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A Decade of Global Research on Traditional Indian Medicine and Sleep Disorders (2016–2025): A Bibliometric and Thematic Evolution Analysis

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Abstract
Sleep disorders are an increasing global public health concern, negatively impacting mental health, productivity, and quality of life. In parallel, Traditional Indian Medicine (TIM)—including yoga, Ayurveda, and meditation—is gaining attention as a holistic, non-pharmacological alternative to improve sleep health and psychological well-being. This study presents the first comprehensive bibliometric analysis of global research exploring the intersection of TIM and sleep disorders from 2016 to 2025. It maps intellectual trends, thematic clusters, and research evolution in the field. A total of 1,225 records were retrieved from the Web of Science Core Collection, with 885 meeting inclusion criteria. VOSviewer and Biblioshiny were used for co-occurrence analysis and thematic mapping. Keyword development was supported by OpenAI's ChatGPT (GPT-4) to enhance conceptual coverage during search formulation. Eleven thematic clusters were identified, including mindfulness, cognitive aging, trauma-informed interventions, and youth sleep health. Thematic evolution showed a progression from general wellness practices to focused clinical applications by 2024–2025.The study reveals a maturing interdisciplinary research field, with increasing global recognition of TIM's relevance in sleep science. This bibliometric overview provides a conceptual roadmap for future integrative health research and policy development.

Keywords: *Traditional Indian Medicine, Ayurveda, Yoga, Sleep Disorders, Sleep Health, Bibliometric Analysis, VOSviewer, Integrative Medicine, Thematic Evolution, Mind-Body Interventions*

INTRODUCTION

In the fast-paced world of today, sleep disorders have become an under-recognized but prevalent health issue, affecting the lives of people in every age group and region of the world. While traditional therapies—largely pharmacological and behavioral—are still the mainstay, there has been increasing scientific and clinical interest in Traditional Indian Medicine (TIM) systems like yoga, Ayurveda, and meditation. These systems focus on holistic equilibrium, body-mind unification, and natural treatments, and therefore hold potential as complementary treatments for sleep disorders. Against this increasing worldwide interest, the present work has the objective of rigorously mapping and assessing a decade of research into the intersection between traditional Indian medicine and sleep disorders using a bibliometric analysis from 2016 to 2025.

Traditional Indian medicine is a multi-faceted array of older healing systems—such as yoga, Ayurveda, meditation, and prāṇāyāma (breath control)—all created to balance body, mind, and spirit for wellness (Telles et al., 2012). Yoga, an internationally accepted discipline, combines physical postures (āsanas), breathing control, and meditative concentration to achieve physiological relaxation and mental sharpness (Woodyard, 2011). Similarly India's traditional system of natural medicine, Ayurveda, recommends individualized lifestyle schedules—comprising herbal medication, dietary modifications, and daily habits (dinacharya)—to reestablish inner equilibrium (dosha) and control over sleeping (Sharma, 2013).

Sleep disorders are usually distinguished by disturbances in sleep amount, quality, or timing, which severely complicate everyday functioning and well-being. According to the DSM-5-TR, insomnia disorder is the most common, characterized by initiation or maintenance of sleep problems for a minimum of three nights a week during a three-month span, in the absence of an opportunity to sleep (American Psychiatric Association [APA], 2022). Other clinically identified sleep-wake disorders are hypersomnolence, narcolepsy, parasomnias, and sleep-related breathing disorders, including obstructive sleep apnea (APA, 2022). The ICD-11 also places these within "Sleep-Wake Disorders," paralleling DSM diagnostic criteria (World Health Organization [WHO], 2022).

Indian traditional approaches and sleep health converge in their common focus on stress management, circadian entrainment, and autonomic nervous system modulation (Manjunath & Telles, 2005). Studies have shown that yogic and meditative exercises are able to downregulate the hypothalamic-pituitary-adrenal (HPA) axis, increase parasympathetic activity, and enhance sleep latency and continuity (Khalsa, 2004; Cui et al., 2021). Adaptogenic herbs such as Ashwagandha (Withania somnifera) in Ayurveda have been shown to exhibit sedative and anxiolytic effects and thus hold potential for the management of insomnia and associated symptoms (Langade et al., 2019).

An increasing number of systematic reviews and clinical trials emphasize the efficiency of single traditional Indian interventions. For example, Wang et al. (2020) established that mindfulness-based therapies significantly improve sleep efficiency and decrease insomnia severity. Similarly, Chen et al. (2020) reaffirmed that yoga-based interventions are effective adjuncts in the treatment of chronic insomnia.

