



# Kids and Their Bones: A Guide for Parents

NIH Osteoporosis and  
Related Bone Diseases ~  
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NIH Pub. 02-5186  
August 2002

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 very important to help prevent osteoporosis and fractures later in life.

Osteoporosis, the disease that causes bones to become less dense and prone to fractures, has been called "a pediatric disease with geriatric consequences," because the bone mass attained in childhood and adolescence is a very 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. Bones are 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 During childhood and adolescence, much more bone is deposited than withdrawn as the skeleton grows in both size and density.

The amount of bone tissue in the skeleton (known as bone mass) can continue to increase until your child reaches his/her mid-20s. At that point, bones have reached their maximum strength and density, or peak bone mass. 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 will last as they get older.*

## 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 prevent or minimize osteoporosis risk as an adult.



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## 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 themselves 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 5–10 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. The benefits of activity are most pronounced in those areas of the skeleton that bear the most weight, such as the hips during walking and running and the arms during gymnastics and upper-body weightlifting.

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## 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.

What are the two most important lifelong bone health habits to encourage now? Proper nutrition and plenty of physical activity.

Eating for healthy bones means getting plenty of foods 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. Younger kids (ages 2–8) are more likely to get adequate calcium, but among older kids (ages 9–19), only 19 percent of girls and 52 percent of boys get enough calcium to ensure optimal peak bone mass. Are your kids getting enough calcium?

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## Recommended calcium intakes\*

Age	Amount of calcium
<b>Infants</b>	
birth–6 months . . . . .	210 mg
6 months–1 year . . . . .	270 mg
<b>Children/Young Adults</b>	
1–3 years . . . . .	500 mg
4–8 years . . . . .	800 mg
9–18 years . . . . .	1,300 mg
<b>Adult Women and Men</b>	
19–50 years . . . . .	1,000 mg
50+ . . . . .	1,200 mg
<b>Pregnant or Lactating Women</b>	
18 years or younger . . . . .	1,300 mg
19–50 years . . . . .	1,000 mg

\*Source: National Academy of Sciences, 1997

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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 calcium-rich foods

Food item	Serving size	Calcium (mg)	Fat (g)	Calories
<b>Milk</b>				
Skim*	8 oz.	301	0.4	86
1%*	8 oz.	300	2.6	102
2%*	8 oz.	298	4.7	121
Whole*	8 oz.	290	8.2	149
<b>Yogurt</b>				
Plain, fat-free*	8 oz.	488	0.4	137
Plain, low-fat*	8 oz.	448	3.8	154
Fruit, low-fat*	8 oz.	338	2.8	243
Frozen, vanilla, soft serve	½ cup	103	4.0	114
<b>Cheese</b>				
American	1 oz.	163	6.9	93
Cheddar*	1 oz.	204	9.4	114
Cottage, 2%	1 cup	156	4.4	203
Mozzarella, part skim	1 oz.	183	4.5	72
Muenster*	1 oz.	203	8.5	104
Parmesan	1 tbsp.	69	1.5	23
Ricotta, part skim*	½ cup	337	9.8	171
Ricotta, whole milk*	½ cup	257	16.1	216
<b>Ice Cream, Vanilla</b>				
Low fat	½ cup	92	2.8	92
High fat	½ cup	87	12	178
<b>Fish and Shellfish</b>				
Sardines, canned in oil, drained, including bones*	3.75 oz.	351	10.5	191
Salmon, pink, canned, including bones	3 oz.	181	5.1	118
Shrimp, canned, drained	3 oz.	50	1.7	102
<b>Vegetables</b>				
Bok choy, raw (Chinese cabbage)	1 cup	74	0	9
Broccoli, cooked, drained, from raw	1 cup	74	0.6	44
Broccoli, cooked, drained, from frozen	1 cup	94	0.2	50
Soybeans, mature, boiled	1 cup	175	15	298
Collards, cooked, drained, from raw*	1 cup	226	0.7	49
Turnip greens, cooked, drained, from raw, leaves and stems	1 cup	197	0.3	29
<b>Others</b>				
Tofu, raw, regular, prepared with calcium*	½ cup	434	5.9	94
Orange (navel)	1 whole	56	0.1	65
Tortilla, corn	1 med.	46	0.7	58
Tortilla, flour	1 med.	40	2.3	104
Almonds (dry roasted)	1 oz.	75	15	169
Sesame seeds, kernels, toasted	1 oz.	37	13.6	161
Dried figs, uncooked*	1 cup	287	2.3	507

