Examine.com

Sleep
Supplement Guide

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Medical Disclaimer

This guide is a general-health document for adults 18 or over. Its aim is strictly educational. It does not constitute medical advice. Please consult a medical or health professional before you begin any exercise-, nutrition-, or supplementation-related program, or if you have questions about your health.

This guide is based on scientific studies, but individual results do vary. If you engage in any activity or take any product mentioned herein, you do so of your own free will, and you knowingly and voluntarily accept the risks. While we mention major known interactions, it is possible for any supplement to interact with other supplements, with foods and pharmaceuticals, and with particular health conditions.

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Words of Caution

Any supplement that can affect the brain, especially supplements with a stimulatory or sedative effect, should first be taken in a controlled situation. Do not take a dose, least of all your first dose, before events such as driving or operating heavy machinery, when impaired cognition may be a risk for your safety and the safety of others.

After taking any supplement for the purpose of improving sleep, don't check your emails, don't log onto Facebook, just relax and prepare for sleep. Blue light (produced by most screens as well as by the sun) can keep you awake even after you turn it off. If you need to use a computer or mobile device before bed, consider using software such as f.lux, which will redden your screen light and get your body ready for sleep. Alternatively, wear blue-light-blocking glasses an hour or two before bedtime. Exposure to light can reduce melatonin in your body even when you're asleep, so turn off any disrupting light before hitting the hay. Finally, minimize the noise in your bedroom, since noise can reduce sleep quality in addition to making it harder to fall asleep.

Remember that supplementation is a solution of last resort, reserved for people who cannot improve their sleep through lifestyle changes. Do not feel you have to take your combo every night, either. If, as weeks go by, the efficacy of your combo wears off, try taking it only three to five nights a week. It may take you a couple of months to determine your best combo, and a couple more to ascertain your best supplementation schedule.

Finally, pause supplementation after a month to determine if non-supplemented sleep quality has improved.

How to Use This Guide

The Examine.com team has been publishing research on nutrition and supplementation since March 2011. Drawing from all we've learned, we've designed this Supplement Guide with two aims in mind: helping you decide which supplements are right for you, based on the scientific evidence, and helping you integrate these supplements into synergistic *combos*.

Core supplements have the best safety-efficacy profile. When used responsibly, they are the supplements most likely to help and not cause side effects.

Primary options may provide substantial benefit, but only in the right context. A primary option is not for everyone, but if you read the entry and find that you meet the criteria, consider adding the supplement to your combo.

Secondary options have less evidence for their effects. They could work or be a waste of money. Keep them in mind, but think twice before adding them to your combo.

Unproven supplements are backed by tradition or by mechanistic, animal, epidemiological, or anecdotal evidence, but not yet by convincing human trials. At this point, they are not good candidates for your combo.

Inadvisable supplements are either potentially dangerous or simply ineffective, marketing claims notwithstanding. Do not add them to your combo. At best, they'll be a waste of money; at worst, they can cause you harm.

Now that you've learned of various supplements worthy of your consideration, you'll learn to integrate them into synergistic **combos**. You'll discover a *core combo* (composed of the core supplements) and several *specialized combos* (composed of primary and secondary options). Each specialized combo is optimized for a specific population. The simplest way to formulate your own combo is to combine the core combo with the specialized combo that best fits your situation, needs, and primary health goal.

Then comes the **FAQ**, in which we cover common questions that may arise when selecting and combining supplements. With all this, you should be able to identify and assemble the supplement combo best suited to your objective.

Introduction

Nearly twenty years ago, as a young pup researching weightlifting out of my dorm room, I suddenly reached my limit. I thought I knew everything about weights and nutrition (ha!) and it was time to move on to the next topic: sleep science. So I bought an accelerometer-equipped sleep watch on this cool new site called "eBay".

Oh my. I was a mild data junkie before then, but the watch turned me into a level 10 junkie. When I got even a bit less sleep, it was highly correlated with lower test scores, more stress, and … gym plateaus! Sleep seemed to be more influential than how much protein I got, what my lifting routine was, and pretty much anything else.

Digging Deeper: Sleep tracking? There's an app for that

In the late 1990s, accelerometer-equipped watches became available for sleep tracking. They weren't used for clinical sleep assessment — for which dedicated home devices,[1] clunkier but more accurate, had recently become available to physicians — but they did provide the curious layman with some sleep data.

Fast-forward a couple decades, and now anyone with a smartphone can use its accelerometer to track sleep, using cheap or free apps. But are these apps accurate? Can they really tell you how much time you spend in the different stages of sleep,[2] or how efficient your sleep was? Well, according to a recent study … no, not really.[3]

Still, those apps might bring potential problems to your attention (e.g., if you learn that you get up at the same time every night, you can try to understand why). They may also, very simply, keep you invested in maintaining healthy sleep patterns.

There is anecdotal evidence that a smartphone will track your sleep more accurately if you strap it to your arm or leg rather than lay it on your bed (especially if your bed is of the memory-foam variety). But if you want better, you can purchase a fitness device. Not all such devices will be equally accurate, however, and any study on a given device is likely to have been funded by the device's manufacturer.[4] (Industry funding does *not* disqualify a study, but an industry-funded study is less likely to get published if it doesn't produce

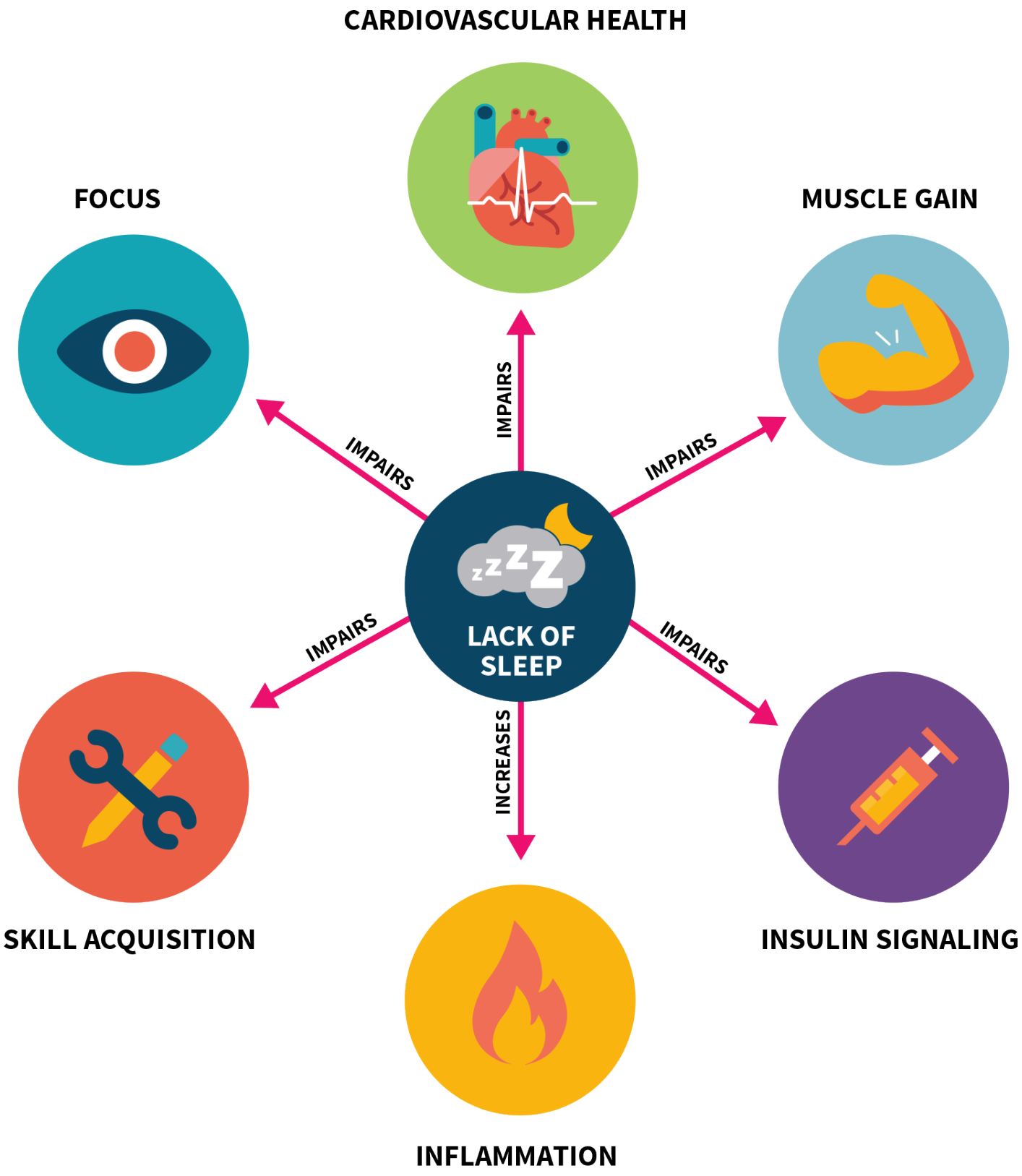
favorable results.)

The problem

Lack of sleep can negatively affect every aspect of your life, including your general fitness. Lack of sleep impairs athletic performance, in both the short term[5][6] and the long term, and it does so in several ways, some more obvious than others:

- **Impaired skill acquisition.** Your ability to build specific brain-muscle connections (let's say, to play the violin or throw a ball accurately) decreases with sleep deprivation, possibly due to a decrease in myelin production.[7] Moreover, to build the *right* brain-muscle connections, you need to repeat the *right* moves, which becomes harder if your focus is impaired.
- **Impaired focus.**[8] Problems to concentrate affect not just mental tasks, such as taking an exam or planning a project, but also physical ones. You simply can't give your all if you're not really "there" when you train or compete.
- **Increased inflammation.**[9][10] Not only does it lead to an increased risk of injury, but even low-level pain[11] will worsen your mood, foster mental and physical fatigue (you'll gas out even sooner, at work and at play), and further impair your focus.
- **Impaired insulin signaling** and thus impaired glucose metabolism.[6][12][13][14][15] Glucose, also known as blood sugar, is a main source of energy; if you cannot burn this fuel efficiently, you'll gas out sooner (and risk developing diabetes,[16][17][18] to boot).
- **Impaired cardiovascular health.** If you don't get enough sleep, you're at a higher risk for cardiovascular disease.[19] Impaired glucose metabolism is one of the probable causes.
- **Impaired muscle gain.** You've probably heard that "you grow when you sleep". In truth, we're still not quite sure that more muscle is built during sleep than during waking hours; but we do know that lack of sleep impairs muscle gain.[6] The reasons are complex; they include a decrease in testosterone production[20][21][22][23][24] and, as we saw, an increase in fatigue (if you can't exercise as hard, or as long, you limit your potential for muscle growth).