In the face of this growing body of evidence, no bibliometric review has so far charted the wider research landscape of traditional Indian medicine on sleep disorders. Reviews that do exist focus on a specific outcome or intervention without analyzing intellectual structure, thematic development, or collaborative networks in the area. This lack of systematic, evidence-based overview hinders scholars and clinicians from having a proper understanding of how this cross-disciplinary field of study is evolving.

To address this critical gap, the present study conducts a decade-long bibliometric analysis (2016–2025) using data retrieved from the Web of Science Core Collection. Employing Bibliometrix (R package), Biblioshiny, and VOSviewer, this research analyzes author keywords, co-occurrence networks, and thematic clusters to reveal dominant research trends, key contributors, and underexplored topics. By mapping the evolution of traditional Indian approaches in sleep research, the study aims to support future scholarly inquiry, guide integrative health policy, and promote the incorporation of evidence-based holistic practices in sleep medicine.

2. METHODS AND RESEARCH DESIGN

2.1. Data Sources and Document Collection

Data for the bibliometric analysis were taken exclusively from the Web of Science Core Collection. Intraday searching on 15 May 2025 was undertaken using an advance topic search query constructed to collect research on traditional Indian medicine and the interlinking of sleep disorders. The search equation included combinations of keywords such as

("(Traditional Indian Medicine" OR "Ayurveda" OR "Panchakarma" OR "Doshas" OR "Yoga" OR "Meditation" OR "Holistic Healing" OR "Mind-Body Connection" OR "Natural Therapies" OR "Integrative Medicine" OR "Spirituality in Healing")

AND

("Sleep Disorders" OR Insomnia OR "Sleep Apnea" OR "Restless Legs Syndrome" OR Narcolepsy OR "Circadian Rhythm Disorders" OR "Sleep Hygiene" OR "Sleep Deprivation" OR "Sleep Quality" OR "Sleep and Mental Health" OR "Cognitive Behavioral Therapy for Insomnia" OR "Pharmacological Interventions" OR Melatonin)

The time frame was limited from 1 January 2016 to 1 May 2025, and document type (articles, review articles, early access, proceedings papers, and book chapters) and language (English language only) were used as filters.A total of 1,225 records were initially identified. Irrelevant types of documents (e.g., editorials, meeting abstracts, news items, corrections, and expressions of concern) were removed from the search, leaving the 885 final dataset of eligible documents. All records and their cited references were then exported in CSV and plain text formats in order to ensure compatibility with bibliometric analysis using any software. These datasets were the basis for the following mapping and network analyses (see Fig. 1).

