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Take Control of Your Health

Vitamin D and Magnesium Support Athletic Performance and Recovery

Analysis by Dr. Joseph Mercola | November 26, 2026

STORY AT-A-GLANCE

- Vitamin D and magnesium work together to regulate muscle contraction, energy production, bone strength, and recovery, forming a nutrient pairing that influences how effectively your body responds to training
- Research consisting of professional and Olympic sports shows widespread vitamin D and magnesium deficiency, which may raise injury risk, slow recovery, weaken strength, and reduce endurance through impaired calcium and adenosine triphosphate (ATP) function
- Magnesium deficiency often hides behind normal blood tests, disrupts cellular energy production, may worsen fatigue and cramps, and may increase soreness, especially in endurance athletes training hard or in hot environments
- Endurance exercise increases magnesium needs by shifting the mineral into working muscles and increasing losses through sweat and urine
- Supplementing magnesium and vitamin D together may improve strength, endurance, recovery, and soreness within weeks, particularly in athletes starting deficient or training at high volumes, without increasing workout intensity

Are you an avid exerciser trying to break a personal record? Once you reach a point where you feel confident, there comes a time when you'll want to take your athleticism to the next level. To do that, the usual answer is to train even harder. However, this approach may not be even needed at all. In fact, the key to better performance could be as simple as addressing certain nutrient deficiencies.

One possible reason why many athletes aren't performing well enough as they'd like is because they're deficient in vitamin D and magnesium. Research shows that these two work together to provide the energy your muscles need to perform their very best. They also affect other biological processes, such as bone strength and stamina, which is why it's in your best interest to make sure these are at optimal levels.

The Interplay Between Vitamin D and Magnesium

A review published in the journal Nutrients examined how vitamin D and magnesium shape athletic performance, recovery, and injury risk across multiple sports. The researchers combed through more than 200 studies to identify how these deficiencies appear in athletes and explain why low levels quietly may undermine strength, endurance, and resilience. The populations covered in this review included professional, Olympic, Paralympic, and recreational athletes across endurance, power, and team sports.[1]

- **Nutrient deficiencies were common —** The researchers discovered these findings even in elite competitors. They also linked low vitamin D and magnesium levels to higher injury rates, slower recovery, and impaired muscle function.*

  That means if you're becoming more prone to injury, or stuck in a performance plateau, you could be lacking certain nutrients instead. Realizing this can prevent you from overtraining to compensate.

- **The extent of vitamin D deficiency among athletes —** The review reported that 32% of professional basketball players qualified as vitamin D deficient, while nearly half fell below optimal levels. Meanwhile, 26% of National Football League (NFL) athletes are deficient, and 42% to 80% have insufficient levels.

  Weightlifters, runners, volleyball players, swimmers, and taekwondo practitioners were also found to be deficient in this nutrient.*

