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REVIEW

# From Needles to Photons: Clinical Efficacy, Safety, and Mechanistic Insights of Laser Acupuncture in Insomnia Management

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**Abstract:** Insomnia constitutes a significant worldwide public health burden. Limitations of conventional treatments, such as cognitive-behavioral therapy and hypnotic medications, have fueled growing interest in complementary and alternative medicine approaches, including laser acupuncture (LA). This comprehensive mini-review evaluates LA's effects and mechanisms for insomnia management. Clinical evidence indicates that LA alleviates both primary insomnia and comorbid cases (eg, with cancer, hypertension, and perimenopausal syndrome). LA demonstrates efficacy comparable to traditional needle acupuncture in improving subjective and objective sleep quality, while also reducing affective symptoms and enhancing quality of life. This provides an appealing alternative for needle-phobia patients. LA appears generally safe, with only mild, transient adverse effects reported. Mechanistic investigations suggest that LA may act via neurotransmitter modulation, autonomic nervous system regulation, and alterations in brain wave activity. However, methodological limitations — particularly small sample sizes, heterogeneous populations, incomplete treatment parameter reporting, and insufficient follow-ups — compromise the current evidence base. Future research should adopt multicenter, large-scale, placebo-controlled randomized trials, complemented by advanced techniques such as neuroimaging, polysomnography, and neuro-chemical assays, to further validate the therapeutic potential of LA and elucidate its underlying mechanisms.

**Keywords:** traditional Chinese medicine, non-pharmacological treatment, auricular therapy, auriculotherapy, sleep disorder, sleep disturbance

## Background

### Prevalence, Health Impacts, and Conventional Management Strategies for Insomnia

Insomnia involves persistent difficulties with sleep initiation or maintenance, causing impaired daytime functioning and reduced sleep quality.[1] It is the most prevalent sleep disorder and the leading reason for seeking sleep medicine services.[2] Insomnia may develop secondary to somatic, psychiatric, circadian, or other sleep disorders, substance use, or medication effects, or occur as a primary condition.[3] A 2025 systematic review encompassing data from 31 countries and territories estimated that 852.3 million adults worldwide have insomnia (16.2% prevalence), with 415 million (7.9%) experiencing severe forms.[4] Prevalence rates exhibit considerable variation across different populations. Among elderly populations, the prevalence of insomnia ranges from 12% to 20%.[5] Longitudinal data from the Study of Women Across the Nation (SWAN) in the United States indicate that insomnia affected 31% to 42% of perimenopausal women during any one-year



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study interval.[6] Additionally, data from the US National Cancer Institute involving 9350 patients revealed that 21% of patients reported insomnia during cancer treatment.[7]

The detrimental effects of insomnia are multifaceted. First, it elevates the risk of cardiovascular diseases (eg, myocardial infarction, atrial fibrillation, and hypertension)[8] and metabolic dysregulation (eg, diabetes and obesity).[9] Second, insomnia adversely impacts mental health,[10] particularly through a bidirectional relationship with anxiety and depression—serving not only as a prodrome to these disorders but also as a consequence or complication thereof.[11] Severe insomnia may further increase the risk of suicide and accidental overdose.[12] Finally, insomnia-induced cognitive impairments (eg, inattention and memory deficits) and daytime fatigue reduce work efficiency[13] and lead to social withdrawal.[14] These functional impairments represent a primary cause of diminished quality of life (QoL) in affected individuals. Insomnia also imposes substantial economic burdens across multiple sectors, including healthcare systems (increased costs and healthcare resource utilization), employers (reduced productivity and higher accident rates), and society at large.[4] In Canada, insomnia-related annual costs are estimated at $1.9 billion (direct) and $12.6 million (indirect),[15] while US estimates suggest annual expenditures of $30–35 billion.[16]