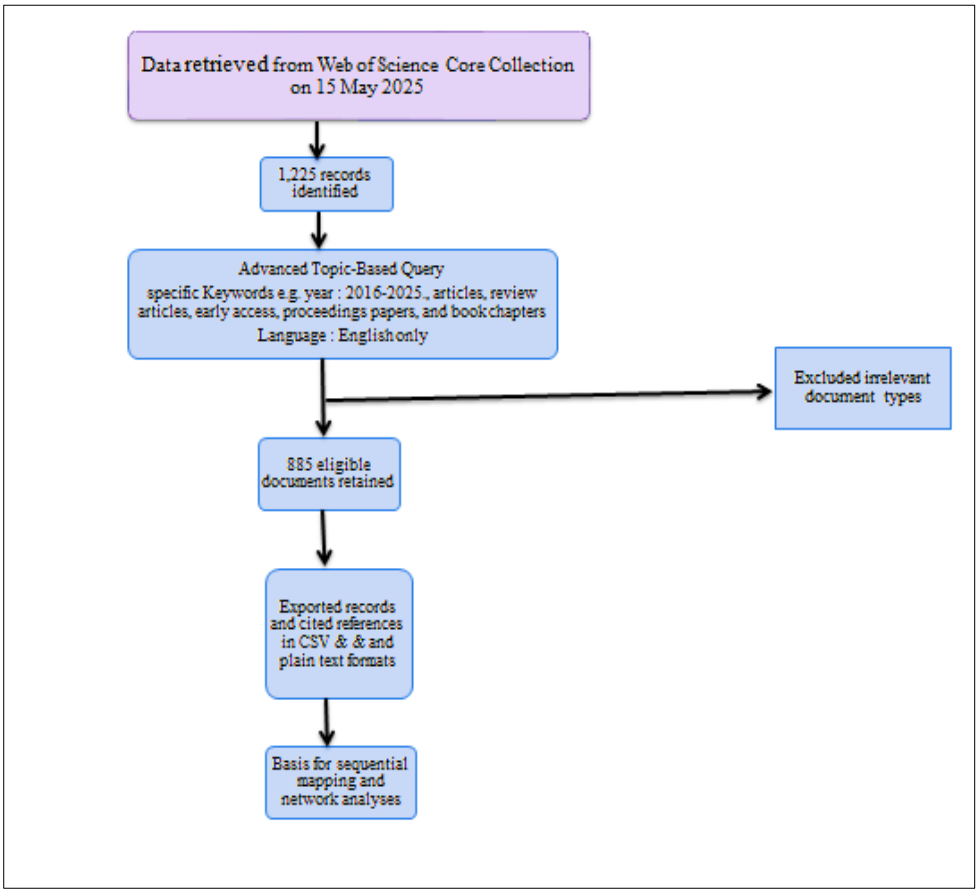

Figure 1. Research flow of literature selection

2.2. Bibliometric Software and Data Analysis

All bibliometric information were obtained from the Web of Science Core Collection and processed with VOSviewer (v1.6.20), Microsoft Excel, and Biblioshiny. VOSviewer allowed for the production of co-occurrence maps based on author keywords, using full counting with a threshold of 3–4 occurrences. Data pre-processing involved cleaning data by stripping away redundant terms and normalizing author and institutional labels. Manual tweaking of cluster numbers (10–15) was used to improve thematic separation. Microsoft Excel was employed to categorize and sort manually co-occurring keywords into more general thematic themes depending on their frequency, salience, and conceptual proximity.

In addition to manual screening and software-based clustering, OpenAI's ChatGPT (version 4, accessed via ChatGPT platform) was used to assist in the generation and refinement of keyword lists during the initial search query development stage. The tool supported exploratory brainstorming for synonyms, alternate terminologies, and keyword groupings relevant to traditional Indian medicine and sleep disorders. All final keywords were reviewed and validated by the authors for conceptual accuracy and alignment with the study objective.

3. RESULTS

3.1. Thematic Cluster Analysis Based on Keyword Co-occurrence (Vosviewer)

The keyword co-occurrence analysis of the author yielded eleven distinct thematic clusters covering a specific focus area in the general topic of traditional Indian medicine and sleep health.

