (2022), 40 hypertensive seniors were randomized to either standard care or an 8-week intervention of Mindfulness-Based Stress Reduction (MBSR) plus daily samavṛtti pranayama (equal ratio breathing) (Noventi et al., 2022). Samavṛtti pranayama involves inhaling and exhaling for equal counts to regulate the breath. The intervention group attended weekly MBSR sessions and practiced the equal-count breathing exercise regularly. Results showed that the combined mindfulness and pranayama program produced significant improvements in sleep quality (assessed via PSQI) compared to controls (Noventi et al., 2022). In addition, the intervention group experienced reductions in anxiety and blood pressure, highlighting the holistic benefit. This trial underscores that even a relatively short program (8 weeks) of pranayama, especially when paired with stress-reduction techniques, can positively affect sleep in older adults (Noventi et al., 2022).

Pranayama has also been studied in populations with sleep disturbances secondary to medical conditions. A noteworthy example is a randomized controlled study of women undergoing radiotherapy for breast cancer, who often experience fatigue and insomnia as side effects. Gündoğdu et al. (2021) evaluated the addition of daily deep breathing and pranayama exercises for patients during their course of radiation therapy (Gündoğdu, 2021). Patients in the intervention group performed slow diaphragmatic breathing and other yogic breathing techniques each day, while controls received standard care without specific breathing exercises. The findings indicated that pranayama helped mitigate insomnia and sleep disruptions in these patients (Gündoğdu, 2021). Over the weeks of radiotherapy, the control group showed a significant worsening of sleep (increases in insomnia scores and declines in PSQI components such as subjective sleep quality and daytime functioning), whereas the pranayama group maintained or improved their sleep ratings (Gündoğdu, 2021). In particular, subjective sleep quality was positively affected in the breathing exercise group, suggesting that pranayama provided a protective effect against treatment-related sleep deterioration (Gündoğdu, 2021). This

evidence supports the use of breathing interventions as an adjunct therapy to improve sleep in patients facing high stress or treatment side effects.

Several trials have targeted primary insomnia or poor sleep in otherwise healthy adults using yoga breathing techniques. In one trial of middle-aged adults with chronic insomnia, a Kundalini yoga intervention (which emphasized pranayama along with meditation and relaxation) was compared to a sleep hygiene education control over 8 weeks. The Kundalini yoga group practiced a daily routine that included slow breathing exercises, chanting, and meditation before bedtime. Results (reported by Khalsa et al., 2020) showed that the yoga breathing program led to significantly greater improvements in insomnia severity and sleep quality than the sleep hygiene alone, including reductions in sleep latency (time to fall asleep) and night-time awakenings. While the exact breathing techniques in Kundalini yoga can be diverse (often including alternate nostril breathing and mantra-related breathing), this study provides evidence that a structured yogic breathing regimen can outperform standard advice in managing chronic insomnia. It should be noted, however, that not all studies in insomnia populations have yielded positive outcomes. A systematic review of yoga for sleep in menopausal women, for instance, found mixed results – with some RCTs showing no significant improvement in PSQI scores compared to controls (Alghosi et al., 2025). Such discrepancies suggest that the effectiveness of pranayama may depend on the population and intervention specifics, warranting further investigation.

3.3 Summary of evidence: Overall, the recent literature indicates a trend toward improved sleep outcomes with pranayama practice in adults. A variety of breathing techniques have been studied – including slow deep breathing, diaphragmatic breathing, alternate nostril breathing, Bhramari (humming breath), 4-7-8 breathing patterns, and others – typically taught in a daily routine lasting 10–30 minutes per day over several weeks. These practices, often delivered in conjunction with relaxation or meditative components, appear to be safe and beneficial for sleep. A recent mini-review of breathing exercise interventions noted consistent success across seven different trials, each reporting enhanced sleep quality in the intervention groups (Steinmane & Fernate, 2025). Importantly, improvements have been observed in both healthy individuals with moderate sleep complaints and in clinical populations (e.g., those with hypertension, cancer, or anxiety) who have comorbid sleep issues. Objective sleep data are limited, but one study by Datta et al. (2017, cited in Pathania et al. 2025) even documented improvements in sleep architecture via polysomnography after a 5-week yoga nidra (yogic relaxation) intervention (Akshita et al., 2025). While most evidence relies on self-reported sleep measures, the consistency of positive findings suggests a real therapeutic signal. At the same time, the variability in outcomes across studies (with a few showing minimal or no effect) highlights that pranayama is not a one-size-fits-all remedy; factors such as adherence, the specific breathing technique, and individual differences likely influence the degree of benefit.

IV. POSSIBLE MECHANISMS

Several physiological and psychological mechanisms have been proposed to explain how pranayama can influence sleep regulation. Autonomic nervous system modulation is thought to be a key pathway. Slow, controlled breathing exercises stimulate the vagus nerve and shift the autonomic balance toward parasympathetic dominance (the “rest and digest” state). This parasympathetic activation is evidenced by increases in heart rate variability (HRV) and vagal tone during and after yogic breathing practices (Tyagi & Cohen, 2016). In practical terms, pranayama induces a relaxation response: it can lower heart rate and blood pressure by reducing sympathetic nervous system drive and enhancing vagal activity. As one study described, focusing on the breath and lengthening the exhalation promotes mental calm and triggers autonomic changes that decrease sympathetic arousal and increase parasympathetic (vagal) tone, creating a physiological state conducive to sleep (Akshita et al., 2025). This effect is akin to activating the body’s natural “braking” system to counteract stress. Indeed, neurophysiological research on yogic breathing and meditation (e.g. OM chanting and yoga nidra) shows down-regulation of arousal systems and a shift toward synchronized, slower brain-wave patterns associated with relaxation and sleep (Kamaraj et al., 2025).

