Clinical Report: Optimizing Bone Health and Calcium Intakes of Infants, Children and Adolescents

Commentary authored by Frank R Greer, MD and Nancy Krebs, MD, Committee on Nutrition, *Pediatrics* 2006; 117(2): 578.

All 75 million "Baby Boomers" are or will be dealing with conditions of aging. One of these is the epidemic of osteoporosis and osteoporosis-related fractures. A 2004 Report of the Surgeon General, *Bone Health and Osteoporosis*, cites the following statistics:

- 10 million Americans >50 years of age have osteoporosis.
- Another 34 million are at risk for osteoporosis.
- Annually, 1.5 million adult Americans suffer osteoporosis-related fractures.
- 20% of older people who have a fractured hip die within 1 year.
- One out of every 2 women >50 years of age will have osteoporosis- related fractures in her lifetime, with risk of fracture increasing with age.
- By 2020 (all "first year" Baby Boomers [born in 1946] will be 74 years old), the number of hip fractures could triple.

In 2002, the Centers for Disease Control (CDC) estimated direct costs for osteoporotic fractures at $12-18 billion a year. What if we could prevent these "conditions" of aging for the next generation by dietary management in infancy, childhood and adolescence? In this policy statement, the American Academy of Pediatrics attempts to help pediatricians, nurses, nurse practitioners and parents optimize bone health along the life span of the child and reduce or prevent bone fractures and osteoporosis later in life. National survey data (from the U.S. Department of Agriculture, the National Institutes of Health, the Institute of Medicine)

consistently show that most children older than 8 years of age in the U.S. are not achieving the recommended daily intake of calcium.

To attain peak bone mass, an individual must have adequate calcium intake during childhood and adolescence. Attainment of peak bone mass during this stage of life may be important in decreasing the risks of osteoporosis and fracture later in life. The active absorption of calcium in the intestine requires vitamin D. Adequate intakes of *both* calcium and vitamin D (minimum intake of 200 International Units/day for all infants, including those who are exclusively breastfed) are essential for good bone health. This policy statement discusses recommended calcium intake, by age group, because of the dynamic physiologic requirements for calcium during different stages of development. During infancy (i.e., the first year of life), "the optimal source of calcium is human milk."

Calcium present in human milk is more bioavalaible to the human infant than the calcium in formula. In the first 6 months of life, exclusively breastfed infants receive approximately 210 mg/day of calcium and there is no scientific evidence that more daily calcium intake than this is beneficial. In the last 6 months of the first year of life, when breastfed infants are supplemented with solid food, their intake is approximately 270 mg/day and increasing calcium intake at this age has also not been shown to increase bone mineralization. Infant formulas (cow, soy, casein hydrolysates) are supplemented with an increased amount of calcium due to its poorer absorption (38% vs. 58% in breast milk). For both breastfed and formula-fed term infants in the U.S., most achieve almost 100% of the recommended calcium intake. This is the *only* age group in which adequate calcium intake is achieved.

In the "old days," preterm infants were changed to full-term infant formula 24–48 hours prior to discharge. When they gained weight for 1–2 days they were discharged on and fed full term

formula at home. What the neonatal care providers did not see was the slowing of growth and sometimes even failure-to-thrive in primary pediatric care. A double-blind randomized study evaluated the growth of preterm infants (ie, <1,800 grams) who were fed either a 22 kcal/oz nutrient-enriched postdischarge, preterm formula or a 20 kcal/oz full-term infant formula from hospital discharge to 12 months corrected age (CA). The preterm infants fed the nutrient-enriched formula weighed more at 1–2 months CA, gained more weight from the first day of the study to 1–2 months CA, and were longer at 3 months CA when compared to the preterms fed term infant formula. In the smallest preterms (i.e., <1,250 grams) there was the largest benefit when the infants were fed the nutrient-enriched formula: at 6 months CA they weighed more and were longer at 1, 3, 6, and 12 months CA and had larger head circumferences than those infants fed term infant formula. Taking nutrient-enriched formula was of particular benefit for the growth of male preterm infants.

The best source of nutrition for the preterm infant is also human breast milk. Preterm infants have increased calcium requirements when compared to their term counterparts. These increased calcium needs can be met by using human milk boosted by fortifiers or by choosing the special "preterm" formulas. Research has shown that there are short-term increases in bone mineralization in preterm infants fed nutrient-enriched formulas (special "preterm" formulas) after discharge. Therefore the AAP recommends that: "After discharge from the hospital, there may be benefits to providing formula-fed preterm infants with special formulas that have increased calcium concentrations rather than those of routine cow's milk-based formulas for term infants."3 The policy continues with the caveat that optimal calcium concentrations and the length of time for use of these special formulas is unknown. The research evidence shows short-term increases in bone mineralization, but long-term benefits have not been proven.