International Journal of Yoga and Allied Sciences
Vol 14, No: 2, July-Dec 2025, ISSN: (2278-5159) pp: 318-329

Impact of pranayama on Sleep quality and Insomnia: A systematic review

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Abstract:

Background: Sleep disturbances, including insomnia, pose significant challenges to individuals' physical and mental health. Too often, insomnia is treated as a symptom without investigation of the cause. Insomnia may be a condition unto itself (primary insomnia), or it may be associated with a medical or psychiatric condition (comorbid insomnia). Traditional approaches often involve medication, but complementary therapies like pranayama are gaining popularity as safe and effective alternatives. Pranayama is a yogic breathing practice that involves controlled breathing techniques (*kumbhaka*) that can promote relaxation and stress reduction. Understanding the impact of Pranayama on sleep can inform holistic treatment strategies. Sleep is a crucial factor in maintaining good physical and mental health. Poor sleep quality and insomnia can significantly affect individuals' well-being. While traditional pharmacological treatments are commonly used to tackle these issues, they can have harmful long-term effects on the body. Complementary therapies, such as pranayama, a form of yogic breathing practice, are increasingly gaining recognition as safe and effective approaches. This study aims to investigate the effectiveness of pranayama in improving sleep quality and reducing the symptoms of insomnia.

Aim: The primary aim of this research is to investigate the effects of regular Pranayama practice on sleep quality and insomnia symptoms. We seek to evaluate whether incorporating pranayama into daily routines can lead to better sleep outcomes and overall health.

Objective: The objective of this study is to evaluate the impact of regular Pranayama practice on sleep quality and insomnia symptoms. We aim to determine whether Pranayama can serve as a viable alternative to traditional sleep medications.

Methods: This study reviewed four research studies that evaluated the effectiveness of different interventions on sleep quality, emotional state, stress level, quality of life, and overall health. A total of 39 articles were identified, out of which only four studies met the inclusion criteria. Various tools were used to evaluate the outcomes of the interventions, including the Pittsburgh Sleep Quality Index (PSQI), DASS-21, Perceived Stress Scale (PSS), WHOQOL-BREF, Patient Health Assessment Questionnaire, and Sleep Quality Questionnaire. Statistical analysis was performed using SPSS and GraphPad Prism Software, and the sample size of the studies ranged from 30 to 60 participants.

Conclusion: In conclusion, our study suggests that incorporating pranayama into daily routines can lead to better sleep outcomes. Pranayama's controlled breathing techniques can promote relaxation and stress reduction, leading to improved sleep quality. Pranayama's non-pharmacological nature makes it a valuable addition to Western therapeutic approaches for managing sleep disorders.

Keywords: Pranayama, Sleep quality, Insomnia, Yogic breathing

1. INTRODUCTION

Sleep is as vital to life as breathing. While breathing sustains life, sleep allows the body to repair and restore itself. During the day, our energy is spent, and sleep replenishes it. Just

like breathing connects us to the energy of creation, sleep connects us to a calm and unchanging reality. Together, breathing and sleep point to the presence of a powerful, unchanging force within us, the same force that governs the universe (Shivananda, 2022). Sleep is a crucial aspect of human behavior that allows the body and mind to rest and recharge however, modern-day challenges such as stress, overwork, and lifestyle habits can disrupt sleep patterns, leading to the widespread occurrence of insomnia (Medic et al., 2017). Maharishi Patanjali states in Patanjali yoga sutra, in the tenth verse in Samadhi pada:

***Abhā va-pratyayā lambanā vṛittinidrā* (PYS, 1.10)**

Sleep is a *vritti* (fluctuation) or modification when there's no assumption or awareness present. It is a state where the mind is empty like a blank page. It might seem like nothing is happening in the mind, but it's still active, just not connected to the brain.