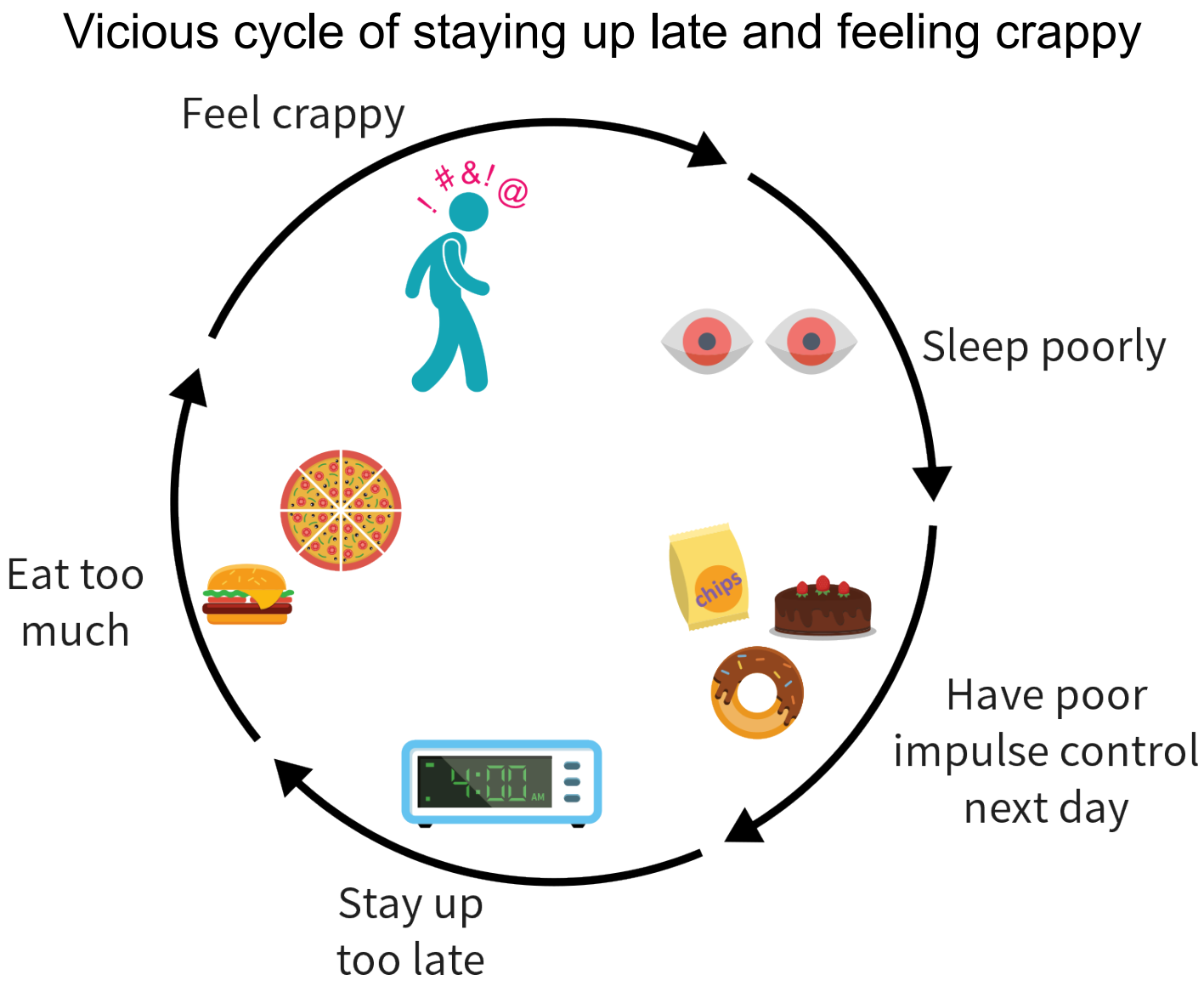
How lack of sleep affects you



Wow. Is that all, now? Not quite. Because in addition to a decrease in athletic performance per se, lack of sleep also causes an **increase in fat gain**. And isn't *that* unfair? If you spend more time awake, shouldn't you burn more calories? And isn't burning more calories what *fat burning* is all about? So why does study after study show that you gain fat as you lose sleep?[25]

The main reason is simple: as you sleep less, you eat more. Even partial sleep deprivation can cause a 20% increase in voluntary energy intake.[15] It also causes your body to burn less fat and more muscle (which is yet another reason why lack of sleep impairs muscle growth).[25]

Now I hope all this bad news won't keep you awake at night, or I've just become part of the problem! Because there are two big reasons people don't get enough sleep, and stress is one of them. The other big reason is that many people simply don't schedule enough time for sleep on a daily basis, instead of hoping to "catch up" during the weekend (a strategy with very limited efficacy). Other reasons, less widespread but harder to address, include pain,[26][27] sleep apnea, and the forms of insomnia not related to stress.



The solutions

So what can you do about it? Let's be blunt: all a supplement can do is *help* you fall asleep, *help* you stay asleep, and *help* you sleep better. No supplement is going to knock you out, and of course, no supplement will pack eight hours of sleep into five hours.

If you want your sleep to improve, you'll have to work with your supplements, not against them. You won't like it, but here it is:

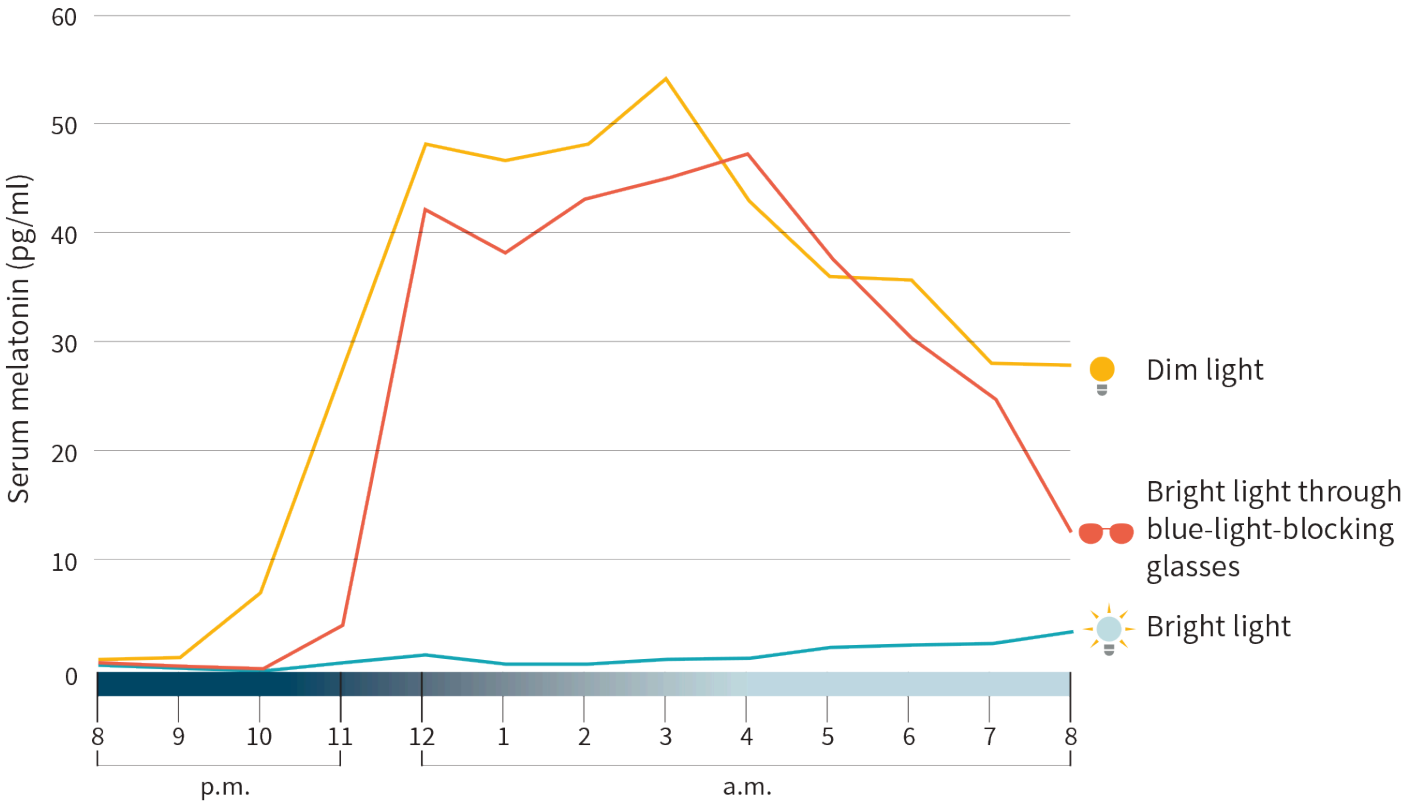
First, you need to schedule enough time for sleep each day.

Second, you should try going to bed at the same time every day, even during the weekend, as this habit both improves sleep quality and reduces sleep onset latency (i.e., the time it takes you to fall asleep).

Third, for at least one hour before bed, you need to relax and avoid sources of blue light.

Blue light (produced by most screens as well as by the sun) can keep you awake even after you turn it off; and even after you fall asleep, it can still reduce your body's production of melatonin, thus decreasing the *quality* of your sleep.

Effect of light on melatonin production



Reference: Kayumov et al. *J Clin Endocrinol Metab*. 2005.[28]

Because playing intense games and answering emails tend to stimulate your brain, those activities are less than ideal near bedtime. Still, if you really need to use your phone, tablet, or computer at night, consider using a program that reddens your screen light after sunset. Or, if you cannot easily adjust the color balance of your screen, start wearing blue-light-blocking glasses a couple of hours before bedtime.

Tip: What should you avoid doing before bed?