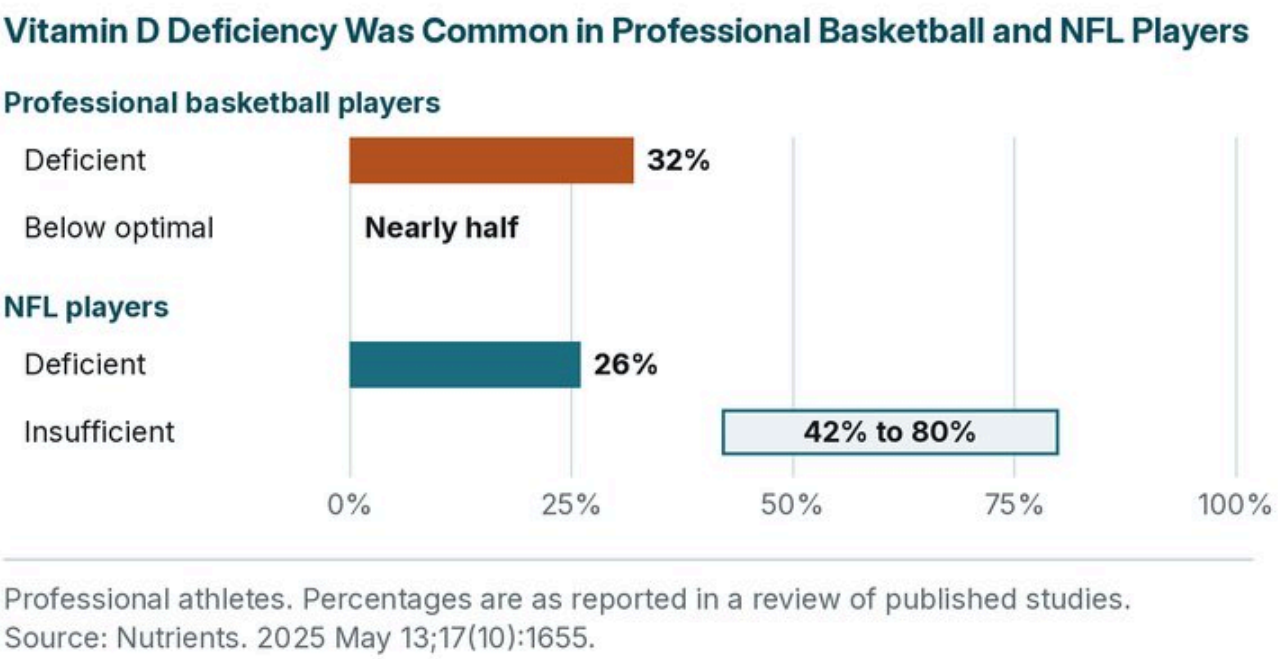


Figure 1. Vitamin D deficiency was reported in 32% of professional basketball players and 26% of NFL players.

These findings carry strong implications because vitamin D regulates calcium movement into muscle and bone*.[2] When levels stay low, muscle contractions may lose efficiency and the body's ability to absorb dietary calcium is reduced*.[3] For an athlete, that may translate into weaker lifts, slower sprints, and more time off due to injury.

- **Magnesium deficiency emerged as an equally serious but more hidden problem —** The authors described how endurance exercise increases magnesium needs by shifting the mineral into working muscles and increasing losses through sweat and urine.

  Even athletes who met the standard dietary allowance still may show signs of deficiency. A meta-analysis cited in the review found that most athletes failed to meet daily magnesium requirements.

- **The importance of proper testing —** The review highlighted a study of British Olympic and Paralympic athletes showing that about 22% had intracellular magnesium deficiency.* However, not many are familiar with this condition, as

deficiency often doesn't present specific symptoms:[4]

> *"Although the signs of magnesium deficiency are often nonspecific, suboptimal magnesium levels should be considered when persistent symptoms such as muscle cramps or spasms, fatigue, low endurance, irritability, poor sleep, delayed recovery, or increased injury risk are present," the researchers reported.*
>
> *"The serum magnesium level may not reflect cellular levels, but it will exclude severe deficiency."*

