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Nutrient of the Month: Thiamine (Vitamin B1)

Long known as one of the essential cofactors for converting carbohydrates into ATP energy within mitochondria, thiamine is increasingly linked to cardiovascular, metabolic, and neurological functions. Body stores of thiamine are small, and it is mostly found in high-functioning, energy-dependent organs that go through it quickly: muscles, heart, brain, and kidneys. Main dietary sources include yeast, sunflower seeds, rice bran, sesame seeds, flaxseed, corn meal, hemp seed, pine nuts, oat bran, whole grains, beans/pulses, other nuts and seeds, wheat germ, liver, meat, fish, and spirulina, but supplements are also important, especially for those with chronic illness and older people. The thiamine molecule contains organic sulfur, which contributes to its sharp smell. Thiamine is degraded in the presence of ultraviolet light, sulfite food preservatives, and high concentrations of tannins (as in black tea, some other herbs, and some fruits).

As one of the hardest-working vital organs, the heart is famously dependent on moment-to-moment energy supply, and thiamine is a crucial factor in cardiac muscle energy production. One study concluded that around one-third of heart failure patients are thiamine-deficient, and supplementation has been shown to improve ejection fraction, a critical functional indicator in cardiac failure. Both elevated body mass index (BMI) and bariatric surgery also pose significant risk for deficiency, underlining the importance of supplementation for people in these overlapping populations. Thiamine deficiency has been found to lead (not surprisingly) to congestive heart failure, but also to peripheral neuropathy, Wernicke’s encephalopathy, and beriberi, and it may further contribute to cardiometabolic disorders like diabetes, dyslipidemias, and obesity. The fat-soluble and more bioavailable analogue of thiamine, benfotiamine, may help limit formation of potentially harmful advanced glycation end products (AGEs) when blood
glucose is elevated, and thus may have particular application in dysglycemias. AGEs (and high blood glucose levels) contribute to biological aging, numerous age-related diseases, and complications in disease. Aging may also predispose to functional thiamine deficiency, as one study discovered that people aged 65 or over showed reduced bioavailability for thiamine despite seemingly adequate intake.

The brain is another extremely energy-hungry organ, and depends on thiamine-related processes for normal glucose processing. Some research proposes that altered thiamine metabolism and resulting changes in brain insulin function may aid development of Alzheimer’s disease (and constitute an early biomarker of it), though this needs to be confirmed. Thiamine’s effects on glucose metabolism and oxidative stress (via glucose toxicity and AGEs), combined with its fairly commonly reduced bioavailability in aging, suggest that it should be kept in mind when addressing conditions affected by dysglycemia, especially cardiometabolic disease, chronic inflammation, and dementia.

Thiamine has also been investigated in other conditions having aspects of glucose dysregulation. Among women aged 52 to 74, those with higher thiamine intakes showed less clouding of their eyes’ lenses over time compared to those with lower intakes; this may also relate to better long-term glucose handling, as age and poor glycemic control are major factors in development of cataracts in type 2 diabetes. Preliminary clinical research found high-dose thiamine effective in reducing college students’ premenstrual symptoms, especially anxiety, depression, sleep problems, and fatigue; it bears pointing out that several symptoms of premenstrual syndrome (PMS) may be linked to changes in the glucose response. Dr. Derrick Lonsdale of the Cleveland Clinic has long postulated that critical alterations in thiamine metabolism can contribute to sudden infant death syndrome (SIDS) through potentially critical energetic impacts, though this is difficult to prove conclusively.

Intestinal malabsorption, heavy or long-term alcohol consumption, and use of furosemide, antibiotics, or phenytoin can induce thiamine deficiency. In addition, a number of variants in genes coding for thiamine-related enzymes or transporters cause minor dysfunction or serious disease (including Leigh syndrome and maple syrup urine disease), and may change an individual’s thiamine requirements. Thiamine deficiency can lead to increased blood levels of lactic acid, though many disease processes and the use of metformin, acetaminophen, alcohol, and other drugs can also cause lactic acidosis. Considering thiamine’s importance in carbohydrate metabolism and managing glucose toxicity, global increases in simple sugar consumption, and relatively common genetic and age-, disease-, and drug-related factors interfering with thiamine usage, many individuals may require greater intakes than Dietary Reference Value recommendations.

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Your Balance Marks Your Sleep

It’s easy to underrate sleep, especially when conflicting work or social needs and opportunities seem more urgent than carving out and sticking to your full eight hours. Though sleep affects performance, quality of sleep varies from day to day, and it can be difficult to discern the immediate effects of changes in sleep. New research in healthy young volunteers found that poor sleep can affect sense of balance in as little as 48 hours. One’s pattern of weight distribution while standing or walking reflects the quality of recent sleep, as it demonstrates integration of cognitive and muscular function. Pressure on the sole of the foot marks balance: excessive variation can indicate involuntary postural instability, while too little variability limits adaptation to circumstances and increases risk of injury.

The evolving science of chronobiology (one’s biological aptitude for earlier or later activity) has increased appreciation for how time of day affects individual performance; the standard 8-to-5 workday clearly does not bring out the best in everyone, and the health costs of shift work are becoming common knowledge. Overall quality of sleep is related to:

- total sleep duration
- level of fragmentation of sleep
- heart rate variability (higher is better)
- nocturnal waking and activity (less is better)
- how well sleep schedule harmonizes with chronobiology

Some people find apps helpful for understanding sleep patterns and optimizing sleeping habits, like Sleep Cycle, Pzizz, Sleep Time, SleepBot, or MotionX 24/7. A heart rate monitor plus heart rate variability app (like EliteHRV or Heart Rate Sensor) may be especially useful for realizing how perceived stressors are impacting sleep quality. It is especially important to ensure that your sleeping environment is conducive to deep rest: quiet, not too hot, uniformly dark, and situated as far as possible from electromagnetic fields.