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All About SUPPLEMENTS

Soy

A Promising Role in Cancer Prevention and Management

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A staple of many Asian diets, soy products have recently become more popular in America as well.

In the past two years, some of the most exciting research findings about soy concern its role in preventing and managing a variety of cancers, including breast, prostate, and colon cancers. This article examines recent research on soy's applications in fighting cancer.

ISOFLAVONES AND OTHER SOY CONSTITUENTS

The soybean is a nutritional powerhouse, packed with protein, fiber, vitamins, and an array of biologically active constituents, most notably isoflavones. These substances make up a subclass of a larger group known as phytoestrogens, which are plant-derived compounds that are molecularly similar to the estrogens naturally found in the human body. The soybean's most plentiful isoflavone

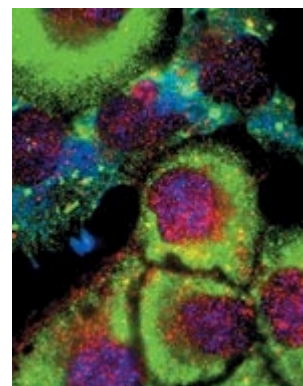
is genistein, followed by daidzein, glycitein, and other structurally similar compounds.

Isoflavones and other phyto-estrogens can interact with estrogen receptors, sometimes weakly mimicking estrogen's effects and other times preventing the estrogen-induced activation of these receptors. These interactions may have profound implications for cancer prevention and management. Isoflavones also have other important properties that make them particularly interesting plant extracts for cancer research. Scientists are now investigating a wide range of soy products and soy-derived formulations as potential chemotherapeutic agents against many types of cancer.

SOY'S MECHANISMS OF ACTION

Recent studies have uncovered numerous mechanisms by which soy-derived isoflavones may help attenuate the risk and progression of cancer, in addition to their effects on estrogen receptors. Findings from the past two years demonstrate that soy isoflavones:

- Inhibit enzymes (such as protein tyrosine kinases and DNA topoisomerases) that promote cancer cell growth.^{1,2}
- Prevent cell mutations by stabilizing cell DNA.²
- Act as antioxidants and increase production of antioxidant enzymes like superoxide dismutase (SOD).^{2,3}
- Inhibit angiogenesis (the formation and differentiation of new blood vessels required for tumor growth).^{1,2,4}
- Promote apoptosis (programmed cell death).^{2,5,6}
- Suppress aberrant cell proliferation.^{4,6}
- Prevent metastasis (the spread of cancer).¹
- Synergize with a chemotherapy drug to suppress the tumor-promoting protein known as cyclooxygenase-2.⁵
- Inhibit osteopontin, a protein involved in the progression from benign to malignant tumors.⁷



Micrograph of prostate cancer cells. Stress granules (green) have accumulated in the cells' cytoplasm due to oxidative stress. Free radicals damage molecules in the cell and can cause cancer. If the stress is severe, the cell will undergo apoptosis, or

Through these diverse effects, soy isoflavones may prove effective in averting and fending off various cancerous processes.

PROSTATE CANCER PROTECTION

Epidemiological evidence suggests that soy intake is associated with a decreased incidence of prostate cancer.⁷⁻⁹ Researchers have postulated that dietary factors, particularly the routine consumption of soy foods in Asia, may be responsible for the significantly lower rate of prostate cancer in Asia compared to the United States.^{1,7}

programmed cell death.

Recently, scientists have theorized that the incidence of latent prostate cancers is similar across many populations, but that the transformation into malignant tumors is substantially influenced by diet.^{7,9} In other words, the soy-rich diet of Asian men may be instrumental in halting the progression from benign to advanced tumors, accounting for this population's markedly lower rate of prostate cancer.^{7,9}

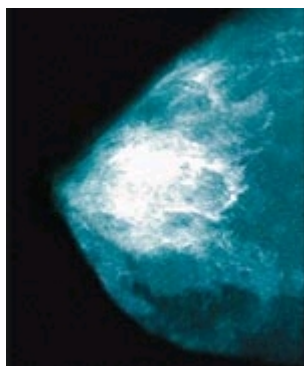
A meta-analysis recently published in the International Journal of Cancer examined the influence of soy products (tofu, soy milk, soy foods, and genistein) on prostate cancer risk. Analyzing the results of eight similarly designed studies, this statistical evaluation found that regular consumption of soy products is associated with a 30% reduction of prostate cancer risk.¹⁰

In an important study conducted in the Netherlands, researchers examined the effects of a soy-based dietary supplement on the rate of increase of prostate-specific antigen (PSA) in men who had undergone treatment for prostate cancer. PSA is a marker of prostate cancer recurrence and metastasis. In this double-blind, placebo-controlled crossover study, 42 men consumed either a supplement containing soy, lycopene, silymarin, and antioxidants or a placebo for 10 weeks. After a four-week washout period, the men received the alternate preparation for 10 weeks. While using the soy-based dietary supplement, the men demonstrated a 2.6-fold improvement in PSA doubling time, from 445 to 1,150 days, thus indicating a delayed progression of the disease. This finding may have important implications for improving long-term outcomes in men who have undergone prostate cancer treatment.