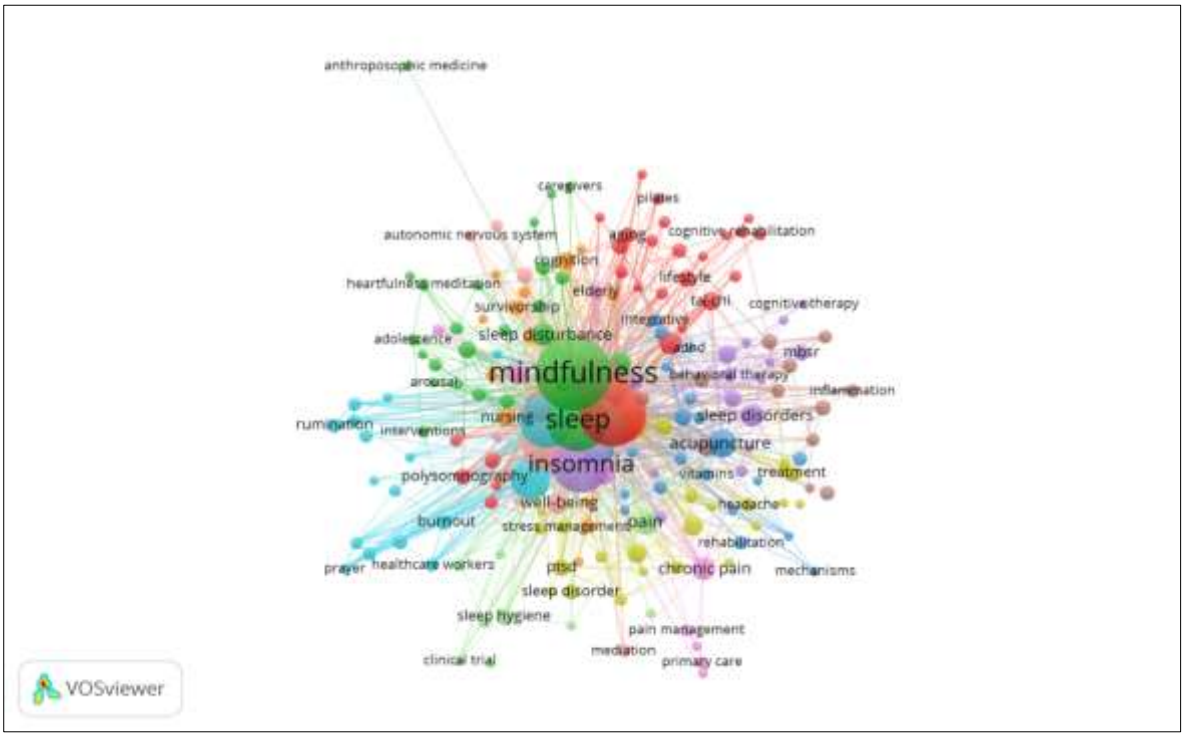

Figure 2. Overlay visualization map of co-occurrence analysis keywords. The network depicts co-occurrence between author keywords as identified by Vosviewer. The size of nodes represents keyword frequency, colour represents clusters formed and line thickness represents the strength of co-occurrence link between keywords. The major clusters are "mindfulness", "sleep", and "insomnia", which indicate the research focus areas in the subject

1. Cluster 1 is primarily concerned with cognitive impairment and non-pharmacological interventions in geriatrics. Cluster 1 includes aging studies, dementia, mild cognitive impairment (MCI), cognitive impairment due to cancer, and associated problems such as fatigue, obesity, and oxidative stress. Non-pharmacological interventions like yoga, pranayama, and tai chi emerge as interventions that serve to increase cognitive and physical strength in the elderly.

2. Cluster 2 concerns the integration and use of complementary medicine for behavioral health and revolves around themes of mind-body practices, meditation, and holistic healing approaches to treat mental health disorders.

3. Cluster 3 encompasses chronic stress, trauma, and pain disorders with common keywords like PTSD, chronic pain, anxiety, and autonomic dysregulation, underlining the therapeutic importance of traditional modalities in trauma-informed care.

4.Cluster 4 deals with sleep disorders and cognitive-behavioral therapies, presenting words like insomnia, sleep quality, CBT-I (Cognitive Behavioral Therapy for Insomnia), and sleep hygiene, demonstrating a meeting of the points between contemporary behavioral science and traditional Indian well-being practices.

5.Cluster 5 talks about emotional exhaustion of healthcare professionals, shedding light on burnout, compassion fatigue, and stress-reduction strategies at work—a post-pandemic concern on the rise.

6.Cluster 6 contains a broader theme of survivorship and health promotion across the life course, with preventive care keywords, resilience, quality of life, and recovery after treatment, with special focus on chronic illness.

7.Cluster 7 refers to depression, aging, and inflammatory processes, reflecting interdisciplinary interest in psychoneuroimmunology and the effects of interventions like Ayurveda and meditation on systemic inflammation and mood in old age.

8. Cluster 8 addresses menopausal and aging pain management, with keyword terms including joint pain, hormonal balance, menopausal symptoms, and natural therapies, and indicating gendered solutions to conventional healing.

