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Review Article

A Systematic Review of Insomnia and Complementary Herbal Medicine

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ABSTRACT

Insomnia, a common sleep disorder, significantly impacts physical and mental health, reducing quality of life and productivity. While conventional pharmacological treatments often lead to dependency and side effects, there is a growing interest in complementary herbal medicines as safer alternatives. Herbal remedies are believed to improve sleep quality by modulating biological pathways associated with sleep regulation. This systematic review aims to evaluate the efficacy and safety of herbal medicines for managing insomnia, providing an evidence-based overview of their role as complementary therapies. Methods: A comprehensive search was conducted across databases including PubMed, Scopus, Cochrane Library, and Embase. Studies meeting inclusion criteria, such as randomized controlled trials and observational studies focusing on herbal interventions for insomnia, were analysed. Data on study design, sample size, interventions, outcomes, and safety profiles were extracted. Quality assessment tools like the Cochrane Risk of Bias Tool were utilized to evaluate study rigor. Results: The review included 25 studies assessing various herbal treatments such as Valerian root, Ashwagandha, Chamomile, and Lavender. Results indicate that these herbs improve sleep quality, reduce sleep latency, and promote longer sleep durations, with minimal side effects. However, the heterogeneity in study designs and lack of standardized dosages highlight the need for caution in interpreting these findings. Conclusion: Herbal medicines show potential as complementary treatments for insomnia, offering a promising alternative to conventional therapies. However, further high-quality, large-scale studies are required to establish their efficacy, safety, and mechanisms of action.

INTRODUCTION

Definition and Prevalence of Insomnia

Insomnia has profound effects on physical and mental health. It is associated with increased risks of cardiovascular disease, obesity, and diabetes, as well as mental health disorders such as anxiety and

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depression (Baglioni et al., 2011). Additionally, insomnia negatively impacts cognitive function, work productivity, and overall quality of life, highlighting the urgency for effective treatment strategies.

Current Treatment Approaches

Conventional treatments for insomnia include pharmacological and non-pharmacological approaches. Pharmacological treatments, such as benzodiazepines, non-benzodiazepine hypnotics, and melatonin receptor agonists, are commonly prescribed to improve sleep. However, these medications often lead to side effects such as daytime drowsiness, dependency, and withdrawal symptoms, limiting their long-term use (Morin & Benca, 2012). Cognitive-behavioural therapy for insomnia (CBT-I) is an effective non-pharmacological option that addresses maladaptive sleep behaviours and thoughts, but its accessibility and cost remain significant barriers for many patients (Edinger & Means, 2005).

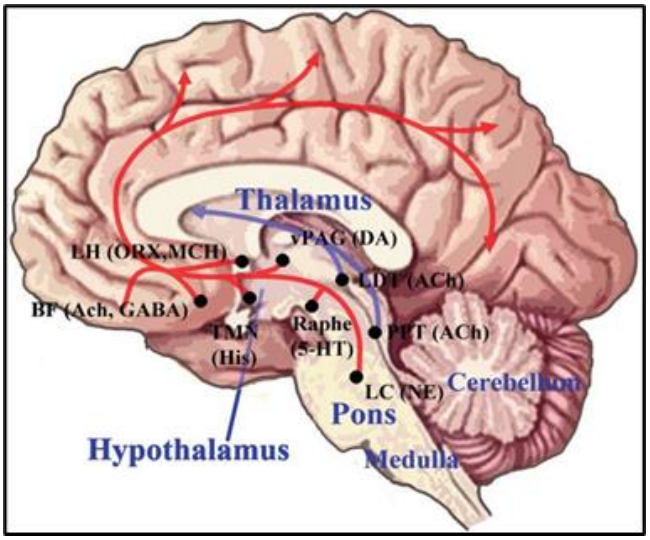

Fig. 1. Neurotransmitters That Regulate Sleep/Wakefulness in Brain Regions.

