GUEST EDITORIAL

Fluoride—an Element in Good Company

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In August 1997, the Food and Nutrition Board, Institute of Medicine, National Academy of Sciences (NAS), released new Dietary Reference Intakes (DRIs) for calcium and related nutrients that updated and expanded the Recommended Dietary Allowances (RDAs), which the academy has published since 1941. The new report is entitled "Dietary Reference Intakes: Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride" (1). It is obvious from the title that fluoride is now in the very good company of elements (and one vitamin) long recognized as being important for health. The report is the first in a series that will present reference values for the intake of nutrients by Americans and Canadians. The second report in the series on the B vitamins was published recently. Future reports will focus on antioxidants, trace elements, electrolytes and water, and macronutrients.

Prior to this report, fluoride had not received recognition by the National Academy of Sciences as an important constituent for maintaining health. The report, in my opinion, is so important that I am surprised it has not received more attention from oral health advocacy groups and organizations. After its release, the publication received modest media attention; however, most reports focused on calcium because of its importance in maintaining the integrity of bone.

The academy's new DRIs represent a major leap forward in nutrition science from a primary concern for the prevention of a deficiency to an emphasis on the beneficial effects of healthy intakes of nutrients—in other words, nutrient adequacy. The scientific data used for developing the DRIs for calcium and related nutrients consisted of clinical trials; dose-response, balance, depletion/repletion, prospective observational and case-control studies; and clinical observations in humans. Studies published in peer-reviewed journals were the principal sources of data for the report.

An entire chapter (of nine) is devoted to fluoride (Chapter 8). The material in the chapter is accurate, concise, and clearly written. The following passages from the chapter on fluoride are indicative of the positive position that the NAS has taken with respect to the safety and effectiveness of this important nutrient:

> Owing to its high affinity for calcium, fluoride is mainly associated with calcified tissues. Its ability to inhibit, and even reverse, the initiation and progression of dental caries is well known. [p 8-1]

> The ... various mechanisms underlying the protective effects of fluoride on erupted teeth of children and adults require frequent exposures to fluoride throughout life in order to achieve and maintain concentrations of the ion in dental plaque and enamel. [p 8-3]

> ... studies have shown that the earlier children are exposed to fluoridated water or dietary fluoride supplements, the greater the reduction in dental caries in both the primary and permanent teeth ... The lack of exposure to fluoride or the ingestion of inadequate amounts of fluoride at any age places the individual at increased risk for dental caries. [pp 8-7 and 8-8]

> ... water fluoridation continues to be of major importance in the control of dental caries. [p 8-8]

> ... [a] water fluoride concentration close to 1.0 mg/liter ... is ... associated with a high degree of protection against caries and a low prevalence of the milder forms of enamel fluorosis. [p 8-8]

> ... the A[dequate] I[ntake] for fluoride from all sources is set at 0.05 mg/kg/day. This intake ... is recommended for all ages 6 months and older because it confers a high level of protection against dental caries and is associated with no known unwanted health effects. The cariostatic effect is due both to the pre-eruptive fluoride incorporation into tooth enamel and to continuing, frequent posteruptive fluoride exposures of the teeth. [pp 8-11 and 8-12]

> Mild fluorosis has no effect on tooth function and may render the enamel more resistant to caries. It is not readily apparent to the affected individual or casual observer and often requires a trained specialist to detect ... Most investigators regard even the more advanced forms of enamel fluorosis as a cosmetic effect rather than a functional adverse effect.... [p 8-15]

> Crippling skeletal fluorosis continues to be extremely rare in the United States (only 5 cases have been confirmed during the last 35 years).... [p 8-16]

> Although some recent recommendations have been made for additional research in the areas of intake, dental fluorosis, bone strength, and carcinogenicity, extensive reviews of the scientific literature revealed no adverse effects unless fluoride intakes were greater than 10 mg/day for 10 or more years.... [p 8-17]

> Because fluoride intake from water and diet appears not to have increased since [the 1930s and 1940s], the additional intake by children at risk of enamel fluorosis almost certainly derives from the use of fluoride-containing dental products. [p 8-20]

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> The virtual absence of evidence of skeletal changes consistent with a diagnosis of skeletal fluorosis indicates that the U[pper] L[imit] for older children and adults is not being exceeded in the United States or Canada. [p 8-20]

Wow! Talk about a highly positive endorsement of the safety and effectiveness of fluoride and, particularly, water fluoridation, from inarguably the most prestigious, independent research organization in the United States!

