

EVIDENCE REVIEW 04 • VITAMIN SAFETY

How much vitamin D is too much?

The adult upper intake level is 4,000 IU a day, but that limit is not a toxicity switch. Risk depends on dose, duration, blood calcium and medical context.

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BOTTOM LINE

For people aged nine and over, 4,000 IU (100 mcg) a day is the tolerable upper intake level for routine intake from all sources. Vitamin D toxicity comes almost entirely from supplements, not sunlight, and does its damage mainly by raising blood calcium.

KEY POINTS

- The adult recommended dietary allowance is 600 IU through age 70 and 800 IU after 70.
- The upper intake level is 4,000 IU (100 mcg) daily from all sources for ages nine and over.
- Toxicity acts through high blood calcium, and can cause kidney injury, soft-tissue calcification and abnormal heart rhythms.
- The often-quoted 17% rise in kidney stones came from a calcium plus vitamin D trial that cannot separate the two.

The number most people have heard is 4,000 IU. What that number means is less widely understood, and the misunderstanding runs in both directions — some treat it as a target, others as a cliff edge.

It is neither. It is a population boundary.

An upper limit is not the point where harm starts

The tolerable upper intake level is the highest average daily intake likely to pose no risk of adverse effects for nearly everyone in the general population. For ages nine and over, including adults, the Institute of Medicine set it at 4,000 IU — 100 micrograms — a day, in its 2010 review.

The value was derived cautiously. It assumed that hypercalcemia is unlikely below roughly 10,000 IU a day, then applied an uncertainty factor to allow for variation between people. The gap between the limit and the dose where problems were actually observed is deliberate padding, not a measurement.

That is why exceeding it briefly is not the same as being poisoned, and why clinicians sometimes prescribe far more for a limited period to correct a documented deficiency. Supervised treatment of a diagnosed problem is a different

activity from long-term self-dosing without monitoring.

For context, the recommended dietary allowance is 600 IU a day through age 70 and 800 IU after 70 — figures many multivitamins already meet.

How toxicity actually causes damage

Vitamin D increases calcium absorption, and that is the mechanism of harm.

Excessive supplemental intake can produce hypercalcemia and hypercalciuria — too much calcium in the blood and urine. Early symptoms are non-specific: nausea, weakness, confusion, dehydration, frequent urination, excessive thirst. Severe cases can progress to kidney injury and failure, calcium deposits in soft tissue and blood vessels, cardiac arrhythmias, and death.

Sunlight does not usually cause this. The skin regulates its own production, so the practical source of vitamin D toxicity is supplements — which is why the total across every product matters more than any single bottle.

The kidney-stone finding needs its absolute numbers

One statistic dominates discussion of vitamin D and kidney stones: a 17% increase.

It comes from the Women's Health Initiative, which randomised postmenopausal women to 1,000 mg of elemental calcium plus 400 IU of vitamin D3 daily, or placebo. Over seven years, kidney stones were reported by **449 women in the supplement group and 381 in the placebo group** — a hazard ratio of 1.17, with a 95% confidence interval of 1.02 to 1.34.

Two qualifications matter, and the relative figure hides both.

The first is arithmetic. Across a trial of more than 36,000 women, the difference is 68 additional stone events over seven years. It is a real finding and it was statistically significant, but "17% more" describes a small absolute difference.

The second is attribution. The trial gave calcium and vitamin D together, and the vitamin D dose — 400 IU — was well under the upper limit. Nothing in that design can separate an effect of calcium from an effect of vitamin D. Other trials of vitamin D with or without calcium have found more hypercalcemia and hypercalciuria without a corresponding rise in stones.

The evidence therefore supports watching total intake and blood calcium. It does not support a claim that doses above 4,000 IU inevitably cause kidney stones.

A safer way to decide

Add up everything: multivitamins, standalone tablets, drops, fortified foods and combination products. Vitamin D is easy to take twice without noticing. Check whether calcium is in the mix as well, since the two interact.

Some people need individual advice rather than a general limit — those with kidney disease, existing high blood calcium, granulomatous disorders such as sarcoidosis, or medications affecting calcium handling. Where high-dose treatment is genuinely indicated, monitoring 25-hydroxyvitamin D and serum calcium is part of the treatment.

One claim to retire: routine high-dose supplementation has not been shown to prevent cardiovascular disease in otherwise healthy people.

In New Zealand, vitamin D supplements are regulated as dietary supplements rather than medicines, so the label rules that apply are the ones described in [what supplement labels are allowed to claim in New Zealand](/supplements/what-supplement-labels-can-claim-in-nz/) (/supplements/what-supplement-labels-can-claim-in-nz/). The intake figures above are the Australia/New Zealand and US reference values, which align on the 4,000 IU upper level for adults. Anyone considering a dose above it should be doing so with a clinician, not on the strength of a label.

SOURCES

01. Vitamin D — Fact Sheet for Health Professionals

NIH Office of Dietary Supplements

<https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/>

02. Dietary Reference Intakes for Calcium and Vitamin D — Tolerable Upper Intake Levels

Institute of Medicine, NCBI Bookshelf

<https://www.ncbi.nlm.nih.gov/books/NBK56058/>

03. Calcium plus Vitamin D Supplementation and the Risk of Fractures

Jackson RD et al., New England Journal of Medicine

<https://www.nejm.org/doi/full/10.1056/NEJMoa055218>

04. Urinary tract stone occurrence in the Women's Health Initiative randomized clinical trial

Wallace RB et al., American Journal of Clinical Nutrition

<https://pubmed.ncbi.nlm.nih.gov/21525191/>

Medical note. General information only. Not personalised nutrition or medical advice. This review explains published research and cannot diagnose or treat a condition. Ask a qualified clinician or pharmacist about your own health, medicines and supplement use.

Source of record. The current version of this review, with working links, is at

<https://www.proteinnotes.com/evidence/how-much-vitamin-d-is-too-much/>