Cognitive-behavioral therapy for insomnia (CBTi) remains the first-line treatment for primary insomnia[17] and is also effective for comorbid cases.[18] Yet, many patients face barriers, such as limited access, high costs, poor adherence, and non-response.[19] Pharmacological therapies for insomnia generally target four principal receptor systems, ie, γ-aminobutyric acid, melatonin, histamine, and orexin/hypocretin,[20] but long-term use is constrained by risks of tolerance, dependence, adverse events, misuse, withdrawal, and rebound insomnia.[17] Recent studies have extensively investigated non-invasive neurostimulation techniques (eg, repetitive transcranial magnetic stimulation, transcranial direct current stimulation, and transcranial alternating current stimulation) for treating insomnia.[21] However, a 2025 review concludes that these approaches remain experimental and are not yet recommended for clinical use, as key parameters including stimulation targeting, intensity, frequency, and optimal patient cohorts require further validation.[21]

## Laser Acupuncture: A Needle-Free Acupuncture Modality for Insomnia

Over the past three decades, various motivational factors have contributed to the increasing interest in complementary and alternative medicine (CAM) therapies and products for insomnia.[22] According to the US National Health Interview Survey, 17.4% of respondents reported experiencing insomnia or trouble sleeping within the preceding 12 months, with 4.5% utilizing CAM therapies such as relaxation techniques, herbal remedies, dietary approaches, or acupuncture for symptom management.[23]

Acupuncture is a commonly used CAM therapy for insomnia, with a favorable safety profile and minimal adverse effects.[17] Nevertheless, its acceptance remains limited,[24] with needle-phobia being a major deterrent.[25] Consequently, laser acupuncture (LA), a needle-free alternative, has gained popularity, particularly among needle-phobic individuals, older adults, and children.[26] LA integrates traditional acupuncture principles with phototherapy, employing low-intensity, nonthermal laser stimulation at selected acupoints.[27,28] The mechanistic basis of LA is rooted in photobiomodulation, wherein photons are absorbed by mitochondrial chromophores such as cytochrome c oxidase, enhancing electron transport and ATP synthesis, modulating nitric oxide and reactive oxygen species, and thereby influencing downstream gene expression and cellular signaling pathways.[29]

Unlike traditional needle acupuncture (TNA), which involves manual needle insertion and manipulation (eg, lifting-thrusting or rotational techniques),[17] LA avoids skin penetration.[30] Notably, a research team in Taiwan developed an advanced LA device with a simulated "lift-thrust" function. This function is achieved by moving the focused laser spot back and forth, concentrating energy at the focal point, which is analogous to the tip of an acupuncture needle. As the laser light enters the body, the focal spot can be repositioned within the acupoint, simulating the needle tip's movement and replicating the lift-thrust technique of TNA to induce the "De-Qi" sensation.[31]

## Gaps in Research and Rationale for the Present Review

The application of LA traces back to the 1970s, with documented success in treating hypertension and asthma in the Soviet Union.[30] Over the past decade, accumulating systematic reviews and meta-analyses have reported its therapeutic value for various conditions, including musculoskeletal pain relief,[32] symptom attenuation in temporomandibular disorders,[33] obesity management,[34] and improvement of nocturnal enuresis in children.[35]

To our knowledge, no review—whether narrative, scoping, or systematic—has yet examined the feasibility of LA for insomnia treatment. Initial investigations indicate that this absence is likely due to the limited number of original clinical studies addressing the topic. To bridge this gap, this comprehensive mini-review aims to: (1) collate the available clinical evidence on the therapeutic effects and safety of LA for insomnia, and (2) propose methodologically sound directions to guide subsequent investigations.

## Advantages of Laser Acupuncture Over Traditional Needle Acupuncture

Beyond its suitability for needle-phobic patients, LA offers several additional advantages.

First, as a non-invasive therapy, LA demonstrates high applicability in treating patients with HIV infection.[28]

Second, LA produces minimal sensation and carries low risks of infection, trauma, and bleeding complications.[30] These attributes enhance its feasibility for individuals with severe comorbidities, hospitalized patients, and those at elevated risk for complications such as bleeding or infection,[30] beyond patients with HIV.

