

Juvenile Bone Health

Revised April 2009

Kids and Their Bones: A Guide for Parents

Typically, when parents think about their children's health, they don't think about their bones. But building healthy bones by adopting healthy nutritional and lifestyle habits in childhood is important to help prevent osteoporosis and fractures later in life.

Osteoporosis, the disease that causes bones to become less dense and more prone to fractures, has been called "a pediatric disease with geriatric consequences," because the bone mass attained in childhood and adolescence is an important determinant of lifelong skeletal health. The health habits your kids are forming now can make, or literally break, their bones as they age.

Why Is Childhood Such an Important Time for Bone Development?

Bones are the framework for your child's growing body. Bone is living tissue that changes constantly, with bits of old bone being removed and replaced by new bone. You can think of bone as a bank account, where (with your help) your kids make "deposits" and "withdrawals" of bone tissue. During childhood and adolescence, much more bone is deposited than withdrawn as the skeleton grows in both size and density.

For most people, the amount of bone tissue in the skeleton (known as bone mass) peaks by their late twenties. At that point, bones have reached their maximum strength and density. Up to 90 percent of peak bone mass is acquired by age 18 in girls and age 20 in boys, which makes youth the best time for your kids to "invest" in their bone health.

Building your children's "bone bank" account is a lot like saving for their education: The more they can put away when they're young, the longer it should last as they get older.

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What Is Osteoporosis? Isn't It Something Old People Get?

Osteoporosis is a disease that causes bones to become fragile and break easily. When someone has osteoporosis, it means his/her “bank account” of bone tissue has dropped to a low level. If there is significant bone loss, even sneezing or bending over to tie a shoe can cause a bone in the spine to break. Hips, ribs, and wrist bones also break easily. The fractures from osteoporosis can be painful and disfiguring. There is no cure for the disease.

Osteoporosis is most common in older people but can also occur in young and middle-aged adults. Optimizing peak bone mass and developing lifelong healthy bone behaviors during youth are important ways to help prevent or minimize osteoporosis risk as an adult.

Factors Affecting Peak Bone Mass

Peak bone mass is influenced by a variety of factors: some that you can't change, like gender and race, and some that you can, like nutrition and physical activity.

Gender: Bone mass or density is generally higher in men than in women. Before puberty, boys and girls develop bone mass at similar rates. After puberty, however, boys tend to acquire greater bone mass than girls.

Race: For reasons still not well understood, African American girls tend to achieve higher peak bone mass than Caucasian girls, and African American women are at lower risk for osteoporosis later in life. More research is needed to understand the differences in bone density between the various racial and ethnic groups. However, because all women, regardless of race, are at significant risk for osteoporosis, girls of all races need to build as much bone as possible to protect them against this disease.

Hormonal factors: Sex hormones, including estrogen and testosterone, are essential for the development of bone mass. Girls who start to menstruate at an early age typically have greater bone density. Those who frequently miss their menstrual periods sometimes have lower bone density.

Nutritional status: Calcium is an essential nutrient for bone health. In fact, calcium deficiencies in young people can account for a 5- to 10-percent lower peak bone mass and may increase the risk for bone fracture in later life. A well-balanced diet including adequate amounts of vitamins and minerals such as magnesium, zinc, and vitamin D is also important for bone health.

Physical activity: Physical activity is important for building healthy bones, and provides benefits that are most pronounced in the areas of the skeleton that bear the most weight. These areas include the hips during walking and running and the arms during gymnastics and weight lifting.

How Can I Help Keep My Kids' Bones Healthy?

The same healthy habits that keep your kids going and growing will also benefit their bones. One of the best ways to encourage healthy habits in your children is to be a good role model yourself. Believe it or not, your kids are watching, and your habits, both good and bad, have a strong influence on theirs.

The two most important lifelong bone health habits to encourage now are proper nutrition and plenty of physical activity.

Eating for healthy bones means getting plenty of foods that are rich in calcium and vitamin D. Most kids get enough vitamin D from sunlight (or from foods like egg yolks or fortified milk), but most do not get enough calcium in their diets to help ensure optimal peak bone mass. Are your kids getting enough calcium?