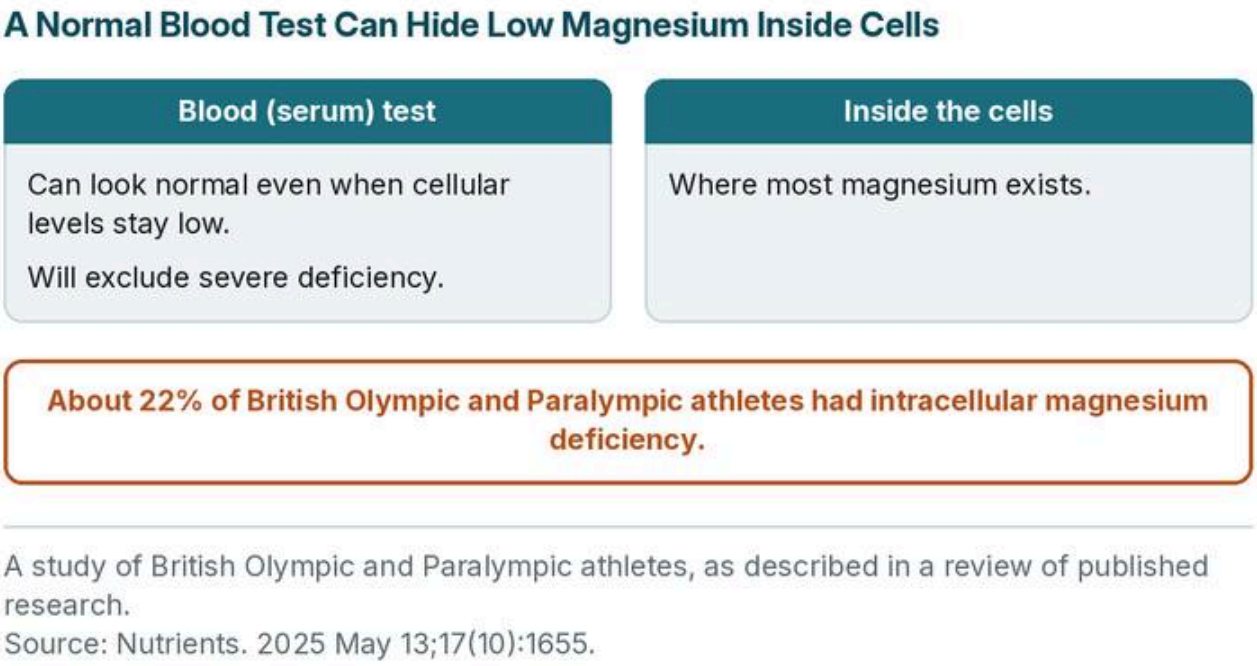


Figure 2. A blood test can look normal while cellular magnesium stays low, and about 22% of British Olympic and Paralympic athletes had intracellular magnesium deficiency.

- **How different variables influenced nutrient outcomes —** Athletes training in hot environments or at high volumes showed greater magnesium losses than those in cooler conditions or lower training loads.

  Indoor athletes and those living at higher latitudes showed lower vitamin D levels compared to outdoor athletes. These comparisons clarify that risk is not evenly distributed. Your sport, climate, and training style shape how fast these nutrients

