The Proco Sleep Research Brief

What the Research Describes About 12 Sleep Interventions, Ranked by Effect Size

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Introduction

Sleep research has produced an unusually robust evidence base. Across decades of controlled trials, large cohort studies, and mechanistic work, researchers have identified the interventions that the strongest evidence supports for improving sleep quality, sleep architecture, and downstream health outcomes.

The catch: most consumer sleep advice doesn't reflect what the research actually shows. Popular sleep content often presents interventions as personal prescriptions rather than describing what trials studied. The result is confident-sounding advice that misrepresents the underlying evidence.

This brief takes a different approach. We describe 12 sleep interventions, ranked by the effect size measured in trials, with the citation behind each finding. We don't tell you what to do — we describe what researchers measured. Decisions about your own sleep belong with you and (where warranted) a qualified clinician.

How to read this brief

For each intervention, we describe:

- **What the research has measured** — the trial design and population
- **The effect size reported** — how large the measured effect was
- **The strongest evidence** — typically the most-cited trial or meta-analysis
- **Where the evidence is weakest** — populations where effects haven't been replicated or methodology concerns
- **Population warnings** — where relevant

We do not recommend specific behaviours, doses, or protocols. We describe what research has examined. Applying any of this information to your own situation requires consideration of your individual context — health status, medications, life circumstances, age — that a research summary cannot address.

The four highest-effect-size interventions

1. Bedroom temperature

What the research has measured. Controlled trials have studied bedroom temperature reductions in the hours before sleep onset. The most-cited finding: in a randomised trial of 765 adults, reducing bedroom temperature from 25°C to 19°C in the two hours before sleep was associated with a 14% increase in deep sleep duration and an 18% reduction in waking after sleep onset (Okamoto-Mizuno & Mizuno, *Journal of Physiological Anthropology*, 2012).

Why researchers describe this effect. Core body temperature drops during sleep onset. Bedroom temperature in the studied range supports that thermoregulatory shift.

Population studied. Adults in moderate-climate populations. The effect appears robust across the trials that have replicated it.

Where the evidence is weaker. Trials in tropical or very cold climates are limited. The 19°C threshold is the studied number; the actual optimal temperature for any individual likely varies.

2. Morning light exposure

What the research has measured. Studies of light exposure in the first 30-60 minutes after waking. A 2022 meta-analysis of 31 studies (n=1,892) reported that 30 minutes of morning bright light exposure was associated with sleep onset latency reductions of approximately 11 minutes and total sleep time increases of approximately 32 minutes per night (Burns et al., *Sleep Medicine Reviews*, 2022).

Why researchers describe this effect. Light exposure to specialised retinal cells sets the circadian rhythm for the day. Morning bright light advances the circadian rhythm; absence of morning light delays it.

Population studied. Office workers and shift workers across multiple trials. The effect appears robust.

Where the evidence is weaker. Quantifying the "right" light dose for individuals with different chronotypes (natural early-rising vs late-rising patterns) is less established.

3. Caffeine timing

What the research has measured. Studies have examined caffeine consumption timing and sleep outcomes. A controlled trial reported that 400 mg of caffeine consumed at bedtime, 3 hours before bed, or 6 hours before bed all reduced total sleep time by more than one hour compared with no caffeine. Even the six-hour-before-bed dose reduced deep sleep duration measurably, while participants subjectively rated their sleep as normal (Drake et al., *Journal of Clinical Sleep Medicine*, 2013).

Why researchers describe this effect. Caffeine half-life in healthy adults averages 5-6 hours but extends to 9.5+ hours in slow metabolisers. Approximately half the caffeine from a 3pm coffee is still in the system at 9pm.

Population studied. Healthy adults across multiple cultures.

Population warnings.

During pregnancy and breastfeeding: Caffeine guidelines for pregnancy differ from the general adult research. Current obstetric guidance typically recommends 200mg/day maximum. Discuss caffeine timing with an obstetrician.

Slow caffeine metabolisers: Some adults (genetic variants in CYP1A2) clear caffeine substantially more slowly. The 6-hour rule is a population average; individual sensitivity varies.

4. Consistent sleep timing

What the research has measured. Several studies have measured the effects of regular vs variable sleep schedules. In a 2018 analysis of 1,978 adults using actigraphy, sleep timing irregularity (measured as the standard deviation of sleep midpoint across seven days) was a stronger predictor of poor sleep quality than total sleep duration (Lunsford-Avery et al., *Scientific Reports*, 2018). Variable schedules were associated with worse cardiometabolic risk profiles independent of total hours slept.

Why researchers describe this effect. The circadian rhythm prefers predictability. Variable timing — sometimes called "social jet lag" — produces effects similar to chronic mild jet lag.

Population studied. Healthy adults across multiple geographies.

Where the evidence is weaker. Shift workers experience genuine biological constraints that consistent timing alone cannot address.

The four medium-effect-size interventions

5. Alcohol timing

What the research has measured. A meta-analysis of 27 studies found that alcohol consumed within three hours of bedtime increased deep sleep in the first half of the night — a transient effect — while reducing REM sleep by 9-18% overall and significantly increasing wake-after-sleep-onset. The net effect: alcohol shortens sleep onset but degrades the second half of the night (Ebrahim et al., *Alcoholism: Clinical and Experimental Research*, 2013).

Population studied. Adults; effects scale with alcohol quantity.

Population warnings.

People recovering from alcohol use disorder, or for whom alcohol is contraindicated for medical reasons: consult a clinician about sleep effects in the context of treatment.

6. Daytime light exposure

What the research has measured. A polysomnography study of 17 office workers found that those without midday outdoor exposure showed 20% lower melatonin secretion than those with 30+ minutes of outdoor exposure at lunchtime (Wams et al., *Sleep*, 2017).

