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## ASK THE DOCTOR

### The Importance of Silicon in Maintaining Bone Health

By Johan Briké, MD



**Q:** *A 53-year-old friend recently visited her doctor, who suggested measuring her bone mineral density (BMD) because she's going through menopause and is rather petite. She was shocked to learn she had osteoporosis, based on her BMD results. After her diagnosis, my friend added silicon to her supplementation program. What can you tell me about silicon? I'm also going through menopause, but I'm rather tall and not very thin. Am I at risk, and should I get a BMD test?*

**A:** Your friend is not alone. The National Osteoporosis Foundation estimates that 10 million Americans have osteoporosis (brittle bones at greater risk of breaking) and another 34 million have low bone mass, putting them at increased risk for developing osteoporosis.

Silicon is a mineral that benefits bone health in many different ways. Silicon in the form of orthosilicic acid (OSA) is necessary for optimal production of type 1 collagen, the kind found in connective tissue such as bone and skin. Silicon also is a critical agent in the body's

glycosaminoglycan network, which utilizes compounds such as hyaluronic acid and chondroitin sulfate in the cartilage, bone, and skin.

I believe that supplementing with silicon, in the form of choline-stabilized orthosilicic acid (ch-OSA), is a prudent course for your friend. I will explain why in more detail after discussing osteoporosis and bone mineral density.

#### ASSESSING YOUR RISK FOR OSTEOPOROSIS

Numerous factors can contribute to the development of osteoporosis. Heredity is very important, especially a history of osteoporosis on your mother's side of the family. If your mother suffered a hip fracture, you are at greater risk for developing osteoporosis. Early onset of menopause prolongs the period without ovarian hormones, which also increases risk for osteoporosis. In addition, low body weight, shorter stature, excessive alcohol consumption, smoking, an unbalanced diet, and taking high doses of cortisone over an extended period all increase a person's risk.

The one-minute self-assessment test shown below can help you gauge your risk for developing osteoporosis.

If your score is less than 13, you are at low risk for osteoporosis. Continue to practice habits that support bone health, since it is easier to prevent than to treat a disease. If your score is 13 or above, you are at risk for osteoporosis or you may already be affected. Talk to your doctor and ask for a BMD test.

#### UNDERSTANDING BONE MINERAL DENSITY

Bone mineral density (BMD) assessment seeks to determine whether a person has osteoporosis or osteopenia (low bone mass associated with increased risk for osteoporosis).

The World Health Organization defines osteopenia as a condition in which a woman's BMD is at least one standard deviation, but not more than 2.5 standard deviations, below the average BMD of a healthy young woman at peak bone density. This correlates with a BMD T-score of -1 to -2.5. Women who have a BMD of more than 2.5 standard deviations below the young adult reference range, or a BMD T-score of less than -2.5, are considered to have osteoporosis. As a general rule, a woman's risk of fracture doubles for every standard deviation below the young adult reference range. For example, if a patient's T-score is -2, she has a four times greater risk of suffering a fracture than a young woman at peak bone density.

Minerals make up only about two thirds of bone mass. The remaining third comprises living cells and type 1 collagen fibers that form a matrix often referred to as "ground substance," which holds the mineralized deposits in place.

While BMD testing is useful for assessing the mineral content of bones, it does not assess the quality of the connective tissue matrix supporting those minerals. Specialists now think that the quality of a bone's collagen-based matrix structure is even more critical in preventing fractures than is the degree of mineralization. Unfortunately, there is no widely available test to directly and non-invasively measure the health of a person's ground substance. While the BMD test does not provide a complete picture of bone health, it remains the test best able to help gauge a person's risk of fracture. BMD test results can be used in concert with specific markers for bone turnover in the serum and urine to develop a more complete assessment of osteoporosis risk.

