

## Vitamin D Boosts Calcium Potency

### Janet Raloff

Many older adults, especially women, face a constant battle to preserve their bones' density. They pop dietary supplements and try to stick to menus with foods rich in calcium. Nevertheless, they can still develop osteoporosis, a condition characterized by brittle bones and a high risk of fractures. A new study shows that how much calcium a woman needs to keep bones strong depends largely on an individual's daily intake of vitamin D, the sunshine vitamin that's also in many fortified foods.

Indeed, the new study finds that in a country where vitamin D intakes are high, women can reduce their daily calcium intake to about one-third of the officially recommended daily amount without compromising their bones' health, says Gunnar Sigurdsson, an endocrinologist at University Hospital in Reykjavik, Iceland, and a study coauthor.

The rub: Few women in North America come close to getting the 400 to 600 international units (IU) of vitamin D per day needed to achieve this calcium-sparing effect (see [Understanding Vitamin D Deficiency](#)).

Many women in Iceland do, Sigurdsson's team found, but largely because these people tend to subscribe to the age-old local practice of fortifying their diets with a daily dose of cod-liver oil. This oil is a rarity: a food naturally rich in vitamin D.

The new study supports a trend seen in earlier studies: that as people consume more vitamin D, the efficiency with which their bodies absorb calcium from food improves, notes Boston University endocrinologist Michael F. Holick. However, he's skeptical about the applicability of numerical data from the new study to populations outside Iceland.

So is Robert P. Heaney, a Creighton University endocrinologist who studies bone formation and loss. He says that the new Icelandic numbers for the minimum vitamin D and calcium concentrations needed to protect our bones are low—in vitamin D's case, by 50 percent—compared with findings from studies conducted in North America and Europe.

Noting that Iceland's population exhibits little ethnic diversity, Heaney questions whether "it might well be different, genetically, in terms of this population's absolute requirements [for these nutrients]." In fact, he points out that few recruits in the new study had vitamin D intake that put them in the



*Fortified milk is a primary source of vitamin D for many people in the United States. In Iceland, many people instead turn to cod-liver oil—a far richer source—to boost their intake of this vitamin.*

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range considered optimal by his and several other recent studies. Therefore, Heaney told *Science News Online*, Sigurdsson's team couldn't tell whether the bone health of women in the new study would have benefited more by consuming additional vitamin D.

One point on which all of these researchers agree: Bone health depends at least as much on vitamin D as on calcium. And for most people living in northern-temperate latitudes, sunshine and diet alone won't provide sufficient vitamin D throughout much of the year. This is one instance in which almost everyone should take a vitamin supplement—especially the elderly and people of color—say the researchers. Elderly people's skin needs more because it manufactures the vitamin less efficiently, and the pigments in dark skin screen out much of the sunlight needed to produce vitamin D.

### **In Iceland**

Sigurdsson's group recruited some 2,300 women between the ages of 30 and 85 who lived in or around Reykjavik, Iceland's capital. In addition to filling out a survey on their food consumption and use of dietary supplements, the participants had blood drawn for measurements of parathyroid hormone (PTH) and 25-hydroxy vitamin D (25-D). PTH is a marker of bone health, and 25-D is the precursor of vitamin D's activated form.

PTH concentrations typically climb as a person's calcium intake falls. When that happens, the hormone triggers a host of changes that keep enough calcium in the blood for use in a host of essential biological processes. The process breaks down bone to liberate its calcium and converts 25-D into the active, hormonal form of vitamin D.

Although the skin can manufacture vitamin D, it needs a threshold amount of ultraviolet (UV) light to do so. The farther one gets from equatorial regions, the lower the sun's UV intensity. In northern latitudes, the UV intensity for 2 to 5 months a year can be so low that it would be virtually impossible to generate as much vitamin D as the body apparently needs. Hence, the growing appreciation among nutrition scientists for the need to supplement the diet with fortified foods and vitamin pills.

Sigurdsson's team recruited the participants for its study monthly, so that the blood values of PTH and 25-D would capture not only summer highs for the vitamin but also winter lows.

To tease out where vitamin D and calcium intakes appeared sufficient in the Reykjavik women, Sigurdsson and his colleagues compared PTH values in relation to vitamin D and calcium consumption. In the Nov. 9 *Journal of the American Medical Association*, they report that in women getting no more than 200 international units (IU) of vitamin D, the need for calcium was high—at least 1,200 milligrams per day. That's the amount of calcium that has been recommended by the Institute of Medicine, which sets dietary requirements in the United States.

However, in Icelandic women getting roughly 500 IU of vitamin D per day, the need for calcium, as evidenced by their PTH values, was only about 800 mg per day.

### **Interpreting calcium sufficiency**

What Sigurdsson's group did was graph how 25-D values in blood correlate inversely with PTH values: Women with high 25-D concentrations had low PTH concentrations. The PTH reading appeared to have bottomed out and stayed there in some women. This value marked a point where bones had enough calcium to prevent a fall in density, the endocrinologist says. And in his population, it occurred where 25-D values were about 18 nanograms per milliliter (ng/ml) of blood.

However, in the October *Journal of Steroid Biochemistry & Molecular Biology*, Heaney reviewed previously published research linking the bone's absorption of calcium and vitamin D intake. The data showed that bones don't get all the calcium they need to retain their density until vitamin D values in blood climb to at least 32 ng/ml. That figure was derived in people with calcium intakes of roughly 1,200 milligrams per day.