We still have a memory when we woke up. It occurs when the quality of *tamas* is dominant, and the qualities of *sattav* and *rajas* diminish. During sleep, there is no awareness of the external world (Sivananda, 2021). Additionally, evidence suggests an increased risk of certain tumors, mortality in males, and suicidal tendencies in adolescents. Moreover, prolonged sleep disturbances can worsen symptoms of gastrointestinal disorders (Medic et al., 2017). Another research indicates that inadequate sleep can significantly elevate the risk of developing obesity, diabetes, high blood pressure, and heart disease (Shankar et al., 2010).

Signs of disturbed sleep include prolonged time taken to fall asleep, frequent awakenings during the night, and extended periods of wakefulness before rising in the morning. Globally, the reported prevalence of insomnia stands at 33% in the general population, with figures of 16% in India (Hiremath et al., 2022). Sleep disturbance can arise from a variety of sources, including cardiovascular diseases (such as coronary artery disease), neurological conditions (such as epilepsy, Parkinson's disease, and headaches), endocrine disorders (like diabetes and thyroid diseases), respiratory diseases (like chronic obstructive pulmonary disease and asthma), mental health issues (like anxiety, depression, and bipolar disorders), and other health problems including kidney disease, gastroesophageal reflex. Additionally, certain medications such as alpha and beta blockers, antiarrhythmic drugs used in cardiovascular diseases, as well as other drugs like beta-agonists, corticosteroids, nicotine patches, and stimulants, can also disrupt normal sleep patterns and quality (Brown L.K., 2008). External factors include environmental conditions (such as excessive brightness or noise), genetic predispositions, night shift work, and aging can also disrupt sleep. These factors can lead to a decline in sleep quality, increasing the risk of developing various health conditions (Almojali et al., 2017).

The WHO (1948) declares, "Health is a state of complete physical, mental, and social wellbeing and not merely the absence of disease or infirmity." It's clear that being healthy involves many parts of our lives, whether it's physical, mental, social, moral, emotional, or spiritual dimensions, we need to take care of all aspects of our well-being.

1.1 AYURVEDIC DEFINITION OF HEALTH

In Sushrut Samhita, Acharya Charaka and Vaghbhata in Sutrasthana define health as:

***"Samadosha, samagnischa samadhatumala kriyaha prasanna atmenindriya manaha swasthya ityabhidheeyate"* (SS, 15/10)**

Sushruta outlines the characteristics of a healthy individual. being healthy means several things: the body doshas should be balanced, digestion should work well, and bodily tissues and waste should function normally. Also, the senses, organs, mind, and soul

should be in a good state. When all of this is in equilibrium, a person is considered healthy.

Ayurveda emphasizes three essential factors for maintaining good health: *Ahara, Nidra*, and *Brahmacharya* (Nirgude et al., 2013). Among these, *Nidra*, or sleep, plays a crucial role in replenishing the body's energy depleted during daily activities. While Ayurveda recognizes the importance of sleep as a fundamental aspect of health, contemporary challenges such as societal pressures, technological advancements, and lifestyle habits pose obstacles to achieving restorative sleep. Understanding the multifaceted nature of insomnia and its pervasive issue and promoting overall wellbeing (Epstein et al., 2017).

Research studies indicate that inadequate sleep can elevate the likelihood of developing conditions such as obesity, diabetes, high blood pressure, and heart disease (Knutson, 2012). Quality sleep offers a plethora of benefits that positively impact both mind and body. It enhances cognitive function and memory retention, boosts self-esteem, and increases confidence. Prioritizing adequate sleep is key to nurturing overall well-being and vitality (Jain et al., 2020).

1.2 INSOMNIA

In today's world, factors like environment, physiology, and psychology can all play a role in its development. These signs and symptoms collectively highlight the pervasive impact of insomnia on overall well-being and functioning (Rathod et al., 2021). Insomnia is the hyperarousal experienced throughout the 24 hours of the day (Morin et al., 2023).