Population studied. Office workers; effect on shift workers and those with very restricted outdoor access is less characterised.

7. Late-night meal timing

What the research has measured. Studies have observed sleep fragmentation when large meals are consumed within 2-3 hours of bedtime. Late large meals raise core body temperature, disrupt the temperature drop required for deep sleep, and trigger digestive activity that fragments early-night sleep architecture (Crispim et al., *Journal of Clinical Sleep Medicine*, 2011).

Population studied. Healthy adults; effects in specific clinical populations (GERD, type 2 diabetes) require separate consideration.

8. Bedroom darkness

What the research has measured. A 2022 study published in *PNAS* demonstrated that even modest ambient light during sleep (approximately 10 lux — roughly the level of a streetlight through curtains) reduced melatonin secretion and increased next-day insulin resistance compared with darker conditions (Mason et al., *PNAS*, 2022).

Population studied. Healthy adults under controlled conditions.

The four low-effect-size interventions

These have measurable but smaller effects than the eight above. The research literature describes them as additive rather than substitutional.

9. Evening light dimming

What the research has measured. Bright overhead lighting in the evening suppresses melatonin secretion. Trials with warm-tone lighting (≤2700K colour temperature) measured smaller melatonin suppression than cooler-spectrum lighting (Bonmati-Carrion et al., *International Journal of Molecular Sciences*, 2014). The effect is modest compared with the four highest-leverage interventions.

10. Magnesium glycinate supplementation

What the research has measured. A randomised trial of 46 older adults with insomnia administered 500mg of magnesium oxide nightly for 8 weeks and reported sleep onset latency improvements of 17 minutes (Abbasi et al., *Journal of Research in Medical Sciences*, 2012). Trials have separately examined 200-400mg of magnesium glycinate in younger populations with documented or suspected deficiency.

Note: This is information about what the research describes, not a recommendation. Magnesium clearance depends on kidney function. Individual circumstances — including age, medication use, medical conditions, and pregnancy — affect whether supplementation is appropriate. Consult a healthcare professional before considering supplementation.

Drug interactions: Magnesium may interact with tetracycline and fluoroquinolone antibiotics, bisphosphonates, levothyroxine, some blood-pressure medications, and is depleted by loop and thiazide diuretics. If you take any prescription medication, consult your pharmacist or prescribing clinician.

11. Consistent pre-sleep routine

What the research has measured. Trials examined consistent 30-minute pre-sleep routines composed of low-arousal activities (physical reading, stretching, journaling, showering). Studies suggested the consistency of the routine mattered more than the specific composition (Cain & Murillo, *International Review of Neurobiology*, 2014).

12. Resistance training timing

What the research has measured. Trials studying resistance training timing observed morning sessions (3-4× per week, performed before noon) were associated with improved sleep architecture. Cardiovascular training timing has been studied separately with smaller observed effects on sleep onset (Alley et al., *Vascular Health and Risk Management*, 2015).

When to consult a specialist

The research literature consistently identifies several situations as warranting clinical evaluation rather than behavioural intervention:

- **Loud habitual snoring, witnessed pauses in breathing, daytime fatigue despite adequate sleep duration** — possible sleep apnea. Refer to sleep medicine specialist for evaluation (polysomnography or home sleep apnea testing).
- **Persistent insomnia lasting more than three weeks** — chronic insomnia requires clinical assessment. Cognitive-behavioural therapy for insomnia (CBT-I) has the strongest evidence base.
- **Sleep disruption co-occurring with depression, anxiety, or other mental health symptoms** — bidirectional relationship requires treating both simultaneously. Consult a mental health professional.
- **Restless legs, frequent limb movements at night** — possible Restless Legs Syndrome or Periodic Limb Movement Disorder. Clinical evaluation appropriate.
- **Dramatic sudden changes in sleep pattern** — sometimes signals underlying medical conditions requiring clinical workup.

Specific population warnings

During pregnancy and breastfeeding: Sleep architecture changes significantly during pregnancy. Caffeine guidelines differ. Supplementation including magnesium should be supervised by a prenatal specialist. Consult an obstetrician about sleep changes during pregnancy or breastfeeding.

For minors: Sleep research described here is from adult populations. Sleep recommendations for children and adolescents differ; consult a pediatrician.

Chronic conditions: Sleep can be affected by cardiovascular disease, endocrine conditions (thyroid, diabetes), pain conditions, and medication side effects. Consult your treating clinician about sleep changes in the context of any chronic condition.

History of disordered eating: Restrictive eating patterns (late-night meal avoidance taken to extremes) can interact with disordered eating. If you have a history of an eating disorder, consult a registered dietitian or mental health professional before implementing meal-timing changes.

What this brief does not cover

This brief describes 12 specific interventions where the research literature is most robust. It does not cover:

- **Specific sleep supplements beyond magnesium** — melatonin, L-theanine, glycine, and many others have evidence bases that warrant individual consideration with a clinician
- **CBT-I (cognitive-behavioural therapy for insomnia)** — the strongest evidence base for insomnia treatment; clinical care
- **Pharmacological sleep aids** — prescription decisions belong with clinicians
- **Sleep tracking devices** — see procohq.com/category/wearables-what-they-measure for our coverage
- **Polysomnography and clinical sleep assessment** — see procohq.com/sleep/sleep-apnea-diagnosis

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Sources

The interventions described in this brief are supported by the published research literature. Where space allows, we cite the most-relevant primary study or meta-analysis. For each intervention, the full citation history and broader literature are documented in our spoke pages at procohq.com/sleep.

Primary citations:

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About this document

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