

Vitamin D

Vitamin D3 (cholecalciferol) is a fat-soluble pro-hormone and an essential vitamin. It's produced naturally by the skin after exposure to ultraviolet radiation, particularly UVB, like in sunlight. It is important for strength trainees, because it is necessary for optimal bone strength, mineral metabolism, immune function, neuromuscular functioning and testosterone synthesis. As a result, [your vitamin D level can slightly influence your strength development \[2, 3, 4\]](#), your [lean body mass \[2\]](#) and your [injury resistance](#), although [the direct short-term benefits for your gains of vitamin D supplementation are not consistent, even when you're deficient](#). Vitamin D also has many effects on the brain, including regulation of the 'liking' neurotransmitter serotonin. [Getting enough vitamin D can improve sleep quality](#) and [significantly reduce the risk of depression](#). The 'winter blues' depression, formally called seasonal affective disorder, is strongly associated with vitamin D deficiency.

How much do you need?

[Vitamin D requirements have been colossally underestimated by public health authorities for a long time](#), comprising what is now widely regarded as one of the most damaging mistakes in public health advice. Many public health institutes recommend daily vitamin D3 intakes of only 400-600 IUs with deficiency being diagnosed only below a serum 25-hydroxyvitamin D level of 20-30 nmol/l. [Meta-analytic research finds all-cause mortality decreases up to 50 nmol/l](#) (20 ng/mL) and many organizations define 50 as the minimum these days, so that should be the minimum target. After this point, more vitamin D supplementation generally doesn't have significant health benefits and [won't further improve your gains \[2, 3, 4, 5\]](#). Up until that point, vitamin D3 supplementation does tend to improve neuromuscular development and performance. [Some research finds health benefits all the way up to 100 nmol/l](#) (40 ng/ml), especially for specific diseases and conditions. Therefore, [some researchers recommend aiming for a vitamin D3 level of 100 nmol/l \[2\]](#). Benefits could theoretically increase up to a serum 25-hydroxyvitamin D level of ~115 nmol/l. [This is the vitamin D level found in traditional](#)

such, most people should emphasize consuming enough omega-3s, not restricting their omega-6 intake of whole foods.

Effects on performance and body composition

Omega-3 fatty acids are [anti-catabolic and even directly anabolic in several ways](#).

- [Omega-3 fatty acids can lower chronic inflammation levels \[2\]](#) and thereby increase the inflammatory signal for cell repair and lower protein breakdown rates, as per the course section on inflammation's signal-to-noise relation with muscle growth.
- [Omega-3s protect you against excessive muscle damage](#) and [improve neuromuscular recovery \[2\]](#).
- [Omega-3 fatty acids can lower cortisol levels, reducing catabolic activity and improving nutrient partitioning \[2\]](#).
- [Omega-3 fatty acids can increase testosterone production](#), according to some research.
- [Omega-3 fatty acids can increase muscle anabolic signaling and protein synthesis rates after meals](#), although [a 2024 meta-analysis](#) found that omega-3s don't generally significantly increase *muscle* protein synthesis, only whole-body protein synthesis.

Various studies have found [increases in lean body mass and muscle growth as a result of increased omega-3 intake \[2, 3, 4, 5, 6, 7\]](#), [as well as increased muscle performance](#) (e.g. strength) [2, 3, 4, 5] and [improved recovery](#). However, the benefits are inconsistent and often small. In many studies they don't reach statistical significance. [A 2022 meta-analysis on older adults](#) found mixed positive effects on strength but no significant effect on lean body mass. [An earlier 2020 meta-analysis in the elderly](#) did find a significant but small positive effect on muscle mass and again mixed effects on functional performance. The benefits were greater in studies with durations of at least 6 months and dosages of at least 2 g EPA + DHA per day. [A 2023 meta-analysis by André et al.](#)