Third, LA is better suited for stimulating acupoints that are difficult to access with TNA, such as auricular acupoints, or those located around the perineum or genitals (eg, used in the treatment of sexual dysfunction).[28]

Finally, the therapeutic outcome of manual acupuncture is heavily dependent on the acupuncturist's expertise and proficiency and may lack reproducibility.[36] In contrast, LA is technically simpler; once effective parameters are set and acupoints have been identified, it can be administered by any trained clinician, and its outcomes are reproducible.[37]

Collectively, it can be postulated that, if shown to be effective for insomnia, LA may offer a viable alternative to insomnia sufferers with comorbid HIV or other infectious and hemorrhagic diseases, as well as for those with genitourinary disorders.

## Literature Search and Screening

Although structured as a narrative mini-review, this article adopts a concise, systematic-style description of the literature search, detailing the process below to ensure transparency and reproducibility. These details are provided to contextualize the discussion, not to reclassify the work as a systematic review.

A systematic search was conducted on September 2025 across three English databases (MEDLINE via PubMed, EMBASE via Ovid, and CENTRAL) and four Chinese databases (CNKI, Wanfang, CQVIP, and SinoMed) to identify published clinical trials and animal studies relevant to LA for insomnia, with the aim of evaluating its clinical efficacy, safety, and potential mechanisms of action.

Clinical trials were eligible if they (1) adopted a parallel-group controlled design (randomized or non-randomized); (2) assessed LA as an intervention for insomnia; (3) reported at least one of the following outcomes: clinical effective rate, sleep scale/questionnaire scores, or objective sleep parameters recorded by polysomnography or actigraphy; and (4) were published in Chinese or English. Eligible animal studies, included to complement clinical findings, were required to (1) apply LA in sleep deprivation models; (2) incorporate behavioral assessments; and (3) explore specific pathways or biomarkers. No restrictions were placed on publication year or study location. The full search strategy is detailed in Appendix 1.

Following the screening process (Appendix 2), 11 clinical studies (Appendix 3) and one animal study (Appendix 4) were included for final analysis.

## Evidence on the Clinical Effects of Laser Acupuncture in Insomnia Treatment

Although clinical data remain limited and somewhat inconsistent, most studies suggest that LA may have potential in alleviating insomnia (Appendix 3).

## Effects of Laser Acupuncture in Primary Insomnia

For primary insomnia, three randomized controlled trials (RCTs) consistently found LA to be as effective as manual acupuncture in reducing Pittsburgh Sleep Quality Index (PSQI) scores and achieving an overall clinical effective rate (≥76%).[38–40] LA was either superior to a commercial Chinese polyherbal preparation[39,40] or comparable to the classic traditional Chinese medicine decoction for insomnia (*Huanglian-Ejiao Decoction*).[38] These findings suggest that LA may serve as an alternative for patients with needle-phobia or those unwilling to ingest bitter herbal decoctions. One study further indicated that LA could simultaneously improve depression and anxiety in patients with primary insomnia.[38] However, a trial from Taiwan reported partially divergent results: although LA significantly reduced PSQI scores relative to placebo-LA and was equivalent to manual acupuncture, neither modality significantly ameliorated patients' depressed mood or daytime sleepiness.[41]

Beyond serving as an alternative, LA may also augment the effectiveness of conventional treatments. Feng et al reported that combining LA with Estazolam resulted in a further reduction in PSQI scores by approximately 2.3 points and Athens Insomnia Scale (AIS) scores by approximately 2.7 points, with effects persisting for at least four weeks after treatment cessation.[42]

## Effects of Laser Acupuncture in Insomnia with Comorbidities

LA has also demonstrated benefits in cases where insomnia co-occurs with other physical or mental disorders. Liang et al observed that the sleep improvements associated with LA were comparable to those associated with Diazepam in cancer survivors with insomnia.[43] Zhang et al found that LA combined with a Chinese herbal formula outperformed Eszopiclone in enhancing sleep and QoL in perimenopausal insomnia patients.[44] Similarly, in hypertensive patients with insomnia, adjunctive LA further improved both sleep quality and blood pressure control beyond routine care alone.[45]

