Calcium and Vitamin D for the Bones

There is no question that a generous intake of calcium plus vitamin D will help build optimum bone mass during childhood and adolescence and will also slow the rate of bone loss that naturally occurs with aging. These combined effects help protect against the development of osteoporosis, a disease caused by failure to build adequate bone mass or by progressive bone loss during aging. Osteoporosis by definition is a condition in which bone mass is sufficiently compromised to result in bone fragility. Most people do not get enough calcium or vitamin D from diet alone, and in many individuals osteoporosis is only recognized when a fracture occurs. Substantial research has shown supplements to be effective in maintaining or increasing bone density.

More than 99 percent of the body's calcium is found in the bones and teeth. While the bones have an obvious structural role, they also serve as the body's reservoir for calcium, since bone calcium can be mobilized and used to maintain the steady state necessary for muscle contraction and nerve transmission. Bone is not a static tissue, but is constantly being resorbed and reformed. The balance determines whether bone is being added or lost in any particular person at any particular time. In growing children, the rate of bone formation is greater than the rate of bone resorption. In healthy young adults, the two processes are roughly balanced. During aging, the rate of formation falls behind the rate of resorption, and there is generally a net loss of bone.

OBSERVATIONS OF AN EXPERT: DR. ROBERT P. HEANEY

Dr. Robert P. Heaney of Creighton University, an internationally recognized expert on calcium and bone health, explains that bone is formed from structural materials such as calcium, phosphorus, and protein, all of which must be obtained from outside sources—that is, from dietary intake. A growing body must obtain these materials in adequate amounts from the diet. Even after growth has stopped, these substances must continue to be provided, because calcium and other components of bone are used for other functions and are lost from the body in considerable quantities every day. These losses must be offset by more intake. Otherwise, the body will treat the bones as a nutritional reserve and extract calcium from them to satisfy other needs. (Heaney, 2000)

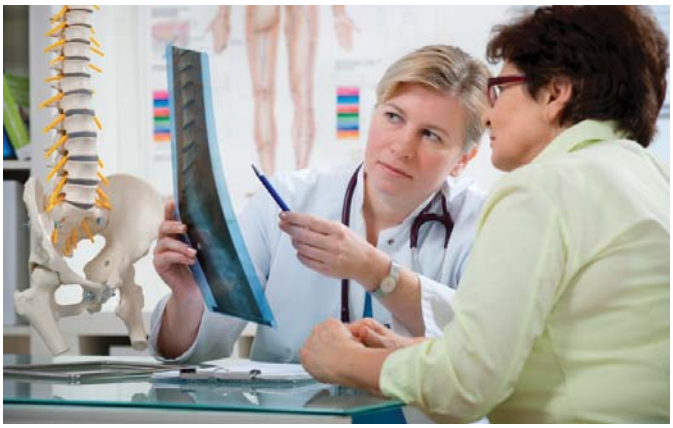
...the current levels of calcium intake in children are not sufficient to fulfill their genetic potential for building bone mass.

"In the past 25 years there have been at least 139 published reports in English exploring the relationship between calcium intake and bone status," according to Dr. Heaney. Almost all the randomized controlled trials in adults showed that increasing calcium intake reduced or stopped age-related bone loss, or reduced the rate of bone fractures, or both. All of the trials in children and adolescents showed that consuming supplemental calcium (from supplements or from dairy products) increased bone growth.

What conclusions can be drawn from these controlled studies? First, the current levels of calcium intake in children are not sufficient to fulfill their genetic potential for building bone mass. Also, current intakes

among adults are not sufficient to protect the "bone capital" they have amassed during their lifetime. Dr. Heaney says "increasing calcium intake across the life span will enhance bone acquisition during growth, stabilize bone mass at maturity," and minimize bone loss during aging. (Heaney, 2000)

In addition to the controlled studies, there have been more than 86 observational studies on the association between calcium intake and bone mass. About three-fourths of these "support the hypothesis that increased calcium intake protects the skeleton." (Heaney, 2000) Taken together, all the available studies firmly establish that high calcium intakes are important throughout life, that most Americans are not getting enough calcium, and that shortfalls of calcium intake have a major impact on bone health.