If you ask people what they'd like to do before bed, you might hear answers such as meditate, read a book, or share some *special time* with their partner. But in reality, texting, playing games, or working is becoming more prevalent by the year, to the probable detriment of sleep quality.[29]

Aside from fiendishly typing and checking social media, are there any other activities you should avoid in order to get a sound night's sleep?

Eating right before bed is often targeted as a sleep killer. But the evidence is more nuanced; in some people, consuming small amounts of food, such as a glass of milk or a small snack, can benefit sleep.[30] Nighttime exercise is another frowned-upon activity, yet recent trial[31] and survey[32] evidence has shown a potential benefit on sleep.

As it stands, more than what your pre-bed activities are, what's likely to hurt your sleep at that time is excess light exposure. The bright lights of a gym will have this effect, but so will using a tablet — a light-emitting device — rather than reading a printed book.[33][34]

All set? Then, after the eyes, the ears. Noise can both reduce sleep quality and make it harder to fall asleep,[35][36][37] so minimize the noise in your bedroom. If that doesn't suffice, get earplugs, but keep in mind that earplugs attenuate high frequencies more than they do low frequencies — they may protect you against cars honking, but not much against traffic rumble.

Noise is bad enough, but heat can be worse.[38] A bedroom warm enough to raise your core temperature can impair sleep quality and even cause insomnia.[39] Conversely, a bedroom cool enough to lower your core temperature (but not so chilly as to be uncomfortable) will help you fall asleep faster and enter the deeper stages of sleep sooner.[40] An instinctive desire to reduce one's core temperature also explains why some people like to keep a foot outside the blanket (hands and feet being especially good at dissipating body heat).

There you have it. If anything, supplementation should be considered a solution of last resort, reserved for people who cannot sufficiently improve their sleep through lifestyle changes. And even if supplements help you, do not feel you have to take them daily: if their efficacy seems to wane as weeks go by, try taking them only three to five nights a week.

It may take you a couple of months to determine your optimal combination of supplements, and a couple more to ascertain your best supplementation schedule. Every few months afterward, consider pausing supplementation to determine if non-supplemented sleep quality has improved.

10 Tips for better sleep

What can
HURT


Light

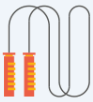

Noise


Heat


Alcohol

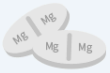

Caffeine

What can
HELP


Exercise


A consistent sleeping schedule


Melatonin


Magnesium


Lavender

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MBA, MPH, PhD(c) in Nutrition

Combos

In this section you'll learn to integrate various supplements into synergistic combos. You'll discover a *core combo* (composed of the core supplements) and several *specialized combos* (composed of primary and secondary options). Each specialized combo is optimized for a specific population. The simplest way to formulate your own combo is to combine the core combo with the specialized combo that best fits your situation, needs, and primary health goal.

Core Combo

Start with 0.5 mg (500 mcg) of melatonin half an hour before bed. You can increase by 0.5 mg each week until you find the lowest effective dose that works, but do not exceed 5 mg (5,000 mcg). Melatonin can also help in case of jet lag.

💡 Tip: Try one combo alone for a few weeks

Taking too many supplements at once may prevent you from determining which ones are truly working. Start with just one of the combos suggested here for a couple of weeks before you consider making any modification, such as adding another supplement, altering a supplements dosage, or incorporating the supplements from an additional combo.

When adding another supplement to your regimen, be methodical. For example, you may wish to take all the supplements from two combos. Select the combo that you wish to try first and take this for a couple of weeks. Then, add one supplement from the second combo and wait another week to see how it affects you. Continue this process until you've added all

the supplements you wish to.

If a supplement appears in two combos you wish to combine, don't stack the doses; instead, combine the ranges. For instance, if the range is 2–4 mg in one combo and 3–6 mg in the other, your new range becomes 2–6 mg. Always start with the lower end of the range — especially in this case, since the reason why one of the ranges has a lower ceiling in one combo may be due to a synergy with another supplement in the same combo. Reading through the full supplement entry may help you decide which dose to aim for, but if you're not sure, lower is usually safer.

Specialized Combos

For people with anxiety and intrusive thoughts

Eating a variety of healthy foods like leafy green vegetables, nuts, and fish will provide enough magnesium to make supplementation unnecessary. If your diet does not provide you with enough magnesium and you cannot modify it so it does, a bedtime dose of 200–350 mg of magnesium (in a form such as citrate, gluconate, or glycinate) will alleviate a deficiency. Magnesium oxide, the cheapest form of magnesium, is associated with intestinal distress and is thus not recommended.

Start with the magnesium. If falling asleep is still a problem after two weeks, add lavender (starting with 80 mg of Silexan per day, working up to 160 mg/day over the course of a week if no lower dose proves effective) and lemon balm (starting with 300 mg/day, working up to 600 mg/day over the course of a week if no lower dose proves effective) half an hour before bed. This specialized combo can be combined with the other one, below.

For people who don't have trouble falling asleep but never feel rested in the morning

Prior to days when you most need to feel rested, add glycine (3–5 g) or valerian (450 mg of an extract standardized to 0.8–1% valerenic acids), also half an hour before bed. This specialized combo can be combined with the other one, above.

Core Supplements

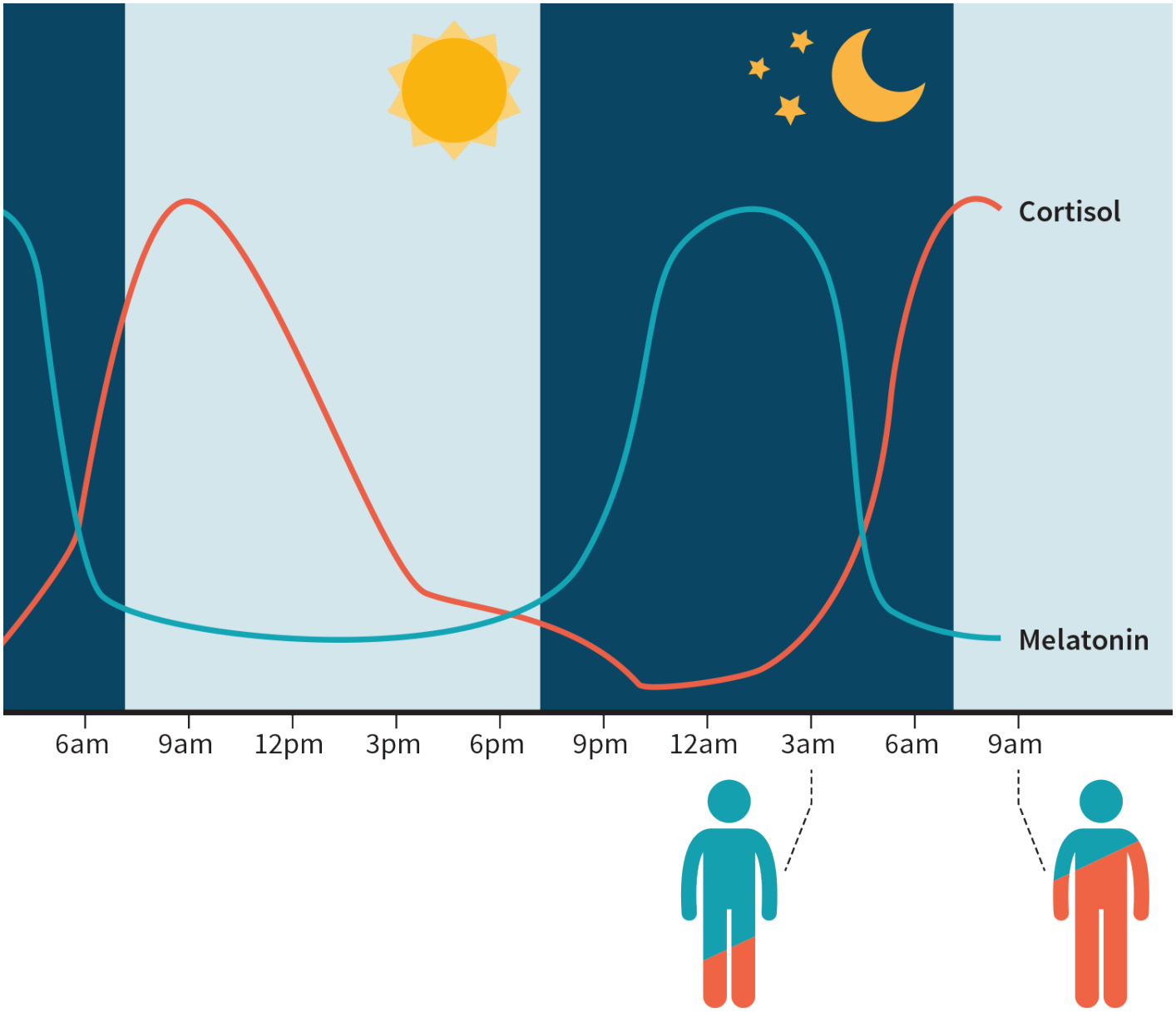
Core supplements have the best safety-efficacy profile. When used responsibly, they are the supplements most likely to help and not cause side effects.

Melatonin

What makes melatonin a core supplement

Melatonin is a hormone involved in the circadian rhythm (which dictates sleeping and waking cycles). As you wake up in the morning, melatonin levels go down, while at night, or if you dim the lights, melatonin production increases.