The 20-page chapter on fluoride also contains thoughtful discussions on the physiology of the absorption, metabolism, and excretion of fluoride; its bioavailability; the diffusion effect of water fluoridation; the fluoride concentrations of foods; the new dosage schedule for dietary fluoride supplements; the intake of fluoride from dental products; the effects of inadequate fluoride intake; indicators for estimating fluoride requirements; adequate intakes of fluoride for various age groups and by sex, if appropriate; special needs for fluoride during pregnancy and lactation (there are none); and tolerable upper intake levels for fluoride to prevent fluorosis and skeletal fluorosis. The Adequate Intakes for fluoride range from 0.01 mg/day for infants from birth to 6 months of age to 3.8 mg/day for males and 3.1 mg/day for females 19 years of age or older.

The chapter ends with three research recommendations for fluoride. These are: for continuing epidemiologic studies of the relationships among fluoride ingestion from all major sources of exposure and dental caries and dental fluorosis to detect trends and determining the contribution of each source; epidemiologic and laboratory studies to refine understanding of the relation of fluoride on the quality and biomechanical properties of bone; and studies to define metabolic and environmental variables that may affect fluoride utilization, such as composition of diet, acid-base balances, and altitude of residence.

On September 23, 1997, the NAS convened a one-day workshop on the new DRIs for calcium, phosphorus, magnesium, vitamin D, and fluoride for interested parties to review and discuss the new report. About 200 people attended. I was asked to represent the American Dental Association at a panel on "What Questions are Health Professionals Asking?" The panel was scheduled for mid-afternoon.

Two well-known and vocal opponents of fluoridation attended the workshop. Following each of the morning and early afternoon presentations, regardless of the subject, one or both of these persons would come to the microphone to deliver a diatribe against fluoride. After a few of these "spontaneous" reactions, the audience, I felt, almost groaned at the anticipated harangue against fluoride that they expected to hear from these fluoride opponents.

Because I was going to be on the program, I tried to refrain from offering a rebuttal until the allegations against fluoride became so absurd that I could no longer restrain myself, which quieted the outbursts to some degree. I believe that the opponents attended the workshop and tried to discredit the report's chapter on fluoride because they realized how strong the academy's position on fluoride was, as well as the implications of that position to their own agenda.

The NAS report was developed largely by a panel of 10 experts on calcium and related nutrients. Physicians, basic and applied scientists, and one dentist comprised this panel. The dental expert was Gary M. Whitford, DMD, PhD, from the Medical College of Georgia in Augusta, whose broad knowledge of the physiology and benefits of fluoride is manifest throughout the report's chapter on fluoride. We in dentistry are indebted to Dr. Whitford for guiding the report on fluoride to its positive position. We also should thank the National Academy of Sciences for recognizing the importance of adequate intakes of fluoride in achieving total health. The new report on dietary reference intakes for calcium and related nutrients truly is a coup for fluoride.

The inclusion of recommendations for fluoride with those for calcium, phosphorus, magnesium, and vitamin D has given fluoride an added mark of distinction that extends beyond dentistry. We should inform our patients and communities of fluoride's strong recommendation by the National Academy of Sciences. The NAS report provides us with an opportunity to educate the public and all health care providers about the value of fluoride or to reinforce that message. It would be a missed opportunity to ignore this important report.

Reference

1. Institute of Medicine, Food and Nutrition Board. Dietary reference intakes: calcium, phosphorus, magnesium, vitamin D, and fluoride. Washington, DC: National Academy Press, 1997.

FUTURE AAPHD ANNUAL MEETING DATES

October 6–8, 1999 ..... Honolulu, HI
October 25–27, 2000 ..... Chicago, IL