Recommended Calcium Intakes

Age	Amount of calcium (milligrams)
Infants	
Birth to 6 months	210
6 months to 1 year	270
Children/Young Adults	
1 to 3 years	500
4 to 8 years	800
9 to 18 years	1,300
Adult Women and Men	
19 to 50 years	1,000
50+	1,200
Pregnant or Lactating Women	
18 years or younger	1,300
19 to 50 years	1,000

Source: National Academy of Sciences, 1997.

Calcium is found in many foods, but the most common source is milk and other dairy products. Drinking one 8-oz glass of milk provides 300 milligrams (mg) of calcium, which is about one-third of the recommended intake for younger children and about one-fourth of the recommended intake for teens. In addition, milk supplies other minerals and vitamins needed by the body. The chart on the next page lists the calcium content for several high-calcium foods and beverages. Your kids need several servings of these foods each day to meet their need for calcium.

How Can I Persuade My Daughter to Drink Milk Instead of Diet Soda? She Thinks Milk Will Make Her Fat.

Soft drinks tend to displace calcium-rich beverages in the diets of many children and adolescents. In fact, research has shown that girls who drink soft drinks consume much less calcium than those who do not.

It's important for your daughter to know that good sources of calcium don't have to be fattening. Skim milk, low-fat cheeses and yogurt, calcium-fortified juices and cereals, and green leafy vegetables can all fit easily into a healthy, low-fat diet. Replacing even one soda each day with milk or a milk-based fruit smoothie can significantly increase her calcium intake.

Selected Food Sources of Calcium		
Food	Calcium (mg)	Daily Value (%)
Sardines, canned in oil, with bones, 3 oz.	324	32
Cheddar cheese, 1½ oz., shredded	306	31
Milk, nonfat, 8 fl oz.	302	30
Yogurt, plain, low fat, 8 oz.	300	30
Milk, reduced fat (2% milk fat), no solids, 8 fl oz.	297	30
Milk, whole (3.25% milk fat), 8 fl oz.	291	29
Milk, buttermilk, 8 fl oz.	285	29
Milk, lactose reduced, 8 fl oz. (content varies slightly according to fat content; average = 300 mg)	285 to 302	29 to 30
Cottage cheese, 1% milk fat, 2 cups unpacked	276	28
Mozarella, part skim, 1½ oz.	275	28
Tofu, firm, with calcium, ½ cup*	204	20
Orange juice, calcium fortified, 6 fl oz.	200 to 260	20 to 26
Salmon, pink, canned, solids with bone, 3 oz.	181	18
Pudding, chocolate, instant, made with 2% milk, ½ cup	153	15
Tofu, soft, with calcium, ½ cup*	138	14
Breakfast drink, orange flavor, powder prepared with water, 8 fl oz.	133	13
Frozen yogurt, vanilla, soft serve, ½ cup	103	10
Ready to eat cereal, calcium fortified, 1 cup	100 to 1000	10 to 100
Turnip greens, boiled, ½ cup	99	10
Kale, raw, 1 cup	90	9
Kale, cooked, 1 cup	94	9
Ice cream, vanilla, ½ cup	85	8.5
Soy beverage, calcium fortified, 8 fl oz.	80 to 500	8 to 50

Chinese cabbage, raw, 1 cup	74	7
Tortilla, corn, ready to bake/fry, 1 medium	42	4
Tortilla, flour, ready to bake/fry, one 6" diameter	37	4
Sour cream, reduced fat, cultured, 2 tbsp	32	3
Bread, white, 1 oz.	31	3
Broccoli, raw, ½ cup	21	2
Bread, whole wheat, 1 slice	20	2
Cheese, cream, regular, 1 tbsp	12	1

Source: Heaney et al. 2000; USDA 2002.

*Calcium values are only for tofu processed with a calcium salt. Tofu processed with a noncalcium salt will not contain significant amounts of calcium.

But My Kids Don't Like Milk.

Drinking milk isn't the only way to enjoy its benefits. For example, try making soup and oatmeal or other hot cereals with milk instead of water. Pour milk over cold cereal for breakfast or a snack. Incorporate milk into a fruit smoothie or milkshake. Chocolate milk and cocoa made with milk are also ways to increase the milk in your child's diet.

Sources of calcium also might include an ounce or two of cheese on pizza or a cheeseburger, a cup of calcium-enriched orange juice, or a small carton of yogurt. Your kids can also get calcium from dark green, leafy vegetables like kale or bok choy, or foods such as broccoli, almonds, tortillas, or tofu made with calcium. Many popular foods such as cereals, breads, and juices now have calcium added too. Check the Nutrition Facts label on the package to be sure.

