The Emerging Issue of 25-Hydroxyvitamin D in Foods

Dear Editor:

With vitamin D at the center of considerable research and clinical interest, it is concerning that the measurement of its metabolized form, 25-hydroxyvitamin D [(25(OH)D], presents such a conundrum. First, available assays for 25(OH)D do not consistently produce the same measured outcomes, and some have reported quantitative amounts ranging from 17.1 to 35.6 ng/mL for the same sample analyzed depending on the assay used (1). The serum concentration of 25(OH)D is the best measure of vitamin D status, and the variation introduced by the assay differences not only impedes pooling 25(OH)D results and cross-comparing research outcomes, it can also cause differences in clinical determinations and resulting interventions. Fortunately, in 2010, a collaborative effort was established to promote the standardization of laboratory measures of serum 25(OH)D (2, 3). Although still a work in progress, these efforts enhance the likelihood that questions about vitamin D benefits and/or adverse effects will be clarified (3).

Second, tables of food composition in the United States do not include the 25(OH)D contained in foods. Many animals consumed as human food metabolize some of the vitamin D in their diets to 25(OH)D, which is the major transport form of vitamin D and can be found in many tissues after slaughter (4). Therefore, animal-derived foods contain 25(OH)D along with the nonmetabolized form. Moreover, 25(OH)D absorbed from the diet has been found to be more potent in increasing serum concentrations of 25(OH)D than is the equivalent amount of nonmetabolized dietary vitamin D (4). When the 25(OH)D content of animal-derived foods is not measured and included in tables of food composition, the ability to obtain a reasonable estimate of total vitamin D intake, and in turn its impact on vitamin D status, is not only uncertain but very likely to lead to underestimates of true intake. There have been reports concerning the discrepancy between recommended intakes for vitamin D and the reported vitamin D intakes based on national surveys that are coupled to available tables of food composition (5). This has caused public health concern and led to discussions about the need to increase vitamin D fortification of the food supply. However, tables of food composition in the United States currently report quantitative amounts in foods for only the nonmetabolized forms of vitamin D. This may explain, in part, the discrepancy between the reported population-based intakes of vitamin D and the measures of serum 25(OH)D from national surveys, the latter being much higher than would be expected given the estimates of intake (6). We, in turn, agree with the conclusion that some, but not all, of the difference between intake and serum measures can be attributed to the contribution of sunlight (7), and the failure to take into account the contributions of 25(OH)D from food is likely a significant factor in this regard.

Recently, the USDA and the Office of Dietary Supplements, NIH, worked collaboratively to demonstrate that there could be meaningful underestimates of vitamin D intake in the United States if 25(OH)D in foods is ignored. With the use of the only available US data, which were preliminary and limited, we concluded that current estimates of vitamin D intake among US men and women aged ≥20 y would be increased by 1.7–2.9 μg/d [or 15–30% of the Estimated Average Requirement (6)] if the 25(OH)D in the diet were included in the intake estimates (8). Those who rely on vitamin D intake estimates should be mindful of this data gap.

Just as importantly, our work (8) has made it clear that, similar to the challenges facing those measuring 25(OH)D in serum, the determination of 25(OH)D amounts in foods requires exploration and standardization of laboratory methodologies. The USDA has conducted initial studies to examine consistency among analytical laboratories in assaying 25(OH)D in various food materials based on the laboratories' existing methods (9). Up to now, the lack of well-characterized control and reference materials, as well as the lack of validated methodologies, has presented analytical challenges. However, the results of our exploration suggest the likelihood of agreement among at least some of the existing analytical laboratories and have yielded several potential standard reference materials for measuring 25(OH)D in foods. Such work needs to continue so that vitamin D intake can be more accurately assessed relative to measures of status and better used to simulate or model the impact of modifying the nutrient content of the food supply. Such modeling is an essential task before health policies and related dietary interventions can be determined as appropriate. Targeted efforts and collaborative activities are needed now to allow for systematic analyses of 25(OH)D in foods and to elevate the determination of 25(OH)D in foods to a higher rung within the nutrition research agenda.

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