1.2.1 Insomnia may be categorized as discussed by Bhandare et al. (2022)

A) Causes as per Physiological disturbances

i. Psychophysiology of sleep disorder
ii. Alcohol or drug-dependent
iii. Hypersomnia
iv. Psychological illness
v. Neurological condition
vi. Other health conditions
vii. Extrinsic insomnia

B) According to sleep disturbance

i. Sleep onset insomnia
ii. Sleep offset insomnia
iii. Sleep maintenance insomnia
iv. Non- restorative sleep

C) According to duration

i. Acute insomnia
ii. Chronic insomnia
iii. Transient insomnia

1.3 PHYSIOLOGY

Individuals with insomnia often experience heightened physiological and psychological arousal, making it difficult to relax and fall asleep. This hyperarousal state may be characterized by increased heart rate, elevated levels of stress hormones such as cortisol, and heightened sensory awareness, contributing to sleep onset and maintenance difficulties (Bonnet & Arand, 2010).

Insomnia may involve disruptions in the body's internal circadian clock, which regulates the timing of sleep and wakefulness. Factors such as irregular sleep schedules, exposure to artificial light at night, and shift work can disrupt circadian rhythms, leading to

insomnia symptoms (Czeisler et al., 1999). Certain medical conditions, such as chronic pain, respiratory disorders, e.g., sleep apnea, gastrointestinal disturbances, and neurological disorders, can contribute to insomnia by causing discomfort, pain, or disruptions in physiological processes that interfere with sleep (Smith et al., 2005). Certain medications, including stimulants, antidepressants, and corticosteroids, can disrupt sleep patterns and contribute to insomnia. Additionally, substance use, such as caffeine, nicotine, and alcohol, can interfere with sleep quality and exacerbate insomnia symptoms (Clark et al., 2017).

1.4 YOGA

The (BG, 6.20) states that yoga is the journey of the self, through the self, to the self." This means practicing yoga is about self-realization. To explore and discover our true nature and connect with our innermost self. According to Sage Patanjali,

***"Vyādhistyānasaṁśayapramāda-ālasya-aviratibhrāntidarśana-alabdha-bhūmikatva- anavasthitatvānicitta-vikṣepāḥteantarāyāḥ"* (PYS, 1.30)**

This means, disease, mental laziness, doubt, lack of enthusiasm, lethargy, clinging to sense enjoyments, false perceptions, non-attaining concentration, and falling away from the state when obtained are obstructing distractions of the mind. This distraction of the mind will result in a series of problems. Maharishi Patanjali puts it in his yoga sutra as

"Duhkhadaurmanasyaangamejayatva
***Svasa-prasvasaviksepasahabhuvaha"* (PYS, 1:31)**

This means grief, mental distress, tremors of the body, and irregular breathing accompany the mental distractions. This is the main cause and symptom one experiences suffering. To overcome the suffering from these diseases, one has to practice yoga to overcome the *chittavrittis*. Yoga Sutra of Patañjali, which begins by defining yoga as

***Yogaś-citta-vṛtti-nirodhaḥ* (PYS, 1.2)**

"To calm and still the fluctuations of the mind." There are multiple thoughts, emotions, and distractions that fluctuate constantly, causing restlessness and agitation. The Ashtanga Yoga of Maharishi Patanjali mentioned eight limbs of yoga, which include Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana, and Samadhi. Each helps to achieve mental tranquility and stability by reducing the constant changes in thoughts and emotions and uplifting human consciousness. The mental-emotional afflictions or impulses that cause us to suffer, called *kleśāḥs*, anticipate many contemporary descriptions of health issues that lead to disorders. In Yoga Sutra 2.3, Sage Patanjali identifies the five *kleshas*-

***Avidyāsmitārāgadveṣābhiniveśāḥkleśāḥ* (PYS, 2.3)**

Avidya, Asmita, Raga, Dvesha, and *Abhinivesha* as the root causes of human suffering. The *kleśāḥs* influence the mental modifications that we call *chittavrittis,* dividing them into *klishta* and *aklishtavrittis* across various aspects such as *brahmana\, viparyaya, vikalpa, nidra,* and *smriti. Klishtavritti,* influenced by *kleshas*, leading to suffering, while *aklishtavrittis,* free from *kleshas*, pave the way for happiness. Overall, Yoga serves as a holistic approach to achieving balance and harmony between the mind and body.