drain.*

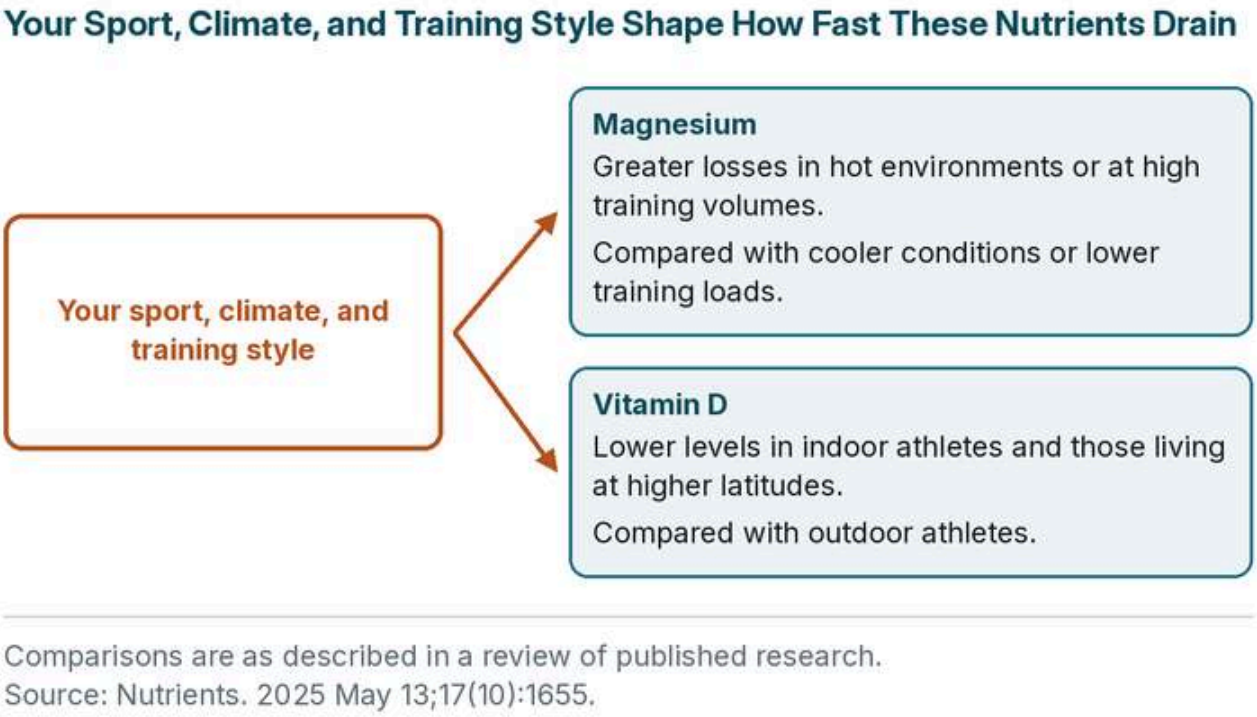


Figure 3. Hot environments and high training volumes were linked to greater magnesium losses, while indoor training and higher latitudes were linked to lower vitamin D levels.

- **The crucial role of magnesium in mitochondrial and muscle function —** Magnesium binds to adenosine triphosphate (ATP), which is your energy currency. Without enough magnesium, ATP remains chemically unstable and less usable.*

  The researchers emphasized that much of the ATP that exists in your body is bound to magnesium. Within the context of athletic performance, this mineral helps maintain energy during exercise, as well as contracting and relaxing muscles.

- **Vitamin D plays a different but complementary role —** The authors described how vitamin D receptors in muscle tissue influence protein synthesis, muscle fiber composition, and neuromuscular coordination. Low vitamin D may weaken these signaling pathways, which reduce force production and increase injury risk.

