



**National Institutes of Health
Osteoporosis and Related
Bone Diseases ~
National Resource Center**

2 AMS Circle
Bethesda, MD 20892-3676

Phone: 202-223-0344
Toll free: 800-624-BONE
Fax: 202-293-2356
TTY: 202-466-4315

Email: NIAMSBoneInfo@
mail.nih.gov

Web site: www.niams.nih.gov/bone

The NIH Osteoporosis and Related Bone Diseases ~ National Resource Center is supported by the National Institute of Arthritis and Musculoskeletal and Skin Diseases with contributions from the National Institute on Aging, the *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, the National Institute of Dental and Craniofacial Research, the National Institute of Diabetes and Digestive and Kidney Diseases, the NIH Office of Research on Women's Health, and the HHS Office on Women's Health.

The National Institutes of Health (NIH) is a component of the U.S. Department of Health and Human Services (HHS).



Phytoestrogens and Bone Health

Many postmenopausal women are looking for alternatives to hormone therapy, especially in light of research findings in 2003 from the Women's Health Initiative. With major funding from the National Institutes of Health, this initiative studied the risks of combined estrogen and progestin therapy, among other health issues of critical importance to postmenopausal women.

Of particular interest are phytoestrogens, which have been gaining popularity because they are marketed as "natural," they provide alleged health benefits, and they are available in a wide range of foods and supplements. This fact sheet provides an overview of phytoestrogens and discusses their potential role in osteoporosis prevention and treatment.

What Are Phytoestrogens?

Phytoestrogens are naturally occurring plant compounds that are similar in some ways to estradiol, the most potent naturally occurring estrogen. However, phytoestrogens tend to have weaker effects than most estrogens; they are not stored in the body; and they can be easily broken down and eliminated.

Observational studies have found a lower prevalence of breast cancer, heart disease, and hip fracture rates among people living in places like Southeast Asia, where diets are typically high in phytoestrogens. These studies have generated a great deal of interest in the United States about the health benefits of phytoestrogens. According to the Food and Drug Administration, sales of soy foods, a major source of phytoestrogens, have increased dramatically in the past decade.

Dietary Sources of Phytoestrogens

Phytoestrogens consist of more than 20 compounds and can be found in more than 300 plants, such as herbs, grains, and fruits. The three main classes of dietary phytoestrogens are described below.

- **Isoflavones** (genistein, daidzein, glycitein, and equol) are primarily found in soybeans, soy products, chickpeas, and other legumes.
- **Lignans** (enterolactone and enterodiol) are found in oilseeds (primarily flaxseed), cereal bran, legumes, and alcohol (beer and bourbon).
- **Coumestans** (coumestrol) can be found in alfalfa and clover.

Most food sources containing these compounds typically include more than one class of phytoestrogens.

Skeletal Effects of Phytoestrogens

Much of the evidence concerning the potential role of phytoestrogens in bone health is based on animal studies. In fact, soybean protein, soy isoflavones, genistein, daidzein, and coumestrol all have been shown to have a protective effect on bone in animals whose ovaries—female reproductive organs that produce estrogen and progesterone—had been surgically removed.

In humans, however, the evidence is conflicting. Studies show that, compared with Caucasians, populations in Hong Kong, China, and Japan, where dietary phytoestrogen intake is high, experience lower rates of hip fracture. Yet, according to *Bone Health and Osteoporosis: A Report of the Surgeon General (2004)*, spine fractures are nearly as common in Asian women as they are in Caucasian women. In addition, reports suggest that Japanese women have a greater risk of sustaining a vertebral fracture than Caucasian women.

Several studies have explored the effects of soy isoflavones on bone health, but results have been mixed, ranging from a modest impact to no effect. Most of these studies have serious limitations, including their short duration and small sample size, making it difficult to fully evaluate the impact of these compounds on bone health.

Ipriflavone Supplements

Ipriflavone, a synthetic isoflavone, has shown some promise in its ability to preserve bone in postmenopausal women. Ipriflavone also has been shown to have a protective effect on bone density in premenopausal women taking gonadotropin-

releasing hormone (GnRH), a treatment for endometriosis. One side effect of this treatment is bone loss.

However, a definitive 3-year study of more than 400 postmenopausal women concluded that ipriflavone did not prevent bone loss. In addition, the compound was linked to lymphocytopenia (a reduction in lymphocytes) in a significant number of study participants. Lymphocytes are a type of white blood cell that helps the body fight infection.

Risks and Benefits Are Unclear

Some studies suggest that, unlike estrogen, phytoestrogens do not appear to increase the risk of breast or uterine cancer. This suggests that they may act more like SERMS (selective estrogen receptor modulators, such as raloxifene and tamoxifen) than actual estrogens. However, other studies have linked high isoflavone levels to an increased risk of breast cancer.

Clearly, additional research is needed to further evaluate the effects of phytoestrogens before making any judgments about their safety and usefulness. Current research should provide important evidence concerning the safety of phytoestrogens and their potential role in the skeletal health of women after menopause.

Key Points

Based on information available at this time, it is reasonable to make the following conclusions concerning phytoestrogens and bone health in postmenopausal women.

- Because of a lack of evidence and concerns about safety, supplementation with synthetic isoflavones (ipriflavone) is not recommended.
- Moderate amounts of foods containing phytoestrogens can be included in the diet.
- Postmenopausal women are encouraged to discuss their phytoestrogen consumption with their physicians.
- Available evidence concerning phytoestrogens and bone health is conflicting and incomplete. Research is currently under way to help clarify the health effects of these compounds.

Resources

For more information on osteoporosis, visit the National Institutes of Health Osteoporosis and Related Bone Diseases ~ National Resource Center Web site at www.niams.nih.gov/bone or call 800-624-2663.

For more information on phytoestrogens, visit the National Center for Complementary and Alternative Medicine Web site at www.nccam.nih.gov or call 888-644-6226 (toll free).

Reviewed May 2009

For Your Information

This fact sheet contains information about medications used to treat the health condition discussed here. When this fact sheet was printed, we included the most up-to-date (accurate) information available. Occasionally, new information on medication is released.

For updates and for any questions about any medications you are taking, please contact the U.S. Food and Drug Administration at 888-INFO-FDA (888-463-6332, a toll-free call) or visit its Web site at www.fda.gov.

For updates and questions about statistics, please contact the Centers for Disease Control and Prevention's National Center for Health Statistics toll free at 800-232-4636 or visit its Web site at www.cdc.gov/nchs.

Recognizing the National Bone and Joint Decade: 2002-2011