Source: USDA Nutrient Data Laboratory, 2002

\* indicates a high calcium source

**Note: You also can increase the calcium in foods by following these suggestions:**

1. Add nonfat powdered milk to all soups, casseroles, and drinks.
2. Buy juices, cereals, breads, and rice that are fortified with calcium.
3. Replace whole milk and cream with skim and low-fat milk in recipes.
4. Replace sour cream with yogurt in recipes.
5. Some bottled waters contain calcium so check the labels for more information.

### **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—cereals, breads, juices—now have calcium added, too. Check the Nutrition Facts label on the package to be sure (see the box on the following page).

### **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 in smaller 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. While it's best to get calcium from food, calcium supplements can also be helpful.

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## 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 percent 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 aged 19–50. Since children and teens aged 9–18 require more calcium, their %DV target is higher, as indicated below:

Age	Recommended calcium intake	%DV target
9–18	1,300 mg	130%DV
19–50	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 5%DV or lower for calcium 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-serve container of yogurt lists 30%DV for calcium, it contains 300 mg of calcium (30% times 10).

Getting plenty of high-calcium foods every day is important. To meet their calcium needs, children aged 9–18 need about 4 servings of foods with a 30%DV for calcium (300 mg each) or 6–7 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.

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## 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 the almost 5 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 optimal 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 will

increase your daughter's risk of osteoporosis and fracture later in life. In severe cases, girls with eating disorders may even develop osteoporosis as early as their 20s. In severe cases, 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.



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## Bone-building activities

- Walking
  - Running
  - Hiking
  - Dancing
  - Soccer
  - Gymnastics
  - Basketball
  - Jumping rope
  - Tennis
  - Volleyball
  - Ice hockey/field hockey
  - Skiing
  - Skateboarding
  - In-line skating
  - Weight lifting
  - Aerobics
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### 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.