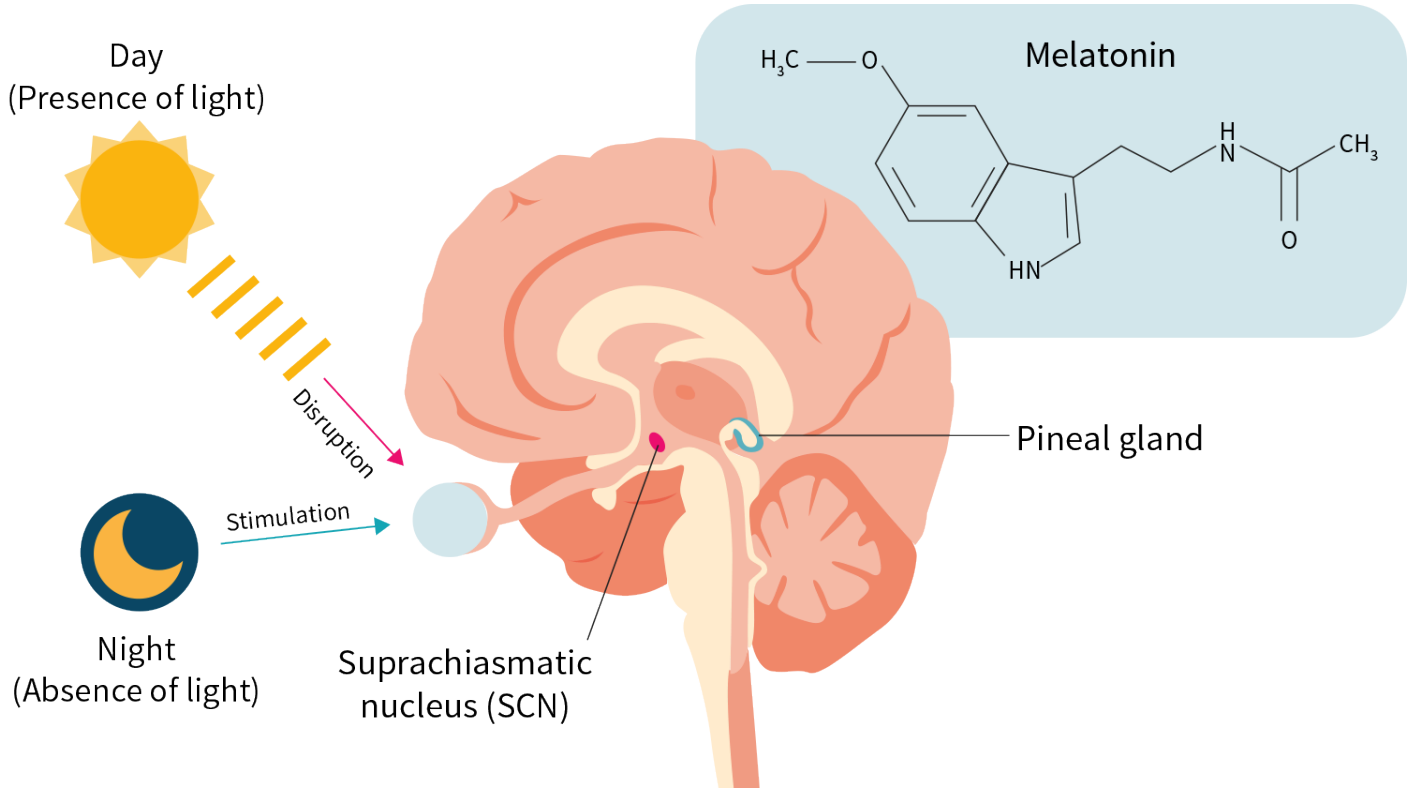
Variation in melatonin and cortisol throughout the day



Your circadian rhythm doesn't exist in a vacuum — it's influenced by external cues, which are referred to as *zeitgebers* (German for "time givers"). Light is one of these zeitgebers. It impacts our circadian rhythm through its interaction with blue light receptors in the retina and the neural pathways that they influence.

Melatonin is one of the primary controllers of our body's circadian rhythm and is produced in the brain, specifically in the pineal gland in the absence of blue-wavelength light (shown below).[41] Therefore, the production of melatonin can be disrupted by exposure to artificial light after sunset.[42] It follows that if melatonin is one of the primary controllers of the circadian rhythm, disruptions to its function may also lead to disruptions in our circadian rhythms.

The effect of light on melatonin production



Reference: Hardeland et al. *Int J Biochem Cell Biol*. 2006.[41]

Oral melatonin may help alleviate insomnia, reduce sleep latency, and improve sleep quality,[43] including in children[44] and the elderly.[45][46] It can also help fight jet lag,[47][48] and so is especially popular among travelers frequently crossing time zones.

Melatonin's benefits hinge on its ability to decrease the time it takes to fall asleep. If you fall asleep easily, you do not need to supplement melatonin.

Your body can make melatonin out of the amino acid L-tryptophan, but since supplemental melatonin is inexpensive, readily bioavailable, and more reliable than tryptophan, there is no reason to include tryptophan in your sleep combo.

How to take melatonin

Take 0.5 mg (500 mcg) half an hour before bed. Increase by 0.5 mg each week until you find the lowest effective dose that works. Do not take more than 5 mg. Time-release melatonin may be more effective at sustaining sleep throughout the night.

💡 Tip: Why don’t you recommend brands or specific products?

For two reasons:

- We don’t test physical products. What our researchers do — all day, every day — is analyze peer-reviewed studies on supplements and nutrition.
- We go to great lengths to protect our integrity. As you’ve probably noticed, we don’t sell supplements, or even show ads from supplement companies, even though either option would generate a lot more money than our Supplement Guides ever will — and for a lot less work, too.

If we recommended any brands or specific products, our integrity would be called into question, so … we can’t do it. That being said, in the interest of keeping you safe, we drew a short list of steps you should take if a product has caught your interest.

Primary Options

Primary options may provide substantial benefit, but only in the right context. A primary option is not for everyone, but if you read the entry and find that you meet the criteria, consider adding the supplement to your combo.

Lavender

What makes lavender a primary option

Lavender (*Lavandula*) is traditionally used in aromatherapy for its relaxing scent. Because of the difficulty of blinding aromatherapy studies, a lot of the evidence for lavender's effects stems from lower-quality studies, but newer studies have examined oral supplementation to treat anxiety.

Intrusive thoughts can increase the time it takes to fall asleep; lavender can ease anxiety,[49] promote relaxation, and reduce those intrusive thoughts.[50][51][52] Lavender may also improve *sleep quality*,[53][54][55][56] and alleviate insomnia,[53][54] though more research is needed to determine the mechanism behind this effect. Likewise, more research is needed to confirm if lavender and lemon balm are synergistic.

Studies on oral supplementation are more recent, and most of them used a proprietary extract. In people with anxiety, Silexan™ was shown to alleviate anxiety,[57][58][59][60] improve sleep quality,[60] and increase sleep duration.[60]

Common methods of lavender administration

Because anxiety is prevalent in younger females, anxiety treatments are often taken along with contraceptive pills. One study has shown that lavender doesn't interact with a type of estrogen-based birth control: ethinyl estradiol with levonorgestrel.

Yet lavender may have hormonal effects. The Endocrine Society and the National Institutes of Health warn that there is some evidence that lavender oil has estrogenic properties and can cause gynecomastia (enlarged breasts in males).

Three case studies of prepubertal gynecomastia have previously been attributed to topical administration of a cologne with lavender as an ingredient.[61][62] More recently, a case-series reported three prepubertal girls and one boy with clinical evidence of estrogenic action associated with a history of using lavender-based fragrance.[63] While the precise development of these conditions can be multifactorial, the gynecomastia resolved once the use of the products was discontinued. Additionally, there is *in vivo* evidence of estrogenic and antiandrogenic properties of both lavender and tea tree essential oils.[62]

If you are using lavender and your breasts become tender, cease use immediately.

How to take lavender

Take 80 mg of Silexan™, a lavender oil preparation standardized for the active component linalool at 25–46% of total weight, 30–45 minutes before bed. After two weeks, if no benefit has been observed, the dose can be increased to 160 mg (this is the *maximum* dose).

Lavender oil is also used in aromatherapy — burned as a candle, heated, placed in a vaporizer, or added to a hot bath. The number of variables (product concentration, proximity of the user to the source, size of the room …) makes recommending dosages exceedingly difficult, but studies have used at least 30 minutes of exposure in a well-ventilated room either at night or in the afternoon.

Magnesium

What makes magnesium a primary supplement

Magnesium is a dietary mineral that plays an important role in the brain. Hypomagnesemia (subnormal magnesium levels in the blood) can result in abnormal neuronal excitations leading to impaired sleep.

Who is more likely to have low magnesium levels?

- **Older people**, because they tend to have relatively low magnesium intakes[64] and may absorb less during digestion.[65]
- **People who sweat a lot**, because magnesium is lost through sweat. Athletes participating in sports requiring weight control may be especially vulnerable.
- **Type 2 diabetics.** It has been estimated that, over all adult ages in developed countries, hypomagnesemia affects less than 15% of healthy people but up to 50% of people with type 2 diabetes.[66]

In addition, certain diuretics, proton pump inhibitors, and the antifungal medication amphotericin B can cause significant magnesium loss.[67]amiloride, eplerenone/Inspra, spironolactone/Aldactone, triamterene/Dyrenium) may not.[67]

High doses of supplemental magnesium can cause diarrhea and general intestinal discomfort[68]; fortunately, magnesium obtained via food has not been seen to cause such problems.[68]

Tolerable Upper Intake Level (UL) for supplemental magnesium (mg)

AGE	MALE	FEMALE	PREGNANT	LACTATING
0–12 months	—	—	—	—
1–3 years	65	65	—	—
4–8 years	110	110	—	—

AGE	MALE	FEMALE	PREGNANT	LACTATING
9 years	350	350	350	350

Reference: Institute of Medicine. Magnesium (chapter 6 in *Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride*. The National Academies Press. 1997.[68])

How to take magnesium

There is no single agreed-on, satisfactory method for assessing magnesium status.[69] To get a better sense of your typical magnesium intake, you should track what you eat for a week. If, on average, you are getting less than 80% of your Recommended Dietary Allowance (RDA), supplementation becomes an option, but you should first try eating more foods rich in magnesium.