1.5 PRANAYAMA

Pranayama is structured around the three phases of breathing: inhalation *(pooraka),* retention *(kumbhaka),* and exhalation *(rechaka),* using the breath as its medium. The various pranayama techniques focus on these three stages. In technical terms, pranayama mainly focuses on retention (holding) Maharishi Patanjali's Yoga Sutras states-

***Tasmin sati śvāsa-praśvāsayorgati-vicchedaḥprāṇāyāmaḥ* (PYS, 2.49)**

Pranayama is when you achieve a stable pause between inhaling and exhaling. Breathing in and out aids in retention, which is vital for absorbing prana, similar to how it's essential

for exchanging oxygen and carbon dioxide in cells. Since the breath is connected to the body's functions, organs, and the mind, controlling it influences all these areas. In the Hatha Yoga text, Hatha Pradipika, in the second verse of the second chapter, Swami Swatmarama mentioned:

Calevātecalaṁcittaṁniścaleniścalaṁbhavet,
yogīsthāṇutvamāpnotitatovāyuṁnirodhayet. **(HYP, 2:2)**

When the life force, or *prana*, is in motion, the mental force or *chitta* also moves. Conversely, when *prana* is still, so is *chitta.* Hence, disruption in respiration leads to disturbance in the mind. Hatha yoga says, control of the prana and the mind is automatically controlled. In pranayama, the focus is on extending the duration of breath retention. The longer the breath is held, the wider the gap between nervous impulses and the brain (Saraswati, 2009).

"Yāvadvāyuḥsthitodehetāvajjīvanamucyate
Maraṇaṁtasyaniṣkrāntistatovāyuṁnirodhayet" **(HYP, 2.3)**

As long as there is *prana* and *vayu* in the body, there is life. When prana departs, so too does life. Therefore, regulate the breath.

1.5.1 PRANAYAMA AS A THERAPY

Each pranayama has unique effects, some generating warmth while others cooling the body. Certain pranayamas invigorate, while others foster harmony and relaxation within the nervous system. Nadi shodhana is recognized for its balancing properties, whereas bhastrika and kapalbhati are regarded as activating techniques. Bhramari and ujjayi, on the other hand, are known for their relaxing effects. Sheetali/sheetkari and chandrabheda promote cooling of the inner body temperature, while suryabheda and moorchha elevate internal heat. All pranayama techniques change how fast we breathe, but some do it more than others. Bhastrika and kapalbhati make us breathe in and out faster. They are like hyperventilation exercises, where we practice breathing rapidly for a long time. Similarly, bhramari, ujjayi, sheetali, and sheetkari slow down our breathing; they are regarded as hypoventilation (Saraswati, 2009).

1.5.2 ACTION OF PRANAYAMA ON INSOMNIA

Pranayama enhances the strength of respiratory muscles, leading to improved tissue perfusion and enhanced oxygen saturation (Hiremath et al., 2022). Regular yoga practice may reduce overactivity of the autonomic nervous system and boost parasympathetic activity. This can lead to lower oxygen consumption and metabolic rate in prefrontal cortex cells, potentially preventing neuronal loss and helping to maintain cognitive function (Rathod & Mishra, 2021).

The critical study found that when people breathe through their nose, it syncs up certain brain activities in areas like the piriform cortex (linked to smell), amygdala (emotional processing), and hippocampus (memory). So, nasal breathing seems to coordinate these brain regions in a synchronized way (Zelano et al., 2016). When people breathe through their mouth, this synchronization pattern doesn't happen in the same way. Plus, breathing through the mouth has been linked to sleep problems and attention issues like ADHD (Sano et al., 2013).