In a study including cancer, post-stroke, and perimenopausal syndrome patients with insomnia, both LA and placebo-LA groups showed a reduction in PSQI scores without significant between-group differences. However, only the LA group had markedly shortened sleep onset latency (SOL), reduced nocturnal awakenings, and improved sleep efficiency (SE) as recorded in sleep diaries.[24]

A Hong Kong RCT assessed elderly patients with chronic illnesses and insomnia, comparing three interventions: LA plus placebo-auricular acupressure (AA), AA plus placebo-LA, and combined LA and AA. All interventions produced comparable improvements in self-rated sleep conditions, depressive symptoms, and health-related QoL, with PSQI and Patient Health Questionnaire-9 (PHQ-9) scores maintaining reductions greater than three points at six-month follow-up. Actigraphy revealed no significant changes in total sleep time (TST) or SOL, but SE improved most in the combined LA and AA group (from 70.7% to 80.2%). Wake after sleep onset (WASO) in the combined LA and AA group decreased from 88.3 minutes at baseline to 65.8 minutes at the end of treatment and further to 61.6 minutes at six-month follow-up; however, the WASO reduction was comparable to that in the AA plus placebo-LA group.[46] These findings suggest that LA enhances subjective sleep quality, depressive symptoms, and QoL in elderly patients, while its effects on objective sleep parameters TST, SOL, or WASO are limited and SE improvement may require combination with AA. Consistently, a Taiwanese study reported that LA was followed by subsequent improvements in subjective sleep quality and QoL in patients with end-stage renal disease undergoing hemodialysis.[47]

## Methodological Constraints and Future Research Priorities

Of the 11 clinical trials included in the efficacy analysis (Appendix 3), ten were RCTs and one was a non-randomized concurrent control trial (NRCCT). The risk of bias was assessed using the ROB 2.0 tool[48] for RCTs and the ROBINS-I tool[49] for the NRCCT. This assessment revealed a moderate to high risk of bias in 90.9% of studies. Primary sources of bias included selection bias from inadequate blinding and allocation concealment, reporting bias from unreported safety outcomes, and measurement bias due to unclear blinding of outcome assessors (Appendix 5 and Appendix 6). The overall quality of the available evidence was thus judged to be very low to low.

When LA was evaluated as a monotherapy for insomnia, only three of the aforementioned trials employed a parallel-arm explanatory RCT design using placebo-LA as an active comparator.[24,41,47] However, these RCTs were limited by small sample sizes (n ≤ 40), with two failing to report sample size calculations and having ≤14 participants per group.[24,41] Such inadequate sample sizes compromise statistical power and risk yielding unreliable results.[50] Additionally, one RCT included patients with insomnia comorbid with multiple conditions,[24] introducing substantial sample heterogeneity and further undermining the validity of the findings. Inconsistencies also existed across these three RCTs: one trial reported LA's efficacy in alleviating concomitant depressive symptoms,[38] whereas the other two demonstrated reductions in depression scale scores that did not reach statistical significance.[24,41] The absence of follow-up assessments in these trials precludes conclusions regarding medium- to long-term benefits of LA.

As an adjunct therapy, LA's potential to enhance the sleep-promoting effects of Estazolam was supported by only one trial.[42]

