

# PEDIATRICS®

OFFICIAL JOURNAL OF THE AMERICAN ACADEMY OF PEDIATRICS

## **Dietary Guidelines for Calcium and Vitamin D: A New Era**

Steven A. Abrams

*Pediatrics* 2011;127;566-568; originally published online Feb 21, 2011;

DOI: 10.1542/peds.2010-3576

The online version of this article, along with updated information and services, is located on the World Wide Web at:

<http://www.pediatrics.org/cgi/content/full/127/3/566>

PEDIATRICS is the official journal of the American Academy of Pediatrics. A monthly publication, it has been published continuously since 1948. PEDIATRICS is owned, published, and trademarked by the American Academy of Pediatrics, 141 Northwest Point Boulevard, Elk Grove Village, Illinois, 60007. Copyright © 2011 by the American Academy of Pediatrics. All rights reserved. Print ISSN: 0031-4005. Online ISSN: 1098-4275.

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™



# Dietary Guidelines for Calcium and Vitamin D: A New Era

Ensuring adequate intake of calcium and vitamin D are important nutritional goals for children. They are primarily important for bone growth and development, and recent data suggest the possibility of other important health benefits for these key nutrients throughout life. These new data prompted the Institute of Medicine (IOM) to reevaluate existing dietary recommendations for calcium and vitamin D. On November 30, 2010, the IOM issued a new report that provides dietary recommended intake (DRI) values for calcium and vitamin D for adults and children.<sup>1</sup> The final publication of the report will be in 2011; thus, it will be known as the 2011 IOM report. Key pediatric values are shown in Table 1. I was a member of both the previous (1997) and current IOM committees.

The previous DRI values provided only adequate intake (AI) values and, in some cases, a tolerable upper intake level (UL) for these key nutrients.<sup>2</sup> AI is a single value that would be likely to meet the needs of most children. It is used for infants when either the content of a nutrient in breast milk is the nutritional standard or when limited data are available regarding the average requirements of a population for the nutrient (estimated average requirement [EAR]). Some knowledge or estimate of the variance around the EAR is needed to calculate the recommended dietary allowance (RDA). The better-known RDA is the intake that meets the requirements of nearly all (98%) of the population. Although both values are important in public policy, providers of pediatric care generally advise individual intakes to achieve the RDA to ensure that a child is very likely to meet his or her nutritional needs.

In the 2011 report released by the IOM committee, the pediatric RDA values for calcium are similar to the previous AI values (maximum of 1300 mg/day for children aged 9–18 years). New strategies are needed, because many adolescents, especially girls, do not currently achieve this intake with diet or supplementation. Public-policy efforts focused on enhancing calcium intake by children and especially adolescents should continue on the basis of these new recommendations.

For vitamin D, the previous AI was 200 IU/day for all infants and children.<sup>2</sup> The authors of 2 recent statements (a joint report from the American Academy of Pediatrics Committee on Nutrition and Section on Breastfeeding<sup>3</sup> and a separate statement from the Pediatric Endocrine Society [PES]<sup>4</sup>) recommended a vitamin D intake of 400 IU/day for all children; in addition, the PES statement indicated a usual target for serum 25-hydroxyvitamin D (25[OH]) of  $\geq 50$  nmol/L (20 ng/mL).<sup>4</sup>

Although the 2011 IOM values and recommendations are similar to these other recommended values, there are several important differences. An AI of 400 IU/day for infants up to 1 year of age was chosen as a single intake to meet the needs of most infants. However, because more data were available for older children, an EAR of 400 IU/day and

**AUTHOR:** Steven A. Abrams, MD

*Department of Pediatrics, Baylor College of Medicine and Texas Children's Hospital, Houston, Texas*

## ABBREVIATIONS

IOM—Institute of Medicine  
DRI—dietary recommended intake  
AI—adequate intake  
UL—upper intake level  
EAR—estimated average requirement  
RDA—recommended dietary allowance  
25(OH)D—25-hydroxyvitamin D

Opinions expressed in these commentaries are those of the author and not necessarily those of the American Academy of Pediatrics or its Committees.

Dr Abrams was a member of both the 1997 and 2011 dietary recommended intakes committees related to calcium and vitamin D. This article, however, reflects a personal commentary, not a committee commentary, and was not reviewed or approved by the Institute of Medicine.