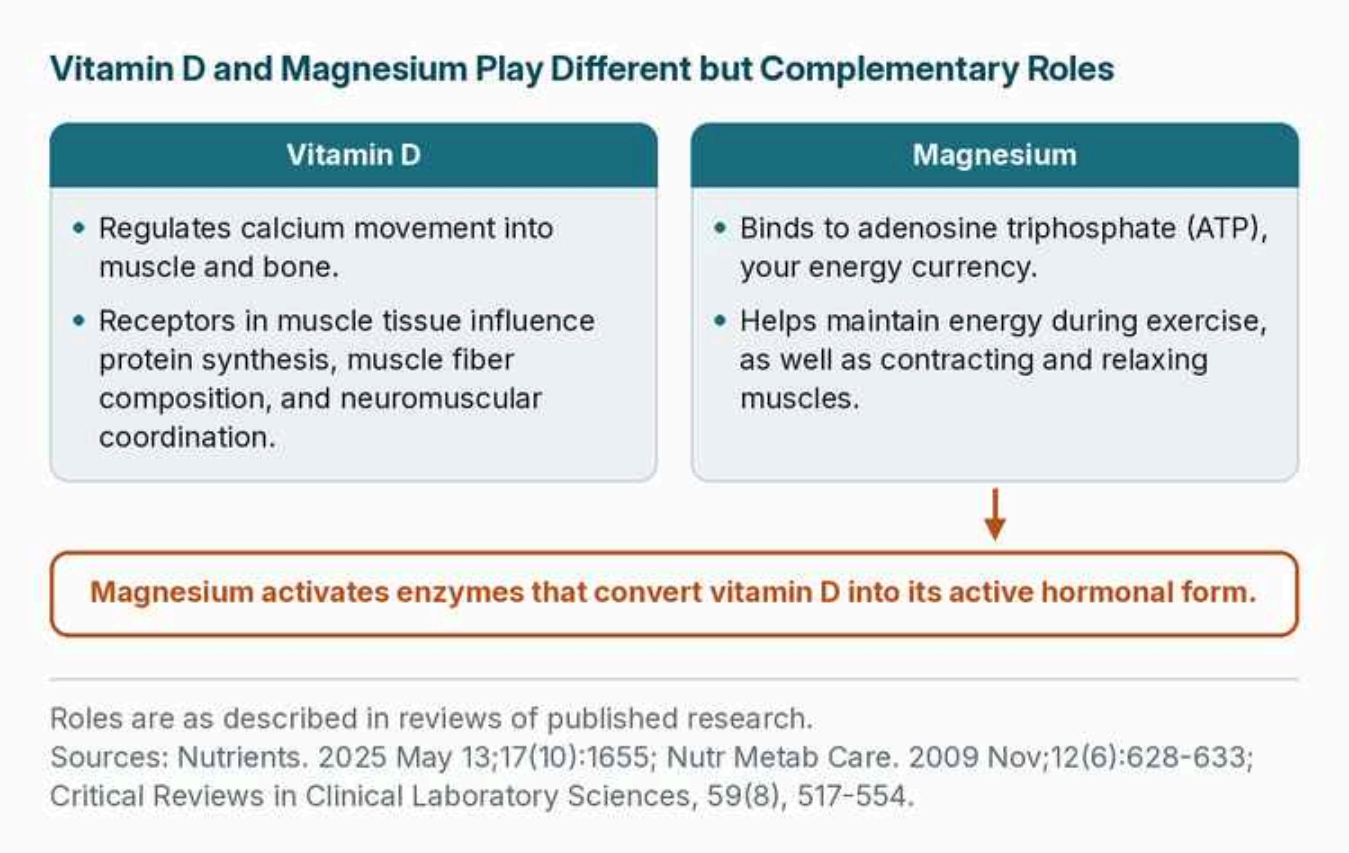
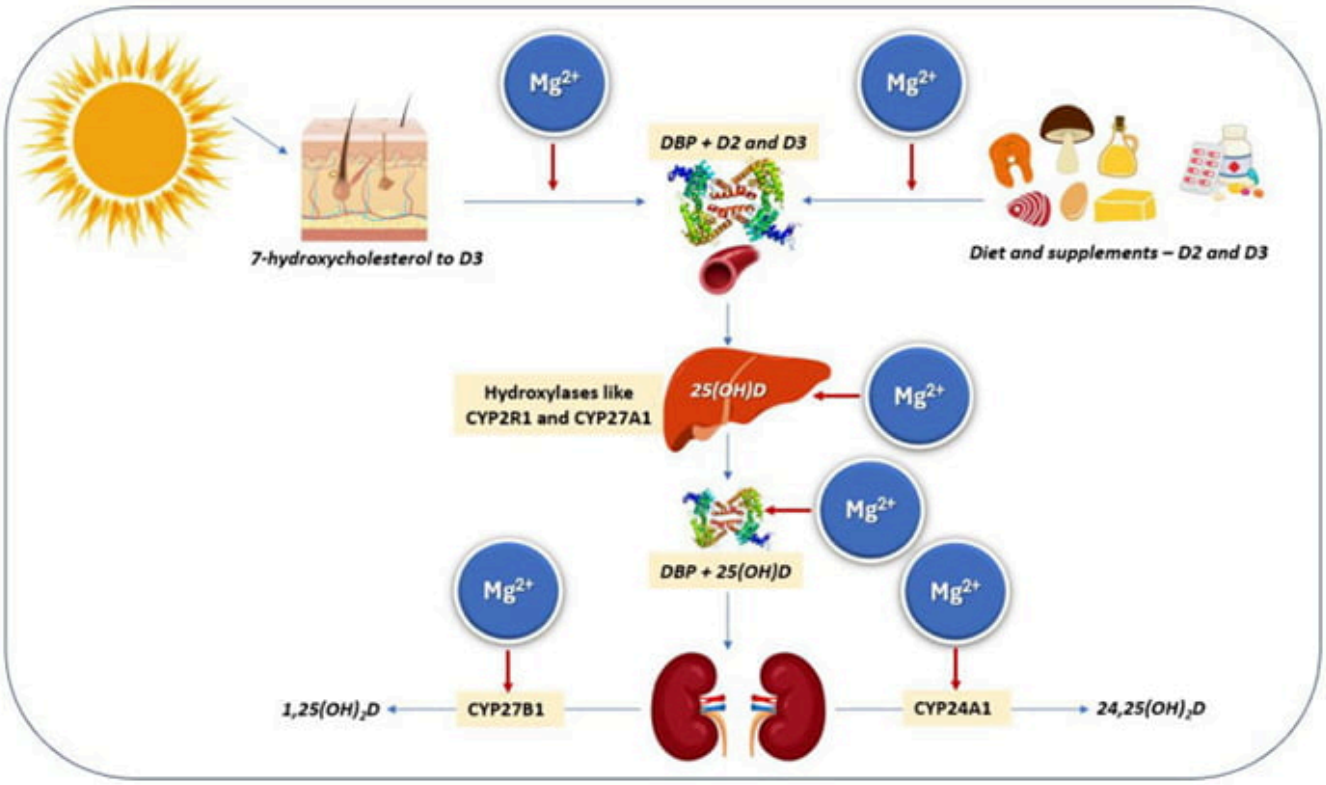