2. LITERATURE REVIEW

This literature review synthesizes findings from recent research studies investigating the efficacy of pranayama and related breathing exercises on sleep quality and the management of insomnia. The study included 60 patients divided into three groups: pranayama group, deep breathing exercise group, and control group. The control group did not receive any intervention, while the other two groups performed either pranayama or deep breathing exercises. The deep breathing exercise group showed a significant improvement in fatigue during the treatment process, unlike the control group. This

finding suggests that deep breathing exercises may help mitigate treatment-induced fatigue. Moreover, both the pranayama and deep breathing exercise groups demonstrated a decrease in insomnia scores post-treatment. Overall, the results of this study are promising, and Pranayama and deep breathing exercises can be effective in reducing fatigue and insomnia in breast cancer patients undergoing radiotherapy. The findings underline the importance of exploring non-pharmacological interventions to improve the quality of life of cancer patients (Gündogdu & Koçaşlı, 2021).

The aim of the study was to evaluate the effect of a Pranayama technique, described in the *Trishikhbrahmana Upanishad,* on the quality of sleep in adults. The *Trishikhbrahmana Upanishad* is a primary text of Yoga philosophy and practices, which provides traditional techniques that can be applied in modern health contexts. The study was conducted on volunteers from North India, using a pretest-posttest control group design. The study group received the Pranayama intervention for 30 days, while the control group did not receive any intervention. This design allowed for a clear comparison between the two groups and the effect of the Pranayama technique on sleep quality. The Pittsburgh Sleep Quality Index (PSQI), a recognized tool in sleep research, was used to assess sleep quality. The results showed a significant improvement in the post-global PSQI score in the study group, indicating that the Pranayama technique improved sleep quality in adults. The authors concluded that the Pranayama technique from the *Trishikhabrahmana Upanishad* has a positive effect on sleep quality in adults (Tyagi et al., 2023).

Assess the impact of practicing Bhr. P for 6 weeks on the quality of sleep and perceived stress levels of school students. Bhr. P is a breathing technique used in yoga to promote relaxation. The study was conducted on 60 students from class X, who were not suffering from ear or respiratory tract infections, chronic illnesses, had not undergone recent surgery, and were not practicing any other relaxation techniques. This was done to ensure that the results were solely due to the practice of Bhr.P. The study found that practicing Bhr.P for 6 weeks led to a significant improvement in the quality of sleep and a reduction in perceived stress levels among the students. The baseline data revealed that there were no significant differences between the age, BMI, sleep quality, and perceived stress levels of male and female participants. This suggests that the benefits of Bhr.P is consistent across different demographic groups. The study highlights that practicing Bhr.P is an effective and safe way to alleviate stress and improve sleep quality. It may provide additional health benefits and can be an inexpensive way to address health issues related to stress and sleep quality. These findings provide new avenues for future research in the field of yoga and its use in improving sleep quality and reducing stress levels among school students (Kumar et al., 2021).

This study has demonstrated that Bhr.P has significant effects on reducing depression, anxiety, and stress scores among COVID-19 patients. It is also observed that it improves sleep quality and overall quality of life among COVID-19 Patients. This suggests that Bhr.P could be a potential non-pharmacological intervention for managing psychological distress and improving sleep quality while in home isolation. But the studies conducted so far have limitations, including small sample sizes, single-centered designs, short evaluation periods, and the lack of a control group. These factors limit the applicability of the findings to everyone’s situation. So, there is a need for multicenter randomized controlled trials to confirm these findings and establish the effectiveness of Bhr.P intervention among larger and more diverse populations (Jagadeesan et al., 2022).

