

SOY

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The benefits of eating soy have been documented in medical literature since 2838 BC where its use is recorded in the *Materia Medica* of the Chinese Emperor Shen Nung (1). More recently epidemiological studies have suggested that rates of osteoporosis, breast cancer, heart disease, and menopausal symptoms are more favorable among cultures that consume a diet that is traditionally high in soy products (2). There are also an abundance of human clinical trials, animal studies, and molecular and cellular biology experiments that show results consistent with the epidemiological evidence, scientifically confirming the health benefits of soy (3-8).

Several constituents have been isolated from soy including isoflavones, phytosterols, protease inhibitors, inositol hexaphosphate, and saponins (9). **Isoflavones** are one of the most promising agents found in soy for the treatment and prevention of osteoporosis, breast cancer, heart disease, and the symptoms associated with menopause (10-13). It is important to remember, however, that the whole soybean is not simply the sum of its isolated constituents. Although largely unexplored, there is an elegant and dynamic interplay between the different parts of the soybean that *collectively* produce a positive effect on the body (14). Nonetheless, the accumulating clinical evidence points to the high concentration of isoflavones found in soy as a main reason for its benefits in the treatment of menopausal symptoms, heart disease, breast cancer, and osteoporosis (15-20).

Isoflavones, sometimes referred to as phytoestrogens, are a group of phytochemicals that are found in soybeans. Three isoflavones that appear to be particularly useful are genistein, daidzein, and to a lesser extent, glycitein. **Isoflavones** possess antioxidant and phytoestrogenic properties. They have been shown to influence intracellular enzymes, protein synthesis, growth factor action, malignant cell proliferation, differentiation, and angiogenesis (21). Isoflavones also play an interesting role in the symbiotic relationship between plants and bacteria (22). When genistein is secreted from the roots of soybeans, it interacts with the microorganism, *Bradyrhizobium japonicum* (23). This interaction results in the formation of root nodules that contain the bacteria. These root nodules then convert atmospheric nitrogen to ammonia that can be used directly by the plant (24-26). As we are discovering, soy not only plays a powerful role in supplying health giving properties to human bodies, it also plays a vital role in the symbiotic relationship between plants and our surrounding atmosphere.

The Beneficial Effects of Soy on Osteoporosis

Cell line, animal, and human data show significant benefits in the prevention and treatment of osteoporosis, with the incorporation of phytoestrogens, such as soy, in the diet (27). Recent human clinical trials centered on the specific health benefit of isoflavones found in soy, as a potential treatment for osteoporosis (28-30). The estrogenic effects of soy have been shown to suppress bone loss to the same degree as daily administration of estrogen (32). However, unlike estrogen, soy does not have the associated risks of endometrial and breast cancer.

The peptides in soy have been proven effective in increasing the amount of calcium that is absorbed from the intestinal tract, leading to an increase in the mass of weight bearing bones - a strong preventive factor in the onset of osteoporosis (33). Finally, soy protein has been shown to

prevent the decline in renal function and progressive hyperparathyroidism that are often associated with aging, and are linked to the onset and progression of osteoporosis (34).

The Beneficial Effects of Soy on Breast Cancer

The consumption of soy is associated with a lowered risk of breast cancer (35). This evidence has come from studies with cultured human breast cancer cells, and from models of breast cancer (36). Genistein, an isoflavone that is found in high concentrations in soy, has a chemical structure similar to estrogen; in fact, some studies indicate that it possesses estrogen-like properties. Intestinal bacteria convert isoflavones such as genistein to hormone-like compounds (37). These compounds influence sex-hormone production, metabolism and biological activity, malignant cell proliferation, intracellular enzymes, and growth factor action. Specifically genistein inhibits the proliferation of human breast cancer cells induced by estradiol. Furthermore, genistein is also a potent protein kinase inhibitor (38), which may prove to have beneficial effects in the treatment of cancer. Scientists theorize that isoflavones found in soy block estrogen receptors in breast tissue, thus reducing its ability to produce cancer cells (39). Collectively, the many beneficial actions of soy with relation to breast cancer make it a strong candidate for a role as a natural cancer-fighting food (40).

The Beneficial Effects of Soy on Heart Disease

Foods containing phytoestrogens, such as soy, reduce cholesterol levels in humans, and a soy-based diet provides protection from the risk of death from heart disease. In 1995, Dr. James Anderson published a meta-analysis in the New England Journal of Medicine that reviewed 38 controlled tests that examines the relationship between soy protein intake and blood lipid levels in humans. The study found that consuming soy protein instead of animal protein at a level of approximately 25 grams per day significantly decreased blood levels of total cholesterol, LDL cholesterol, and triglycerides (41). High LDL and total cholesterol levels, coupled with low HDL cholesterol levels are known risk factors for heart disease. There is also a growing body of evidence proving the cardioprotective benefits of soy in perimenopausal and menopausal women (42). Specifically, scientific studies are measuring the effects of soy on systemic arterial compliance, an important measure of arterial health. Perimenopausal and menopausal women taking soy isoflavones show a significant improvement in systemic arterial compliance to about the same extent as is achieved with conventional hormone replacement therapy (43).

The Beneficial Effects of Soy on Menopausal Symptoms

Common symptoms of menopause include hot flashes, depression, anxiety, sleep disturbances, and hair loss. These symptoms are most often related to a deficiency of estrogen in the body, due to the cessation of ovarian function. Interestingly, the term "hot flashes" does not exist in the Japanese language. Epidemiological studies show that women in Asia have a higher occurrence of natural trouble-free menopause, which scientists postulate is due to the high concentration of soy products in the typical Asian diet. Controlled studies suggest that phytoestrogens found in soy reduce the severity of, and in some cases diminish menopausal symptoms (45). They appear to substitute for the lack of human estrogen, mitigating the effects of its absence (46). The scientific evidence suggests that the ingestion of soy can mimic the effects of synthetic estrogen in the body, without providing the risks associated with traditional hormone replacement therapy (47). Women taking synthetic estrogen are 4 to 13 times more likely to develop endometrial cancer, and face a 1 to 13% increase in the risk of getting breast cancer. Although the addition of progesterone reduces these risks, they are still significant. Current scientific studies show that the estrogenic activities of soy isoflavones provide the beneficial effects of reducing hot flashes,

vaginal dryness, and other symptoms of menopause without the associated risks of taking synthetic estrogen and progesterone (48-53).

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