My Teenage Son Loves Milk, But It Seems to Upset His Stomach. Could He Have Lactose Intolerance?

People with lactose intolerance have trouble digesting lactose, the sugar found in milk and dairy foods. Lactose intolerance is not common among infants and young children, but can occur in older children, adolescents, and adults. It is more common among people of African American, Hispanic, Asian, and American Indian descent.

Most kids with lactose intolerance are able to digest milk when it is served in small amounts, and combined with other foods like cereal. They may tolerate other dairy products such as cheese or yogurt even if milk is a problem. Lactose-free milk products are now available in most stores, and there are pills and drops you can add to milk and dairy products that make them easier to digest.

Be sure to include plenty of foods with calcium in the meals and snacks you plan for your kids. Almonds, calcium-fortified orange juice, tortillas, fortified cereals, soy beverages, and broccoli with dip are a few great choices. Although it's best to get calcium from food, calcium supplements can also be helpful.

How to Read a Food Label for Calcium

The food label, called Nutrition Facts, shows you how much one serving of that food contributes to the total amount of calcium, as well as other nutrients, you need every day. This is expressed as a percentage of the daily value (%DV) of calcium that is recommended. For labeling purposes, this is based on the daily calcium recommendation of 1,000 milligrams for people 19 to 50 years old. Since children and teens 9 to 18 years old require more calcium, their %DV target is higher, as indicated below:

Age	Recommended calcium intake	%DV target
9 to 18	1,300 mg	130%DV
19 to 50	1,000 mg	100%DV

Here is an easy rule of thumb for evaluating the calcium content of a food: 20%DV or more is high for calcium. That means it is a high-calcium food and contributes a lot of calcium to the diet. A food with a calcium content of 5%DV or lower contributes little calcium to the diet and is a low source.

If you want to convert the %DV for calcium into milligrams, you can multiply by 10. For example, if a single-serving container of yogurt lists 30%DV for calcium, it contains 300 mg of calcium (30×10).

Getting plenty of high-calcium foods every day is important. To meet their calcium needs, children 9 to 18 years old need about four servings of foods with a 30%DV for calcium (300 mg each) or six to seven servings of foods with a 20%DV for calcium (200 mg each) every day. Foods with a lower %DV for calcium are also important to fill gaps and help ensure that your children get all the calcium they need.

My Daughter Is Constantly Dieting. Should I Be Concerned?

Maintaining proper weight is important to overall health, but so is good nutrition. If your daughter is avoiding all milk and dairy products and severely restricting her food intake, she is probably not getting enough calcium. She needs a more balanced diet that includes low-fat milk products and other calcium-rich foods. Calcium supplements may also be helpful to ensure that she gets enough of this essential nutrient.

You should discuss your concerns with your daughter's doctor. If your daughter is one of up to 3 percent of American girls and young women with eating disorders, the problem is even more serious. Eating disorders, especially anorexia nervosa, can lead to missed or irregular menstrual periods or the complete absence of periods, known as amenorrhea. These are signs of low estrogen, a hormone that is essential for developing bone density and reaching peak bone mass. Girls with anorexia nervosa will often have fractures as a first sign of the disease. Furthermore, reduction in estrogen production in adolescence can increase your daughter's risk of osteoporosis and fracture later in life. In severe cases, girls with eating disorders may even develop osteoporosis in their twenties, and they may find the damage to their bones cannot be reversed later in life.

Look for the following signs and see your daughter's physician if you think your daughter has, or is at risk of developing, an eating disorder:

- missed menstrual periods after having had them regularly for at least several months
- extreme and/or unhealthy-looking thinness
- extreme or rapid weight loss
- frequent dieting practices such as
 - eating very little
 - not eating in front of others

- trips to the bathroom following meals
- preoccupation with thinness
- focus on low-calorie and diet foods
- overtraining or excessive exercise.

Should I Give My Kids Calcium Supplements?

Experts believe calcium should come from food sources whenever possible. However, if you think your children are not getting adequate calcium from their diet, you may want to consider a calcium supplement. For optimal absorption, no more than 500 mg of calcium should be taken at one time.

How Does Physical Activity Help My Kids' Bones?

