

SOY AND OSTEOPOROSIS

Osteoporosis is a disease characterized by low bone mass and deterioration of bone tissue. This leads to increased bone fragility and risk of fracture, particularly of the hip, spine and wrist.

1.4 million Canadians suffer from osteoporosis. One in four women over the age of 50 has osteoporosis. One in eight men over 50 also has the disease. However, the disease can strike at any age. (Source: www.osteoporosis.ca, the official Web site of Osteoporosis Canada).

Women from certain Asian countries have lower rates of hip fractures than women from western countries¹. There may be several possible reasons for this finding and diet has been acknowledged as an important factor.

Interestingly, calcium intake (mainly from soybean products, small fish with bones and vegetables) is lower in Japan for example, than in Western countries. While an adequate calcium intake is important, it clearly does not provide the complete solution to protecting us against osteoporosis.

Researchers are now focusing on the potential benefits of soy foods in relation to bone health, in particular soy protein and its constituent phytoestrogens (isoflavones), since there is a marked difference in the consumption of soy foods between traditional Asian and western diets².

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How is calcium lost from the body?

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The amount and type of protein we eat, seems to determine how much calcium is conserved or lost from the body. Generally, a high protein intake, particularly from animal sources as is common in western countries such as Canada, increases the loss of calcium from the body via effects on the kidneys. A report from an osteoporosis conference held by the American Dietetic Association together with the National Dairy Council in the US³ concluded that for every 1g of protein consumed, 1mg of calcium is lost in the urine.

The Fact is...

- ◆ The role of soy protein in bone health continues to obtain worldwide scientific interest.
- ◆ There have been many conflicting arguments reported in media regarding soy and osteoporosis. A common perception is that it is 'too early' to be promoting the health benefits of soy consumption and its positive effects on osteoporosis. Media report that results of studies conducted to date have been inconclusive.

- ◆ Some media have resisted the argument that some Asian cultures (e.g. Japanese) have a lower incidence of osteoporosis because of the large amount of soy consumed in their daily diet. The media has argued that a low incidence of osteoporosis in Asian populations compared to western populations could be attributed to numerous dietary factors or lifestyle/cultural habits rather than increased soy consumption.
- ◆ Calcium-enriched soy milks are an excellent source of dietary calcium. Health Canada recognizes fortified plant-based beverages (with 275 mg or more of calcium) to be an excellent source of calcium.
- ◆ The bio-availability of calcium from soy beans is similar to dairy milk, despite phytic acid being present in various levels in different soy foods.
- ◆ Studies conducted in 2000 and 2001 revealed that consumption of foods containing soy protein (containing high levels of naturally occurring isoflavones) resulted in significant increase or maintenance in bone mineral content and density at the lumbar spine after six months.
- ◆ Short and long term studies have found that soy protein consumption prevents bone loss in the spine of women suffering menopausal symptoms and bone mineral content in the spine of post-menopausal women. In addition, a recently published two-year study found that consumption of two servings of isoflavone-rich soymilk each day prevented bone loss in a group of menopausal women.
- ◆ While the exact manner in which soy isoflavones exert a protective effect on bone is not known at this time, research does show that soy isoflavones are selective estrogen receptor modulators (SERMs) and studies suggest they stimulate bone formation and reduce bone resorption.
- ◆ Scientific evidence clearly shows that consuming a diet rich in soy protein has clear heart health benefits. Additionally, a growing body of scientific evidence supports that the consumption of soy foods in the diet has several other important health benefits including maintaining bone health.

However, not all proteins have the same effect on increasing calcium loss through the kidneys. When animal protein is replaced with soy protein, much less calcium is lost⁴. A study of middle-aged and elderly women in China with various dietary patterns, found that urinary calcium excretion increased with a higher intake of animal protein (including dairy) and nondairy animal protein but decreased with a higher plant-protein intake⁵. A study of Japanese men and women, aged 20-79 years, confirmed that excess protein, particularly the type rich in sulphur-containing amino acids (such as from meat) may increase calcium loss in the urine⁶.

Studies have also found that the intake of animal protein as compared to plant-derived protein, is linked with an increased risk of fractures. Researchers at the Yale University School of Medicine examined 34 scientific studies from 16 countries around the world, and found that as animal protein intake increases, so do female hip fracture rates⁷.

Scientists at Wayne State University, Detroit found that although a twofold increase in protein intake (at constant levels of calcium and phosphorus intake) causes a 50% increase in the amount of calcium lost in the urine, a soy protein-based diet is able to maintain calcium balance under these conditions⁸. This is thought to be due to the lower content of sulphur amino acids found in soy protein as compared to animal proteins. Sulphate, produced by the metabolism of sulphur-containing amino acids, is thought to

have a negative effect on the reabsorption of calcium by the kidneys back into the blood stream.

Estrogens are important for bone

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Estrogen is well-recognized for helping to maintain bone mass⁹. Estrogen down regulates the activity of bone-dissolving cells, known as osteoclasts. Phytoestrogens have been suggested as having the potential to reduce bone loss due to their similarity to estrogen and as demonstrated with the clinical use of the medication Ipriflavone. Ipriflavone is a synthetic isoflavone that is approved in countries such as Italy and Japan¹⁰ for the treatment of osteoporosis. It is strikingly similar to genistein and daidzein (the isoflavones found in soy) and one of its metabolites is, in fact, daidzein. To be most effective on bone, Ipriflavone needs to be metabolised to daidzein¹¹.

How do soy phytoestrogens help maintain bone mass?

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Research presented at the North American Menopause Society Meeting 2000, has confirmed that soy foods have beneficial effects on the activity of bone cells. Post-menopausal women who consumed soy drink or soy nuts each day for a period of three months, experienced a drop in NTx -a chemical marker showing that bone-dissolving cells were less active when consuming the soy diet. The level of a protein called osteocalcin also increased indicating that the bone-making cells were more active¹². Soy protein¹³ and the isoflavone genistein¹⁴ has been shown to help maintain bone mass and prevent osteoporosis in rats, according to studies which simulated the post-menopausal period in women. In fact genistein was almost as effective as Premarin, the commonly prescribed form of Hormone Replacement Therapy. The same protection was not found in studies using purified isoflavone extracts from red clover. These contain two other isoflavones and only a small amount (9%) of genistein¹⁵.

Improving bone mineral density

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Short-term studies in post-menopausal women have found an improvement in bone mineral density (BMD) and/or bone mineral content (BMC) with the consumption of soy. Postmenopausal women who consumed 40 grams of soy protein with naturally occurring isoflavones daily for six months, significantly increased the BMD and BMC of their spines, in a study at the Department of Food Science and Human Nutrition, University of Illinois¹⁶. In peri-menopausal women, supplementing the diet with soy protein with naturally occurring isoflavones for six months suppressed bone loss from their spine¹⁷. Incorporating 45 grams of soy grits into the daily diets of Australian women resulted in a 5% increase in BMC, according to a short term study from the Royal Women's Hospital, Melbourne¹⁸.

What we don't yet know is whether soy protein and its constituent isoflavones can prevent bone loss over several years and reduce the risk of actually developing a fracture. Longer term studies on humans are now ongoing and future research should clarify these issues.

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