

Building Strong Bones:

Calcium Information for Health Care Providers

You can play a critical role in making sure tweens* and teens get 1,300 mg of calcium every day¹—at least 3 cups of low-fat or fat-free milk, plus other calcium-rich foods—to build strong bones for life.

Calcium is essential to overall health and bone development, but most children and teenagers are not getting enough. In fact, fewer than one in 10 girls and just more than one in four boys ages 9 to 13 are at or above their adequate intake of calcium.²

You can help children achieve lifelong bone health by talking to parents and young people about the importance of calcium consumption, especially during ages 11 to 15, a time of critical bone growth. Children and teenagers can get most of their daily calcium from 3 cups of low-fat or fat-free milk (900 mg), but they also need additional servings of calcium-rich foods to get the 1,300 mg of calcium necessary for optimal bone development.

Research suggests many parents don't know that children and teenagers need almost twice as much calcium as children younger than age 9.

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*Note: Tweens are kids ages 9 to 12.



U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

National Institutes of Health

National Institute of Child Health and Human Development

How does pediatric bone development influence osteoporosis later in life?

The tween and teen years are critical for bone development because most bone mass accumulates during this time. In the years of peak skeletal growth, teenagers accumulate more than 25 percent of adult bone,³ and by the time teens finish their growth spurts around age 17, 90 percent of their adult bone mass is established.

Calcium is critical to building bone mass for supporting physical activity throughout life, and for reducing the risk of bone fractures, especially those due to osteoporosis. The onset of osteoporosis later in life is influenced by two important factors:

- Peak bone mass attained in the first two to three decades of life
- The rate at which bone is lost in the later years

Although the consequences of low calcium consumption may not be visible in childhood, the National Institute of Child Health and Human Development (NICHD) recognizes lack of calcium intake as a serious and growing threat to the health of young people later in life. At a time when they require more nutrients to feed their rapidly growing and developing bodies, tweens and teens who don't get enough calcium are at increased risk for osteoporosis later in life.

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Why are milk and dairy products especially good sources of calcium?

- Although calcium is found in a variety of foods, the *1994 National Institutes of Health (NIH) Consensus Statement on Optimal Calcium Intake* designated dairy products as the preferred source of calcium because of their high calcium content.⁴
- The *2005 Dietary Guidelines for Americans* also recommends milk and milk products as sources of dietary calcium based on studies that show a positive relationship between intake of milk and milk products and bone mineral content or bone mineral density in one or more skeletal sites.⁵
- The NICHD has described low-fat or fat-free milk as the best source of calcium because it has high calcium content without added fat, and because the calcium is easily absorbed by the body.
- Other foods, including dark green, leafy vegetables such as kale and spinach, are also healthy dietary sources of calcium, but it takes many servings of these vegetables to get the same amount of calcium in 3 to 4 cups of milk.
- In addition to calcium, milk provides other essential nutrients that are important for optimal bone health and development, including:
 - Vitamins D, A, and B12
 - Potassium
 - Magnesium
 - Phosphorous
 - Riboflavin
 - Protein



What kind of milk is best for children?

Children 1 to 2 years old should drink whole milk.

After age 2, low-fat or fat-free milk should become the regular drink.⁶ Regardless of fat content, an 8-ounce glass of milk contains about 300 mg of calcium.

What if children don't like milk?

If it is a question of taste, there are plenty of ways to get calcium into the diet:

- Try flavored low-fat or fat-free milk, such as chocolate, vanilla, or strawberry. Flavored milk has the same amount of calcium as plain milk.
- Serve low-fat or fat-free milk or yogurt smoothies. These can be made at home or there are ready-made versions available at many grocery stores.
- In moderation, low-fat or fat-free ice cream and frozen yogurt are calcium-rich treats.
- Serve non-milk sources of calcium, such as broccoli, spinach, or orange juice with added calcium.

How does bioavailability affect calcium absorption?

Bioavailability, the degree to which the intestinal system absorbs calcium, depends on the overall level of calcium in a food and the type of food being consumed. Calcium in foods such as milk and milk products is highly bioavailable, meaning that it is easily absorbed. Absorption is similarly high in grain foods.