Muscles get stronger when we use them. The same idea applies to bones: the more work they do, the stronger they get. Any kind of physical exercise is great for your kids, but the best ones for their bones are weight-bearing activities like walking, running, hiking, dancing, tennis, basketball, gymnastics, and soccer. (Children who tend to play outside will also have higher vitamin D levels.) Swimming and bicycling promote your kids' general health, but are not weight-bearing exercises and will not help build bone density. Organized sports can be fun and build confidence, but they are not the only way to build healthy bones.

The most important thing is for your kids to spend less time sitting and more time on their feet and moving. Alone or with friends, at home or at the park, one of the best gifts you can give your kids is a lifelong love of physical activity.

Bone-Building Activities

- | | |
|----------------------------------|----------------------|
| • Walking | • Soccer |
| • Tennis | • Skateboarding |
| • Running | • Gymnastics |
| • Volleyball | • In-line skating |
| • Hiking | • Basketball |
| • Ice hockey/
field
hockey | • Lifting
weights |
| • Dancing | • Jumping rope |
| • Skiing | • Aerobics |

Is It Possible to Get Too Much Exercise?

For most people, including children and teens, the challenge is to get enough physical activity. However, excessive exercise and overtraining, often coupled with restrictive eating, can be a problem, especially for some female athletes and dancers, as well as girls who become obsessive about weight loss. Overtraining, like eating disorders, can result in decreased estrogen and eventually lead to thin bones that break easily.

Years ago, it was not unusual for coaches and trainers to encourage athletes to be as thin as possible for many sports, including dancing, gymnastics, figure skating, running, and diving. Fortunately, many coaches now realize that being too thin is unhealthy and can negatively affect performance as well as lifelong health.

What Else Can My Kids Do Besides Eating Calcium-Rich Foods and Getting Plenty of Weight-Bearing Exercise to Keep Their Bones Healthy?

They should avoid smoking. You probably know that smoking is bad for the heart and lungs, but you may not know that it's harmful to bone tissue. Smoking may harm your bones both directly and indirectly. Several studies have linked smoking to higher risk of fracture. The many dangers associated with smoking make it a habit to be avoided.

You may think it's too early to worry about smoking, but the habit typically starts during childhood or adolescence. In fact, most people who use tobacco products start before they finish high school. The good news? If your kids finish high school as nonsmokers, they will probably stay that way for life.

Children who learn good eating and exercise habits by their preteen years are more likely to carry these habits with them for the rest of their lives.

My Son Has Asthma and Takes a Steroid Medication to Control It. His Doctor Said This Might Affect His Bones. Is There Anything We Can Do About This?

Asthma itself does not pose a threat to bone health, but some medications used to treat the disease can have a negative effect on bones when taken for a long time. Corticosteroids, a type of anti-inflammatory medication, are often prescribed for asthma. These medications can decrease calcium absorbed from food, increase calcium loss from the kidneys, and shrink a child's bone bank account.

Kids with asthma need to take special care of their bones, making sure to get enough calcium and weight-bearing exercise. Some health care providers recommend extra calcium each day: between 1,000 and 1,500 mg. Many people think milk and dairy products – great sources of calcium and vitamin D – trigger asthma attacks, but this is probably true only if your child is allergic to dairy foods. Unfortunately, this misconception often results in an unnecessary avoidance of dairy products, which is especially risky for kids with asthma, who need extra calcium during their bone-building years.

Because exercise can often trigger an asthma attack, many people with asthma avoid weight-bearing physical activities that strengthen bone. Kids with asthma may be able to exercise more comfortably in an air-conditioned place, such as a school gym or health club.

Talk to your child's doctor for more information about protecting his bones while he is taking asthma medications.

My 8-Year-Old Son Is a Daredevil and Has Already Broken Several Bones. Could He Have a Problem Like Osteoporosis at This Young Age?

Osteoporosis is rare among children and adolescents. When it occurs, it is usually caused by an underlying medical disorder or by medications used to treat such disorders. This is called secondary osteoporosis. It may also be the result of a genetic disorder such as osteogenesis imperfecta, in which bones break easily from little or no apparent cause. Sometimes there is no identifiable cause of juvenile osteoporosis. This is known as idiopathic juvenile osteoporosis. Two or more low-impact fractures may be a sign of one of these disorders.

If you are concerned about your son's frequent fractures, talk to his doctor for more information.

How Can I Get Through to My Kids? They Sure Don't Think About Their Bones.