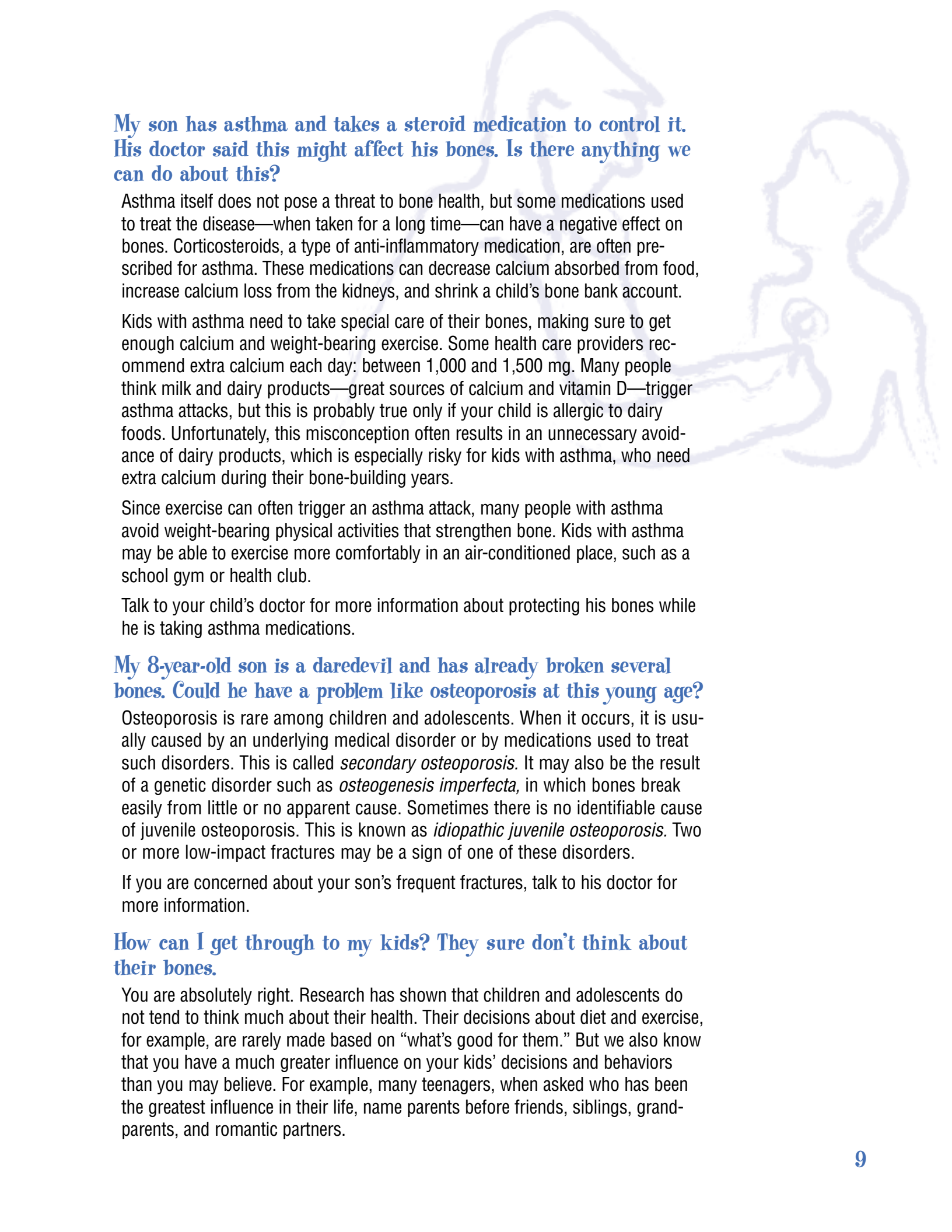
### So, my kids need to eat foods that are rich in calcium and get plenty of weight-bearing exercise. Is there anything else they can do to keep their bones healthy?

Yes. 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. Tobacco, nicotine, and other chemicals found in cigarettes may be directly toxic to bone, or they may inhibit absorption of calcium and other nutrients needed for bone health. 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. In fact, most people who use tobacco products start before they finish high school. The good news? If your kids finish high school as non-smokers, 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—when taken for a long time—can have a negative effect on bones. 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.

Since 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.

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## 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

Anti-convulsants (e.g., for epilepsy)  
Corticosteroids (e.g., for rheumatoid arthritis, asthma)  
Immunosuppressive agents (e.g., for cancer)