Recommended Dietary Allowance (RDA) for magnesium (mg)

AGE	MALE	FEMALE	PREGNANT	LACTATING
0–6 months	30*	30*	—	—
7–12 months	75*	75*	—	—
1–3 years	80	80	—	—
4–8 years	130	130	—	—
9–13 years	240	240	—	—
14–18 years	410	360	400	360
19–30 years	400	310	350	310

AGE	MALE	FEMALE	PREGNANT	LACTATING
31–50 years	420	320	360	360
51 years	420	320	—	—

* Adequate intake (AI)
Reference: Institute of Medicine. Magnesium (chapter 6 in *Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride*. The National Academies Press. 1997.[68])

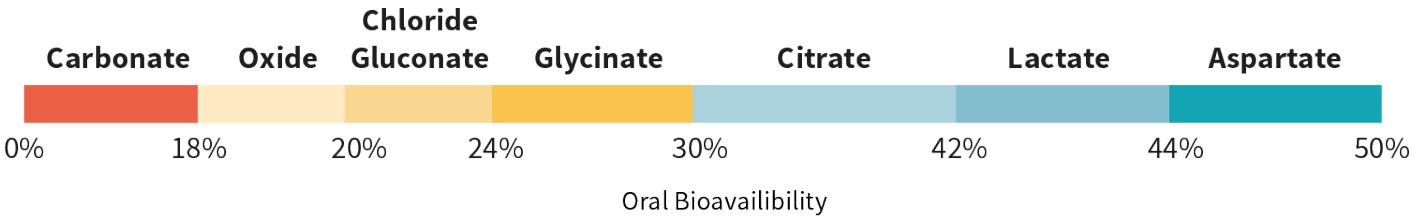
A diet comprising magnesium-rich foods renders supplementation unnecessary, at least for the purpose of preventing anxiety. In case of magnesium deficiency, adding or increasing dietary sources of magnesium should be the first option, but in the absence of practical ways of doing so, supplementation can be used.

If you cannot get enough magnesium through foods, start supplementing with **200 mg** of magnesium once a day. Capsules with 400 mg are common, but keep in mind that the Tolerable Upper Intake Level (UL) for supplemental magnesium for adults is 350 mg. The higher the dose, the higher the risk of gastrointestinal issues.

If your magnesium intake is very low, take up to **350 mg** of magnesium once a day.

Commonly supplemented forms include citrate, gluconate, and glycinate. To increase absorption, magnesium gluconate should be taken with food; other forms can be taken on an empty stomach. **Avoid magnesium oxide.** It has poor bioavailability (rats absorbed only 15% in one study;[70] humans, only 4% in another[71]) and is especially liable to cause intestinal discomfort and diarrhea.[71][72][73]

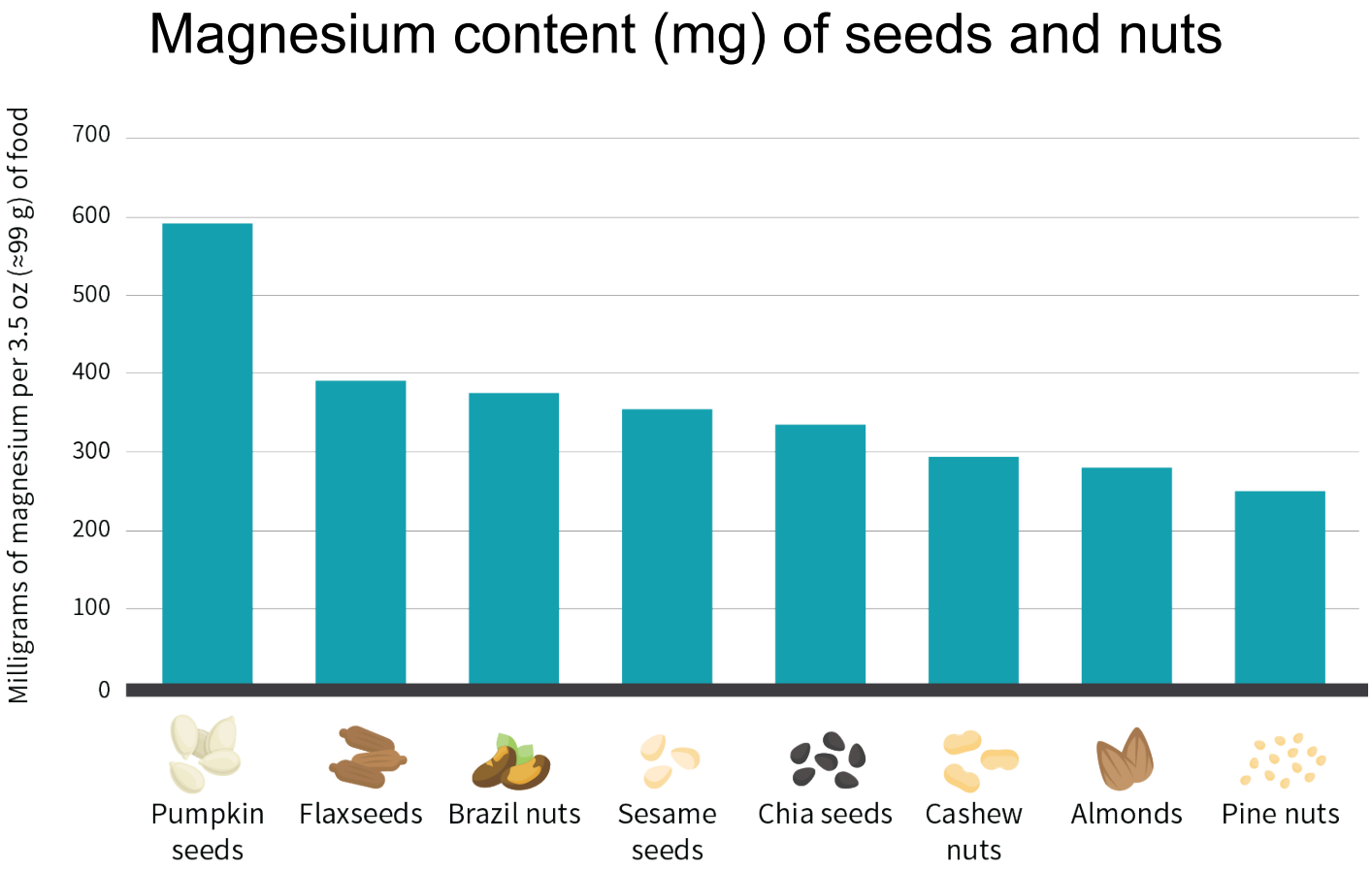
Oral bioavailability of various magnesium salts in humans



Reference: Ranade et al. *Am J Ther*. 2001.[74]

Since calcium, iron, magnesium, and zinc compete for absorption, it is better to take them at least one hour apart from each other. Magnesium may impair the absorption of other pharmaceuticals, notably bisphosphonates and antibiotics, especially those in the tetracycline class (e.g., doxycycline) or quinolone class (e.g., ciprofloxacin).[75] Take magnesium at least 6 hours apart from bisphosphonates or antibiotics.

Because magnesium might have a sedative effect and improve sleep quality, it is best to take it before bed.



Secondary Options

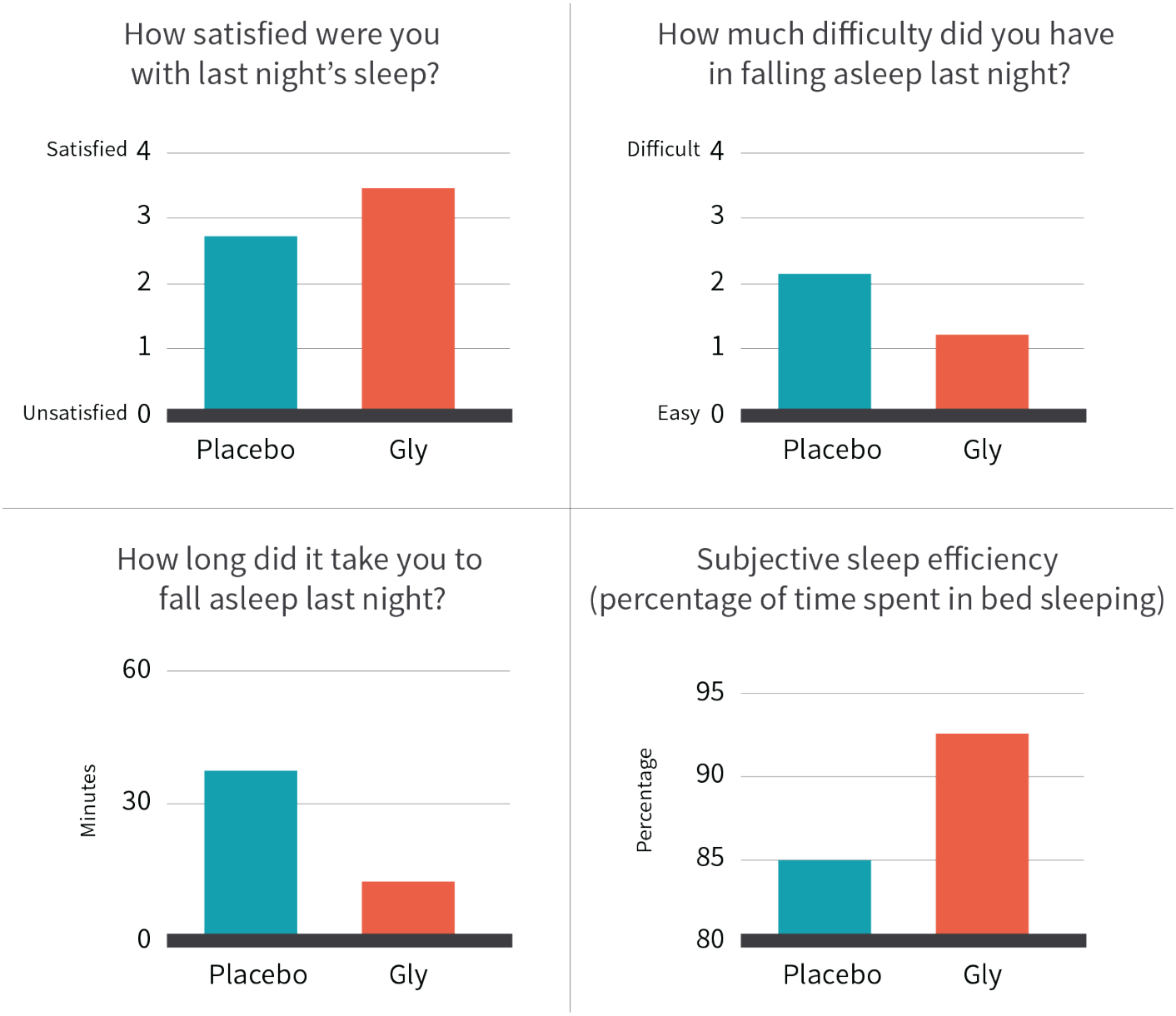
Secondary options have less evidence for their effects. They could work or be a waste of money. Keep them in mind, but think twice before adding them to your combo.

Glycine

What makes glycine a secondary option

Studies on glycine have not found supplementation to improve sleep quality or reduce the amount of time it takes to fall asleep, but participants reported feeling significantly more rested the following morning.

