

Soy Phytoestrogens (Plant Estrogens) and Breast Cancer Risk

By Barbour Warren, Ph.D. and Suzanne Snedeker, Ph.D.

Estrogen is one of the major reproductive hormones in women. It is also a hormone that can cause breast cancer in both humans and animals. Phytoestrogens are similar chemicals

produced by various plants, such as soybeans, flaxseeds and

sesame seeds. These three plants produce large amounts of phytoestrogens, with some of the highest levels being found in soy beans. Many processed foods, including some protein bars, breakfast cereals, cookies, multigrain breads, and doughnuts also have high phytoestrogen levels because soy is added to these foods. This BCERF Brief will describe the existing evidence for a link between soy phytoestrogen exposure and breast cancer risk.



Although there has been a large amount of research on this topic, current evidence does not either prove or disprove a link between soy phytoestrogen exposure and breast cancer risk. Because of these uncertainties, moderation should be exercised in the amount soy-based foods people choose to eat. Use of soy supplements is not recommended at this time.

How phytoestrogens act in the body

The actions of phytoestrogens in the body are complex and can vary, depending on:

- the level of phytoestrogen exposure
- differences in soy metabolism (including estrogen activation)
- the age of the people eating these foods.

Level of exposure

Researchers have shown using breast tumor cells in the laboratory that cells exposed to *low levels* of phytoestrogens are stimulated to divide and multiply. In contrast, breast tumor cells exposed to *high levels* of phytoestrogens stop dividing. However, the levels considered high in these studies are unlikely to be reached by eating soy foods.

Activation of phytoestrogens

Phytoestrogens in food are present in an inactive form that does not act like estrogen. However, after they are eaten, they are metabolized and activated by our small intestines and the bacteria in our large intestines. People differ in how they metabolize soy

phytoestrogens. Because of these individual differences, people are exposed to different levels of activated phytoestrogens after eating soy foods. These differences in metabolism have made it difficult to evaluate how the estrogen-action of soy phytoestrogens affects breast cancer risk.

Age of exposure

While there are indications of differences in the ways that soy phytoestrogens may affect breast cancer risk at different times in life, there are no clear answers that can guide dietary recommendations. It is important to understand that responses are different at the different life stages, as is discussed below.

Exposure before birth. *Does the intake of soy phytoestrogens during pregnancy decrease or increase the breast cancer risk of a woman's children?* There are no available studies in people to determine whether the intake of phytoestrogens during pregnancy decreases or increases the breast cancer risk for a woman's children. What is known is based primarily on laboratory animal studies. Researchers have treated pregnant rats and mice with soy phytoestrogens alone, or soy phytoestrogens plus a cancer causing chemical, and then determined whether their offspring develop mammary tumors (breast cancers). The results of these studies have varied and do not point to a clear answer on whether exposure to phytoestrogens



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before birth has any effect on the risk of breast cancer later in life. Because of the lack of clarity of these studies, women who have not consumed soy regularly are advised against consuming high amounts of soy foods during pregnancy.

Exposure before and during puberty. *Does soy formula or do soy products given to young children affect their risk of breast cancer later in life?* Up to 36% of all infants consume soy formula during their first year of life and these infants have been shown to have high levels of soy phytoestrogens in their blood. Future studies need to evaluate the potential effects on these children, since this is an important developmental time for many organs, including the breast.

Studies of both laboratory animals and humans have examined two specific periods of soy phytoestrogen exposure: shortly after birth, and just before puberty. Several of the laboratory animal studies of exposure to soy phytoestrogens before puberty have shown a decrease in mammary tumors. However, different results were observed when soy phytoestrogen exposure was started *before* puberty and *continued throughout life*. Four of six studies that examined this type of lifetime exposure to soy phytoestrogens did not see an increase or decrease in mammary tumors. However, two of these six studies did report an increase in the incidence of mammary tumors. So, while some laboratory animal studies of exposure to soy phytoestrogens during puberty suggest a decrease in the development of mammary tumors, more study of the duration of soy exposure, especially the effect of lifetime exposure, is needed.

Two human studies of Asian women living in China and California have observed a lower breast cancer risk in those who ate higher levels of soy foods before and during puberty. The girls who ate the most soy foods during these periods had an adult breast cancer risk that was about half of those who ate the least amount of soy food. One study of western women in Canada has also been conducted. Although these women ate much smaller amounts of soy phytoestrogens during adolescence, they also had reduced breast cancer risk. These studies suggest a beneficial effect of soy food consumption during adolescence on reducing breast cancer risk, but much more study is needed before any recommendations can be made.

Adulthood. Several clinical trials have been conducted in premenopausal and postmenopausal women given either soy phytoestrogens or a placebo. Risk was evaluated by looking at early markers of breast cancer risk, including mammographic density and markers of breast cell proliferation, both of which are linked to an increased risk of breast cancer. Two studies used a high dose of a soy supplement and followed women for one year, and another study used a similar level of phytoestrogens from soy foods over a two-year period. None of these long-term studies reported any effect of soy intake on mammographic density, suggesting that soy phytoestrogen intake does not increase or decrease breast cancer risk. Less reliable studies that measured phytoestrogen exposure using a questionnaire, did find higher mammographic density in women that ate higher levels of soy foods. Other studies have examined breast biopsies of women on short-term soy phytoestrogen diets. They reported no effect on markers of breast cell proliferation. However, other similar studies looking at the fluid removed from the breasts of premenopausal women did find changes indicating increased breast cell proliferation.

A number of other human studies have looked at the level of soy in the diet and the risk of breast cancer. These studies have been difficult to interpret, since the country of origin, the types and levels of soy foods, and the quality of the studies differed widely. To address these problems, researchers did a reanalysis using only the higher quality studies and separated the results by country of origin. They found that the risk of breast cancer was weakly to moderately decreased in the Asian women with the highest consumption of soy foods. In western women who consumed low levels of soy foods, no relationship was found between intake of soy and breast cancer risk. Some researchers have speculated that in Asian women, eating soy foods earlier and throughout life may play a role in lowering breast cancer risk. But more research is needed in this area.



CONCLUSION

The effects of soy phytoestrogen on breast cancer risk have been studied in a number of ways. Unfortunately the results of these studies have not produced clear answers about the relationship of soy phytoestrogens to breast cancer risk. Therefore, it is prudent to exercise moderation in the amount of soy foods that are eaten. At this time, use of dietary supplements that contain soy phytoestrogens is not recommended.

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