11

BOOSTING BREAST CANCER DEFENSE

Abundant intake of soy products may also offer protection against breast cancer. Numerous epidemiological studies indicate that the soy-rich diet consumed by Asian populations may play a role in the lower incidence of breast cancer seen in Asia as compared to the United States.^{6,12}



Enhanced contrast MRI of breast cancer.

A recent meta-analysis of several studies relating soy intake to breast cancer risk generated noteworthy findings. The studies making up the meta-analysis utilized food-frequency questionnaires to track participants' intake of soy foods, soy protein, and isoflavones. Analysis of the data revealed that consumption of soy products reduced breast cancer risk in pre- and postmenopausal women by up to 22%. These findings suggest that soy consumption during adolescence reduced the risk of developing breast cancer later in life. The reduction in breast cancer risk was greatest in females who consumed soy products throughout adolescence and adulthood.¹³

In a related study, scientists examined the effect of isoflavone supplementation on superoxide dismutase (SOD) and ceruloplasmin. While SOD is an antioxidant enzyme associated with breast cancer protection, ceruloplasmin is a protein linked with estrogenic activity and increased breast cancer risk. Seven postmenopausal breast cancer survivors consumed soy isoflavone concentrate for 24 days. At the study's end, the women demonstrated increased SOD activity, but no change in ceruloplasmin level. This suggests that supplementing with soy isoflavone concentrate may boost

antioxidant defenses and support protection against breast cancer.³

Because breast cancer metastases (cancer that has spread to other locations) rather than the primary tumor is the cause of breast cancer mortality, scientists used an animal model to investigate whether soy-derived genistein may help prevent the spread of breast cancer following surgery. Female nude mice underwent surgery to remove malignant tumors and were then fed a genistein-supplemented diet. After five weeks on the genistein-enriched diet, the mice exhibited a 10-fold reduction in the metastatic burden in the lungs compared to that of a control group that did not receive genistein. According to the study authors, "dietary intervention following cancer surgery can affect the outgrowth of seeded tumor cells."¹⁴ Further studies are indicated to determine whether these effects may also apply to women following surgical treatment of breast cancer.

SOY PRODUCTS AND FORMULATIONS

- There are numerous ways to harness the health-promoting benefits of soy. The following soy products may be included in a healthy diet and supplement program:
- Whole soybeans
- Tofu
- Soy milk
- Textured soy protein

- Fermented soy products, such as miso, natto, and tempeh
- Isolated soy protein
- Soy isoflavones (e.g., genistein, daidzein, glycitein).

AVERTING LIVER CANCER

A fascinating case-control study published in the International Journal of Cancer evaluated the connection between soy intake and liver cancer incidence. The researchers interviewed 176 Japanese subjects suffering from hepatocellular carcinoma (liver cancer) and 560 control subjects. They collected information concerning the subjects' intake of two isoflavone-rich soy foods—miso soup and tofu—over a period covering at least two years before the cancer diagnosis. The researchers found that, compared to those who ate soy foods once a week or less, hepatocellular carcinoma incidence was 50% lower in those who consumed miso soup or tofu more than five times a week.¹⁵



PREVENTING LUNG CANCER

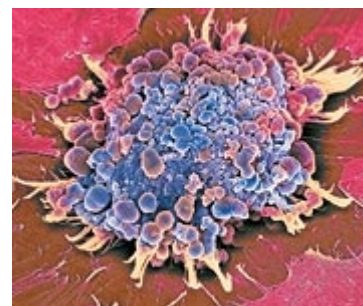


Liver

Recently, the Journal of the American Medical Association published a large-scale, case-controlled study evaluating the effect of phytoestrogen intake on lung cancer risk. Questionnaires completed by 1,674 lung cancer patients and 1,735 controls tracked smoking history and dietary intake of isoflavones and 11 other phytoestrogens. Study subjects with the highest intake of total phytoestrogens exhibited a 46% reduction in lung cancer risk. Interestingly, non-smokers and current smokers reaped greater protective benefits than former smokers, and men showed a stronger trend for decreasing risk with increased phytoestrogen intake than did women.¹⁶

CHEMOTHERAPY SYNERGY

In numerous recent animal and in-vitro studies, scientists have found that soy isoflavones synergize with chemotherapy drugs in the eradication of cancer. When genistein was administered with chemotherapy drugs such as cisplatin, docetaxel, and 5-fluorouracil, researchers noted improved inhibition of tumor growth and increased induction of apoptosis (programmed cell death) of various cancer cell lines in the laboratory.^{5,17} Rats treated with daidzein in conjunction with the drug tamoxifen demonstrated superior protection against experimentally induced breast cancer than did rats receiving tamoxifen alone.¹⁸ Other research has revealed that high doses of genistein used in combination with tamoxifen inhibit breast tumor growth in mice.¹⁹



Cancer cell apoptosis (programmed cell death)

CONCLUSION

Soy and its constituents continue to be intriguing subjects of medical investigation, with a growing body of research pointing to their promising anti-cancer benefits. Further studies should help scientists gain a better understanding of soy's unique effects in promoting health and fighting numerous cancers.

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