3. RESEARCH METHODOLOGY

3.1 Search strategies

This review is based on a thorough search of electronic databases, including PubMed and Google Scholar. We meticulously analyzed English scientific studies published between January 2014 and December 2023, which included randomized controlled trials, case studies, experimental studies, and pilot studies. Our search strategy included the terms "pranayama," "insomnia," and "sleep quality," ensuring a comprehensive analysis. For this review, we solely relied on electronic searches of online databases. We are confident that the results of this review will provide valuable insights into the effects of pranayama on sleep disorders and insomnia.

3.2 Screening and Selection

Our thorough article selection process involves a series of screenings based on study design, titles, and full-text articles. This meticulous approach ensures that only eligible articles are chosen for our study, giving us the most accurate and reliable results possible.

3.3 Inclusion criteria

The systematic review is an extensive study that includes articles written in English, with the specific titles “Pranayama” and “Sleep Quality/Insomnia.” These articles are not just abstracts or summaries but provide the full text for a comprehensive understanding of the subject matter. The scope of the review is broad and inclusive, considering participants of all age groups, from children to the elderly. Moreover, it does not limit the health condition of the participants, meaning individuals suffering from any disease, whether chronic or acute, are included in the study. We studied the scientific papers published between January 2014 to December 2023. This wide-ranging approach ensures a thorough and inclusive examination of the effects of Pranayama on sleep disorders or insomnia across diverse populations.

3.4 Exclusion criteria

The current systematic review has excluded certain studies from its analysis. These include studies that have not been published in English, abstracts, conference proceedings, editorials, letters, or any other publications where the full text is not available. Additionally, reviews, meta-analyses, opinion pieces, and other forms of non-original research have been excluded. Studies that do not measure or report outcomes related to sleep quality or insomnia, and studies that do not involve pranayama as an intervention, have also been excluded. Finally, duplicate studies and combined studies have been removed from the review.

3.5 Data extraction

The included studies were thoroughly evaluated based on the predetermined criteria. The extracted information from the records consisted of the author and year of publication, variables, research method, apparatus/tools, results, and conclusion. The independent and dependent variables, sample size, groups, and intervention were also recorded. Any uncertainties or questions were resolved through brainstorming and mutual discussion.

4. Results

A total of 4 studies were included in the review [Figure 2.1]. A total of 39 articles were identified through various databases, including Google Scholar (14), and PubMed (25). Out of these, 35 studies were excluded from the review due to various reasons. Two studies were excluded as they were duplicates, two more studies were excluded because they were systematic and meta- analysis, 18 studies were not aligned with the study’s focus, 7 studies combined multiple interventions or topics, 5 studies were not matching the inclusion criteria, and 1 study was not in the English Language. The Pittsburgh Sleep Quality Index (PSQI) was the most commonly used tool for evaluating sleep quality, whereas the Bhr.P intervention, a breathing exercise demonstrated through Zoom, was

also used. Emotional state and stress level were evaluated using the DASS-21 and the Perceived Stress Scale (PSS), respectively. Quality of life was assessed using the

WHOQOL-BREF, and health and sleep were evaluated through the Patient Health Assessment Questionnaire and Sleep Quality Questionnaire.
Statistical analysis was performed using the SPSS software version 25.0 and GraphPad Prism Software. In addition, the Pranayama technique from the Trishikhabrahmana Upanishad was also utilized. The sample size of the studies ranged from 30 to 60.