What about the role of calcium in treating people who have already suffered significant bone loss? "With the stimulus of growth long past, and with some of the bony scaffolding already destroyed by prior bone loss, supplemental calcium alone does not usually restore lost bone. However, high calcium intakes play a crucial and often little appreciated role as an adjuvant to formal therapeutic regimens." Dr. Heaney suggests that it would be prudent to include 1600 to 2400 mg per day of calcium as part of any treatment regimen directed at increasing bone mass. (Heaney, 2000)

Dr. Heaney has also emphasized the critical importance of the interaction of calcium and vitamin D in bone health and possibly in other conditions. Both are needed to ensure sufficient calcium absorption to meet the body's needs. Also, "population intakes of both nutrients are recognized to be inadequate and to be in need of improvement." (Heaney, 2008a)

THE NIH CONSENSUS CONFERENCES ON OSTEOPOROSIS

The National Institutes of Health convened consensus conferences on osteoporosis in 1984, 1994, and 2000. All emphasized the importance of calcium intakes as well as other actions to reduce the risk of osteoporosis. The Consensus Conference on Osteoporosis Prevention, Diagnosis, and Therapy convened by NIH in 2000 had this to say about calcium and osteoporosis: "Calcium is the nutrient most important for attaining peak bone mass and for preventing and treating osteoporosis. Sufficient data exist to recommend specific dietary calcium intakes at various stages of life." Yet only about 25 percent of teenage boys, around 10 percent of teenage girls, and approximately half of older adults actually consume the recommended amounts of calcium, according to the consensus conference report. The consensus conference also emphasized the role of vitamin D, which is required for optimal calcium absorption. (NIH, 2000)

Randomized clinical trials have demonstrated that adequate calcium intake from diet or supplements increases bone mineral density. In some trials, combined supplementation with vitamin D and calcium has resulted in significant reductions in hip fracture and other fractures. The panel recommends that calcium and vitamin D also be given in conjunction with any drug therapy for osteoporosis. Other recommendations for prevention and treatment include getting plenty of weight-bearing exercise and avoiding falls. (NIH, 2000)

SURGEON GENERAL'S REPORT ON BONE HEALTH AND OSTEOPOROSIS

In a major report issued in 2004, the U.S. Surgeon General concluded: "Physical activity and calcium and vitamin D intake are now known to be major contributors to bone health for individuals of all ages. Even though bone disease often strikes late in life, the importance of beginning prevention at a very young age and continuing it throughout life is now well understood.... It is never too late for prevention, as even older individuals with poor bone health can improve their bone health status through appropriate exercise and calcium and vitamin D intake." (Department of Health and Human Services, 2004)

INCIDENCE OF OSTEOPOROSIS

According to the nonprofit National Osteoporosis Foundation (NOF), about 10 million Americans already have osteoporosis, and another 34 million have low bone mass that puts them at risk for osteoporosis. (National Osteoporosis Foundation, 2012) Every year, there are more than two million fractures due to osteoporosis. The cost of treating these fractures in 2005 was $19 billion, which amounts to $52 million a day.

The NOF notes that "many Americans do not get the amount of calcium they need every day." (National Osteoporosis Foundation, 2012) NOF's recommended solution for this problem is for people to modify their dietary habits to increase consumption of dairy products and other foods providing calcium, but it is recognized that "calcium-fortified foods and calcium supplements are helpful for people who are unable to get enough calcium in their diets." Vitamin D is also critical, and it is hard to get enough vitamin D from foods alone. The skin makes vitamin D in response to sunlight, but concerns about skin cancer have led many people to stay out of the sun, cover up, or use sunscreen or sunblock, thus dramatically limiting vitamin D production. Therefore, NOF recommends that "people who do not get enough vitamin D should consider taking a supplement." (National Osteoporosis Foundation, 2012)

