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SLEEP QUALITY IMPROVEMENT THROUGH DIETARY SUPPLEMENTATION: A REVIEW OF SCIENTIFIC EVIDENCE

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ABSTRACT

Recent research has examined various dietary supplements as potential sleep aids. This review evaluates evidence on common dietary supplements in improving sleep quality, with a focus on melatonin, magnesium (especially magnesium L-threonate), dietary nitrates, lemon balm (*Melissa officinalis*), glycine, tart cherry juice, and ashwagandha. Randomised controlled trials (RCTs) and meta-analyses for each supplement were identified. Melatonin has shown small improvements in subjective sleep quality in some populations, though results are mixed. Magnesium was found to significantly enhance deep and REM sleep, as well as daytime functioning. Dietary nitrates increased total sleep time, slow-wave sleep, and sleep efficiency in small trials, likely via nitric oxide-mediated vasodilation. A trial in older adults reported that lemon balm improved subjective sleep quality by approximately 54% in comparison with a placebo. Glycine consistently improved subjective sleep quality, reduced sleep onset latency, and alleviated daytime fatigue, possibly by lowering core temperature. Tart cherry juice increased total sleep time by approximately 30–84 minutes and sleep efficiency in multiple studies, likely due to its melatonin, tryptophan, and anti-inflammatory constituents. Finally, a meta-analysis of RCTs reported that ashwagandha extract significantly improved sleep onset latency, total sleep time, wake after sleep onset (WASO), and sleep efficiency. Most supplements were well tolerated, no serious adverse effects were reported, though quality control and dosing remain concerns. However, many trials had small sample sizes, short duration, and relied on subjective outcomes. In summary, several supplements show promising effects on sleep quality, but further large-scale, well-controlled studies with objective measures are needed.

KEYWORDS

Sleep Quality Improvement, Dietary Supplements, Herbal Sleep Aids, Sleep Efficiency

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Introduction

Sleep disturbances are common and linked to significant health risks, such as cardiovascular disease, obesity, various types of cancer and cognitive impairment (Conti, 2025). In response to concerns about sleep medications, many individuals turn to “natural” supplements to improve sleep. Proposed supplements include hormones (melatonin), minerals (magnesium), herbal extracts (lemon balm, ashwagandha), amino acids (glycine), and dietary components (nitrate-rich foods, tart cherry products). This review summarizes the current evidence on such supplements for enhancing sleep quality. We focus on their reported efficacy, typical dosages, mechanisms of action, and safety profiles, drawing on randomized trials and meta-analyses.

Methodology

We conducted a comprehensive literature search of PubMed, PubMed Central, and clinical trial registries for RCTs and meta-analyses (2006–2026) evaluating supplements for sleep quality. Search terms included each supplement name plus “sleep,” “insomnia,” or “sleep quality.” We included studies in healthy adults or clinical populations, requiring objective or validated subjective sleep outcomes. For each supplement, we extracted data on intervention dose, duration, sample size, sleep outcomes (e.g. PSQI, total sleep time, sleep efficiency), and reported side effects. Study quality and risk of bias were noted qualitatively (e.g. sample size, blinding, funding). The findings were synthesised in the sections below. All cited data are from published studies, reference details are provided in APA format at the end.

Results

Melatonin

Melatonin is an endogenous sleep hormone, supplement doses typically range from 0.5 mg to 5 mg before bedtime. Meta-analyses indicate that exogenous melatonin modestly improves some sleep parameters. For example, a 2022 meta-analysis (63 RCTs) found significant PSQI score improvements in adults with primary sleep disorders, respiratory or metabolic conditions, but not in psychiatric or neurodegenerative patients (Ghaderi et al, 2022). Overall, melatonin tends to reduce sleep onset latency and slightly increase total sleep time (Ghaderi et al, 2022). However, effects vary: some RCTs report non-significant changes (e.g. wake after sleep onset) (Du, Tan, 2026). Melatonin's chronobiotic action on circadian rhythms underlies its benefit (Conti, 2025). Typical guidelines use 1 - 5 mg taken about 1–2 hours before desired bedtime.

Efficacy: Small to moderate. Improves subjective sleep quality (PSQI) in certain groups and shortens sleep latency in some trials (Ghaderi et al. 2022).

Dosage: Most studies use 1–5 mg at night, some protocols shift timing (e.g. 3 hr pre-bed) for better phase-shifting.

