



SOYFOODS OFFER HEALTH BENEFITS FOR ALL CONSUMERS, BUT STUDIES SHOW THAT POSTMENOPAUSAL WOMEN MAY REAP PARTICULAR BENEFITS. THIS FACT SHEET DISCUSSES RECENT RESEARCH INTO THE BENEFITS AND SAFETY OF SOY FOR WOMEN, FROM HEART DISEASE TO HOT FLASHES.

INTRODUCTION

Traditional soyfoods such as tofu and miso have been widely used in many East Asian countries for centuries. They have also been consumed by health-conscious individuals in Western countries for several decades. In recent years, because of purported health benefits, increased numbers of non-Asians have incorporated soy into their diets. Soyfoods hold particular appeal for postmenopausal women because they are uniquely rich sources of isoflavones, one type of phytoestrogen.

Isoflavones exhibit estrogen-like effects under certain experimental conditions and are posited to reduce risk of coronary heart disease (CHD),¹ osteoporosis,² certain forms of cancer,³ and to alleviate menopause-related hot flashes.⁴ Consequently, many women view soyfoods as natural alternatives to conventional hormone therapy. Women who use alternative therapies express a desire to have control over their symptoms and the way in which their menopause is treated.⁵

Not surprisingly, interest in alternative therapies increased following the publication of the results of the Women's Health Initiative (WHI) trial in 2002, which showed that the risk of long-term use of combined hormone therapy (estrogen plus progestin) outweighed the benefits.⁶ In 2010, 11-year follow up data from the WHI trial found not only that combined hormone therapy increases breast cancer risk but also breast cancer mortality.⁷ In fact, many years after discontinuing this therapy, breast cancer risk is still significantly increased.⁸

However, isoflavones are not without controversy. Their estrogen-like effects have raised concern that these soybean constituents possess some of the same undesirable properties as hormone therapy. Most debated is whether soyfoods – because they contain isoflavones – are contraindicated for women who have breast cancer or who are at high risk of developing this disease.⁹ As discussed, the evidence indicates not only that soyfoods are safe for women with breast cancer but potentially beneficial.

OVERVIEW ON ISOFLAVONES

Isoflavones have a limited distribution in nature such that diets that do not include soyfoods are almost devoid of these compounds.¹⁰ Not surprisingly, whereas average isoflavone intake among older adults ranges from about 30-50mg/d in Japan and in Chinese cities such as Shanghai,¹¹ intake is less than 3mg/d in the United States, Canada and Europe.¹²⁻¹⁸ More specifically, according to a recent analysis, which used the United States Department of Agriculture isoflavone database and the National Health and Nutrition Examination Survey III 24-hour dietary recall data to estimate intake, Americans ingest only 2.35mg isoflavones daily.¹⁸

Isoflavones occur in soybeans as glycosides,¹⁹ but upon ingestion, the sugar is hydrolyzed thereby allowing absorption to occur.²⁰ In fermented soyfoods such as miso, tempeh and natto, substantial amounts of the isoflavones occur as aglycones due to bacterial hydrolysis. The three isoflavones genistein, daidzein and glycitein and their respective glycosides account for approximately 50,40 and 10%, respectively, of the total isoflavone content of soybeans.¹⁹

Each gram of soy protein in soybeans and traditional Asian soyfoods is associated with approximately 3.5mg of isoflavones.¹¹ In this document, isoflavone amounts are expressed in aglycone equivalent

SOURCES OF SOY PROTEIN

SOYFOOD	SERVING SIZE	GRAMS OF SOY PROTEIN
Fortified soymilk	1 cup	6-7
Soy cereal	1 ¼ cup	7
Soy yogurt, vanilla	1 cup	6
Soy breakfast patty	2 patties	11
Soy bar	1 bar	14
Soy chips	1 bag	7
Soy nut butter	2 tbsp	7
Soy nuts, roasted, unsalted	¼ cup	11
Tofu	½ cup	10
Edamame	½ cup	11
Soy burger	1 patty	13-14
Soy pasta	½ cup (cooked)	13
Soy pudding	½ cup	6

Soyfoods are a unique dietary source of isoflavones, a phytoestrogen that may offer heart health benefits and may help alleviate hot flashes during menopause.



weights. Consequently, one serving of a traditional soyfood, such as 3 to 4 ounces of tofu or 1 cup of soymilk, typically provides about 25mg of isoflavones.