All included trials documented treatment frequency and duration. Nevertheless, at least four reviewed studies[39,40,44,45] failed to report specific laser parameters employed during treatment. Among those providing parameter details, only one trial comprehensively reported all essential parameters,[47] while the remainder frequently omitted complete data on wavelength, irradiance, power, and beam profile—key determinants of LA efficacy.[27] Pulse duty cycle (9.1%) and irradiance (18.2%) demonstrated the poorest reporting rates (Appendix 7). Inadequate documentation of laser parameters undermines the reliability, reproducibility, and clinical applicability of the findings, thus impeding both protocol standardization and broader clinical implementation. Acupoint depth is another crucial factor, as therapeutic effect depends on reaching specific tissue depths.[51] Optimal wavelength selection correlates strongly with acupoint depth: longer wavelengths, given their enhanced tissue penetration, suit deeper acupoints, whereas shorter wavelengths prove more appropriate for superficial sites. Consistent with this principle, Naeser et al recommended 632.8 nm lasers for superficial acupoints and 904 nm lasers for deeper ones.[52] With the exception of one trial employing variable wavelengths (630–780 nm) according to acupoint depth,[43] most adopted a fixed wavelength irrespective of acupoint depth, potentially leading to systematic underestimation of LA's true efficacy.

Notably, while all 11 included trials supported the efficacy of LA for insomnia, determining the optimal parameters for its management is currently not feasible. This is precluded by incomplete and highly heterogeneous reporting of laser parameters—evidenced by power outputs ranging from 2.5 mW to 600 mW and energy densities between 0.375 J/cm$^2$ and 540 J/cm$^2$ (Appendix 7)—coupled with evidence of predominantly low to very low quality (Appendix 5 and Appendix 6).

These limitations underscore the need for rigorously designed, multicenter RCTs with larger samples and extended follow-ups to appraise (1) LA's standalone efficacy, including symptom improvement magnitude, effects on comorbid affective symptoms, and durability of therapeutic response, and (2) its synergistic benefits with conventional therapies (eg, sedatives/hypnotics or CBTi). Future studies should also standardize the reporting of LA parameters, including (1) equipment model, (2) laser settings (ie, wavelength, power, pulse frequency, duty cycle of the pulse, irradiance area, irradiance, radiant energy, energy density per acupoint), and (3) duration and irradiation frequency applied to each acupoint. Where feasible, multi-arm clinical trials are recommended to compare the effects of different laser parameter combinations on insomnia, thereby distinguishing effective from ineffective parameter sets and further identifying optimal parameters tailored to different subtypes of insomnia.

## Clinical Safety Profile of Laser Acupuncture in Insomnia Treatment

A systematic review encompassing 21 RCTs on LA for various conditions, with a focus on safety, indicated that LA appears to be a safe and well-tolerated intervention. All reported adverse events (eg, tingling, pain flare-ups, transient fatigue, dry mouth) were generally mild, transient, and resolved spontaneously within 24 hours without specific treatment.[26] The only notable precaution concerns ocular exposure to visible or invisible laser beams, which can be easily mitigated by wearing protective goggles during treatment.[26]

However, among the available trials on LA for insomnia, only two reported safety outcomes (Appendix 3). One study observed no adverse events,[38] while the other, involving 46 patients receiving combined placebo-AA (a plaster containing a small dried stem of *Junci medulla* to mimic real AA) and LA, reported ear itchiness in two participants and acupoint tenderness in one.[46] However, it remains unclear whether these reactions were due to LA or the *Junci medulla* application.

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Taken together, it is imperative that forthcoming clinical studies on LA for insomnia implement thorough and systematic safety reporting.

## Mechanistic Insights into Laser Acupuncture for Insomnia: Neurotransmission and Autonomic Regulation

Only one preclinical study has explored the mechanisms of LA in insomnia.[53] Zhou et al reported that rats rendered insomniac via intraperitoneal injection of para-chlorophenylalanine exhibited marked reductions in hypothalamic serotonin and 5-hydroxyindoleacetic acid (5-HIAA), which were reversed by LA. Concurrently, LA administration resulted in significantly lower hypothalamic norepinephrine and dopamine levels than those in the untreated models. These results suggest that LA's sleep-promoting effects may involve upregulation of hypothalamic serotonin and 5-HIAA alongside downregulation of norepinephrine and dopamine.[53] Serotonin, norepinephrine, and dopamine are pivotal neurotransmitters governing sleep-wake cycles.[17] Insomnia patients commonly display reduced serotonin levels[54] and elevated nocturnal circulating norepinephrine,[55] while activation of ventral tegmental area dopamine neurons promotes wakefulness via $D_2/D_3$ receptors.[56] Coincidentally, our prior work has identified analogous neurotransmitter modulation as a key mechanism underlying TNA's therapeutic effects on insomnia,[17] lending further support to Zhou et al's proposed mechanism for LA.[53]

