

[NUTRACEUTICALS]

by Linda Milo Ohr

Bolstering Bone Health

An estimated 10 million Americans have osteoporosis, and 34 million more have low bone mass, according to the National Osteoporosis Foundation. When it comes to bone health, osteoporosis is a top concern, especially among women, but the focus goes beyond this disease and women. Although women are at greater risk, 20% of those affected by osteoporosis are men. Bone development and maintenance of bone mineral density are critical for bone health for all ages and both sexes. Eighty-five percent of adult bone mass is acquired by age 18 in girls and age 20 in boys. Some of today's nutraceutical ingredients focus on building strong bones through infancy and childhood and helping to prevent bone loss in one's later years. Here is a quick look.

Vitamin D, Calcium, Phosphorus, and Magnesium

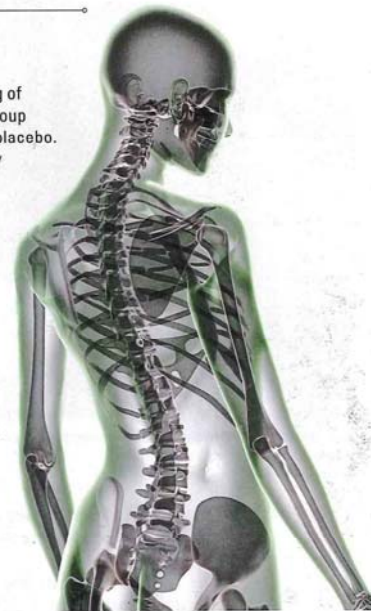
Vitamin D and calcium are essential for bone development and strong bones. Vitamin D helps the body effectively absorb and retain calcium and phosphorus, two minerals important for development and maintenance of healthy bones. Some studies also suggest that older people who take vitamin D seem to fall less often, probably due to better muscle function. In a meta-analysis, Bischoff-Ferrari et al. (2009) showed that supplemental vitamin D in a dose of 700–1,000 IU a day reduced the risk of falling among older individuals by 19%.

Kärkkäinen et al. (2010) showed that daily vitamin D and calcium supplementation had a positive effect on the skeleton in ambulatory postmeno-

chocalciferol (vitamin D-3) + 1,000 mg of calcium for 3 years while the control group received neither supplementation nor placebo. Total body BMD increased significantly more in the intervention group than in the control group.

Tenta et al. (2011) showed that increasing dietary intake of calcium and vitamin D in osteopenic postmenopausal women appeared to be effective in producing favorable changes in several bone metabolism and bone mass indices and in counterbalancing seasonal variations in hormonal and biochemical molecules. In a 30 mo study, 40 postmenopausal women (ages 55–65) were equally randomized into a control group and a dietary group, receiving 1,200 mg of calcium and 7.5 µg of vitamin D-3 through fortified dairy products for the first 12 mo. Vitamin D-3 increased to 22.5 µg for the remaining 18 mo of intervention. The test group showed more favorable changes in total body BMD than the control group. In addition, after 30 mo of intervention, during winter, serum vitamin D levels significantly decreased in the control group while it remained at the same high levels as in the summer period in the test group.

Ingredient suppliers offer various mineral forms to aid in the development of foods and bev-



Vitamin K-2 promotes bone health by activating osteocalcin, a vitamin K-dependent protein that binds calcium to the bone matrix, building strong bones. Photo courtesy of Danisco

Bone development and maintenance of bone mineral

density are critical for bone health for all ages and both sexes.

pausal women with adequate nutritional calcium intake. The OSTPRE-FPS was a randomized population-based open trial with a three-year follow-up in 3,432 women (ages 66–71). A randomly selected subsample of 593 subjects underwent bone mineral density (BMD) measurements. The supplementation group received 800 IU of

erages targeting bone health.

• ICL Performance Products, St. Louis, Mo. (phone 800-244-6169, www.icl-perfproducts.com), offers *Mag-nificent*®, which provides two key minerals, magnesium and phosphate, in one ingredient. Magnesium also assists with the absorption of calcium and phosphorus. It is

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Mag-nificent® from ICL Performance Products provides two key minerals, magnesium and phosphate, in one ingredient.

Photo courtesy of ICL Performance Products

compatible for use with calcium phosphate to balance the essential minerals.