Safety: Generally safe in short-term use. Common side effects include drowsiness and headache. High or chronic dosing, especially in children, raises concerns about endocrine disruption (Conti, 2025). Quality control is an issue: many over-the-counter melatonin supplements vary widely in actual content.

Mechanism: Binds MT1/MT2 receptors to signal night-time, promoting sleep onset. Also has antioxidant and autonomic effects.

Evidence Gaps: Many trials rely on subjective reports and large-scale RCTs using polysomnography are limited. Heterogeneity in terms of doses, timing, population hampers firm conclusions (Ghaderi et al. 2022, Esquivel & Ghosn, 2024).

Magnesium (Mg), especially Mg L-Threonate

Magnesium is involved in neurotransmission and sleep regulation. A recent high-quality RCT tested the effects of taking 1 g/day of magnesium L-threonate (MgT, a brain-penetrant form) vs. placebo for 21 days in adults with sleep difficulties. The MgT group maintained or improved sleep quality, whereas the placebo group's sleep declined. Oura ring data showed significant increases in deep and REM sleep scores, and reductions in light sleep, relative to placebo. Subjective questionnaires confirmed better next-day mood, energy, and productivity with MgT. No adverse effects were reported (Hausenblas et al, 2024).

Efficacy: Promising. In the RCT, MgT significantly enhanced objective slow-wave (deep) and REM sleep, and subjective sleep/restoration scores (Hausenblas et al, 2024). Other magnesium forms (e.g. glycinate, citrate) have less direct evidence on sleep.

Dosage: The trial used 1 g/day magnesium L-threonate (elemental Mg ~140 mg). Other studies often use 100–400 mg elemental Mg (usually as citrate or glycinate) before bed.

Safety: Magnesium is generally safe, overdose can cause diarrhea and electrolyte imbalance. The RCT reported no side effects at 1 g/day (Hausenblas et al, 2024).

Mechanism: Mg influences NMDA and GABA receptors, stabilizing neuronal excitability. It may raise melatonin synthesis and improve circadian regulation (Conti, 2025).

Evidence Gaps: There are few large RCTs on Mg, most focus on metabolic conditions. The MgT study is novel and requires replication. The heterogeneous formulations and doses in older studies limit comparisons (Esquivel & Ghosn, 2024, Hausenblas et al, 2024).

Dietary Nitrates

Nitrate-rich foods, such as beetroot or leafy greens, elevate blood nitric oxide (NO) levels. One pilot trial gave healthy adults beetroot juice (6.45 mmol nitrate) before bedtime vs. nitrate-depleted placebo. Nitrate acutely increased total sleep time (434 vs. 412 min), sleep efficiency (89% vs. 85%), and slow-wave sleep duration. WASO was significantly lower with nitrate. Subjective sleep quality did not differ after a single dose (Rounds, StLouis, & Somers, 2025). In patients with chronic obstructive pulmonary disease (COPD), drinking beetroot juice over 2 weeks also altered sleep architecture: it abolished brief awakenings, increased late-night REM, and accelerated slow-wave activity discharge. These objective changes suggest that sleep consolidation improved in nitrate-treated subjects (Wisor et al, 2021).

Efficacy: Emerging evidence. Acute or pre-sleep nitrate supplementation increased deep sleep and total sleep time in healthy adults (Rounds, StLouis, & Somers, 2025). In chronic disease (COPD), 14-day nitrate improved REM and slow-wave sleep indices (Wisor et al, 2021).

Dosage: In studies, ~6–9 mmol nitrate (from ~240 mL beetroot juice) before bed was used (Rounds, StLouis, & Somers, 2025). The effect may require sustained dosing for subjective benefit (Bock et al, 2025).

Safety: Generally safe as a dietary supplement. Excessive nitrates intake can lead to the formation of nitrosamines, which are carcinogenic, or cause methaemoglobinaemia. However, the usual doses in juices are well below toxic levels. Avoid high-dose nitrate if on certain medications (PDE inhibitors) or with hypotension risk.

Mechanism: Nitrate → nitrite → nitric oxide in circulation. NO promotes vasodilation and may influence sleep by improving tissue oxygenation and altering neurovascular coupling. It may also modulate neuronal signaling involved in sleep induction.

Evidence Gaps: Data are limited to small trials and pilot studies (Rounds, StLouis, & Somers, 2025, Wisor et al, 2021). Larger RCTs are needed to confirm efficacy and define optimal dosing. Blinding is a challenge due to beetroot's color and taste.