The effects of glycine on subjective sleep quality



While some studies have shown improvements on the perception of sleep quality with glycine supplementation, those studies have all been short term.

Reference: Yamadera et al. *Sleep Biol. Rhythms*. 2007.[76]

Though glycine does not provide the health benefits that result from improved sleep quality, the perception of having had a good night's sleep can make for a comfortable and energetic morning. Plus, glycine is cheap and safe, making it a viable supplement option.

However, studies on glycine have all been short term (four days or less), and anecdotal reports suggest that benefits wear off. Therefore, glycine is probably best used intermittently.

How to take glycine

Take 3–5 g of glycine 30–60 minutes before sleep. Glycine is usually taken with food, but further research is needed to determine how important mealtime supplementation really is. If eating too close to bedtime disrupts your sleep, take glycine on an empty stomach instead.

Glycine can be purchased as pills but is cheaper as a bulk powder, which should be mixed with water and tastes rather sweet.

Lemon Balm

What makes lemon balm a secondary option

Lemon balm (*Melissa officinalis*) is a light sedative. Like lavender, with which it may be synergistic, lemon balm can reduce the time it takes to fall asleep.

Unlike benzodiazepines (diazepam/Valium, alprazolam/Xanax, clonazepam/Klonopin), lemon balm is not potent enough to have addictive or habit-forming properties. Nevertheless, any supplement with a sedative effect can disrupt working memory and reduce attention span. **Do not drive or operate heavy machinery after taking lemon balm or any other supplement with a sedative effect. Do not take lemon balm during the day.**

How to take lemon balm

Take 300–1,200 mg of lemon balm 30–60 minutes before bed. Start with 300 mg; ramp up to 600 mg over the course of a week if no lower dose proves effective. Only take a dose larger than 600 mg if it provides noticeably greater benefits.

Lemon balm is also used in aromatherapy, but studies tend to examine oral supplementation because it is a more reliable delivery method.

Valerian

What makes valerian a secondary option

The root of valerian (*Valeriana officinalis*) was one of the first sleep aids on the market. Like

glycine, it seems to improve subjective reports on sleep and mood (well-being, alertness) the morning after supplementation.

Valerian is one of the best-researched sleep aids, second only to melatonin, yet how it influences sleep on a neural level is still uncertain. Moreover, like St. John's Wort (*Hypericum Perforatum*), it interacts with the activity of CYP3A4, an enzyme that helps in the metabolism of a wide range of pharmaceuticals — from antibiotics to blood pressure medicines. If you are currently on any medication, speak with your physician before taking valerian.

How to take valerian

Take a capsule or prepare an infusion 30–60 minutes before bed. While infusions are difficult to dose due to variations in steeping, look for capsules that contain 450 mg of a valerian extract standardized for 0.8–1% valerenic acids.

Unproven Supplements

Unproven supplements are backed by tradition or by mechanistic, animal, epidemiological, or anecdotal evidence, but not yet by convincing human trials. At this point, they are not good candidates for your combo.

Of the supplements we have reviewed, none currently fit the above description.

Inadvisable Supplements

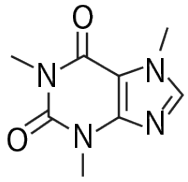
Inadvisable supplements are either potentially dangerous or simply ineffective, marketing claims notwithstanding. Do not add them to your combo. At best, they'll be a waste of money; at worst, they can cause you harm.

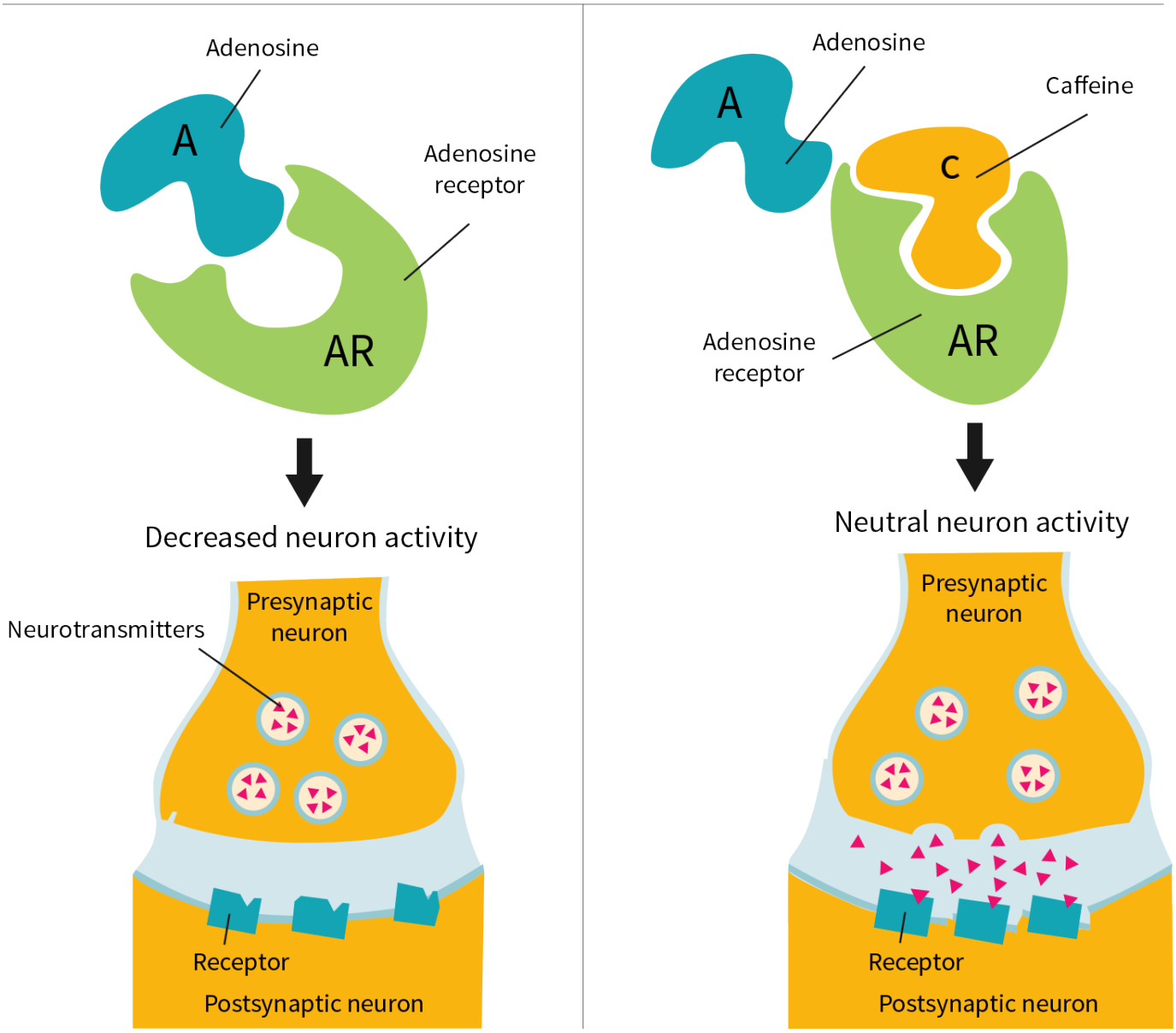
Caffeine

What makes caffeine an inadvisable supplement

Caffeine's primary mechanism of action, shown in the figure below, is interfering with the effects of a molecule called adenosine.[77] Adenosine promotes sleepiness by binding to certain receptors in the brain and interferes with the release of neurotransmitters that are associated with wakefulness, such as dopamine. Caffeine disrupts this process by preventing the binding of adenosine to its receptors, thus allowing the normal release of neurotransmitters associated with wakefulness.

The mechanism of caffeine

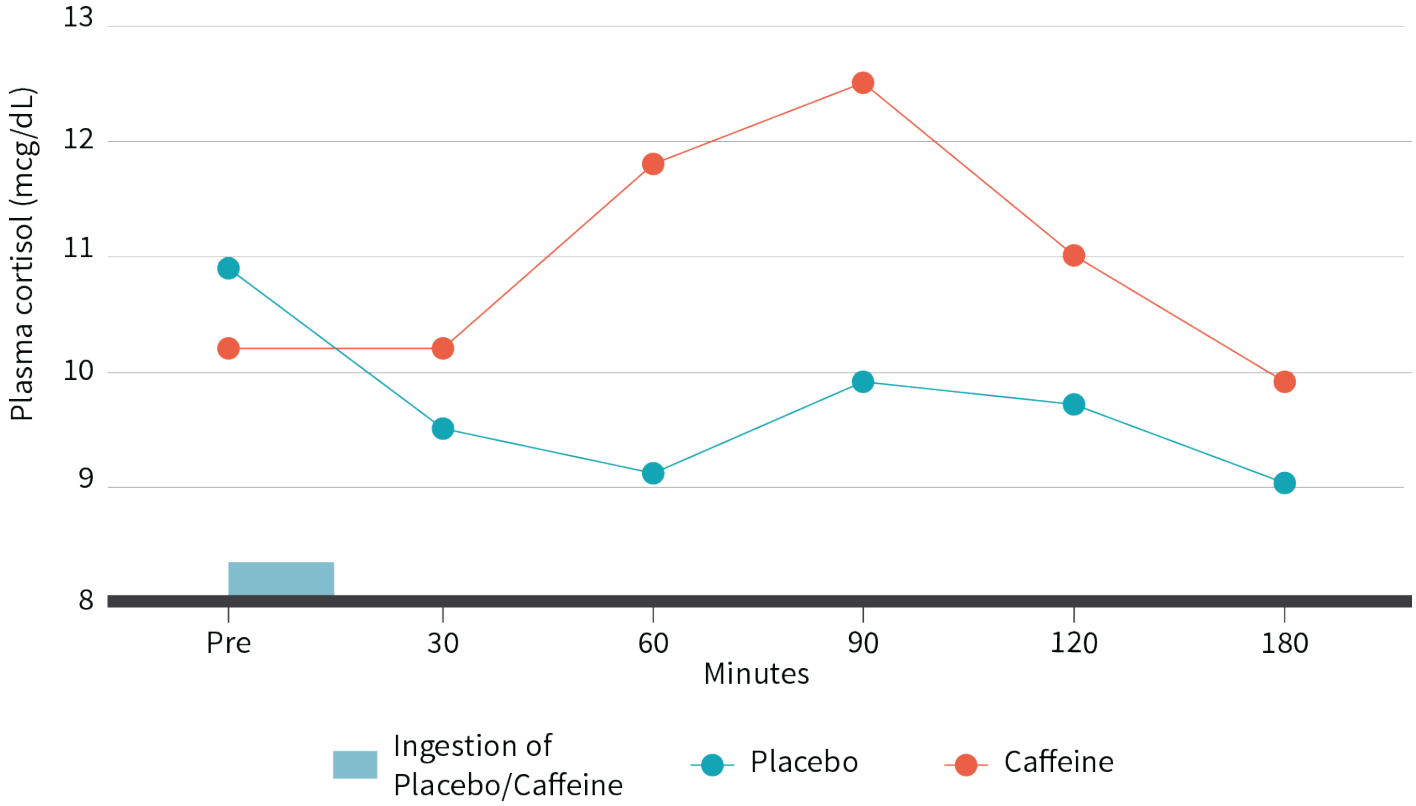




Reference: Ferré. *J Neurochem*. 2008.[77]