	Keywords	Number of Keywords	Focus	Broad Themes
Cluster 1	aging, attention, biomarker, cancer survivors, cancer-related cognitive impairment, cognitive function, cognitive rehabilitation, dementia, fatigue, lifestyle, mild cognitive impairment, non-pharmacological intervention, nonpharmacological interventions, obesity, oxidative stress, pilates, polysomnography, postmenopausal women, pranayama, prevention, psychological health, qigong, supportive care, symptom management, tai chi, traditional chinese exercise, traumatic brain injury, yoga	28	**Cognitive Decline & Non-Pharmacological Aging Interventions**	Aging, dementia, MCI, cancer-related cognitive impairment, fatigue, obesity, oxidative stress, non-pharmacological therapies (yoga, tai chi, pranayama, etc.)
Cluster 2	actigraphy, adolescence, alzheimer's disease, anthroposophic medicine, arousal, caregivers, cognitive behavioral therapy for insomnia, cyclic vomiting, flexibility, health, heartfulness meditation, hyperarousal, intervention, interventions, mind-body, mind-body therapy, mindfulness, mindfulness-based intervention, mood, perceived stress, pre-sleep arousal, relaxation, sleep, sleep disturbance, sleep problems, wellbeing	26	**Sleep Health, Stress, and Mindfulness**	Sleep problems (insomnia, arousal), adolescence, caregivers, perceived stress, mind-body therapies (CBT-I, mindfulness, relaxation, heartfulness meditation)
Cluster 3	acupuncture, adhd, aromatherapy, cognitive behavioural therapy, complementary, diet, dietary supplements, integrative, mechanisms, mind-body medicine, mood disorders, neurofeedback, nutrition, physical activity, polycystic ovary syndrome, reflexology, rehabilitation, stress reduction, supplements, telehealth, traditional chinese medicine, vitamins	22	**Integrative & Complementary Medicine for Behavioral Health**	Complementary therapies (acupuncture, aromatherapy), ADHD, mood disorders, diet, nutrition, supplements, telehealth, neurofeedback
Cluster 4	aerobic exercise, behavioral, chronic, complementary therapies, headache, mantra, migraine, mind-body therapies, nightmares, older people, posttraumatic stress disorder, ptsd, public health, restless legs syndrome, sleep	22	**Chronic Stress, Pain, and Trauma-Related Disorders**	PTSD, migraine, headache, tinnitus, nightmares, spirituality, stress management, public health, older adults,

	disorder, spirituality, stress management, systematic reviews, therapy, tinnitus, treatment, veterans			veterans, mind-body therapies
Cluster 5	anxiety, behavioral therapy, circadian rhythm, cognitive behavioral therapy, cognitive therapy, excessive daytime sleepiness, fibromyalgia, fibromyalgia syndrome, insomnia, mbsr, mindfulness meditation, narcolepsy, obstructive sleep apnea, psychotherapy, sleep disorders, sleep initiation and maintenance disorders, yoga nidra	17	**Sleep Disorders & Cognitive-Behavioral Therapies**	Insomnia, sleep apnea, narcolepsy, fibromyalgia, anxiety, circadian rhythm, CBT, psychotherapy, MBSR, yoga nidra
Cluster 6	behavioral intervention, burnout, cognitive arousal, compassion fatigue, emotion regulation, healthcare workers, insomnia severity index, loneliness, meditation, mental health, nurses, occupational health, postpartum, prayer, rct, rumination, worry	17	**Emotional Exhaustion in Healthcare Professionals**	Burnout, compassion fatigue, insomnia severity, emotion regulation, healthcare workers, nurses, rumination, meditation, prayer, RCTs
Cluster 7	adults, cognition, exercise, health promotion, mind-body interventions, nursing, patient-reported outcomes, pediatric cancer, physical fitness, psqi, psychoeducation, quality of life, sleep disturbances, survivorship, symptoms, wellness	16	**Health Promotion & Survivorship Across the Lifespan**	Survivorship (adult and pediatric), quality of life, physical fitness, mind-body interventions, sleep disturbances, wellness, nursing, psychoeducation
Cluster 8	aged, cbt, cortisol, depression, depressive symptoms, herbal medicine, inflammation, melatonin, mindfulness-based stress reduction, non-pharmacological, parkinson's disease, physical exercise, trauma	13	**Depression, Aging & Inflammation**	Depression, trauma, Parkinson's, aged population, inflammation, cortisol, melatonin, herbal medicine, MBSR, physical exercise
Cluster 9	back pain, chronic pain, elderly, menopause, mind-body exercise, older adults, pain management, primary care, quality of sleep, sleep medicine, vasomotor symptoms	11	**Pain Management in Aging and Menopausal Health**	Chronic/back pain, menopause, elderly, mind-body exercise, vasomotor symptoms, pain management, sleep quality, primary care, older adults
Cluster 10	adaptation, autonomic nervous system, heart rate variability, hypertension, mediation,	10	**Psychophysiological Resilience & Adaptation**	Stress, resilience, adaptation, heart rate variability,

	psychological, psychology, resilience, stress, well-being			autonomic nervous system, psychological well-being, hypertension, mediation
Cluster 11	children, clinical trial, college students, laughter yoga, life satisfaction, pain, psychological distress, sleep health, sleep hygiene, sleep quality	10	**Psychological Well-being and Health Interventions**	Children, Clinical Trial, College Students, Laughter Yoga, Life Satisfaction, Pain, Psychological Distress, Sleep Health, Sleep Hygiene, Sleep Quality

Table 1: **Identified thematic clusters.** Each cluster represents a distinct research theme derived from co-occurrence of author keywords, highlighting focus areas and broader thematic orientations.