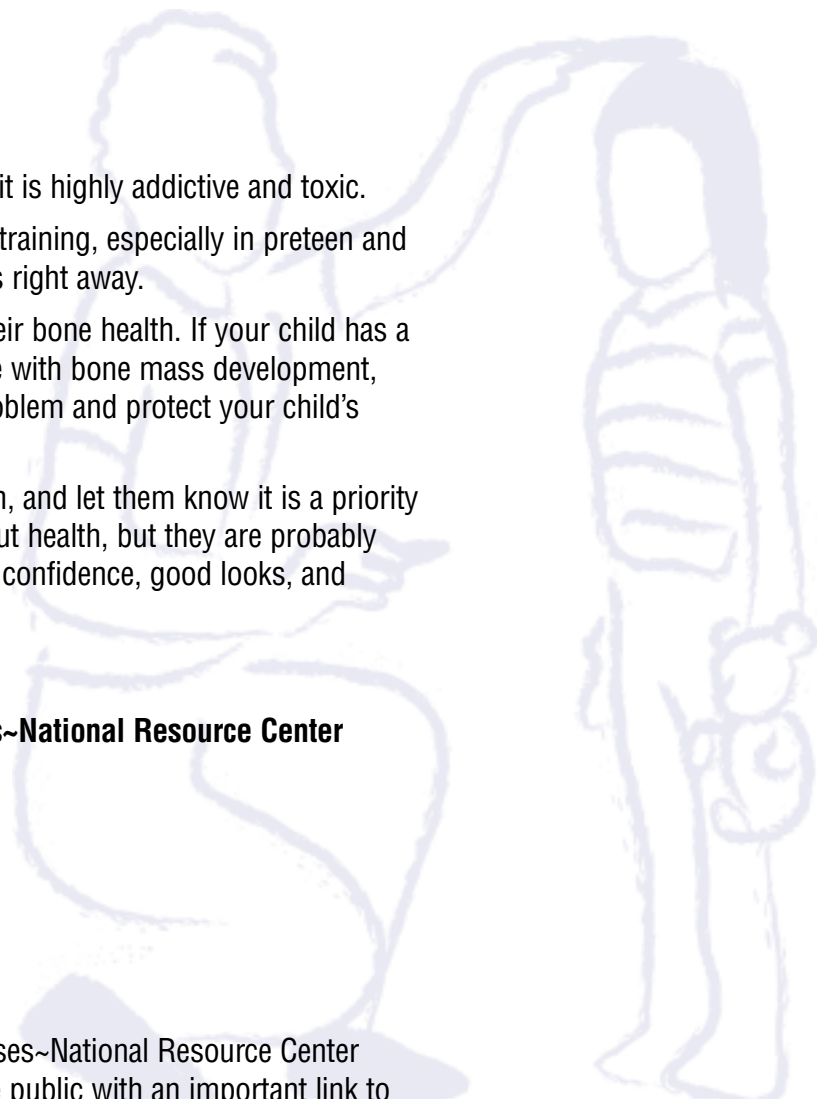
### Behaviors

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

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The best way to help your kids develop healthy habits for life is to be a good role model yourself. 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.

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- 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 teenaged 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**

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The NIH Osteoporosis and Related Bone Diseases~National Resource Center provides patients, health professionals, and the public with an important link to resources and information on osteoporosis and other metabolic bone diseases.

#### **National Institute of Arthritis and Musculoskeletal and Skin Diseases**

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877-22-NIAMS (226-4267) (free of charge)  
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[www.niams.nih.gov](http://www.niams.nih.gov)

The NIAMS information dissemination efforts include providing general information, distributing patient and professional education materials, and referring people to other sources of information. Additional information and updates can also be found on the NIAMS Web site.



### **Milk Matters Campaign**

[www.nichd.nih.gov/milkmatters/milk.cfm](http://www.nichd.nih.gov/milkmatters/milk.cfm)

Milk Matters is a public health campaign sponsored by the National Institute of Child Health and Human Development. It is designed to increase calcium consumption among children and teens to help them build strong and healthy bones.

### **National Bone Health Campaign**

[www.cdc.gov/powerfulbones](http://www.cdc.gov/powerfulbones)

The NBHC is a multiyear campaign to promote optimal bone health in girls 9–12 years old, and reduce their risk of osteoporosis later in life. The NBHC is sponsored by the Centers for Disease Control and Prevention, the Department of Health and Human Services' Office on Women's Health, and the National Osteoporosis Foundation.

### **National Osteoporosis Foundation**

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The National Osteoporosis Foundation (NOF) is the leading nonprofit, voluntary health organization dedicated to promoting lifelong bone health in order to reduce the widespread prevalence of osteoporosis and associated fractures, while working to find a cure for the disease through programs of research, education, and advocacy.