However, calcium in foods high in oxalic acid (such as spinach, sweet potatoes, and beans) or phytic acid (such as unleavened bread, raw beans, seeds, and nuts) may be poorly absorbed. Oxalates in particular are strong inhibitors of calcium absorption. As a result, additional servings of certain calcium-rich foods are needed to compensate for their low calcium bioavailability.

According to the National Academy of Sciences' 1997 Report on Dietary Reference Intakes, the body absorbs about one-tenth as much calcium from spinach as it does from milk. High bioavailability is one of the reasons that the NICHD describes low-fat and fat-free milk and milk products as the best dietary sources of calcium.

What about people who have trouble digesting milk or milk products?

Individuals with lactose intolerance are unable to digest significant amounts of lactose due to an inadequate amount of the enzyme lactase.⁷

Research shows that lactase is high at birth in all infants regardless of race or ethnicity, but wanes in non-Caucasians and other populations that don't traditionally include dairy products in their diets by age 5 to 7.⁸

There are three main types of lactose intolerance:

- Primary lactose intolerance, in which individuals who were able to digest lactose previously begin experiencing symptoms of digestive discomfort with no history or signs of underlying intestinal disease, is the most common form of lactase deficiency.
- Secondary lactose intolerance is the result of a gastrointestinal disease, such as severe gastroenteritis.
- Congenital lactose intolerance, such as galactosemia, is a lifelong complete absence of lactase, and it is relatively rare. However, it is not uncommon for secondary lactose intolerance to be misdiagnosed during the newborn period as congenital lactose intolerance.⁹

Clinical symptoms of lactose intolerance can include abdominal pain, diarrhea, flatulence, and bloating. The severity of symptoms differs, often depending on the amount of lactase remaining in the body and how much lactose has been consumed.

Individuals vary in their degree of lactose intolerance, but even children and teenagers with primary lactose intolerance can usually consume 8 to 12 ounces (1 to 1½ cups) of milk without experiencing symptoms.

For more information on lactose intolerance, see the *Milk Matters* fact sheet, *Lactose Intolerance: Information for Health Care Providers*.

What is the role of physical activity in bone development?

Weight-bearing activity determines the strength, shape, and mass of bone. Activities such as running, dancing, and climbing stairs, as well as those that increase strength, such as weight lifting, can help bone development. For children and teenagers, some of the best weight-bearing activities include team sports, such as basketball, volleyball, soccer, and softball. Studies show that absence of physical activity results in a loss of bone mass, especially during long periods of immobilization or inactivity.

Are there any special calcium recommendations for lactating or pregnant teens?

Increasing dietary calcium does not prevent the loss of calcium that occurs during lactation, and the calcium lost seems to be regained after weaning.¹⁰ Therefore, the Dietary Reference Intakes do not recommend increasing calcium intake for lactating adolescents above normal levels for that age group. However, the *1994 NIH Consensus Statement on Optimal Calcium Intake* recommends that lactating teenagers and young adults increase their calcium intake to up to 1,500 mg per day.

What about calcium supplements?

Experts suggest that the preferred source of calcium is through calcium-rich foods.¹¹ However, if calcium cannot be obtained through the diet, calcium supplements can be given to children.

Where can I get more information about calcium and building strong bones?

- For information and patient education materials about calcium and bone health in tweens and teens, visit the *Milk Matters* Web site at <http://www.nichd.nih.gov/milk>.
- To learn more about lactose intolerance, see the *Milk Matters* fact sheet, *Lactose Intolerance: Information for Health Care Providers*. To order a free copy, call 1-800-370-2943 or visit <http://www.nichd.nih.gov/milk>.

Other resources:

- The National Library of Medicine at the NIH provides information on calcium through its MedlinePlus Web site at <http://www.nlm.nih.gov/medlineplus/calcium.html>.
- The American Academy of Pediatrics provides information on calcium and bone health on its Web site at <http://www.aap.org/healthtopics/calcium.cfm>.
- The NIH Office of Dietary Supplements Web site also provides information about calcium at <http://dietary-supplements.info.nih.gov/factsheets/calcium.asp>.
- The NIH Osteoporosis and Related Bone Diseases National Resource Center provides a gateway to research articles, provider newsletters, and information for parents at <http://www.osteoporosis.gov>.