Heaney's own data have demonstrated how the gut's absorption of calcium from foods climbs with vitamin D intake. In one study, reported 2 years ago, his team brought in the same group of postmenopausal Nebraska women for testing on a spring morning in two successive years. They chose spring, Heaney explains, "because that's when their background vitamin D level would be an at annual low—just coming out of winter, when they hadn't made the vitamin in their skin for several months."

Each time, the women were fed a breakfast containing 500 mg of calcium. At the first visit, the women hadn't been taking vitamin D supplements and their blood values of 25-D were around 20 ng/ml—or roughly comparable to high values in the new Icelandic study. On average, the Nebraska women absorbed only about 22 percent of the calcium from their food, Heaney and his colleagues reported in the April, 2003 *Journal of the American College of Nutrition*.

The next year, these women received 25-D supplements for more than a month prior to the testing, an amount calculated to be equivalent to some 1,200 to 1,500 IU of vitamin D per day. This led to 25-D blood values of about 35 ng/ml and a mean absorption of 37 percent of the calcium in food.

Such data drive home how important sufficient vitamin D intake is to calcium, Holick says. First, it can boost by almost 70 percent how much calcium can be absorbed from foods or supplements. Moreover, by getting enough calcium, the body doesn't have to waste some of its valuable vitamin D to suppress PTH values. And that's important, Holick notes, since vitamin D offers a host of therapeutic benefits beyond bone strengthening. It boosts immunity and muscle strength and shows some evidence of fighting diabetes and gum disease ([SN: 10/09/04, p. 232](#)).

So, how much vitamin D do studies suggest most U.S. residents need? Probably at least 1,000 IU per day, Holick and Heaney agree. Indeed, Heaney concludes in his October paper, if one accepts the 32 ng/ml value of 25-D as the necessary minimum for preventing bone loss in the United States, a minimum daily intake of some 2,600 IU of vitamin D per day would be needed to meet the needs of 97 percent of U.S. residents. That's well above the existing 400 to 600 IU intake recommended 8 years ago by the Institute of

Medicine. That's why there's a move afoot to change vitamin D's recommended intake, says Heaney.

Indeed, he notes that last year, the Institute of Medicine convened a conference on how to go about updating its recommended-intake values. At that meeting, he says, vitamin D emerged as "the poster child" for the vitamin most critically in need of a boost in its recommended-daily intake.

**References:**

Brender, E. 2005. Vitamin D: JAMA Patient Page. *Journal of the American Medical Association* 294(Nov. 9):2386. Available at <http://jama.ama-assn.org/cgi/content/full/294/18/2386>.

Heaney, R.P. 2005. The Vitamin D requirement in health and disease. *Journal of Steroid Biochemistry & Molecular Biology* 97(October):13-19. Abstract available at <http://dx.doi.org/10.1016/j.jsbmb.2005.06.020>. Reprint available at <http://www.direct-ms.org/pdf/VitDGenScience/Heaney%20vit%20D%20requirement%202005.pdf>.

Heaney, R.P., *et al.* 2003. Calcium absorption varies within the reference range for serum 25-hydroxyvitamin D. *Journal of the American College of Nutrition*. 22(April):142-146. Available at <http://www.jacn.org/cgi/content/full/22/2/142>.

Food and Nutrition Board, Institute of Medicine and National Research Council. 1997. *Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride*. Washington, D.C.: National Academies Press. Available at <http://www.nap.edu/books/0309063507/html/>.

Steingrimsdottir, L. . . . and G. Sigurdsson. 2005. Relationship between serum parathyroid hormone levels, vitamin D sufficiency, and calcium intake. *Journal of the American Medical Association* 294(Nov. 9):2336-2341. Abstract available at <http://jama.ama-assn.org/cgi/content/abstract/294/18/2336>.

Whiting, S.J., and M.S. Calvo. 2005. Dietary recommendations to meet both endocrine and autocrine needs of Vitamin D. *Journal of Steroid Biochemistry & Molecular Biology* 97(October):7-12. Abstract available at <http://dx.doi.org/10.1016/j.jsbmb.2005.06.022>.

**Further Readings:**

Raloff, J. 2005. Bread and chocolate, no longer D-minimus. *Science News Online* (May 7). Available at <http://www.sciencenews.org/articles/20050507/food.asp>.

\_\_\_\_\_. 2005. Understanding vitamin D deficiency. *Science News Online* (April 30). Available at <http://www.sciencenews.org/articles/20050430/food.asp>.

\_\_\_\_\_. 2005. Season affects cancer surgery survival. *Science News Online* (April 23). Available at <http://www.sciencenews.org/articles/20050423/food.asp>.

\_\_\_\_\_. 2004 Vitamin D: What's enough? *Science News* 166(Oct. 16):248-249. Available at <http://www.sciencenews.org/articles/20041016/bob9.asp>.

\_\_\_\_\_. 2004 Vitamin boost. *Science News* 166(Oct. 9):232-233.  
Available at <http://www.sciencenews.org/articles/20041009/bob8.asp>.  
\_\_\_\_\_. 2004. Should foods be fortified even more? *Science News Online*  
(Sept. 11). Available at  
<http://www.sciencenews.org/articles/20040911/food.asp>.