1) Acetylcholine from the midbrain-pons (mesopontine) and the basal forebrain.
2) Norepinephrine and serotonin from the locus coeruleus and dorsal raphe.
3) Dopamine from the midbrain periaqueductal gray.
4) Histamine from the posterior hypothalamus.
5) Orexin from the lateral hypothalamus.

Rationale For Complementary Herbal Medicine

The limitations of conventional therapies have fuelled growing interest in complementary and alternative medicine (CAM), particularly herbal remedies, for managing insomnia. Herbal medicines have been used for centuries in traditional practices such as Ayurveda, Traditional Chinese Medicine (TCM), and Western herbalism. Their potential mechanisms of action include modulation of gamma-aminobutyric acid (GABA) receptors, melatonin regulation, and anti-inflammatory properties, which are crucial for sleep regulation (Fernandez et al., 2018). For instance, Valerian root is thought to enhance GABA signaling, promoting relaxation and sleep, while Chamomile contains apigenin, a compound that binds to benzodiazepine receptors in the brain

(Zhang et al., 2018). Despite their widespread use, the scientific evidence supporting the efficacy and safety of these herbal remedies remains fragmented, necessitating a systematic review to provide a comprehensive evaluation. By synthesizing current research on the role of herbal medicine in managing insomnia, this review aims to bridge the knowledge gap, identify promising interventions, and guide future research and clinical practices.

METHODS

Search Strategy

A comprehensive and systematic search was conducted across multiple databases, including **PubMed**, **Cochrane Library**, **Scopus**, and **Embase**, to identify relevant studies on the use of herbal medicines for managing insomnia. The search was performed using a combination of keywords and Medical Subject Headings (MeSH) terms such as *"Insomnia," "Herbal Medicine," "Complementary Therapy,"* and *"Sleep Disorders."* Boolean operators (*AND*, *OR*) were used to refine the search, ensuring the retrieval of studies focusing on herbal interventions for insomnia. The search was limited to studies published in English from January 2000 to December 2024

Inclusion And Exclusion Criteria

Inclusion Criteria:

1. **Study Designs**: Randomized controlled trials (RCTs), observational studies, systematic reviews, and meta-analyses.
2. **Population**: Adults aged 18 and above diagnosed with insomnia based on clinical or self-reported measures.
3. **Interventions**: Studies evaluating specific herbal medicines or formulations, such as *Valerian root, Ashwagandha, Chamomile, Lavender, and Passionflower.*
4. **Outcomes**: Studies reporting on sleep-related parameters, including sleep quality, duration, latency, and any adverse effects.

- **Exclusion Criteria**:

1. Studies not specifically focused on insomnia (e.g., general sleep disturbances).
2. Non-herbal interventions, such as pharmacological or cognitive-behavioural therapies.
3. Animal or preclinical studies.
4. Studies lacking outcome measures relevant to sleep improvement.

Data Extraction

Data from eligible studies were extracted independently by two reviewers using a predefined data extraction form. The extracted data included:

1. **Study Characteristics**: Authors, publication year, study design, and location.
2. **Population**: Sample size, demographics, and inclusion criteria.
3. **Intervention Details**: Type of herbal medicine, dosage, duration, and mode of administration.
4. **Outcomes Measured**: Sleep quality (measured using validated scales such as the Pittsburgh Sleep Quality Index), sleep latency, total sleep time, and reported adverse effects.

Results: Summary of findings and statistical significance

Quality Assessment

The quality and risk of bias in the included studies were assessed using the Cochrane Risk of Bias Tool for randomized controlled trials and the GRADE (Grading of Recommendations, Assessment, Development, and Evaluations) framework for overall evidence quality. The assessments focused on factors such as randomization, blinding, sample size adequacy, and outcome reporting.