Limited clinical trials have also offered exploratory insights or indirect evidence. For instance, extensive data indicate that individuals with insomnia exhibit elevated nocturnal cardiac sympathetic drive compared to good sleepers, as evidenced by an increased low-frequency/high-frequency (LF/HF) ratio in heart rate variability (HRV).[57] Subjectively, patients often describe this hyperarousal as a "tired but wired" state, wherein sleep initiation is impaired despite exhaustion.[57] Research on elderly insomniacs further suggests that dysregulated autonomic activity may underlie the relationship between objective and subjective sleep measures, potentially contributing to adverse health outcomes.[58] Expanding on this, HRV analysis has been employed to explain LA's therapeutic effects on insomnia. Chen et al observed that chronic insomnia patients treated with LA showed a significant decline in the LF/HF ratio concurrent with sleep improvement, whereas no such reduction occurred in the placebo-LA recipients, suggesting that LA may ameliorate insomnia by restoring autonomic balance.[24] Similarly, Wu et al investigated LA's impact on long-term night-shift workers using HRV.[59] These workers typically display heightened sympathetic and parasympathetic activation alongside elevated heart rates, necessitating greater autonomic regulation to adapt to altered sleep-wake schedules. Following LA treatment, increased HF activity, decreased LF activity, and reduced LF/HF ratios were observed, indicating enhanced vagal nerve activity and suppressed sympathetic tone, with effects persisting ≥40 minutes.[59] These findings also imply LA's potential applicability in circadian rhythm sleep-wake disorder, shift work type (See ICD-11, code: 7A64).[60] Additionally, a Taiwanese study demonstrated that 830 nm LA applied to Zusanli (ST36), Yongquan (KI1), and the palm was followed by improved sleep quality in hemodialysis patients. The authors proposed that this effect may result from LA-induced relaxation, potentially mediated by the modulation of brain wave activity, including increased alpha rhythm power and theta activities, along with decreased beta activities.[47]

## Summary and Research Outlook

The non-invasive nature, technical simplicity, and reproducibility of LA make it an attractive CAM therapy for insomnia. However, the current clinical trial evidence on LA for insomnia remains considerably limited, with only 11 relevant trials identified through comprehensive database searches. Available findings indicate that LA is well-tolerated and potentially effective for both primary insomnia and insomnia comorbid with somatic or mental disorders. In primary insomnia, results from five trials demonstrated significant improvements in sleep quality, with efficacy comparable to TNA and superior to commercial Chinese polyherbal preparation. These attributes render LA particularly suitable for needle-averse patients. Adjunctive use with hypnotics such as Estazolam appears to provide additional sleep-promoting benefits, though evidence regarding its effects on comorbid depression or anxiety in patients with primary insomnia remains inconsistent. Among six trials examining comorbid insomnia, LA significantly improved sleep in cancer- and perimenopause-related insomnia beyond placebo effects. It also simultaneously enhanced both sleep quality and overall QoL in elderly chronic disease patients and those undergoing hemodialysis for end-stage renal disease.

Nevertheless, existing evidence is substantially constrained by methodological shortcomings, including a limited number of studies, small sample sizes, incomplete LA parameter reporting, and insufficient follow-up durations. These shortcomings preclude definitive conclusions regarding its standalone efficacy, long-term benefits, and integrative potential. In addition, considerable heterogeneity in trial designs—such as widely varying control interventions, diverse patient populations, and divergent laser parameters across studies—currently prevents clear determination of response rates across different insomnia subtypes (primary insomnia and insomnia comorbid with various common conditions). It also remains impossible to establish optimal laser parameters protocol of LA based on existing clinical evidence.