Figure 4. Vitamin D and magnesium play different roles, and magnesium activates the enzymes that convert vitamin D into its active form.

- **The interaction between vitamin D and magnesium —** Magnesium activates enzymes that convert vitamin D into its active hormonal form. When magnesium runs low, vitamin D can remain less effective, even if blood levels appear acceptable. In reality, magnesium is found in every step of the way during the metabolization of vitamin D, the researchers said. The image below shows the process:



Source: ***Nutrients. 2025 May 13;17(10):1655***

Increasing Proper Magnesium and Vitamin D Levels May Benefit Athletic Performance

In related research, a narrative review published in the Translational Journal of the American College of Sports Medicine evaluated how magnesium and vitamin D supplementation influence exercise performance and recovery. The researchers reviewed 13 human studies that tested supplementation strategies to figure out what measurable changes show up in performance, fatigue, and recovery.[5]

The populations covered across the selected studies included recreationally active adults, trained athletes, and physically active individuals with documented nutrient insufficiency. Some trials focused on endurance athletes, others on strength or mixed exercise protocols.

- **A possible beneficial pattern emerged —** Supplementation appeared to produce the strongest benefits in people who started with low nutrient status or who trained at higher volumes.*

Several trials reported improvements in physical performance after magnesium supplementation. The rate of improvement varied by study design, but overall, measurable gains appeared within weeks. In endurance-focused trials, participants showed improved time to exhaustion and reduced oxygen cost during submaximal exercise, meaning they performed the same workload with less effort.

- **Physical performance changes —** Muscular strength, power output, and endurance capacity improved most often. Some studies reported stronger grip strength and leg power, while others documented longer exercise duration before fatigue set in.* Interestingly, these changes also occurred without changes in training volume.

- **Benefits were observed within weeks —** Short-term studies lasting four to six weeks already showed performance changes, while longer interventions maintained or slightly enhanced those improvements over time.

- **The largest benefits appeared in specific subgroups —** Physically active individuals with low baseline magnesium intake or signs of deficiency experienced greater performance gains than those who already met recommended intakes. Endurance athletes, who lose more magnesium through sweat and urine, showed stronger responses than strength-focused athletes in several trials.