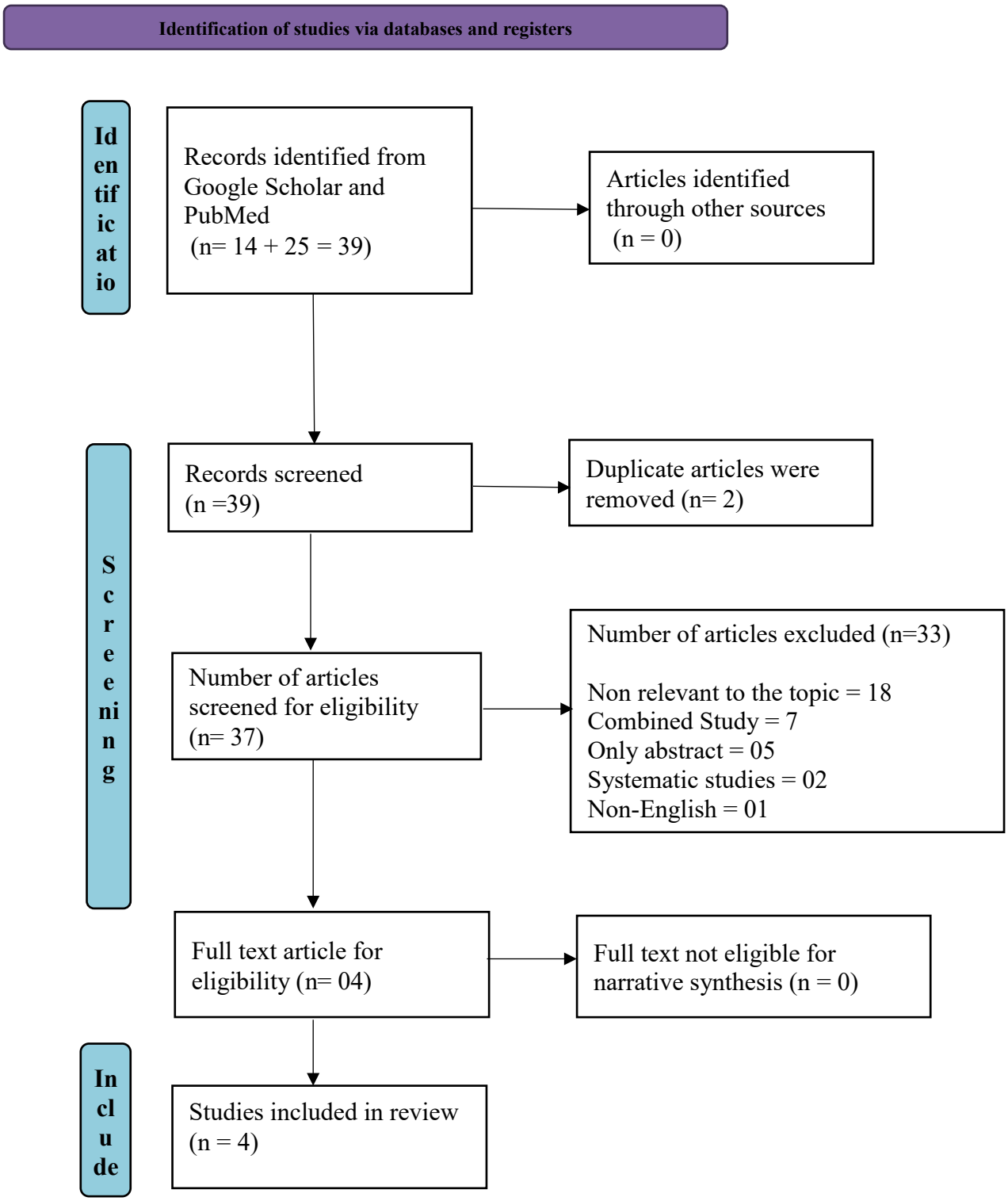

Table 1: Table showing the article included for the review

S. No.	Author (Year)	Variables		Research Method			Apparatus/Tools	Result	Conclusion
		Independent Variables	Dependent variables	Sample Size	Design	Intervention			
1	Tyagi et al. (2023)	Pranayama	Sleep quality, sleep latency, sleep duration.	30 People	Randomized Controlled Trial	30 days	Pranayama technique from Trishikhbrahmana Upanishad. Pittsburgh Sleep Quality Index (PSQI) for sleep quality assessment. GraphPad Instat Software for statistical analysis.	Significant improvement in post-global PSQI score in the study group, sleep quality increased. No significant change in pre- and postglobal PSQI scores in the control group.	The pranayama technique improves sleep quality in adults. Larger sample size studies may further support the textual claim.
2	Gündogdu & Koçaşlı (2021)	Pranayama & deep breathing	Fatigue, Insomnia	60 patients	Randomized Controlled Trial	5 times a week for 6 weeks	Descriptive characteristics questionnaire, Fatigue Visual Analog Scale (VAS) Score, Piper Fatigue Scale (PFS), Insomnia Visual Analog Scale (VAS), Pittsburgh Sleep Quality Index (PSQI).	The fatigue VAS score increased in the control group, with different deep breathing exercises (pranayama and deep breathing techniques) have been effective in decreasing fatigue and enhancing sleep quality.	pranayama and deep Breathing exercises were found to be effective in reducing fatigue and insomnia
3	Kumar, Abhishek & Venkatesh (2021)	Bhramari Pranayama.	Sleep quality, Perceived stress levels	60 subjects	Experiment Study	6 weeks	Pittsburgh Sleep Quality Index (PSQI), Perceived Stress Scale (PSS), Statistical analysis using SPSS software version 25.0.	Bhramari Pranayama practice significantly improves sleep quality and reduces perceived stress. Post-practice, there was a significant reduction in perceived stress levels.	Bhramari Pranayama substantially improves sleep quality and reduces perceived stress. The practice of Bhramari Pranayama is an effective way to reduce stress.
4	Jagadeesan et al. (2022)	Bhramari Pranayama	Depression, anxiety, and stress.	42 patients	Quasi-Experimental study	15 days ago	DASS – 21, PSQI, WHOQOL-BREF.	Bhramari pranayama reduced depression, anxiety, stress significantly. Patients showed improved quality of life and sleep.	Bhramari pranayama intervention positively impacted psychological health and sleep quality.

5. CONCLUSION