EXPANDED HEALTH CLAIM APPROVED BY FDA

The Food and Drug Administration (FDA) is authorized by law to permit "health claims" in food labeling regarding nutrients scientifically demonstrated to reduce the risk of a disease. One of the first health claims approved by FDA in 1993 was for the role of calcium in protecting against osteoporosis. (FDA, 1993) In 2008, FDA revised the calcium health claim to permit mention of the fact that vitamin D also plays a critical role in maintaining bone health and protecting against osteoporosis. (FDA, 2008) The claim is permitted for foods or dietary supplements that provide at least 200 mg of calcium per serving; if vitamin D is included, the product must provide at least 80 International Units per serving. The FDA regulation permitting the claim suggests model language such as:

> "Adequate calcium and vitamin D throughout life, as part of a well-balanced diet, may reduce the risk of osteoporosis."

REVISING RECOMMENDATIONS FOR CALCIUM AND VITAMIN D

In the years since new Dietary Reference Intakes (DRIs) for calcium and vitamin D were initially established in 1997, there has been extensive research suggesting that higher recommendations may be warranted, especially for vitamin D. (Dawson-Hughes, Heaney, et al., 2005; Holick, 2006; Vieth, 2004; Vieth, Bischoff-Ferrari, et al., 2007) As a result of this new evidence, the Institute of Medicine convened an expert panel to consider whether the official values should be revised. (Institute of Medicine, 2009; Yetley, Brule, et al., 2009).

RECOMMENDATIONS OF THE INSTITUTE OF MEDICINE

After two years of deliberations, the panel issued new DRIs for calcium and vitamin D in November 2010. (Institute of Medicine, 2010) The new report adopts Estimated Average Requirements (EARs) and Recommended Dietary Allowances (RDAs) for both nutrients, in place of the Adequate Intakes (AIs) established in 1997. Quantitatively, the RDAs for calcium are very similar to the former AIs for calcium, while the new RDAs for vitamin D are substantially higher than the earlier AIs.

NEW DIETARY REFERENCE INTAKES FOR CALCIUM, 2010

POPULATION GROUP	CALCIUM EAR	CALCIUM RDA
Boys and girls 9 to 18	1100 mg	1300 mg
Men 19 to 50	800 mg	1000 mg
Women 19 to 50	800 mg	1000 mg
Men 51 to 70	800 mg	1000 mg
Women 51 to 70	1000 mg	1200 mg
Men over 70	1000 mg	1200 mg
Women over 70	1000 mg	1200 mg

NEW DIETARY REFERENCE INTAKES FOR VITAMIN D, 2010

POPULATION GROUP	VITAMIN D EAR	VITAMIN D RDA
Children and adults to age 70	400 IU	600 IU
Adults over 70	400 IU	800 IU

The EAR "is the average daily nutrient intake level that is estimated to meet the nutrient needs of half of the healthy individuals in a life stage or gender group. Although the term 'average' is used, the EAR is actually an estimated *median* requirement. Therefore, by definition, the EAR exceeds the needs of half of the population and is less than the needs of the other half." (Institute of Medicine, 2010)

The RDA is derived from the EAR. Specifically, the RDA is the EAR plus two standard deviations and is intended to cover the needs of virtually all (97.5 percent) of the healthy population. (Institute of Medicine, 2010)

The new DRI committee on calcium and vitamin D also established a Tolerable Upper Intake Level (UL) for calcium of 2500 mg per day for children and for adults up to age 70, but a lower UL of 2000 mg per day for men and women over the age of 70. An upper level of 4000 IU was set for vitamin D for children and adults in all age groups. ULs for both nutrients apply to total dietary intake.

CALCIUM AND VITAMIN D INTAKES ARE BELOW RECOMMENDED LEVELS

National surveys show that calcium and vitamin D intakes are below recommended levels—not just for some people, but for most people, and especially for women. (Moshfegh, Goldman, et al., 2009)

RDAs for calcium in boys and girls ages nine to 18 are higher than for any other age group—1300 mg per day, which is the equivalent of about four glasses of milk per day. Over 80 percent of boys ages nine to 13 and almost 60 percent of boys ages 14 to 18 fail to achieve this level of intake. Among girls in this age range, the situation is even worse, with about 90 percent of girls falling short of the RDA. Clearly almost all teenage girls and many teenage boys would benefit from supplemental calcium to ensure adequate bone strength and growth.