¹ Food and Nutrition Board, Institute of Medicine. (1997). *Dietary Reference Intakes for Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride*. Washington, DC: National Academy Press.

² Moshfegh, A. J., Goldman, J., & Cleveland, L. (2005). *What We Eat in America, NHANES 2001-2002: Usual Nutrient Intakes From Food Compared to Dietary Reference Intakes*. Retrieved August 5, 2005, from <http://www.ars.usda.gov/ba/bhnrc/fsrg>.

³ Bailey, D. A., Martin, A.D., McKay, H.A., Whiting, S., & Mirwald, R. (2000). Calcium accretion in girls and boys during puberty: A longitudinal analysis. *Journal of Bone and Mineral Research*, 15(11), 2245-50.

⁴ National Institutes of Health, NIH, DHHS. (1994). Optimal Calcium Intake. NIH Consensus Statement Online, 12(4):1-31. Retrieved August 23, 2005, from http://consensus.nih.gov/cons/097/097_statement.htm.

⁵ U.S. Department of Agriculture, DHHS. (2005). *Dietary Guidelines for Americans, 2005* [Electronic version]. Retrieved May 9, 2005, from <http://www.health.gov/dietaryguidelines/dga2005/document/html/chapter5.htm>.

⁶ U.S. Department of Agriculture, DHHS. (2005). *Dietary Guidelines for Americans, 2005* [Electronic version]. Retrieved May 9, 2005, from <http://www.health.gov/dietaryguidelines/dga2005/document/html/chapter5.htm>.

⁷ Swagerty, D.L., Walling, A.D., & Klein, R.M. (2002). Lactose intolerance. *American Family Physician*, 65(2), 1845-1850.

⁸ American Academy of Pediatrics, Committee on Nutrition. (1990). The practical significance of lactose intolerance in children: supplement. *Pediatrics*, 86, 643-644.

⁹ American Academy of Pediatrics, Committee on Nutrition. (1978). The practical significance of lactose intolerance in children. *Pediatrics*, 62, 240-245.

¹⁰ Kalkwarf, H. J., Specker, B. L., Bianchi, D. C., Ranz, J., & Ho, M. (1997). The effect of calcium supplementation on bone density during lactation and after weaning. *New England Journal of Medicine*, 337(8), 523-8.

¹¹ National Institutes of Health, DHHS. Consensus Development Conference Statement on Optimal Calcium Intake. Retrieved August 16, 2005, from http://consensus.nih.gov/cons/097/097_statement.htm.

What can I do to help my patients?

There are many things you can do as a health care provider, including:

- Provide parents with copies of the *Milk Matters* booklet, *For strong bones...For lifelong health...Milk Matters*. This booklet explains the importance of calcium for tweens and teens and lists good sources of calcium. To order free copies of the booklet, call 1 800 370 2943 or visit <http://www.nichd.nih.gov/milk>.
- Encourage your patients to consume at least 3 cups of low-fat or fat-free milk every day, and to have additional servings of other calcium-rich foods. If they don't like milk, suggest other foods containing calcium.
- Raise awareness among your patients about the importance of calcium by displaying a *Milk Matters* poster in your office or waiting area. To order free posters, call 1 800 370 2943 or visit <http://www.nichd.nih.gov/milk>.
- Suggest that your tween and teen patients include weight-bearing physical activity in their day to help strengthen bones. In addition, the 2005 *Dietary Guidelines for Americans* recommends that children and adolescents should engage in at least 60 minutes of physical activity on most, preferably all, days of the week.
- Consider sharing information about pediatric bone health with your colleagues and encourage them to discuss calcium with patients.
- Seek out opportunities to talk with interested groups about the importance of calcium for young people ages 11 to 15. These could include Parent Teacher Association (PTA) meetings, church or synagogue youth group meetings, and YMCA and community center gatherings.



For additional copies of this fact sheet or to order free copies of patient education materials, contact the **NICHD Information Resource Center** at:

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