- **Vitamin D supplementation showed a similar pattern but with more variation —** Trials that enrolled participants with low baseline vitamin D levels reported improvements in muscle strength, sprint performance, and recovery markers. In contrast, studies involving participants who already had adequate vitamin D levels showed little change in performance metrics.

- **Combining magnesium and vitamin D may create synergistic benefits —** The interactions between magnesium and vitamin D during metabolism may make their combined effects greater than either nutrient alone. The authors noted that research is still needed to clarify their combined effects on exercise performance. Thus, addressing one while ignoring the other may limit the outcomes.

- **Other helpful effects —** Several studies reported reduced markers of muscle damage and perceived soreness following supplementation. Participants described themselves feeling less exhausted after training sessions and more prepared for subsequent workouts.*

- **Biological mechanisms of vitamin D and magnesium —** The researchers touched upon the different roles of these nutrients within the context of athletic performance. When it comes to vitamin D, it helps with muscle function, bone mineralization, and immune function. As for magnesium, it plays a role in muscle strength and cardiorespiratory function.

Practical Strategies to Maintain Optimal Vitamin D Levels

Based on the published findings, vitamin D may help improve your athletic performance. But that's not all it offers. I'm a big advocate of producing it through sunlight exposure, and only taking a supplement if tests show that you're still way off target.

1. **Prioritize sunlight as your primary vitamin D source —** Your skin has a built-in system for producing vitamin D when exposed to direct sunlight. Regular sun exposure on larger areas, such as arms and legs, allows this process to function as best as possible.

   Pay attention to how your skin responds. Redness or burning signals excess exposure, while normal skin tone suggests you're within a safe range. This simple visual check adapts naturally to season, latitude, and skin type, helping you stay within a healthy window.

2. **Remove vegetable oil from your diet before increasing midday sun exposure —** If you've been eating a diet that is high in canola, soybean, sunflower, or other vegetable oils, your skin tissues have now accumulated **linoleic acid** (LA).

When exposed to ultraviolet light, LA oxidizes and increases sunburn risk (especially during solar noon). To protect your health, it would be wise to minimize your LA intake to 2 to 5 grams per day. One way to do this is by replacing vegetable oils with animal fats like tallow, ghee, or grass fed butter.

To monitor your LA intake, I recommend using my PAX app, which is slated for release sometime in 2026. It contains a feature called Food Buddy, which calculates your daily LA consumption to a tenth of a gram. Give your body roughly six months without vegetable oils to allow LA to clear from tissues. As that happens, your tolerance to sunlight improves, and your skin responds more comfortably to sun exposure.

Here's another handy tip — increase your intake of C15:0 fat, also known as pentadecanoic acid, found in grass fed dairy. In a previous article, I noted how it may help push LA out from your tissue, expediting the process further. Read "**The Fast-Track Path to Clearing Vegetable Oils from Your Skin**" to get the complete details.

3. **Choose vitamin D3 and support it with magnesium and K2 —** When supplementation becomes necessary, vitamin D3 is the one that your skin produces, while **D2 may disrupt vitamin D balance and reduce usable D3 levels**. Pairing D3 with magnesium and vitamin K2 may make the process safer and more efficient. Magnesium activates vitamin D so your body can use it, and K2 helps guide calcium into bones rather than soft tissues.

   These nutrients function as a team. Without magnesium and K2, maintaining healthy vitamin D levels may require you to take far higher doses, which complicates the problem more instead of solving it. Supporting D3 with its cofactors may improve efficiency and lower the likelihood of calcium mismanagement.

4. **Check your vitamin D status twice each year —** It's important to have your blood tested to know where you stand. I recommend aiming for 60 to 80 nanograms per milliliter (ng/mL). If results come back low, focus on lowering your LA intake so you can eventually expose your skin during mid-day sun, when vitamin D production is at its greatest. This will also help you determine if you truly need to take a supplement.