Only one animal study has explored LA for insomnia. Drawing on its outcomes alongside indirect evidence from clinical trials, it is preliminarily suggested that the therapeutic effects of LA may involve the regulation of sleep/wake-related neurotransmitters (eg, serotonin, norepinephrine, dopamine) and the restoration of autonomic nervous system balance in patients with insomnia.

Based on the identified research gaps, the following directions are proposed for future studies on LA for insomnia.

Clinical trials should: (1) Conduct large-scale, multicenter, placebo-controlled RCTs with extended follow-up to assess the short- to long-term efficacy and safety of LA as a monotherapy, and to determine whether its effects are specific or placebo-related; (2) After efficacy is established, perform multi-arm trials comparing different laser parameter combinations to identify optimal protocols for various insomnia subtypes; and (3) Investigate the combined effects of LA with conventional treatments (ie, CBTi, hypnotics), assessing whether it enhances therapeutic outcomes or reduces medication-related side effects. These findings will inform the clinical guideline developers regarding the potential integration of LA into comprehensive insomnia management strategies.

Mechanistic research should focus on: (1) Examining the synergy between photobiological and acupoint-specific effects to establish a theoretical framework linking LA to sleep-wake regulation. This may involve studying how specific laser parameters modulate photoreceptors (eg, cytochrome c oxidase in cellular mitochondria),[61] trigger intracellular signaling, and influence neuronal activity in sleep-wake nuclei; (2) Applying neuroimaging, polysomnography, neurochemical analyses to elucidate laser photomodulation effects on neuroendocrine function, autonomic activity, and circadian rhythm pathways at the systems level; and (3) At the molecular level, utilizing metabolomic and epigenomic approaches to explore whether LA can exert long-term regulatory effects beyond immediate responses—particularly on core insomnia-related pathways such as the HPA axis—and to characterize associated epigenetic and gene expression networks.

In summary, while LA shows promise for insomnia management, higher-quality studies are needed to validate its clinical value and facilitate evidence-based implementation.

## Abbreviations

5-HIAA, 5-Hydroxyindoleacetic Acid; AA, Auricular Acupressure; AIS, Athens Insomnia Scale; CAM, Complementary and Alternative Medicine; CBTi, Cognitive-Behavioral Therapy for Insomnia; HF, High-Frequency; HRV, Heart Rate Variability; LA, Laser Acupuncture; LF, Low-Frequency; NRCCT, Non-Randomized Concurrent Control Trial; PHQ-9, Patient Health Questionnaire-9; PSQI, Pittsburgh Sleep Quality Index; QoL, Quality of Life; RCT(s), Randomized Controlled Trial(s); ROB 2.0 Tool, Revised Cochrane Risk of Bias Tool for Randomized Trials; ROBINS-I Tool, Cochrane Risk of Bias in Non-Randomized Studies-of Interventions; SE, Sleep Efficiency; SOL, Sleep Onset Latency; SWAN, Study of Women Across the Nation; TNA, Traditional Needle Acupuncture; TST, Total Sleep Time; WASO, Wake After Sleep Onset.

## Data Sharing Statement

Data availability is not applicable as no new data was generated for this paper.

## Author Contributions

Fei-Yi Zhao: Conceptualization, Investigation, Formal analysis, Funding acquisition, Writing - original draft. Wen-Jing Zhang: Investigation, Formal analysis, Writing - review & editing. Chin Moi Chow: Formal analysis, Writing - review &

editing. Peijie Xu: Data curation, Formal analysis, Writing - review & editing. Li-Ping Yue: Formal analysis, Writing - review & editing. Yuen-Shan Ho: Conceptualization, Writing - review & editing. Qiang-Qiang Fu: Validation, Formal analysis, Writing - review & editing. Russell Conduit: Conceptualization, Project administration, Formal analysis, Writing - review & editing. All authors gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors declare no competing interests.

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