[www.pediatrics.org/cgi/doi/10.1542/peds.2010-3576](http://www.pediatrics.org/cgi/doi/10.1542/peds.2010-3576)

doi:10.1542/peds.2010-3576

Accepted for publication Dec 15, 2010

Address correspondence to Steven A. Abrams, MD, Baylor College of Medicine, 1100 Bates St, Houston TX 77030. E-mail: [sabrams@bcm.edu](mailto:sabrams@bcm.edu)

PEDIATRICS (ISSN Numbers: Print, 0031-4005; Online, 1098-4275).

Copyright © 2011 by the American Academy of Pediatrics

**FINANCIAL DISCLOSURE:** *Dr Abrams serves as a scientific consultant to the Milk Processors Education Program.*

**TABLE 1** Selected Calcium and Vitamin D DRI Values for Children and Adolescents

Age	Calcium, mg/d		Vitamin D, IU/d	
	Recommended Intake <sup>a</sup>	Tolerable UL	Recommended Intake <sup>a</sup>	Tolerable UL
0–6 mo	200	1000	400	1000
6–12 mo	260	1500	400	1500
1–3 y	700	2500	600	2500
4–8 y	1000	2500	600	3000
9–18 y	1300	3000	600	4000

<sup>a</sup> Recommended intake values are the RDA values for children aged 1 year and older and AI values for infants younger than 1 year.

an RDA of 600 IU/day were set for children older than 1 year. Thus, 600 IU/day represents an intake of vitamin D that would meet the needs of nearly all children (98%) older than 1 year. The UL was set at 1000 IU/day for infants in the first 6 months of life but increased proportionally for older children to a maximum of 4000 IU/day in children aged 9 years and older. This UL is not a recommended dose but, rather, an upper safe intake level and should not be routinely recommended for children.

After reviewing a large body of literature, the IOM did not find convincing evidence for the use of non–bone-related outcomes in establishing the EAR or RDA in any age group. Additional studies are needed related to these outcomes, but pediatricians should be aware that there have been few controlled trials, especially in children, related to vitamin D and non–bone-related outcomes.

What does this mean? The new vitamin D RDA for children older than 1 year is the highest RDA ever recommended for healthy children by the IOM. It is above the amount provided by a liter (or quart) of milk or fortified juice at current fortification levels and well above typical dietary intakes for any group of children. Achieving this intake from dietary sources would require an increased proportion of fortified foods and beverages in the US food and beverage supply. For example, yogurts are increasingly but not uniformly being

fortified with vitamin D. A modest increase in the concentration of vitamin D in fortified milk and juices would likely be reasonable to consider but would require statutory changes and careful consideration of the risks of such changes. Pending such changes in fortification and diet, the use of supplements will need to be considered for many children while encouraging diets with adequate calcium and vitamin D. Monitoring of the food supply related to fortification should be performed to ensure that overfortification does not occur.

The 2011 IOM committee,<sup>1</sup> in agreement with the Pediatric Endocrine Society,<sup>4</sup> targeted a serum value for 25(OH)D of at least 50 nmol/L as meeting the needs of nearly all children (and adults).<sup>5</sup> This value is lower than that recommended by some experts. In contrast, clinical laboratories typically report serum 25(OH)D values at <75 to 80 nmol/L as “insufficient,” even for children. However, pediatric data do not support this description. It should be noted that pediatric DRI values are not intended for populations other than healthy children. Caution should be used when providing high doses of vitamin D for children with chronic illnesses or populations such as preterm infants or routinely targeting higher 25(OH)D values.

Pediatricians and families alike have been slow to accept the need for supplementation of breastfed infants with

vitamin D. The 2011 IOM report provides strong support for ensuring that infants receive an average of 400 IU/day of vitamin D from dietary sources or supplements. The IOM report, as well as the American Academy of Pediatrics guidelines, does not recommend reliance on sunlight exposure to produce vitamin D in the skin in any population. Advising families that they do not need to give their children dietary or supplemental vitamin D, because there is abundant sunshine, is inappropriate advice and should be abandoned even in southern climates. Educational efforts are urgently needed in this regard because of limited compliance with current recommendations.<sup>5</sup>

In summary, pending further research, providing infants younger than 1 year with a total intake of 400 IU/day and older children with 600 IU/day is advised by the 2011 IOM report to meet the needs of nearly all children. These values are slightly, but not greatly, different from current American Academy of Pediatrics guidelines. It is likely that the American Academy of Pediatrics will evaluate these new IOM recommendations and consider revising its recommendations on the basis of that review. Parents and pediatricians should be aware of the updated insights regarding slightly more vitamin D being potentially needed to meet the needs of nearly all children.