People with a caffeine tolerance may still be able to fall asleep after ingesting caffeine, but this stimulant will still negatively affect sleep quality. Caffeine should not be consumed before sleep even by the most veteran coffee drinkers. While some studies suggest that caffeine paired with 15–30 minute “power naps” can benefit alertness more than caffeine or naps alone, this benefit does not extend to longer sleep durations as caffeine will cause cortisol levels to rise after about 30 minutes.

Effects of caffeine on cortisol levels

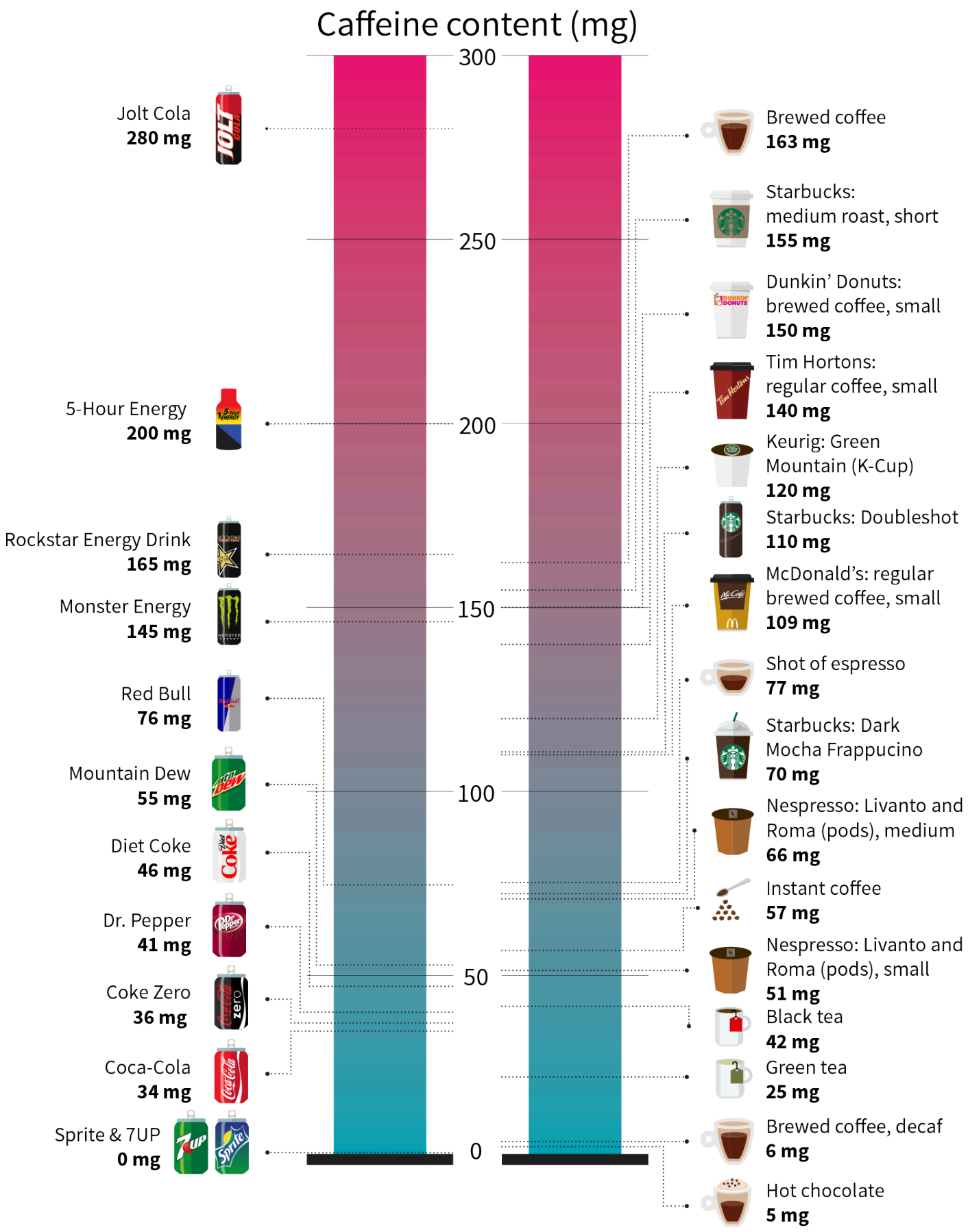


Reference: Lovallo et al. *Pharmacol Biochem Behav*. 1996.[78]

You might already be consuming more caffeine than you think. When you calculate your daily intake, consider all your beverages, foods, and supplements. Bear in mind that caffeine can be "hidden" in a product — for instance, if you read "guarana seeds" on a label, remember that those are richer in caffeine than coffee seeds.

Avoid caffeine at least 6 hours before you go to bed.

Caffeine content of popular drinks



References: McCusker et al. *J Anal Toxicol*. 2006.[79] ● Desbrow et al. *Nutr Health*. 2019.[80] ● Ludwig et al. *Food Funct*.

2014.[81] ● Fox et al. *J Agric Food Chem*. 2013.[82] ● McCusker et al. *J Anal Toxicol*. 2003.[83] ● Angeloni et al. *Food Res Int*. 2019.[84]

Stimulants

What makes stimulants an inadvisable supplement

People with sleep issues or those trying to improve sleep quality should be aware of the stimulants they may be taking (supplement or drugs) and when.

If you choose to take a stimulant, respect the recommended dosage. Be aware that most fat burners, pre-workout supplements, energy drinks, or other products marketed at “energy-boosting” are likely to contain stimulants, such as caffeine or synephrine. Be especially careful if you take several such products, as their effects (and side effects) can cumulate or even synergize.

As a general rule of thumb, avoid taking any stimulants at least 6 hours before you go to bed.

FAQ

Q. What about the supplements not covered in this guide?

Our guides are regularly updated, often with new supplements. We prioritize assessing (and reassessing) the most popular of them and those most likely to work. However, if there is a specific supplement you'd like to see covered in a future update, please let us know by filling out this survey.

Q. Can I add a supplement not covered in this guide to my combo?

Supplement with your current combo for a few weeks before attempting any change. Talk to your physician and research each potential addition. Check for known negative interactions with other supplements and pharmaceuticals in your current combo, but also for synergies. If two supplements are synergistic or additive in their effects, you might want to use lower doses of each.

Q. Can I modify the recommended doses?

If a supplement has a recommended dose range, stay within that range. If a supplement has a precise recommended dose, stay within 10% of that dose. Taking more than recommended could be counterproductive or even dangerous. Taking less could render the supplement ineffective, yet starting with half the regular dose could be prudent — especially if you know you tend to react strongly to supplements or pharmaceuticals.

Q. At what time should I take my supplements?

The answer is provided in the "How to take" section of a supplement entry whenever the evidence permits. Too often, however, the evidence is either mixed or absent. Starting with half the regular dose can help minimize the harm a supplement may cause when taken during the day (e.g., fatigue) or in the evening (e.g., insomnia).

Q. Should I take my supplements with or without food?

The answer is provided in the "How to take" section of a supplement entry whenever the evidence permits. Too often, however, the evidence is either mixed or absent. Besides, a supplement's digestion, absorption, and metabolism can be affected differently by different foods. Fat-soluble vitamins (A, D, E, K), for instance, are better absorbed with a small meal containing fat than with a large meal containing little to no fat.

Q. What are DRI, RDA, AI, and UL?

The Dietary Reference Intakes (DRIs) is a system of nutrition recommendations designed by the Institute of Medicine (a US institution now known as the Health and Medicine Division). RDA, AI, and UL are part of this system.

- Contrary to what the name suggests, a **Recommended Dietary Allowance** (RDA) doesn't represent an *ideal* amount; it represents the *minimum* you need in order to avoid deficiency-related health issues. More precisely, it represents an amount just large enough to meet the minimum requirements of 97.5% of healthy males and females over all ages — which implies that the RDA is too low for 2.5% of healthy people.
- The **Adequate Intake** (AI) is like the RDA, except that the number is more uncertain.
- The **Tolerable Upper Intake Level** (UL) is the maximum safe amount. More precisely, it is the maximum daily amount deemed to be safe for 97.5% of healthy males and females over all ages — which implies that the UL is too high for 2.5% of healthy people.

As a general rule, a healthy diet should include at least the RDA of each nutrient — but less than this nutrient's UL. This rule has many exceptions, though. For instance, people who sweat more need more salt (i.e., sodium), whereas people who take metformin (a diabetes medicine) need more vitamin B_{12}.

Moreover, the DRIs are based on the median weight of adults and children in the United States. Everything else being equal (notably age, sex, and percentage of body fat), you likely need a lesser amount of nutrients if you weigh less, and vice versa if you weigh more. The numbers, however, are not proportional — if only because the brains of two people of very different weights have very similar needs. So you can't just double your RDIs for each nutrient if you weigh twice as much as the median adult of your age and sex (even if we overlook that people weighing the same can differ in many respects, notably body fat).

Q. I took 350 mg of supplemental magnesium and

experienced diarrhea. Why is that?

If magnesium is indeed the culprit, then your diarrhea was probably caused by too large a dose reaching the colon. Alternatively, it could mean that your body's levels of magnesium are in fact sufficient, making supplementation unnecessary.