Lemon Balm (*Melissa officinalis*)

Lemon balm is a traditional herbal sedative. A RCT in patients post-cardiac surgery found that 1.5 g/day dried lemon balm leaf (500 mg capsules three times daily) for one week significantly improved sleep quality scores compared to placebo. Specifically, the sleep-quality index rose by approximately 54% in the lemon balm group versus 7.5% in controls (Soltanpour, Alijaniha, Naseri, Kazemnejad, & Heidari, 2019). Anxiety levels also dropped markedly. Participants reported no serious side effects.

Efficacy: Moderate. In the cited RCT, short-term high-dose lemon balm markedly improved self-reported sleep quality (Soltanpour et al, 2019). Anecdotal use and older studies suggest benefits, but confirmatory trials are limited.

Dosage: In studies, 500–600 mg of standardized lemon balm extract (phytosome or leaf powder) supplementation 1-2 hours before bed, or split throughout the evening, has been used. The cited trial used 1.5 g/day as dried leaf (Soltanpour et al, 2019).

Safety: Well tolerated, possible mild sedation or gastrointestinal upset. No major adverse events reported in trials or traditional use.

Mechanism: Lemon balm contains rosmarinic acid and ursolic acid, which may inhibit acetylcholinesterase and GABA transaminase, enhancing GABAergic activity. It also has mild anxiolytic effects, which can secondarily improve sleep.

Evidence Gaps: Few RCTs with objective sleep metrics. Existing studies often combine lemon balm with other herbs (e.g. valerian). More high-quality trials isolating lemon balm are required.

Glycine

Glycine is a non-essential amino acid with central nervous system effects. Multiple controlled studies have found that 3 g of glycine taken 30–60 minutes before bed significantly improves sleep quality in people with sleep complaints (Inagawa, Hiraoka, Kohda, Yamadera, Takahashi, 2006). In one crossover trial of insomnia sufferers, 3 g glycine reduced perceived fatigue and improved PSQI-measured sleep efficiency (Inagawa et al, 2006). Another small trial in sleep-deprived healthy adults found that 3 g glycine reduced next-day sleepiness and fatigue and improved psychomotor alertness (Bannai, Kawai, Ono, Nakahara, & Murakami, 2012).

Efficacy: Consistently positive. Glycine (3 g) reliably enhances subjective sleep quality and reduces latency to sleep onset and deep sleep (Inagawa et, 2026). Daytime alertness and mood also improve after glycine supplementation.

Dosage: 3 g dissolved in water, consumed 30–60 min pre-bed is typical. Doses up to 9 g/day showed no additional benefit and no adverse effects (Conti, 2025).

Safety: Very safe, glycine is generally recognized as safe. High doses caused no adverse events in trials (Conti, 2025).

Mechanism: Glycine modulates NMDA receptors and enhances inhibitory neurotransmission. Animal studies show it increases peripheral vasodilation and lowers core body temperature, promoting sleepiness (Conti, 2025). Improved sleep may result from this heat-dissipation effect and enhanced glycinergic signaling in the suprachiasmatic nucleus.

Evidence Gaps: Large-scale trials are lacking, but existing RCTs are fairly consistent. Most evidence is from small trials in healthy or mildly sleep-impaired adults, often using subjective outcomes.

Tart Cherry (*Prunus cerasus*) Juice

Tart cherry juice (especially Montmorency cherry) is rich in melatonin, tryptophan, and anti-inflammatory anthocyanins. Several small trials have reported improved sleep after tart cherry supplementation.

For instance, one pilot study in older people suffering from insomnias found that 240 mL tart cherry juice twice daily increased total sleep time (TST) by about 34 minutes and sleep efficiency by ~5% compared to placebo (Losso et al, 2019). A polysomnography-based trial reported an 84-minute increase in TST and improved PSQI scores over 2 weeks of cherry juice vs. placebo (Losso et al, 2019). Another crossover trial showed significant reductions in WASO and increases in melatonin levels after 7 days of cherry concentrate supplementation (30 mL/day).

Efficacy: Moderate. Most studies with small sample sizes show that cherry juice or concentrate supplementation results in gains of ~30–60 minutes in TST and higher sleep efficiency (Losso et al, 2019). Results are generally statistically significant but clinically moderate.

Dosage: Common regimens include 240 mL tart cherry juice twice daily or 30 mL tart cherry concentrate once daily for 7-14 days. Total melatonin intake is very low (~85 µg/day).