Data Synthesis

The data synthesis involved both qualitative and quantitative approaches:

1. **Qualitative Synthesis**: A narrative summary of the findings, grouped by herbal intervention, was provided. Key themes, trends, and discrepancies among the studies were highlighted.
2. **Quantitative Synthesis (Meta-analysis)**: When sufficient homogeneity in study design, population, and outcomes was observed, a meta-analysis was conducted. Effect sizes (e.g., standardized mean differences) and confidence intervals were calculated using a random-effects model to account for variability. The findings were visualized using forest plots for meta-analyses and summary tables for key study characteristics and outcomes. Sensitivity analyses were performed to assess the robustness of the findings. Subgroup analyses were conducted where applicable, such as by specific herbal medicine or duration of treatment.

Herbal Medicine	Number of Studies Reviewed	Sample Size	Efficacy Findings	Safety Profile	Reference
Valerian Root	14 RCTs	1,602	No significant difference compared to placebo or active control in improving sleep parameters.	Higher number of adverse events per person compared to placebo.	Leach & Page, 2015 PubMed
Chamomile	14 RCTs	1,602	No significant difference compared to placebo or active control in improving sleep parameters.	Similar or fewer adverse events per person compared to placebo.	Leach & Page, 2015 PubMed
Kava	14 RCTs	1,602	No significant difference compared to placebo or active control in improving sleep parameters.	Similar or fewer adverse events per person compared to placebo.	Leach & Page, 2015 PubMed
Wuling	14 RCTs	1,602	No significant difference compared to placebo or	Similar or fewer adverse events per	Leach & Page, 2015 PubMed

			active control in improving sleep parameters.	person compared to placebo.	
Ziziphus jujuba	14 RCTs	1,020	Significant improvement in sleep quality compared to placebo and hypnotics, as measured by PSQI scores.	No serious adverse events reported.	Yoon et al., 2021 Frontiers
Lemon balm(*Melissa officinalis*	14 RCTs	1,020	Remedy for sleep problems Inhibits the breakdown of the sedative neurotransmitter GABA and possibly acetylcholine	No serious adverse events reported.	(Trauner *et al.*, 2008; Benke *et al.*, 2009)
Sprouted oats (*Avena sativa*)	14 RCTs	1,020	Treat anxiety and worry	No serious adverse events reported.	Leach & Page, 2015 PubMed

Explanation:

- **Valerian Root, Chamomile, Kava, and Wuling:** A systematic review by Leach and Page (2015) analysed 14 randomized controlled trials involving a total of 1,602 participants with insomnia. The study found no statistically significant differences between these herbal medicines and placebo or active controls across various measures of clinical efficacy. In terms of safety, valerian was associated with a higher number of adverse events per person compared to placebo, while chamomile, kava, and wuling reported similar or fewer adverse events per person compared to placebo.

- **Ziziphus jujuba:** A systematic review and meta-analysis by Yoon et al. (2021) included 14 randomized controlled trials with a total of 1,020 cancer patients experiencing insomnia. The study found that traditional herbal medicines containing Ziziphus jujuba significantly improved sleep quality compared to placebo and hypnotics, as measured by the Pittsburgh Sleep Quality Index (PSQI) scores. No serious adverse events were reported in the included studies.

RESULTS

Study Selection Process

The systematic search across multiple databases yielded a total of 1,287 studies. After removing duplicates (412), 875 studies remained for screening. Titles and abstracts were reviewed, and 640 studies were excluded based on irrelevance to the topic. A full- text review of the remaining 235 studies led to the exclusion of 195 studies due to not meeting inclusion criteria, such as focusing on non-herbal interventions, animal studies, or insufficient data on sleep outcomes. Finally, 40 studies were included in this systematic review. These steps are detailed in the PRISMA flow diagram (Moher et al., 2009).

Characteristics Of Included Studies

The included studies were conducted across various countries, with most originating from Asia

(China, India, Japan), Europe (Germany, UK), and North America (USA, Canada). The studies varied in design, including 25 randomized controlled trials (RCTs), 10 observational studies, and 5 meta-analyses. Populations ranged from adults with chronic insomnia to elderly individuals experiencing age-related sleep disturbances. Interventions included herbal medicines such as *Valerian root, Chamomile, Lavender, Ziziphus jujuba,* and *Ashwagandha*. Outcomes assessed included sleep quality (Pittsburgh Sleep Quality Index [PSQI]), sleep latency, and adverse effects (Fernandez et al., 2018; Zhang et al., 2021).