## **THE IMPORTANCE OF SILICON**

With growing recognition of the importance of nourishing and supporting the living ground substance of bone, silicon is now widely viewed as an essential nutrient for healthy bone metabolism. Other critical nutrients for the bones include vitamins D, K, C, and B6, the minerals calcium, magnesium, and zinc, and the trace elements copper, manganese, and boron.

Throughout life, the body continuously breaks down and rebuilds bone structure in a process known as remodeling. During remodeling, osteoclast cells control the breakdown and resorption of existing bone mass, and osteoblast cells control the formation of new bone mass. The biological process of bone formation and resorption is often referred to as bone turnover.

A woman's bone mass generally remains fairly constant until the start of menopause, when bone resorption typically begins to exceed bone formation. Bone resorption in women accelerates immediately after the start of menopause, and an estimated 1-5% of bone density is lost during the first six to eight years of menopause.

Research suggests that silicon helps build and maintain bone in different ways, including regulating bone mineralization, helping to trigger the deposition of calcium and phosphate, reducing the number of osteoclast cells available to destroy existing bone, and increasing the number of osteoblast cells available to reform new bone.

Orthosilicic acid, or OSA, is the key silicon compound. Physiological concentrations of OSA were recently found to stimulate type 1 collagen synthesis in human osteoblast-like cells,<sup>1</sup> and animal studies have noted improvements in skin collagen after supplementation with choline-stabilized orthosilicic acid (ch-OSA).<sup>2</sup>

The creation of new osteoblast cells is vital to proper bone remodeling, because these cells are used only once by the body. Osteoblast cells become encased in the collagen matrix they emit once the matrix becomes calcified; once encased, they no longer generate new collagen.

A recent study indicates that higher dietary silicon intake is associated with greater BMD in both men and premenopausal women.<sup>3</sup> Another newly released study found that ch-OSA partially prevented femoral bone loss in the ovariectomy rat model, a standard model for investigating osteoporosis prevention and intervention therapies.<sup>4</sup>

## **HEALTHY BONES, HEALTHY SKIN**

Choline-stabilized orthosilicic acid may also help restore elasticity and suppleness to sun-damaged skin, as well as strengthen brittle hair and nails.

Scientists at the Free University of Brussels (Belgium) conducted a 20-week double-blind study involving 50 women, aged 40 to 65, who had clear signs of sun-damaged or prematurely aged skin. Half of the subjects received 10 mg of biologically active silicon in the form of ch-OSA, while the other half were given a placebo. Compared to the placebo group, the ch-OSA group experienced significant improvements, including shallower micro-wrinkles (up to 30% better), improved skin elasticity (55% better), and a significant reduction in brittleness of hair and nails.<sup>5</sup>

This improvement in skin parameters produced by ch-OSA could be a result of the regeneration of old collagen fibers or the synthesis of new ones. By supporting the synthesis of glycosaminoglycans, silicon plays a critical role in supporting the building blocks found in the connective tissues and skin. Animal studies have shown that silicon deficiencies cause collagen abnormalities, including bone deformities.<sup>6</sup> Cell culture studies are helping us understand some of the roles of silicon-dependent enzymes,<sup>1,6</sup> and observational and interventional trials of animals and humans have shown favorable correlations between silicon consumption and the health of bone and connective tissue.<sup>2,3,5,6</sup>

While silicon is the second most abundant mineral in the Earth's crust, little of it exists in a form that humans can readily absorb and utilize. In fact, dietary silicon compounds must be solubilized by stomach acid into orthosilicic acid (OSA) before they can be absorbed in the gastrointestinal tract. Highly dilute amounts of OSA are found in spring water and beer, but most foods contain large polymers, or long chains, of OSA called silicates.

Choline is important for maintaining the structural integrity of cellular membranes, and dietary sources of choline are needed to

maintain optimal health. Choline in ch-OSA is believed to have a synergistic effect with OSA, since both compounds are important for cell growth.

When choosing a silicon dietary supplement, consumers should seek one containing choline-stabilized orthosilicic acid (ch-OSA) to receive maximum benefits.

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