9. Cluster 9 is concerned with psychophysiological adaptation and resilience, with such constructs as coping, neuroplasticity, and homeostasis, usually in mindfulness or yoga-based interventions.

10. Cluster 10 integrates concepts of integrative health and psychological well-being an intervention, with a focus on constructs of wellness, self-regulation, emotional balance, and holistic self-care.

11. Cluster 11 involves research in the area of psychological health and intervention with a health-focused perspective, with specific concern towards youth populations such as children and university students. The cluster captures the increasing focus on lifestyle and non-pharmacological intervention—laughter yoga, life satisfaction intervention, and sleep behavioral intervention

Together, these clusters form a dynamic, cross-disciplinary research setting across classical Indian medicine and contemporary sleep science, mental illness, and aging-related therapy, and reflect the growing integration of evidence-based non-pharmacological treatments into global health paradigms.

3.2. Thematic Map and Conceptual Structure (Biblioshiny)

In an attempt to visualize the map of research on sleep disorders and traditional Indian medicine, a thematic map was drawn based on Biblioshiny's co-occurrence of author keywords feature. This method of mapping is based on Callon's centrality and density measures and provides a two-dimensional space in which to measure the relevance (centrality) and advancement (density) of research areas in the topic.

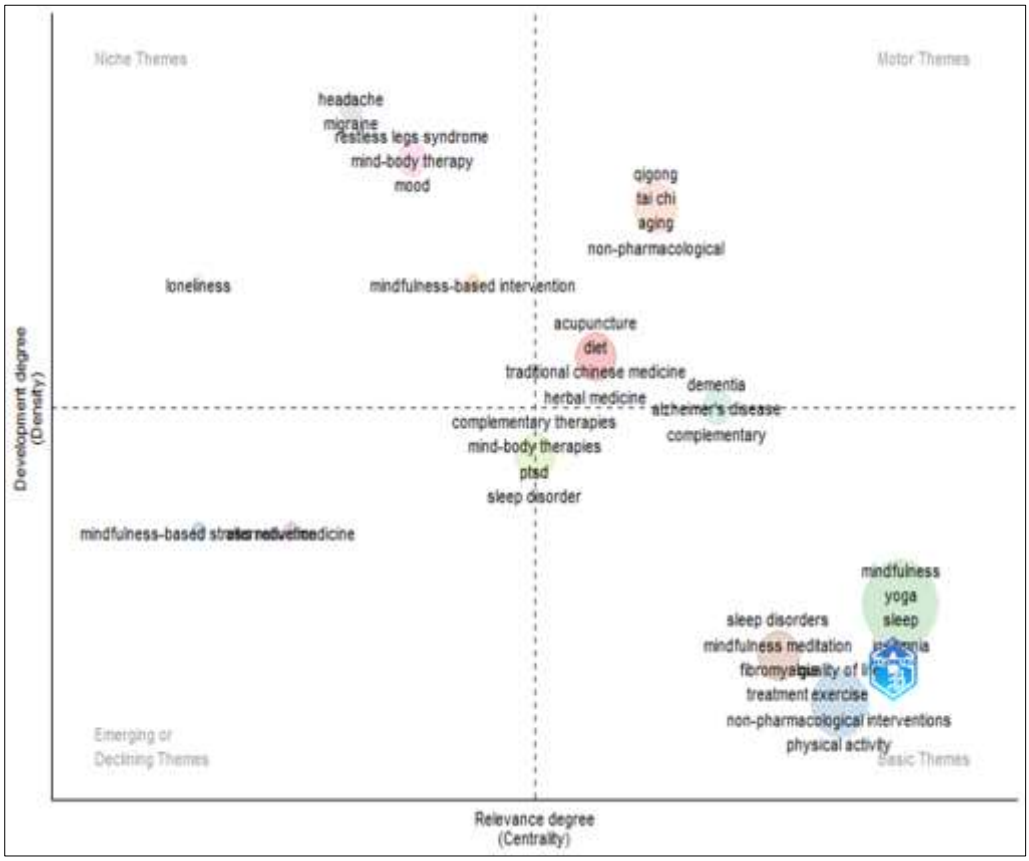

Figure 3: Thematic Map of Author Keywords Related to Traditional Indian Medicine and Sleep Disorders (2016–2025) The thematic map illustrates four quadrants according to Callon's centrality (x-axis) and density (y-axis), representing the abstract field structure. Motor themes (upper-right) are well developed and central themes; basic themes (lower-right) are central but weakly developed; niche themes (upper-left) are well developed but peripheral; and emerging or declining themes (lower-left) are weakly developed and marginal in use. The size of the clusters illustrates the number of co-occurring keywords, and colors indicate different thematic areas.