Recommendations for calcium in adults in the age range 19 to 50 are a little lower—1000 mg per day, which is the equivalent of about three glasses of milk per day. However, *more than two-thirds of adult women in this age group fail to get the recommended amount of calcium.* About half of these women get 800 mg or less, and about a quarter of them get 600 mg or

less. Men in the age range 19 to 50 do a little better, with "only" about 40 percent falling short of the RDA for calcium. Most adult women are not getting enough calcium to maintain healthy bones, and the same is true of a large fraction of men. A calcium supplement would certainly help to fill these gaps.

RDAs for calcium in women over age 50 and in men over age 70 are higher—1200 mg per day—and a larger percentage of them fall short of this level. *More than 90 percent of women over 50* fail to achieve recommended intakes of calcium, along with *more than 80 percent of men over 70*. This has unmistakable consequences for bone health, and a calcium supplement would be an easy and inexpensive option for increasing intake.

The situation with vitamin D intake is similar. At least 90 percent of men and women fall short of the EAR and the RDA for vitamin D, considering only dietary intake. (Moshfegh, Goldman, et al., 2009) Multivitamins with vitamin D and calcium supplements with vitamin D can help address these shortfalls. Vitamin D is also synthesized in the body in response to sunlight, so dietary intake is not the only source. Blood levels of an intermediate form of vitamin D (25OHD) are considered a valid measure of overall vitamin D status, reflecting the contribution of both dietary intake and sun exposure.

HALF OF WOMEN OVER 50 HAVE LOW BONE MINERAL DENSITY

The National Osteoporosis Risk Assessment study showed that almost half of women over 50 have undiagnosed low bone mineral density. In other words, they are unknowingly at risk of bone fractures. The study measured the bone mineral density of more than 200,000 postmenopausal women 50 years of age or older with no previous diagnosis of osteoporosis. The women were recruited from more than 4,000 medical practices in 34 states, and the average age at the time of recruitment was 65 years. Forty percent of the women had low bone mineral density (osteopenia but not osteoporosis) and an additional seven percent had bone mineral density so low as to constitute osteoporosis. During the year following recruitment into the study, the women with osteopenia had twice the rate of bone fracture and the women with osteoporosis had four times the rate of bone fracture, compared to women with normal bone density. (Siris, Miller, et al., 2001)

The National Osteoporosis Risk Assessment study "reaffirms the existence of a large population of women expected to live well into the 21st century who are at risk for future fracture. It also affirms the immediacy of risk…; the risk of fracture is not a decade or more in the future but, rather, exists at the time of the diagnosis." (Siris, Miller, et al., 2001)

HELPING WOMEN COMPLY WITH CALCIUM RECOMMENDATIONS

More than 100 women with low bone density were included in an osteoporosis education program and were counseled by a dietitian. Six months later, 77 percent of the women were adhering to calcium recommendations and 91 percent were using calcium supplements. Barriers to full adherence included the participants' uncertainty about identifying good sources of calcium,

as well as concerns about weight gain and fat content of some calcium-rich foods. "The only significant independent predictor of calcium adherence at follow-up was use of a calcium supplement." (French, Vernace-Inserra, et al., 2008)

Researchers in Cleveland examined barriers to calcium supplement use in 185 women ages 20 to 64 who visited suburban clinics. (Tyler, Werner, et al., 2008) Calcium supplement use was higher among women who used multivitamins, who believed themselves to be at some risk of osteoporosis, and who were older. Ninety-six percent of those who never used supplements said they would consider taking a calcium supplement if their physician recommended it. The authors suggest that these barriers "seem amenable to focused and brief office-based interventions that could increase the number of women meeting calcium intake guidelines." (Tyler, Werner, et al., 2008)

NOT JUST A WOMEN'S ISSUE

Osteoporosis can also strike men, particularly older men. It has been estimated that "one in five men over the age of 50 will suffer an osteoporotic fracture during their lifetime, and men who sustain fractures have an increased mortality risk." (Khosla, 2010) In fact, the incidence of osteoporosis-related fracture in men is similar to that of myocardial infarction and exceeds that of lung and prostate cancers combined. (Binkley, 2009) Clearly it is just as critical for men to obtain adequate amounts of calcium and vitamin D as it is for women.