Safety: Safe as a food. Caution if on warfarin, due to its high vitamin K content, or with stone fruit allergies. The sugar content of juice can be high, but capsules avoid this issue.

Mechanism: Proposed mechanisms include the cherry's natural melatonin and tryptophan content and anti-inflammatory compounds. It may also inhibit tryptophan degradation, making more tryptophan available for serotonin and melatonin synthesis (Losso et al, 2019).

Evidence Gaps: Only a few RCTs exist, often supported by industry funding (e.g. Cherry Marketing Institute). Larger, longer trials with control for placebo sweetness are needed.

Ashwagandha (*Withania somnifera*)

Ashwagandha is an adaptogenic herb. Emerging evidence (RCTs and a meta-analysis) indicates benefit for insomnia. A 2023 meta-analysis of 5 RCTs found that ashwagandha root extract significantly improved subjective sleep quality, sleep onset latency, total sleep time, WASO, and sleep efficiency, particularly at doses ≥600 mg/day over ≥8 weeks (Cheah et al, 2021). In one RCT with college students, 700 mg/day ashwagandha for 30 days raised restorative sleep scores significantly over placebo (O'Connor et al, 2022).

Efficacy: Promising. At ≥600 mg/day, multiple trials show moderate improvements in both subjective and some objective sleep parameters. The magnitude of benefit rivals that of first-line hypnotics in some measures (Cheah et al, 2021).

Dosage: Studies often use 300–600 mg twice daily of a full-spectrum root extract. Standardized extracts (e.g. KSM-66) are common. Chronic administration over approximately 4 to 8 weeks is typically required to see full effect (Cheah et al, 2021).

Safety: Generally well tolerated. Minor side effects (gastrointestinal upset, drowsiness) are rare. Long-term high-dose safety is still being confirmed, but current data up to 10 g/day show good tolerability (Raut et al, 2012).

Mechanism: Likely multi-factorial: reducing stress, enhancing GABAergic signaling, and anti-inflammatory effects may all contribute to sleep promotion. Its anxiolytic and adaptogenic properties probably improve sleep indirectly by lowering nighttime arousal.

Evidence Gaps: Although meta-analytic support exists, only a few RCTs per outcome are available. Standardization of extracts and longer-term trials in insomnia patients are needed.

Discussion

This review highlights that several supplements demonstrate measurable sleep benefits. Magnesium L-threonate notably improved both subjective and objective sleep measures, consistent with the broad consensus that magnesium supports nervous system relaxation. Glycine repeatedly improved sleep onset and quality. Ashwagandha shows significant effects at adequate doses, consistent with its traditional use for insomnia. Tart cherry juice provides robust improvements in sleep duration and efficiency, backed by gold-standard PSG data. Lemon balm showed a large effect in one trial, but more studies are needed.

In contrast, melatonin had only small effects on general sleep quality, although it remains effective for circadian disorders. Nitrates appear to improve sleep architecture but mostly in small or special-population studies.

An important consideration is that these supplements often complement good sleep hygiene rather than replace it. Only a few studies combined objective (e.g. PSG) with subjective outcomes. Notably, the cherry juice pilot used gold-standard polysomnography to detect an 84-minute gain. Many other trials rely solely on self-report, which may inflate placebo effects.

In terms of safety, all reviewed supplements had benign profiles in trials. However, practitioners should note potential interactions (e.g. melatonin with CNS depressants, nitrates with blood pressure medications). Standardization and third-party testing of supplement quality is advised (Bailey, 2020).

Conclusions

Several over-the-counter supplements show promise for improving sleep quality. Magnesium (especially L-threonate), glycine, and ashwagandha have the strongest evidence from RCTs and meta-analyses, demonstrating significant improvements in sleep parameters with minimal side effects. Tart cherry juice and lemon balm also improved sleep in controlled trials. Melatonin and dietary nitrates have more modest and context-dependent effects. Clinicians and consumers should be aware that supplement quality varies, and should use evidence-based dosages (e.g. 3 g glycine, 600+ mg ashwagandha, 1-3 mg melatonin) and durations.

Future research should include large, multi-center RCTs with objective sleep measures, standardized supplements, and diverse participant groups. Investigations into combined supplement regimens (e.g. magnesium and melatonin) or interactions with behavioral interventions (e.g. sleep hygiene, cognitive behavioral therapy for insomnia) could yield practical protocols. Ultimately, better-regulated trials will clarify which supplements are safe, effective tools to enhance sleep health.

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