You are absolutely right. Research has shown that children and adolescents do not tend to think much about their health. Their decisions about diet and exercise, for example, are rarely made based on “what's good for them.” But we also know that you have a much greater influence on your kids' decisions and behaviors than you may believe. For example, many teenagers, when asked who has been the greatest influence in their life, name parents before friends, siblings, grandparents, and romantic partners.

Disorders, Medications, and Behaviors That May Affect Peak Bone Mass

Primary Disorders

Juvenile arthritis
 Diabetes mellitus
 Osteogenesis imperfecta
 Hyperthyroidism
 Hyperparathyroidism
 Cushing's syndrome
 Malabsorption syndromes
 Anorexia nervosa
 Kidney disease
 Liver disease

Medications

Anticonvulsants (e.g., for epilepsy)
 Corticosteroids (e.g., for rheumatoid arthritis, asthma)
 Immunosuppressive agents (e.g., for cancer)

Behaviors

Prolonged inactivity or immobility
 Inadequate nutrition (especially calcium, vitamin D)
 Excessive exercise leading to amenorrhea
 Smoking
 Alcohol abuse

The best way to help your kids develop healthy habits for life is to be a good role model. Research suggests that active children have active parents. If you make physical activity a priority and try hard to maintain a healthy diet, including plenty of calcium, chances are your positive lifestyle will “rub off” on them along the way. Here are some things you can do:

- Be a role model. Drink milk with meals, eat calcium-rich snacks, and get plenty of weight-bearing exercise. Don't smoke.
- Incorporate calcium-rich foods into family meals.
- Serve fat-free or low-fat milk with meals and snacks.
- Stock up on calcium-rich snacks that are easy for hungry children to find, such as:
 - cheese cubes and string cheese
 - single-serving puddings
 - yogurt and frozen yogurt
 - cereal with low-fat milk
 - broccoli with yogurt dip
 - calcium-fortified orange juice
 - individual cheese pizzas
 - tortillas
 - almonds.
- Limit access to soft drinks and other snacks that don't provide calcium by not keeping them in the house.
- Help your kids to find a variety of physical activities or sports they enjoy participating in.
- Establish a firm time limit for sedentary activities such as TV, computers, and video games.
- Teach your kids to *never start* smoking, as it is highly addictive and toxic.
- Look for signs of eating disorders and overtraining, especially in preteen and teenage girls, and address these problems right away.
- Talk to your children's pediatrician about their bone health. If your child has a special medical condition that may interfere with bone mass development, ask the doctor for ways to minimize the problem and protect your child's bone health.
- Talk to your children about their bone health, and let them know it is a priority for you. Your kids may not think much about health, but they are probably attracted to such health benefits as energy, confidence, good looks, and strength.

Where Can I Go for More Information?

NIH Osteoporosis and Related Bone Diseases ~ National Resource Center

2 AMS Circle
Bethesda, MD 20892-3676
Phone: 202-223-0344
Toll Free: 800-624-BONE
TTY: 202-466-4315
Fax: 202-293-2356
Email: NIAMSBoneInfo@mail.nih.gov
Website: http://www.niams.nih.gov/Health_Info/bone/default.asp

National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) Information Clearinghouse National Institutes of Health

1 AMS Circle
Bethesda, MD 20892-3675
Phone: 301-495-4484
Toll Free: 877-22-NIAMS (226-4267)
TTY: 301-565-2966
Fax: 301-718-6366
Email: NIAMSinfo@mail.nih.gov
Website: <http://www.niams.nih.gov>

Milk Matters Campaign

Website: <http://www.nichd.nih.gov/milk>

National Bone Health Campaign

Website: <http://www.cdc.gov/powerfulbones/>

National Osteoporosis Foundation (NOF)

1232 22nd Street, NW
Washington, DC 20037-1202
Phone: 202-223-2226
Toll Free: 800-231-4222
Email: patientinfo@nof.org
Website: <http://www.nof.org>

For Your Information

For updates and for any questions about any medications you are taking, please contact

U.S. Food and Drug Administration

Toll Free: 888-INFO-FDA (888-463-6332)
Website: <http://www.fda.gov/>

For updates and questions about statistics, please contact

Centers for Disease Control and Prevention's National Center for Health Statistics

Toll Free: 800–232–4636

Website: <http://www.cdc.gov/nchs>

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