POTENTIAL EFFECTS BEYOND BONE

Some studies suggest that improved calcium and vitamin D intakes could have benefits beyond their effects on bone. These benefits could potentially affect conditions such as cancer and hypertension, as well as numerous other health risks.

A study of calcium and cancer in the NIH-AARP Diet and Health Study found that cancers of the digestive system, especially colorectal cancers, were lower in men and women with higher intakes of calcium. The study evaluated calcium intake from foods or supplements in more than 36,000 men and more than 16,000 women who developed cancer over a period of seven years. (Park, Leitzmann, et al., 2009) Other epidemiological studies have reported an effect of vitamin D in lowering colorectal cancer. (Giovannucci, 2006) Such an effect was not observed in the Women's Health Initiative. (Wactawski-Wende, Kotchen, et al., 2006) However, many of the women in that study did not actually take the calcium and vitamin D supplements they were assigned to take. (Jackson, LaCroix, et al., 2006)

A recent review attempted to define optimal vitamin D serum levels associated with multiple health outcomes. The authors assert that "a large majority of the U.S. population could benefit from vitamin D supplementation, which is a simple, highly affordable, and well-tolerated strategy that could reduce osteoporosis and fractures and could probably reduce falls associated with lower-extremity weakness, could improve dental health, and reduce the incidence of colorectal cancer in older adults." (Bischoff-Ferrari, Giovannucci, et al., 2006) They suggest that the optimal serum vitamin D level is at least 75 nanomoles per liter (nmol/L), and ideally 90

to 100 nmol/L. An intake in adults of at least 1000 IU (25 mcg) of vitamin D is needed to bring vitamin D concentrations in at least 50 percent of the population up to 75 nmol/L. They urge an increase in currently recommended levels of intake for vitamin D. (Bischoff-Ferrari, Giovannucci, et al., 2006) A benefit-risk assessment indicates that the recommended increased intakes of vitamin D can be considered both beneficial and safe. (Bischoff-Ferrari, Shao, et al., 2010)

Improved vitamin D status may protect cardiovascular health. Recently published epidemiological studies have suggested that vitamin D status (measured by serum 25-hydroxyvitamin D levels) is inversely associated with the risk for cardiovascular events and related deaths. (Dobnig, Pilz, et al., 2008; Giovannucci, Liu, et al., 2008; Wang, Manson, et al., 2010)

Researchers in New Zealand have published a meta-analysis and other findings suggesting the possibility that calcium supplementation may increase the risk of cardiovascular events, including myocardial infarction (MI). (Bolland, Avenell, et al., 2010; Bolland, Grey, et al., 2011) In contrast, a systematic review and meta-analysis by other researchers at Brigham and Women's Hospital in Boston reported that calcium supplements appear to have minimal cardiovascular effects and that vitamin D supplements may reduce cardiovascular risk. (Wang, Manson, et al., 2010) Both groups agree that additional research is warranted to clarify the effects of these nutrients on cardiovascular endpoints.

Harvard Medical School and the Brigham and Women's Hospital are currently undertaking a large, long-term clinical trial funded by the National Institutes of Health on the effect of 2000 IU vitamin D supplementation (and/or 1 gram of omega-3 fatty acids from fish oil) on both cardiovascular and cancer outcomes (the VITAL or Vitamin D and Omega-3 Trial). (VITAL Study, 2012)

NEED FOR A BROADER APPROACH TO CLINICAL TRIALS

In a major lecture delivered in 2008, Dr. Robert Heaney of Creighton University noted that clinical trials tend to measure single outcomes of nutritional interventions, even when the nutrients are known to affect multiple metabolic systems. (Heaney, 2008b)

Dr. Heaney explains, "If one takes vitamin D as an example, one notes at the outset that there are credible scientific data suggesting that vitamin D has an effect on blood pressure, insulin sensitivity, bone density, fall frequency, osteoporotic fracture risk, calcium absorption efficiency, resistance to infection, periodontal disease, and the development of various epithelial cancers, to mention only some." (Heaney, 2008b) How could one design a clinical trial to measure a composite of these effects?