1. **Motor Themes (Upper-Right Quadrant) :** Motor themes are dense and central, meaning that they are well established and highly interlinked to the broader research area. They are the field's central motivational themes. The most prominent motor themes in this study are acupuncture, diet, traditional Chinese medicine, herbal medicine, qigong, tai chi, aging, and non-pharmacological intervention.
2. **2. Basic Themes (Lower-Right Quadrant) :** Basic themes are highly central but low-density, i.e., highly applicable but weakly elaborated. Basic themes are constitutive building blocks of the field of study but need to be strengthened and theoretically integrated. Basic themes that were found to be central were mindfulness, yoga, sleep, sleep disorders, mindfulness meditation, fibromyalgia, quality of life, treatment, exercise, non-pharmacological interventions, and physical activity.
3. **3. Rising or Falling Themes (Lower-Left Quadrant) :** Low centrality and low density are both features of themes here, referring either to emerging research areas or topics losing research steam. MBSR and integrative medicine were positioned here in this research.
4. **Niche Themes (Upper-Left Quadrant) :** Niche themes are highly central but of low density, meaning that while they are precisely defined and are coherent within themselves, they are isolated from mainstream discourse. Niche domains that have been identified include headache, migraine, restless legs syndrome, mind-body therapy, mood, and loneliness.

3.3 Time period emerging/ dominant themes

The evolution of themes analysis was done using the Conceptual Structure → Thematic Evolution tool in Biblioshiny based on author keywords in the time ranges given. Through the analysis, the emergence, evolution, and consolidation of themes in the scientific literature on traditional Indian medicine and sleep disorders between 2016–2025 were followed.