Another mechanism is the reduction of psychological stress and hyperarousal. Difficulty sleeping is often perpetuated by anxiety, rumination, or an overactive mind at bedtime. Pranayama, especially when combined with mindfulness, teaches individuals to disengage from racing thoughts and induce mental tranquility. Breathing techniques like Bhramari (humming breath) and slow diaphragmatic breathing have a soothing effect on the mind, in part through the vibratory and vagal stimulation they provide, which can alleviate anxiety. Studies have observed that practices such as yoga nidra meditation and pranayama significantly reduce anxiety levels and stress hormones (Akshita et al., 2025c). This anxiolytic effect is directly relevant to sleep: by lowering pre-sleep anxiety and muscular tension, pranayama may shorten sleep latency and reduce nighttime awakenings. The deliberate focus on breath also serves as a form of mindfulness, diverting attention away from worries and creating a state of relaxed awareness that precedes sleep onset.

Additionally, pranayama might influence neuroendocrine factors involved in sleep regulation. Preliminary evidence suggests that yogic practices can increase melatonin secretion (Alghosi et al., 2025) – melatonin being the hormone that facilitates sleep-wake regulation. Although robust endocrine studies are limited, one hypothesis is that the reduction in evening cortisol (stress hormone) and sympathetic output through breathing exercises allows the body’s natural melatonin rise at night to go unopposed, thereby improving the ability to initiate and sustain sleep. Breathing techniques that include breath retention (kumbhaka) may also stimulate baroreceptor reflexes and nitric oxide release, which have calming and vasodilatory effects conducive to sleep.

In summary, pranayama likely aids sleep via multiple interrelated pathways: it calms the autonomic nervous system (increasing vagal/parasympathetic activity) (Alghosi et al., 2025), reduces stress and mental arousal (Akshita et al., 2025) and possibly optimizes neurohormonal responses (like melatonin release and cortisol reduction) (Alghosi et al., 2025). These physiological and psychological changes mirror those seen in the natural transition to sleep, suggesting that pranayama essentially helps prepare the body and mind for restful sleep. While more research is needed to pinpoint exact mechanisms, the existing findings align with a theoretical model in which yogic breathing enhances the relaxation response and counters the hyperarousal that underlies many cases of insomnia.

V. LIMITATIONS

Despite encouraging findings, the current literature on pranayama and sleep has important limitations. First, many of the studies had small sample sizes – often on the order of a few dozen participants – which limits statistical power and the generalizability of results. Few large-scale trials have been conducted, and the largest RCTs to date enrolled just around 100–150 people. Relatedly, several trials were single-center studies and may not represent diverse populations. Second, there is significant heterogeneity in interventions across studies. “Pranayama” encompasses a variety of breathing techniques (slow vs. fast breathing, nasal vs. mouth breathing, added humming or breath holds, etc.), and the included studies used different protocols (from daily 10-minute breathing exercises to intensive combined yoga programs) with varying durations (ranging from a few weeks to several months). This variability makes it difficult to compare results directly or identify which specific breathing practices are most effective.

Another limitation is the heavy reliance on subjective sleep measures. Most studies assessed outcomes via self-reported questionnaires like the PSQI or sleep diaries. While these are valuable tools, they can be prone to placebo effects and reporting biases. Very few studies incorporated objective measures such as polysomnography (the gold-standard sleep study) or actigraphy to corroborate self-reported improvements. The lack of objective sleep data means we have limited insight into whether pranayama improves sleep architecture (e.g., increasing deep sleep or REM) or just the perception of sleep quality.

VI. CONCLUSION

In conclusion, the past decade of research suggests that pranayama (yogic breathing practices) holds promise as a complementary intervention for improving sleep in adults. Multiple studies across different adult populations have reported that regular pranayama practice can lead to better sleep outcomes, such as enhanced sleep quality, reduced insomnia severity, shorter sleep latency, and fewer nighttime disturbances. These benefits have been observed in healthy adults with generalized sleep complaints, as well as in clinical groups like older adults with hypertension and patients undergoing cancer treatment, among others. The overall evidence indicates that pranayama is a safe, low-cost, and non-pharmacological approach that may help fill a gap in the management of chronic sleep disturbances, potentially reducing reliance on sedative medications. Furthermore, the mechanistic understanding – that pranayama down-regulates stress physiology and activates the parasympathetic relaxation response – provides a plausible explanation for its sleep-enhancing effects.

VII. IMPLICATIONS FOR FUTURE RESEARCH

There is a clear need for larger, well-designed RCTs to confirm and expand upon these findings. Future studies should aim to include sufficient sample sizes to detect clinically meaningful improvements in sleep and should utilize **objective sleep measures** (e.g., actigraphy or polysomnography) alongside subjective scales (Alghosi et al., 2025). Comparing pranayama directly to standard treatments like CBT-I, other relaxation techniques, or aerobic exercise would help establish its relative efficacy (Alghosi et al., 2025). Research should also investigate which specific breathing techniques or protocols are most effective – for instance, is a slow breathing exercise with a prolonged exhalation more beneficial for insomnia than other forms of pranayama? Long-term follow-up is needed to see if improvements in sleep persist and whether continued practice of pranayama is required to maintain benefits. As the demand grows for integrative and non-drug therapies for sleep, establishing a robust evidence base for pranayama will be important for its integration into mainstream clinical practice. In summary, pranayama appears to be a promising **adjunct therapy for sleep disturbances**, with initial evidence of efficacy and a strong theoretical rationale. Ongoing and future research will help clarify its role and optimize its use in the management of adult insomnia and poor sleep quality.

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