As an example, Dr. Heaney points to a review article on the aggregated effects of vitamin D on BMD (bone mineral density), bone fracture rate, colon cancer risk, tooth attachment loss in periodontal disease, and lower extremity neuromuscular function. (Bischoff-Ferrari, Giovannucci, et al., 2006) Dr. Heaney urges the development of a global functional index for various nutrients or combinations of nutrients, to permit more effective research into nutritional benefits.

KEY SCIENTIFIC STUDIES

The conclusions and recommendations mentioned earlier are based on a large number of clinical trials, some of which are summarized below, with more recent studies cited first.

To study the effect of calcium supplementation alone (without vitamin D), researchers gave 1200 mg of calcium or a placebo to 930 men and women for a period of four years. During treatment, there were significantly fewer fractures in the calcium group. Not

surprisingly, the benefit was maintained only while the treatment continued and was not maintained during the six or seven years of follow-up after treatment was discontinued. (Bischoff-Ferrari, Rees, et al., 2008)

In a study in Australia, 323 men at least 40 years old were given 600 mg or 1200 mg of calcium supplementation, or a placebo, for two years. Bone mineral density increased in the men receiving 1200 mg but not in the men who got only 600 mg of calcium. The authors conclude that the effects of 1200 mg of calcium on bone mineral density in men are similar to the effects observed in postmenopausal women. (Reid, Ames, et al., 2008)

In 96 adolescent girls with low calcium intakes, supplementation for 18 months with about 500 mg of calcium increased bone mineral density at "all skeletal sites" and improved other markers of bone health, compared to girls given a placebo. The supplement was given as calcium citrate malate dissolved in fruit juice. Two years after the treatment was discontinued the benefits were no longer evident, indicating that ongoing supplementation is required to maintain the effects. (Lambert, Eastell, et al., 2008)

In a study of more than 36,000 postmenopausal women who were already enrolled in the Women's Health Initiative, researchers studied the effect of 1000 mg of calcium and 400 IU of vitamin D on fracture rates. The supplements were meant to be taken for a period of seven years, but many women failed to comply, and there was widespread calcium supplement use (and thus high overall calcium intake) in the placebo group, a limitation acknowledged by the study authors. Overall, there was no effect on fracture rates, but in women in the treatment group who actually took the supplement there was a significant decreased risk of hip fracture. (Jackson, LaCroix, et al., 2006)

In another study in Australia, 1,460 women over the age of 70 were given 1200 mg of calcium per day or a placebo for a period of five years. Overall, there was no benefit, possibly because more than 40 percent of the subjects failed to comply with the treatment. Among 830 patients who actually took 80 percent or more of their tablets (calcium or placebo), the calcium group had a significantly reduced risk of fracture. They also had improved measurements of bone density and bone strength. The authors conclude that calcium supplementation in this group was ineffective as a public health intervention because of poor compliance, but was effective in those women who took the supplements. (Prince, Devine, et al., 2006)

Researchers at the USDA Human Nutrition Research Center on Aging at Tufts University studied bone density in almost 400 men and women over 65 years of age. The subjects were given 500 mg of calcium plus 700 IU of vitamin D per day, or a placebo, for a period of three years. The group that received calcium and vitamin D experienced a significantly lower rate of bone loss and fewer nonvertebral fractures, compared to the placebo group. The researchers conclude that supplementation with calcium and vitamin D "may substantially reduce the risk of nonvertebral fractures among men and women 65 years of age or older." (Dawson-Hughes, Harris, et al., 1997)

A four-year study of calcium supplementation conducted in New Zealand confirmed that the beneficial effects of calcium supplements are maintained over several years of regular use. In this study, 78 women who were at least three years beyond menopause were assigned to calcium (1 gram per day) or a placebo. The rate of total body bone loss was lower in the calcium group than in the placebo group. In addition, calcium supplementation was associated with a lower fracture rate. In the placebo group, seven women experienced nine fractures during the study, while there were only

two fractures in the group getting 1 gram of calcium daily. (Reid, Ames, et al., 1995)

