

## The urgent need to recommend an intake of vitamin D that is effective<sup>1,2</sup>

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The report by Hyppönen and Power in this issue of the Journal (1) highlights a frustrating and regrettable situation for nutrition researchers. In the early 1970s, the same serum 25-hydroxyvitamin D [25(OH)D] concentrations reported by Hyppönen and Power were thought to be indicative of “healthy” white adults in the United Kingdom (2). However, during those early years after the discovery of 25(OH)D, the adequacy of its serum concentration was based simply on whether the concentration was enough to prevent osteomalacia or rickets. Three decades later, we know that 25(OH)D concentrations relate to many other aspects of health, including fracture risk, bone density, colon cancer, and even tooth attachment (3); we also know that much higher concentrations of 25(OH)D are needed to prevent adverse outcomes. Indeed, in the 1958 British birth cohort, lower 25(OH)D is associated with a higher percentage of hemoglobin A<sub>1C</sub> (a measure of long-term glucose concentration), which further emphasizes the need to maintain optimal 25(OH)D concentrations (4).

Randomized trials using the currently recommended intakes of 400 IU vitamin D/d have shown no appreciable reduction in fracture risk (3). In contrast, trials using 700–800 IU vitamin D/d found less fracture incidence, with and without supplemental calcium (3). The reduction in fracture incidence occurs when mean serum 25(OH)D concentrations exceed 72 nmol/L, and this change may result from both improved bone health and reduction in falls due to greater muscle strength (3). Although it is not yet proven through clinical trials, higher intakes may also reduce the incidence of colon and other cancers, and these relations indicate that the desirable 25(OH)D concentration is  $\geq 75$  nmol/L (3). One recent report associates greater 25(OH)D concentrations with lower risk of nursing home admission; the most desirable category of concentration starts at 75 nmol/L (5).

Human diets do not provide sufficient vitamin D; if they did, the abovementioned associations between health and serum 25(OH)D concentrations would not be so routinely observed. The vitamin D provided by foods and supplements is overwhelmed by the effect of skin exposure to ultraviolet B light. Geography, season, skin color, and sun-related behavior are the main predictors of vitamin D nutritional status (6–10). Correction of low 25(OH)D concentrations can happen only if some or all of the following are implemented: the encouragement of safe,

moderate exposure of skin to ultraviolet light; appropriate increases in food fortification with vitamin D; and the provision of higher doses of vitamin D in supplements for adults.

Evaluation of most relations of health and disease that involve vitamin D leads to the conclusion that a desirable 25(OH)D concentration is  $\geq 75$  nmol/L (30 ng/mL) (3–5). If a concentration of 75 nmol/L is the goal to be achieved by consumption of vitamin D, then why is it so rare for members of the population to accomplish this? One reason is that almost every time the public media report that vitamin D nutrition status is too low, or that higher vitamin D intakes may improve measures of health, the advice that accompanies the report is outdated and thus

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misleading. Media reports to the public are typically accompanied by a paragraph that approximates the following: "Current recommendations from the Institute of Medicine call for 200 IU/d from birth through age 50 y, 400 IU for those aged 51–70 y, and 600 IU for those aged >70 y. Some experts say that optimal amounts are closer to 1000 IU daily. Until more is known, it is wise not to overdo it." The only conclusion that the public can draw from this is to do nothing different from what they have done in the past.

Supplemental intake of 400 IU vitamin D/d has only a modest effect on blood concentrations of 25(OH)D, raising them by 7–12 nmol/L, depending on the starting point. To raise 25(OH)D from 50 to 80 nmol/L requires an additional intake of  $\approx$ 1700 IU vitamin D/d (11). Safety is the first priority when giving advice to increase supplementation or fortification with any nutrient. A recent review in this Journal applied the risk assessment method used by the Food and Nutrition Board to update the safe tolerable upper intake level (UL) for vitamin D (12). The method focuses on the risk of hypercalcemia. The conclusion was that the UL for vitamin D consumption by adults should be 10 000 IU/d (12). This indicates that the margin of safety for vitamin D consumption for adults is >10 times any current recommended intakes.

The balance of the evidence leads to the conclusion that the public health is best served by a recommendation of higher daily intakes of vitamin D (3). Relatively simple and low-cost changes, such as increased food fortification or increasing the amount of vitamin D in vitamin supplement products, may very well bring about rapid and important reductions in the morbidity associated with low vitamin D status. The current UL is but one impediment to this action; another is the perpetuation of outdated intake recommendations.

It is important for major journals such as the *AJCN* to publish evidence of a widespread nutrient deficiency. Regrettably, we are now stuck in a revolving cycle of publications that are documenting the same vitamin D inadequacy (1–3, 5, 7–9, 13–17). This phenomenon has been referred to as "circular epidemiology" (18), and, for vitamin D, the phenomenon will continue for as long as the levels of vitamin D fortification and supplementation and the practical advice offered to the public remain essentially the same as they were in the era before we knew that 25(OH)D even existed. As scientists, the purpose of our work is to improve the health of the public. We know the realities of serum 25(OH)D concentrations in populations around the world, and we have come to the conclusion that public health will benefit from improved vitamin D nutritional status. We know the intakes of vitamin D needed to bring about desirable 25(OH)D concentrations, so why is the science not making a difference to public health? A major reason is that there is little public pressure on policy makers to support efforts to update recommendations about nutrition. Public pressure is generally rooted in the media, but we do not think that the public media present the vitamin D story in a complete and accurate manner. Reports about vitamin D inadequacies are presented straightforwardly, but, when it comes to discussing the intake of vitamin D needed to correct the situation, outdated official recommendations for vitamin D are propagated by the public media. This probably occurs because of restrictive editorial policies driven by concern about possible litigation if media were to advise a "toxic" intake greater than the UL. The unfortunate result is that there is minimal motivation for

policy makers to implement the relatively simple steps that could correct this nutrient deficiency.

Because of the convincing evidence for benefit and the strong evidence of safety, we urge those who have the ability to support public health—the media, vitamin manufacturers, and policy makers—to undertake new initiatives that will have a realistic chance of making a difference in terms of vitamin D nutrition. We call for international agencies such as the Food and Nutrition Board and the European Commission's Health and Consumer Protection Directorate-General to reassess as a matter of high priority their dietary recommendations for vitamin D, because the formal nationwide advice from health agencies needs to be changed. 

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