You're Likely Deficient in Magnesium

If you've been exercising and correcting your vitamin D levels properly, but you're not reaching your goals yet, it's time to check your magnesium levels. Most people are low on cellular energy, and increasing magnesium may be one of the quickest ways to reverse it. As noted earlier, it's bound to ATP. Here's how you can support your magnesium levels:

1. **Food oftentimes isn't enough —** Even with a clean, whole-food diet, many people fall short on magnesium. That's because modern agriculture has stripped the soil of much of its mineral content. This means that vegetables may contain less magnesium. And while nuts and seeds contain this mineral, they also contain high levels of LA.

   I generally recommend you get your nutrients from food, but magnesium is a rare exception. Reaching the recommended Daily Value of 420 milligrams per day[6] through diet alone is difficult.

2. **Find your ideal dose using magnesium citrate —** This type of magnesium is highly bioavailable and costs little, but it has laxative properties. Instead of viewing that as a downside, use it as a measuring tool. One approach is to start with a low amount and slowly increase. When stools turn loose, you can back down slightly. That point marks your ideal daily dose.

Once you identify the dosage, you can switch to a gentler form at the same dose. Magnesium glycinate, magnesium malate, and magnesium L-threonate are all good choices.

3. **Match the magnesium form to your main concern —** Not all magnesium supplements work the same way. If tension, irritability, restlessness, or poor sleep are your concerns, magnesium glycinate may offer a calming effect without sedation.

   If you have low energy, muscle soreness, or brain fog, magnesium malate supports energy production by feeding your mitochondria. When mental clarity matters most, you may want to consider magnesium L-threonate, which helps support cognitive function.

4. **Topical magnesium can also be useful —** Magnesium oils, lotions, and bath flakes can also help improve your magnesium status, and provide a pleasant, relaxing sensation. A simple and inexpensive way to boost your magnesium may be to take regular Epsom salt baths, especially in the evening.

5. **Keep supplementation simple and clean —** Choose high-quality magnesium supplements free from artificial colors, fillers, and unnecessary binders.

**These findings are from research conducted in clinical settings. Results may not apply to all individuals.*

This article is for informational purposes only and does not constitute medical advice. Consult a qualified healthcare provider before making changes to your health regimen.

Frequently Asked Questions (FAQs) About Magnesium and Vitamin D

Q: Why do vitamin D and magnesium matter for athletic performance?

A: Vitamin D and magnesium work together to support muscle contraction, energy production, bone strength, and recovery. When either runs low, strength, endurance, and injury resistance may decline, even with consistent training.

Q: How common are vitamin D and magnesium deficiencies in athletes?

A: A review reported that deficiencies are widespread, including among elite athletes. Significant percentages of professional and Olympic athletes have low vitamin D or magnesium.

Q: Why don't standard blood tests always catch magnesium deficiency?

A: Most magnesium exists inside cells, not in blood. Serum magnesium can look normal even when cellular levels stay low, which may explain ongoing fatigue, cramps, poor sleep, and slow recovery.

Q: Who benefits most from correcting vitamin D and magnesium levels?

A: Athletes with frequent injuries, performance plateaus, heavy training loads, indoor training, hot environments, or signs of low energy may see the greatest improvements once deficiencies are corrected.

Q: What practical steps help restore vitamin D and magnesium levels?

A: Regular sunlight exposure, reducing vegetable oil intake, appropriate vitamin D3 supplementation with magnesium and K2, proper testing, and using well-absorbed magnesium forms, such as glycinate, malate, or L-threonate, at the right dose may support long-term performance and recovery.

Sources and References

- [1, 4] Nutrients. 2025 May 13;17(10):1655
- [2] Nutr Metab Care. 2009 Nov;12(6):628-633
- [3] Critical Reviews in Clinical Laboratory Sciences, 59(8), 517-554
- [5] Translational Journal of the ACSM 6(4):p e000179, Fall 2021
- [6] NIH, Magnesium