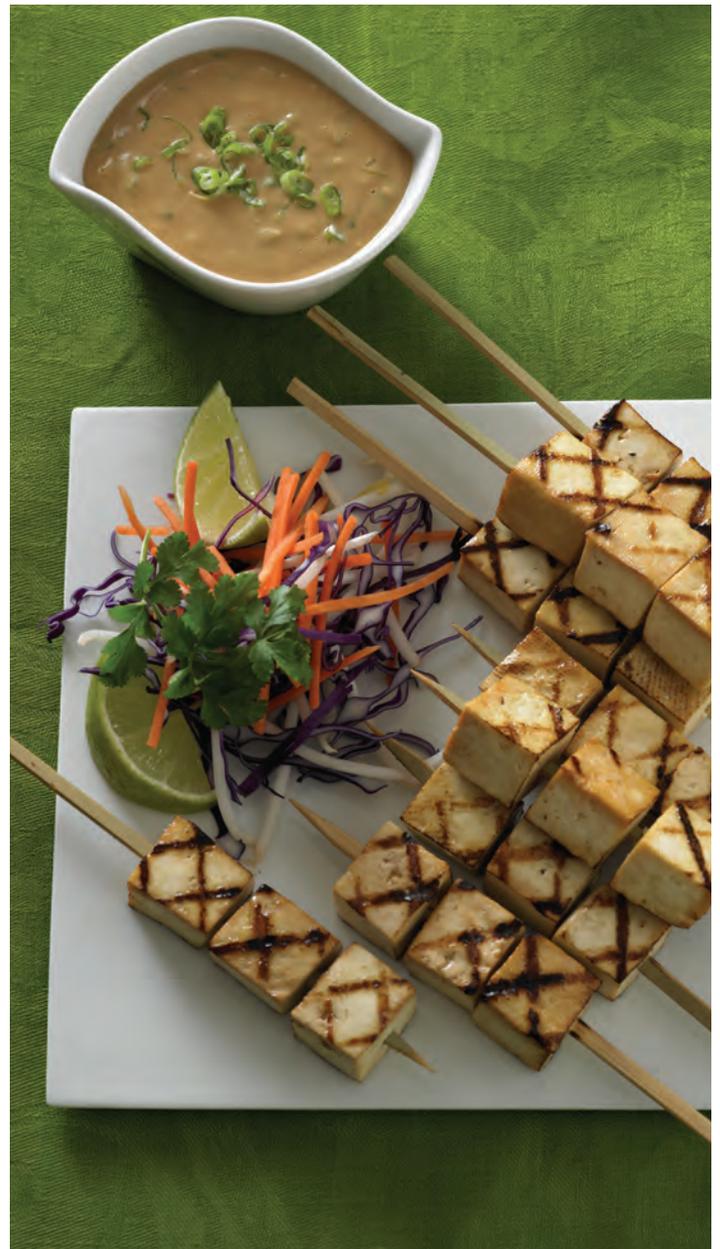
Soy protein is added to a wide range of commonly consumed foods in the United States. However, isoflavone exposure from these foods is almost negligible for two reasons. First, the amount of soy protein in these foods is quite small because it is added for functional (not nutritional) purposes such as bleaching, moisture retention, oxidation inhibition and improved texture. And second, the isoflavone concentration of the soy protein used in this way is generally quite low in comparison to traditional soyfoods. The isoflavone-to-protein ratio noted above for traditional soyfoods does not apply to most highly refined forms of soy.

Isoflavones are diphenolic compounds with a chemical structure similar to the hormone estrogen which allows them to bind to both estrogen receptors (ER) – ER α and ER β .^{21, 22} For this reason, they are able to exert estrogen-like effects under certain experimental conditions and so are commonly referred to as phytoestrogens. Their relative binding affinity is lower than that of estrogen (17 β -estradiol), but circulating levels of isoflavones in those consuming soyfoods are approximately three orders of magnitude higher than levels of estrogen.²³ However, whereas estrogen binds to and transactivates ER α and ER β equally, isoflavones preferentially bind to and transactivate ER α .²⁴⁻²⁷ This difference in binding and transactivation between isoflavones and estrogen is important because the two estrogen receptors have different tissue distributions and, when activated, can have different and sometimes even opposite physiological effects. This appears to be the case in the breast, where ER β transactivation is thought to inhibit the proliferative effects of ER α transactivation.^{28, 29} In fact, recent findings implicate ER α -specific agonists with having growth inhibitory effects in several cancer models.³⁰