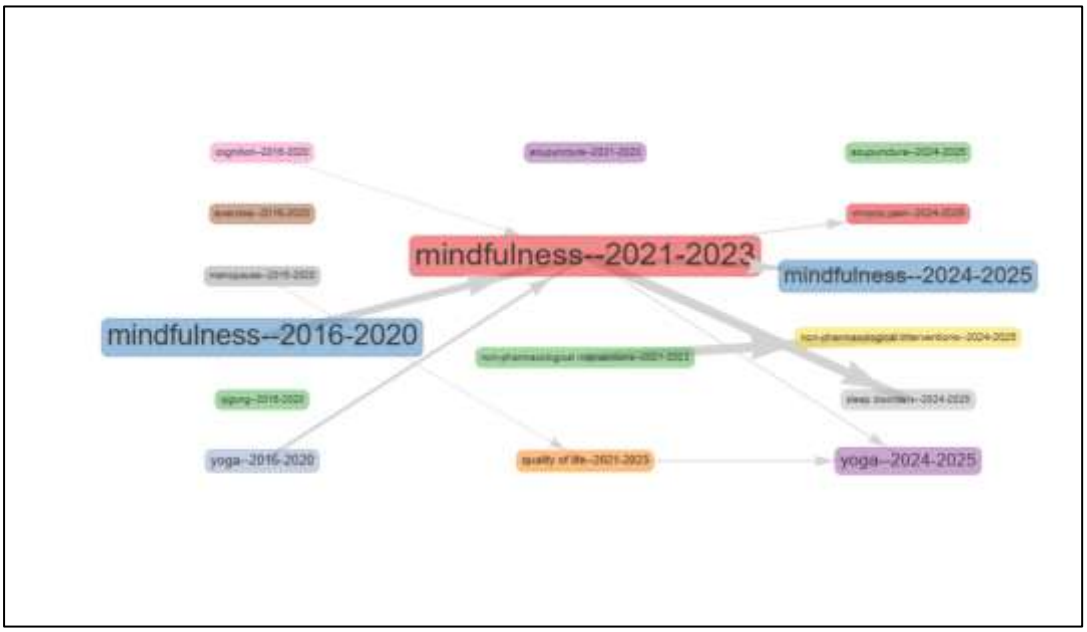

Figure 4 Thematic evolution of research themes from 2016 to 2025 based on author keywords.
Evolution of thematic research themes between 2016 and 2025 based on author keywords. The map shows the progression of core and emerging themes in three time periods, from foundational practices of mindfulness and yoga to specialist themes of sleep disorders, chronic pain, and integrative interventions.
In the first phase of 2016–2020, the area was characterized by the introduction of core themes like mindfulness, yoga, qigong, exercise, cognition, and menopause. These themes indicated an exploratory phase in which the focus was on determining the therapeutic significance of traditional mind-body disciplines and their possible implications for cognitive function and women's health.
In the second phase (2021–2023), these novel subjects developed into more core and diversified research areas, such as acupuncture, non-pharmacological treatments, quality of life, and sleep disturbance. The thematic domain was broadened to incorporate the general management of sleep disorders and mental health with integrative health interventions.
By 2024–2025, the discipline had become more clinically focused and specialized. Topics like mindfulness, yoga, chronic pain, insomnia, sleep disorders, and non-pharmacological treatment became popular. Outcomes based on evidence were the research emphasis during this time, with effectiveness of these ancient methods in the management of fatigue, mental health symptoms, and well-being. This reflects a shift from interest per se to applied, outcome-based investigation on the application of traditional Indian practice in integrative healthcare.
This development is a reflection of the maturation of the discipline in that early exploratory research has been followed by more clinically oriented research in keeping with patient-centred, non-pharmacological, and complementary styles of therapy

4. DISCUSSION

This article demonstrates a holistic bibliometric overview of worldwide research on the intersection of Traditional Indian Medicine (TIM) and sleep disorders over a decade (2016–2025). Employing co-occurrence analysis through VOSviewer and conceptual mapping using Biblioshiny, the article determines significant research themes, their conceptual relationships, and temporal development.
Eleven thematic clusters were found in total, including categories like mindfulness, cognitive aging, recovery from trauma, integrative therapies, and youth mental health. These clusters indicate the multi-faceted character of TIM-based research ongoing today and its applicability to lifespan and clinical

settings. Especially significant is the shift from general wellness techniques to specialized, evidence-supported interventions like yoga nidra, cognitive behavioral therapy for insomnia (CBT-I), and Ayurvedic treatments, demonstrating an increasing scientific intensity in the field.

The thematic map showed mature "motor themes" such as acupuncture and non-pharmacological treatments to be both central and advanced, while base but underdeveloped "basic themes" such as mindfulness, exercise, and yoga indicate potential for additional empirical reinforcement. Niche domains like headache and migraine therapy, and up-and-coming subjects such as mindfulness-based stress reduction (MBSR) present potential for cross-disciplinary investigation.

The temporal analysis also brought to light the progression of the field: the initial period (2016–2020) was exploratory, emphasizing core wellness principles, whereas the subsequent period (2024–2025) placed greater emphasis on clinical verification, symptom-specific interventions, and population-level applications such as for healthcare professionals and youth.

This trend reflects increasing maturity of the field from theory-driven interest in conventional healing to outcome-based studies grounded in integrative medicine. Furthermore, the growing prominence of clinical trial language, cognition impairment, and emotion regulation in recent clusters suggests increasing concordance with biomedical research and psychological health frameworks

5. CONCLUSION

This research is the first to perform a ten-year bibliometric and thematic development analysis of the convergence of Traditional Indian Medicine and sleep disorders. Synthesizing results from 885 valid publications with the help of VOSviewer and Biblioshiny, this work determined major thematic clusters, concept structures, and temporal changes in the evolution of the field.

The findings indicate a progressively maturing evidence base, whereby time-honored healing practices like yoga, Ayurveda, pranayama, and meditation are increasingly researched using rigorous, cross-disciplinary methodologies. The rise of clinically relevant themes—e.g., insomnia, chronic pain, and emotional burnout—indicates the increased incorporation of TIM into international health paradigms and mental health policy agendas.

This bibliometric review not only charting present intellectual trends, but also provides a basis for informing future research, promoting evidence-based interventions, and informing public health policies directed towards non-pharmacological sleep treatments. Additional multi-database analysis, incorporation of citation mapping, and broadening to practitioner views could enhance depth of understanding and translational influence.

Use of AI Tools

OpenAI's ChatGPT (GPT-4, accessed via the ChatGPT platform) was used solely during the development of the literature search strategy to refine and expand author keyword combinations. It assisted in brainstorming synonyms and thematic terminology. The AI was not used for data analysis, interpretation, or manuscript writing. All final content was independently developed and reviewed by the authors.

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