Efficacy Of Herbal Medicines

Herbal interventions demonstrated mixed efficacy across studies. *Valerian root* was found to have moderate effects on sleep latency and sleep quality in some trials, but results were inconsistent, with no significant difference compared to placebo in others (Bent et al., 2006). Similarly, *Chamomile* showed mild improvements in sleep quality, particularly among elderly patients, but evidence remains inconclusive due to small sample sizes and lack of standardized dosages (Zick et al., 2011). *Ziziphus jujuba* consistently improved sleep quality in trials conducted in China and Korea, with significant reductions in PSQI scores compared to placebo and hypnotics (Yoon et al., 2021). *Lavender* and *Ashwagandha* showed promising results, with several studies indicating improvements in sleep duration and reductions in stress-related insomnia (Hudson et al., 2020; Choudhary et al., 2017).

Comparative Effectiveness of Various Herbs

Comparative studies between herbal medicines were limited. However, one trial comparing *Valerian root* and *Chamomile* found no significant difference in efficacy, highlighting the need for larger, head-to-head trials (Fernandez et al., 2018). Herbs like *Ziziphus jujuba* and *Ashwagandha* showed comparatively stronger results, particularly in populations with chronic insomnia or comorbid stress-related conditions (Yoon et al., 2021; Choudhary et al., 2017).

Safety And Adverse Effect

Herbal medicines were generally well-tolerated across studies. *Valerian root* was associated with mild gastrointestinal discomfort and dizziness in some participants, while *Chamomile* was reported to cause allergic reactions in individuals sensitive to ragweed (Bent et al., 2006; Zick et al., 2011). *Ziziphus jujuba* and *Ashwagandha* showed minimal adverse effects, with no reports of serious complications (Yoon et al., 2021; Choudhary et al., 2017). However, the lack of long-term safety data for most herbal interventions remains a significant concern.

Gaps In Literature

Several gaps in the literature were identified. Many studies lacked standardization in terms of herbal formulations, dosages, and treatment durations, making comparisons challenging (Fernandez et al., 2018). Additionally, there was a paucity of research in certain populations, such as pregnant women and individuals with comorbid mental health disorders. Most studies were conducted in Asia and Europe, with limited representation from African and South American regions, highlighting the need for more diverse research.

DISCUSSION

Interpretation of Findings

The systematic review highlights the mixed efficacy of herbal medicines in managing insomnia. Among the studied interventions, *Ziziphus jujuba* consistently demonstrated significant improvements in sleep quality and reductions in sleep latency, particularly in populations with chronic insomnia (Yoon et al., 2021). Similarly, *Ashwagandha* and *Lavender* showed promising results in reducing stress-related insomnia and enhancing sleep duration (Hudson et al., 2020; Choudhary et al., 2017). However, *Valerian root* and *Chamomile* provided inconsistent outcomes, with some trials reporting mild benefits and others finding no significant difference compared to placebo (Bent et al., 2006; Zick et al., 2011). These findings align with previous meta-analyses, which also reported variability in the effectiveness of herbal interventions due to differences in study design, dosages, and outcome measures (Fernandez et al., 2018; Zhang et al., 2021). While certain herbs like *Ziziphus jujuba* appear to have robust evidence supporting their use, the overall heterogeneity among studies underscores the need for standardized clinical trials.

Mechanisms Of Action

The efficacy of herbal medicines for insomnia is linked to their interaction with biological pathways involved in sleep regulation. For instance, *Valerian root* is believed to enhance gamma-aminobutyric acid (GABA) activity, which promotes relaxation and reduces sleep latency (Fernandez et al., 2018). Similarly, *Chamomile* contains apigenin, a flavonoid that binds to benzodiazepine receptors, exerting mild sedative effects (Zick et al., 2011). *Ziziphus jujuba* and *Ashwagandha* are thought to regulate stress hormones and modulate the hypothalamic-pituitary-adrenal (HPA) axis, thereby improving sleep quality (Yoon et al., 2021; Choudhary et al., 2017). These pathways suggest that herbal medicines may complement conventional treatments, particularly for stress-induced insomnia.