- Corn Products International Inc., Westchester, Ill. (phone 708-551-2700, www.cornproducts.com, www.gtcnutrition.com), offers a seaweed-derived mineral source, *Aquamin™*, which is rich in calcium, magnesium, and 74 other trace minerals including zinc, iron, and selenium. It is produced from the red algae *Lithothamnion calcareum*. During a five-year lifespan, these algae absorb essential minerals from the sea, giving *Aquamin* its unique multi-mineral content. The algae then break down naturally and settle on the seabed. The calcified skeletal remains are harvested, washed, dried, and milled into four forms for different food and drink applications.

- Innophos Inc., Cranbury, N.J. (phone 609-495-2495, www.innophos.com), won an innovation award

at Health Ingredients Europe 2010 for *VersalCAL® Clear*, a highly soluble calcium phosphate for clear beverages. The ingredient contains 15% elemental calcium and 24% phosphorus.

Dairy Foods and Soy Foods

Dairy foods play an important role in bone health because they are an excellent source of several essential nutrients that work together to help protect bones; these nutrients include calcium, magnesium, phosphorus, potassium, protein, and vitamin D. An American Academy of Pediatrics (AAP) report recommended children and adolescents drink three to four 8 oz glasses of milk per day (or the equivalent) to achieve the recommended adequate calcium intake (Greer et al., 2006). The AAP suggests getting calcium from dairy foods such as milk, flavored milk, cheese, and yogurt.

Another study, reported in the journal *Pediatrics*, showed that starting as early as 10 years of age, self-imposed restriction of dairy foods because of perceived milk intolerance is associated with lower spinal bone mineral content values (Matlik et al., 2007). The long-term influence of these behaviors may contribute to later risk for osteoporosis. In this study of 291 girls, those with perceived milk intolerance consumed an average of 212 mg of total food calcium per day less than girls without perceived milk intolerance. Spinal bone mineral content was significantly lower in the girls with perceived milk intolerance compared with the girls without perceived milk intolerance.

Although soy may not come to mind as quickly as dairy when it comes to bone health, a survey by the United Soybean Board, Chesterfield, Mo. (phone 800-989-8721, www.unitedsoybean.org), showed that more Americans than ever before recognize the health benefits that soy foods provide for women's health.

"Many women see improve-

ments with soy foods in hot flash relief and in the prevention of bone loss," says Lisa Kelly, who represents the United Soybean Board. In the 2011 Consumer Attitudes about Nutrition survey, the number of Americans who stated soy is good for women was five times greater than in 2010 (15% in 2011 vs 3% in 2010). Soy foods provide high quality protein, which may be important for bone health, and some soy foods (calcium-set tofu, calcium-fortified soymilk) are good sources of calcium and vitamin D.

Vitamin K-2

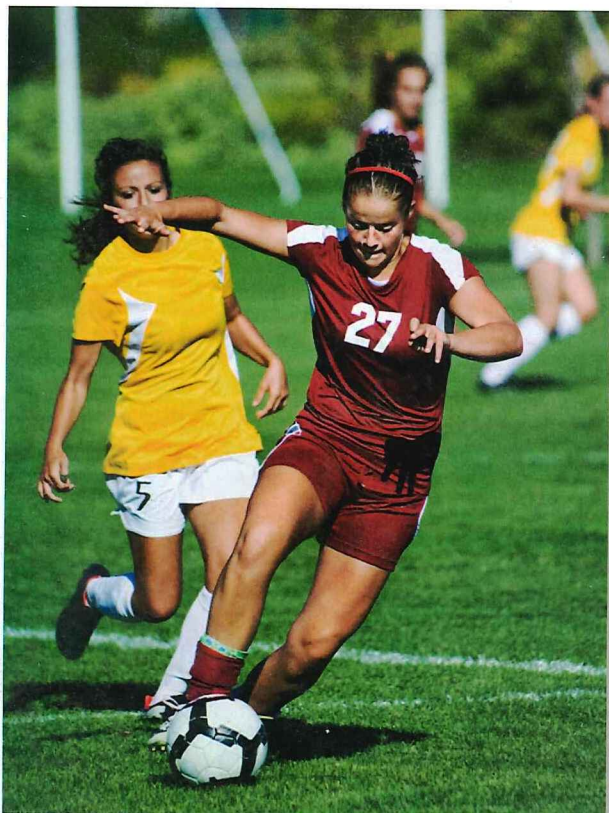
Vitamin K-2 promotes bone health by activating osteocalcin, a vitamin K-dependent protein that binds calcium to the bone matrix, building strong bones. Van Summeren et al. (2008) showed that a better vitamin K status was associated with a more pronounced increase in bone mass in healthy children. In 307 healthy children (average age of 11.2 years), bone mineral content (BMC) of the total body, lumbar spine, and femoral neck was determined at baseline and 2 years later. Vitamin K status was also measured at both time points. Improvement of vitamin K status over 2 years was associated with a marked increase in total body BMC.