A study from France showed that calcium and vitamin D supplementation can not only decrease bone loss and reduce the incidence of fractures, but may slightly *increase* bone mass, even in the very old. For a period of 18 months, more than 3000 women over the age of 69 received 1.2 grams of calcium and 800 IU of vitamin D a day, or a placebo. In the supplemented group, there were 43 percent fewer hip fractures. Most surprisingly, bone density actually increased slightly in the group of elderly women who received the supplement. The authors concluded that "it may never be too late to prevent hip fracture." (Chapuy, Arlot, et al., 1992)

Researchers in The Netherlands conducted a meta-analysis of 33 studies on calcium and bone mass in adults 18 to 50 years of age. The intervention trials indicate that a calcium supplement of about 1000 mg per day in premenopausal women "can prevent the loss of more than 1 percent of bone per year" at most bone sites. This could have a substantial impact on bone mass around the time of menopause. (Welten, Kemper, et al., 1995)

WHAT WOULD IT COST TO INCREASE CALCIUM INTAKE?

Increasing daily calcium intake by 1000 mg per day can be accomplished by using a dietary supplement, consuming foods fortified with calcium, or ingesting more dairy products. All three are considered to be roughly equivalent in terms of the bioavailability of the calcium they contain. (Institute of Medicine, 1997)

Food sources of calcium tend to be more expensive than dietary supplement sources. Of course, they also provide nutrients other than calcium, as well as calories. The cost of adding 1000 mg of calcium to the diet would be about six cents a day for a calcium carbonate antacid (without vitamin D), around 14 to 18 cents a day for calcium tablets with vitamin D, about 30 cents a day for calcium chews with vitamin D, approximately a dollar a day if the calcium comes from lowfat milk, and over a dollar a day if the calcium comes from calcium-fortified orange juice. Most of these prices are for national brands of each product. Purchasing store brands or buying on sale would decrease the cost.

COST OF 1000 mg OF CALCIUM FROM DIETARY SUPPLEMENTS, MILK, OR FORTIFIED ORANGE JUICE

This table shows the amount of each product that would need to be consumed to provide 1000 mg of additional calcium per day, and the cost for each product. Prices are for products purchased from supermarkets and drug stores in the upper Midwest early in 2012.

PRODUCT	COST PER DAY	CALORIES	VITAMIN D
Store-brand dietary supplement, calcium carbonate, two tablets provide 1000 mg calcium, plus vitamin D	$ 0.14	—	yes
Brand-name dietary supplement, calcium carbonate, two tablets provide 1000 mg calcium, plus vitamin D	$ 0.18	—	yes
Dietary supplement, soft calcium chews, two chews provide 1000 mg calcium, plus vitamin D	$ 0.32	40	yes
Antacid (and dietary supplement), calcium carbonate, chewable, two tablets provide 1000 mg calcium (no vitamin D)	$ 0.06	20	no
Lowfat milk, 1% fat, 3.3 cups provide 1000 mg calcium, plus vitamin D	$ 1.02	360	yes
Calcium-fortified orange juice, 3 cups provide 1000 mg calcium, plus vitamin D	$ 1.62	330	yes

Whether to change overall dietary habits to make room for additional high-calcium foods or simply to add a calcium supplement is a matter of personal choice. Adding a supplement may be the easiest and most inexpensive option, but any of these alternatives would be an economical and sound investment in long-term health for consumers.

Bottom Line

A generous intake of calcium, plus an appropriate amount of vitamin D, can significantly increase bone mass in growing children and young adults and can substantially decrease bone loss during aging. Most Americans do not get the amount of calcium recommended for optimal bone health, and shortfalls throughout life can result in fractures as people age. These fractures can be both costly and traumatic. It would make sense for most people to increase their calcium intake by 500 to 1000 mg per day, and one of the easiest and most economical ways to do this is to use a daily calcium supplement, preferably with vitamin D.

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