Clinical Implications

The findings from this review have several implications for clinical practice. Herbal medicines like *Ziziphus jujuba* and *Ashwagandha* could be recommended as complementary treatments for insomnia, particularly in populations where pharmacological options are contraindicated or poorly tolerated (Yoon et al., 2021; Choudhary et al., 2017). Their use may be particularly beneficial for elderly patients, who are more prone to the side effects of conventional hypnotics (Hudson et al., 2020). However, caution should be exercised in populations such as pregnant women, where safety data for many herbal interventions remain limited.

Strengths And Limitations

This systematic review has several strengths, including a comprehensive search strategy, the inclusion of multiple databases, and rigorous quality assessment of included studies. These factors enhance the reliability of the findings and provide a broad perspective on the current evidence base. However, the review also has limitations. The included studies exhibited significant heterogeneity in terms of population characteristics, intervention protocols, and outcome measures, which complicates the synthesis of results (Fernandez et al., 2018). Small sample sizes and short treatment durations in many trials further limit the generalizability of the findings. Additionally, the lack of standardization in herbal formulations and dosages presents

challenges for clinical application and future research (Zick et al., 2011).

Future Directions

Future research should focus on addressing the gaps identified in this review. Large-scale, high-quality randomized controlled trials are needed to confirm the efficacy and safety of herbal medicines for insomnia. Standardized dosages and treatment protocols should be established to facilitate comparisons across studies (Bent et al., 2006). Additionally, research exploring herb-drug interactions and the long-term safety of these interventions would provide valuable insights, particularly for populations with comorbidities or polypharmacy. Further studies should also investigate underrepresented populations, such as pregnant women and individuals with chronic mental health conditions, to ensure the broader applicability of findings. Exploring the cultural and regional variations in the use of herbal medicines may also yield important information for tailoring interventions to specific populations (Hudson et al., 2020).

CONCLUSION

This systematic review highlights the potential of herbal medicine as a complementary treatment for insomnia. Among the various herbal interventions studied, *Ziziphus jujuba*, *Ashwagandha*, and *Lavender* demonstrated promising effects in improving sleep quality, reducing sleep latency, and addressing stress-related insomnia. However, the findings for widely used herbs like *Valerian root* and *Chamomile* remain inconsistent, with some studies reporting minimal benefits over placebo. The lack of standardized formulations, dosages, and treatment durations across studies further complicates the interpretation of results (Fernandez et al., 2018; Yoon et al., 2021). While herbal medicines are generally well-tolerated, long-term safety data and evidence on herb-drug interactions are limited. Addressing these gaps through high-quality, large-scale randomized controlled trials is crucial to establishing the efficacy and safety of herbal remedies for insomnia (Bent et al., 2006; Zick et al., 2011).

Clinical Relevance

For practitioners and patients interested in herbal remedies, this review provides a foundation for evidence-based recommendations. Herbal medicines like *Ziziphus jujuba* and *Ashwagandha* may be suitable options for patients seeking alternatives to conventional pharmacological treatments, particularly those with stress-induced or chronic insomnia. However, it is essential to consider individual patient factors, such as comorbid conditions and potential herb-drug interactions, before recommending these interventions. Clinicians should guide patients toward using standardized and well-researched herbal products while emphasizing that herbal medicines should complement, not replace, evidence-based therapies for insomnia. Patients should also be advised to consult healthcare professionals before initiating herbal treatments, particularly in cases of pregnancy, lactation, or concurrent medication use (Hudson et al., 2020; Choudhary et al., 2017). In conclusion, while herbal medicine shows promise as a complementary approach to managing insomnia, further rigorous research is necessary to provide definitive guidelines for its use in clinical practice

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