Vitamin K-2 is offered by several suppliers, who promote its benefits both for bone health and for cardiovascular health.

- PL Thomas, Morristown, N.J. (phone 973-984-0900, www.plthomas.com, www.menaq7.com), offers a natural vitamin K-2, *MenaquinGold™*. The patented, self-affirmed GRAS ingredient provides natural vitamin K-2 as an extract of natto, a fermented soy food from Japan. Natto is particularly rich in the highly bioavailable form of vitamin K-2 called menaquinone-7 (MK-7).

- Frutarom USA, North Bergen, N.J. (phone 201-861-9500, www.frutarom.com), launched *unik2™*, a highly bioavailable and potent

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Girls acquire 85% of adult bone mass by age 18.

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vitamin K-2 MK-7. It is also derived from Japanese-produced natto. The recommended daily dose of *unik2* powder 0.2% is 22.5 mg/day while the 0.15% oil has a recommended daily dose of 30 mg.

• Danisco USA Inc., New Century, Kan. (phone 913-764-8100, www.health.danisco.com, www.danisco.com), offers both a naturally derived as well as synthetic vitamin K, *Activ™ KMK-7*. The natural vitamin K-2 (MK-7) is a pure natural extract of natto while the synthetic form is made using a proprietary process that also results in a very pure ingredient.

Inulin and Oligofructose

Inulin and oligofructose are believed to promote bone health by affecting calcium absorption. Corn Products' *NutraFlora®*, composed of short-chain fructooligosaccharides, is a prebiotic fiber derived from beet or cane sugar. According to company

information, studies show that about 3 g of *NutraFlora* per day may significantly and immediately improve calcium and magnesium absorption in human subjects.

An inulin-enriched oligofructose, *Orafti® Synergy1* (BENE0 Inc., Morris Plains, N.J., phone 973-867-2140, www.beneo-orafiti.com), has been shown to increase calcium absorption and bone density. This was demonstrated in a double-blind study of 100 adolescents who were given either 8g *Orafti® Synergy1* or an equivalent amount of placebo every day for a year. Calcium absorption and bone density were far higher in those who consumed the inulin-enriched oligofructose. After one year, BMD was significantly higher. The researchers also measured BMC and found that in the *Orafti® Synergy1* group, bone calcium accretion increased by an extra 30 mg per day, which served as proof that the extra calcium was actually deposited in the bones.

Sensus America Inc., Lawrenceville, N.J. (phone 646-452-6140, www.sensus.nl), also offers *Frutafit®* inulin and *Frutalose®* oligofructose, which are colorless, neutral-tasting prebiotics that can be used to enrich a variety of food products. Cargill Inc., Minneapolis, Minn. (www.cargill.com), offers *Oligo-Fiber®* inulin for increased calcium absorption.

Collagen Peptides

Collagen, which represents 90% of organic bone mass, has been shown to trigger bone formation and thus help prevent bone disease. Rousselot Inc., Mukwonago, Wis. (phone 888-455-3556, www.rousselot.com), offers *Peptan™* collagen peptides to help keep bones healthy and strong. The *Peptan* peptides are type-I collagen peptides and have the same amino acid content found in human bones and skin.

Last year at the International Osteoporosis Foundation World Congress in Florence, Italy, Rousselot presented two *in vivo*

experiments on bone health using *Peptan Hydrolyzed Collagen* (Rousselot, 2010). These studies were performed on ovariectomized mice, which are a good model for post-menopause osteoporosis. Both studies showed that daily intake of *Peptan* increased bone mineral density and bone strength. The studies also showed that *Peptan* had a preventive effect on bone loss when given to the mice pre-ovariectomy. **FT**



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