Pediatric advisory panels should carefully consider the pros and cons of recommending higher vitamin D intakes, especially those above the UL, for both healthy children and those with chronic illnesses. Evidence should be derived from randomized clinical trials that include enough subjects and adequate duration of exposure to evaluate both safety and efficacy.

## REFERENCES

1. Institute of Medicine. *Dietary Reference Intakes for Vitamin D and Calcium*. Washington, DC: National Academies Press; 2011
2. Institute of Medicine. *DRI Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride*. Washington, DC: Institute of Medicine; 1997
3. Wagner CL, Greer FR; American Academy of Pediatrics, Section on Breastfeeding and Committee on Nutrition. Prevention of rickets and vitamin D deficiency in infants, children, and adolescents [published correction appears in *Pediatrics*. 2009;123(1):197]. *Pediatrics*. 2008;122(5):1142–1152
4. Misra M, Pacaud D, Petryk A, Collett-Solberg PF, Kappy M; Drug and Therapeutics Committee of the Lawson Wilkins Pediatric Endocrine Society. Vitamin D deficiency in children and its management: review of current knowledge and recommendations. *Pediatrics*. 2008;122(2):398–417
5. Perrine CG, Sharma AJ, Jefferds MED, Serdula MK, Scanlon KS. Adherence to vitamin D recommendations among US infants. *Pediatrics*. 2010;125(4):627–632

**BUILDING A BETTER MEMORY:** *I run an integrative, interdisciplinary course for first year medical students. On each administered test, several questions seem remarkably difficult for the students to answer. I remain flummoxed as to why students do not perform better on these questions. The lectures are terrific, the material clear, and the content emphasized repeatedly. The students spend hours reviewing the material. Practice questions are even provided at the end of each week. New data, however, may provide a clue. As reported in The New York Times (January 20, 2011: Science), taking tests (or immediate retrieval tests) may enforce learning better than repetitively reviewing the material or making complex concept maps. According to the article, researchers assigned 200 college students to one of four groups. All students read passages about a scientific subject. Students in group 1 simply read the material while students in group 2 read the material several times. Students in group 3 engaged in concept mapping where they used the material to create a set of diagrams to help organize the material. Group 4 students were immediately given a test on the material once they had finished reading. Once the test was completed, they could look over the material again and take another test. One week later, all students were asked to predict how they would perform on a test of the material and then given a short-answer test that assessed their ability to recall facts and draw logical conclusions based on the reading material. Students who took the test immediately after reading the material predicted a worse outcome than students from the other groups. However, just the opposite occurred. Those who had taken the tests did 50 percent better. In a second experiment, students were only separated into concept makers and immediate retrieval practice testing. The results were even more striking as again, one week later the immediate retrieval practice takers not only did better on factual recall, but could make better diagrams. Why students who take tests immediately after reading material are better able to recall the material later is unknown. It could be that the immediate retrieval tests force students to re-evaluate what they really do know, better organize the material, or simply practice what they will need to do on a later examination. The effort put into recalling something may help reinforce it in our brains. Alas, as often as I tell the students to practice commitment, e.g. take an immediate test of their recall, they too often do not believe me. Maybe I will make this article mandatory reading for the course.*

Noted by WVR, MD

## Dietary Guidelines for Calcium and Vitamin D: A New Era

Steven A. Abrams

*Pediatrics* 2011;127;566-568; originally published online Feb 21, 2011;

DOI: 10.1542/peds.2010-3576

### Updated Information & Services

including high-resolution figures, can be found at:  
<http://www.pediatrics.org/cgi/content/full/127/3/566>

### Subspecialty Collections

This article, along with others on similar topics, appears in the following collection(s):

#### Gastrointestinal Tract

[http://www.pediatrics.org/cgi/collection/gastrointestinal\\_tract](http://www.pediatrics.org/cgi/collection/gastrointestinal_tract)

### Permissions & Licensing

Information about reproducing this article in parts (figures, tables) or in its entirety can be found online at:

<http://www.pediatrics.org/misc/Permissions.shtml>

### Reprints

Information about ordering reprints can be found online:

<http://www.pediatrics.org/misc/reprints.shtml>

American Academy of Pediatrics

DEDICATED TO THE HEALTH OF ALL CHILDREN™