The research examined the impact of Pranayama, a breathing exercise, on sleep quality and insomnia. It found that regular practice of Pranayama techniques, including *Nadi Shodhan and Bhramari,* improved sleep initiation, maintenance, and efficiency. Breast cancer patients undergoing radiotherapy experienced decreased insomnia scores and fatigue after practicing Pranayama and deep breathing exercises. Another technique from the *Trishikhbrahmana Upanishad* significantly improved sleep quality among adults. School students practicing Bhramari Pranayama for six weeks reported improved sleep quality and reduced stress levels, consistent across different demographic groups. Bhramari Pranayama also reduced depression, anxiety, and stress scores among COVID-19 patients in home isolation, improving their overall quality of life and sleep quality. However, these findings need further validation through robust studies. Pranayama, by calming the mind and relaxing the nervous system, can enhance sleep and well-being. It is recommended for daily practice. In conclusion, Pranayama appears promising for improving sleep quality and managing insomnia, but further research is needed to explore its potential as a therapeutic tool for sleep disorders.

6. Limitations of the work

The study faced certain limitations due to the differences in intervention protocols, outcome measures, and participant characteristics across the studies analyzed. Furthermore, small sample sizes and the lack of long-term follow-up data in some studies made it difficult to assess the sustained effects of pranayama interventions on sleep outcomes. Most studies relied on self-reported measures of sleep quality and psychological well-being, which may be biased. Future research should prioritize larger, well-controlled studies with objective measures of sleep quality and longer follow-up periods to draw more reliable conclusions about the efficacy and safety of pranayama interventions. To address the gaps in the current literature, larger-scale, multi-center randomized controlled trials (RCTs) are needed to validate the findings of existing studies and to provide more information about the long-term effects of pranayama interventions on sleep outcomes. It is important to note that the findings of this study cannot be generalized to all COVID-19 patients as this was a single-center study with a small sample size. Further multicenter clinical trials are needed to confirm our results.

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