In the future, split your daily dose into multiple doses. If the problem persists, reduce your daily dose to 200 mg. If you are using magnesium oxide, switch to a different form of magnesium such as citrate, gluconate, or glycinate

Q. What's the difference between elemental magnesium and other kinds of magnesium?

"Elemental" refers to the weight of the mineral by itself, separately from the compound bound to it. For instance, ingesting 500 mg of magnesium gluconate means ingesting 27 mg of elemental magnesium.

Product labels display the elemental dosage. On a label, "27 mg of magnesium (as magnesium gluconate)" means 27 mg of elemental magnesium (and 473 mg of gluconic acid).

Q. How does alcohol affect my sleep?

At first, alcohol can help you fall asleep, but this effect fades off after a few days if you keep drinking close to bedtime.[85] And right from the start, it will impair the quality of your sleep.[86][87] Ironically, alcohol-use disorders have even been linked to insomnia, though their being cause or consequence is uncertain.[85]

In short, don't use alcohol as a sleep aid — it might help you relax, but it will impair the quality of your sleep. You may find it beneficial to avoid alcohol after dinner.

Q. Is melatonin supplementation safe?

In a review of 195 reviews of melatonin (i.e., an umbrella review), only 5.6% reported adverse effects and most of these effects were mild symptoms, such as dizziness, nausea, headaches, and fatigue.[88] In some studies, pharmacological doses as high as 75 milligrams have been used without any serious adverse effects being reported.[89] It is worth noting, however, that there aren't many long-term studies that have been conducted on melatonin.

There are, however, two things that should be kept in mind: First, a recent study found that many melatonin supplements do not meet the label claims.[90] Second, some of the supplements that were tested in this study were contaminated with serotonin, a neurotransmitter, that may affect the study results.

Q. Will supplementing melatonin affect my own production of melatonin?

It seems unlikely with low doses. Studies that have administered melatonin at doses of 0.5 milligrams,[91] 2.0 milligrams,[92] 5.0 milligrams,[93] and 50 milligrams[91] have found no significant effect on the body's ability to produce a basal level of melatonin.

Q. Are there specific species of lavender that have more active constituents?

Lavender is a plant from the *Lamiaceae* family that includes various different species. Most lavender species share similar major chemical constituents, consisting of terpenes, alcohols, ketones, and polyphenols.[94] While constituents and properties are similar among species, lavender essential oil extracts can range from 26–57% linalool and 4–35% linalyl acetate,[95] with linalool considered the primary active constituent.[96]

Q. How much sleep should I get?

How much sleep *you* need may take some trial-and-error testing to see what works best. But if you're looking for some general guidelines, check out the recommendations from the National Sleep Foundation below.[97]

Recommended hours of sleep

AGE	RECOMMENDED	MAY BE APPROPRIATE	NOT RECOMMENDED
0–3 months	14–17	11–19	<11 or >19
4–11 months	12–15	10–18	<10 or >18

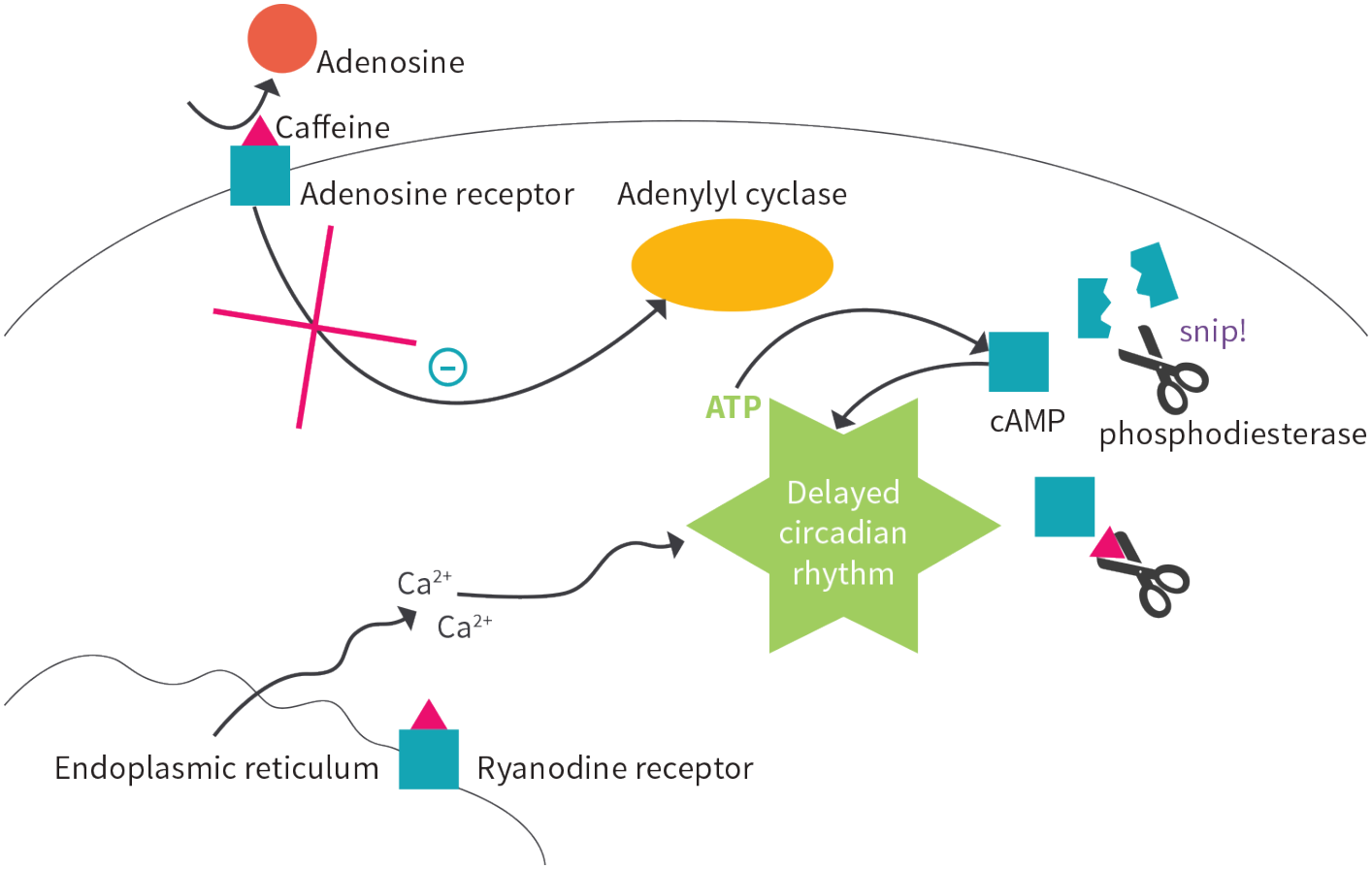
AGE	RECOMMENDED	MAY BE APPROPRIATE	NOT RECOMMENDED
1–2 years	11–14	9–16	<9 or >16
3–5 years	10–13	8–14	<8 or >14
6–13 years	9–11	7–12	<7 or >12
14–17 years	8–10	7–11	<7 or >11
18–25 years	7–9	6–11	<6 or >11
26–64 years	7–9	6–10	<6 or >10
≥65 years	7–8	5–9	<5 or >9

Adapted from Hirshkowitz et al. *Sleep Health*. 2015.[97]

Q. How exactly might caffeine screw up my circadian rhythm?

The circadian clock in humans is controlled primarily by the suprachiasmatic nucleus (SCN) within the brain. The SCN is a group of cells that sit by the optic nerve and respond to light and other stimuli that come in from the eye. Hypothetically, caffeine could affect the SCN (and other tissues throughout the body) in various ways, depicted below.

Possible ways caffeine could affect circadian rhythm



One way is through increasing a cell's levels of cyclic AMP (cAMP), which is often created inside a cell in response to a signal. This occurs for two reasons. First, caffeine blocks adenosine receptors that normally reduce cAMP levels. Second, caffeine binds phosphodiesterase enzymes that act to degrade cAMP.[98] When these enzymes are blocked, cAMP levels are raised.

It's also been shown that circadian rhythms within the SCN are regulated in part by the release of calcium ions during the stimulation of ryanodine receptors,[99] which caffeine also binds.[100]

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Bios

Michael Hull

Senior research manager • MSc in human nutrition

Michael received a BSc in exercise science with a minor in nutrition from George Mason University (where he mentored under GMU's resident sports dietitian, Deanna Busteed, MS, RD, CSSD), then an MSc in human nutrition from McGill University. His master's thesis examined how modifiable lifestyle factors can potentially predict vitamin D status. As a full-time senior researcher at Examine.com, he primarily writes and updates the Supplement Guides, maintains the company's database of supplement studies, and blogs about various health topics. When not working for Examine.com, he enjoys finding ways of using technology to further science communication.

Wyatt Brown

Researcher

Searching for ways to improve his health and frequently confused by the conflicting messages from publications and popular authors, Wyatt dove head first into the scientific research and became fascinated by its logic and methods. Contributing to his most respected website has only intensified his interest and motivated him to pursue an education in nutrition.

Kamal Patel

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Kamal Patel is cofounder and director of Examine.com. He holds two master's degrees from the Johns Hopkins University, in business and in public health, and is on hiatus from a PhD in nutrition for which he's investigated the link between diet and chronic pain. He's published peer-reviewed articles on vitamin D and calcium, as well as on a variety of clinical research topics. He's also been involved in research on fructose and liver health, on nutrition in low-income areas, and on mindfulness meditation.

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Pierre-Alexandre holds graduate degrees from New York University, the University of Toulouse II, and the University of St Andrews. At NYU, he was MVP then captain of the Taekwondo Club, president of the Karate Club, and founder of the Martial Arts Club. After graduation, he wrote a grammar book, then found himself working as assistant professor of French in Taiwan. After some years enjoying the best foods in Asia, he moved back to France to freelance as a writer, translator, and copy editor. He's Examine.com's resident copy editor and has been overseeing our Supplement Guides since 2016.

... and the rest of the team!

With degrees in nutrition, exercise science, medical science, public health, pharmacology, toxicology, microbiology, biophysics, biomedical science, neuroscience, chemistry, and more, the members of our team are all accredited experts, but with very different backgrounds, so that when we review the evidence, we get the full picture.