The preference of isoflavones for ER β is the major reason that isoflavones are seen as capable of exerting tissue-specific effects and for being classified as selective estrogen receptor modulators (SERMs).³¹⁻³³ In tissues that possess estrogen receptors, SERMs exert estrogen-like effects in some cases but no effects or antiestrogenic effects in others. The pharmaceutical industry has for many years been actively developing SERMs.³⁴ Widely used SERMs include tamoxifen and raloxifene, both of which are used to treat breast cancer, the latter of which is also used for the treatment of osteoporosis.³⁵ In addition to being classified as phytoestrogens and SERMs, the European Food Safety Authority proposed a new classification for compounds such as isoflavones, which is "endocrine active substances."³⁶

Soyfoods are unique because they are rich dietary sources of isoflavones, compounds classified as phytoestrogens but that differ from the hormone estrogen.

From the above discussion, it is clear that isoflavones should not be equated with the hormone estrogen. The literature is replete with clinical examples of differences between these two molecules.^{33, 37-57} Furthermore, isoflavones may exert potentially relevant hormone-independent physiological effects.⁵⁸ Therefore, the classification related to their hormonal activity may be an incomplete characterization. Finally, not only should isoflavones not be equated with estrogen but soyfoods should not be equated with isoflavones. The soybean, like all foods, is a collection of hundreds of biologically active molecules.⁵⁹



SOY, ISOFLAVONES AND HOT FLASHES

Hot flashes are the most common reason given by women seeking treatment for menopausal symptoms. For the majority of women who experience them, hot flashes begin prior to menopause. Ten to 15% of these women experience hot flashes that are severe and frequent.⁶⁰ Although hot flashes usually subside after six months to two years,^{60, 61} many women report having them for up to 20 years after menopause.⁶² In the Study of Women's Health Across the Nation (SWAN), a multiethnic/multiethnic observational study of the menopausal transition involving 3,302 women enrolled at seven U.S. sites, among women who began having hot flashes during the pre- or perimenopausal period, the average duration of hot flashes was 11.8 years.⁶³ The etiology of hot flashes is not fully understood but the drop in circulating estrogen levels that occurs during menopause is recognized as one factor.

The low incidence of hot flashes in Japan helped raise initial speculation that isoflavones could be useful in their prevention.⁶⁴ Even Chinese-American and Japanese-American women are about one-third less likely to report experiencing hot flashes than Caucasian women.⁶⁵ Interestingly, among Asian women, chilliness and shoulder aches are much more commonly reported menopausal symptoms than hot flashes. It is possible that part of the reason for the low prevalence of hot flashes among Japanese women is their reluctance to report having symptoms.⁶⁶ One study found that hot flash frequency was lower among Japanese compared to Caucasian women when based on a subjective determination (personal diary), but not when determined objectively by measuring sternal and nuchal skin conductance.⁶⁷

Since 1995, more than 50 clinical trials have examined the impact of isoflavone exposure on the alleviation of menopause-related hot flashes. In recent years, investigators have gravitated toward the use of supplements rather than soyfoods to enhance compliance and reduce the complexity of study design. The results of these trials have produced inconsistent results. Although some reviews and analyses of the literature have concluded that isoflavone-rich products alleviate hot flashes,^{4, 68} most have found that the data do not allow for definitive conclusions to be made even though more trials than not showed benefit.⁶⁹⁻⁷¹ However, with one exception, analyses of the clinical research have failed to consider the importance of subanalyzing the data according to the genistein content of the isoflavone intervention product.⁷²

Fortified soymilk is a good source of isoflavones and also contains calcium, vitamin D and protein, which offer additional bone health benefits.

This exception is a systematic review and meta-analysis published in 2012, which included 19 and 17 trials, respectively, all of which intervened with isoflavone supplements derived from soy. The meta-analysis of the data on hot flash frequency, which included 13 studies involving 1,196 women, found isoflavones were consistently efficacious, reducing the number of hot flashes per day by about 21% more than the reduction in the placebo group ($p < 0.00001$). Similarly, in the nine trials involving 988 women that evaluated hot flash severity, isoflavones reduced symptoms by about 26% more than the reduction in the placebo group ($p < 0.001$). When considering the combined effect of the placebo and isoflavones, the overall reduction in frequency and severity was approximately 50 percent.

Subanalysis of the data revealed three interesting findings. First, baseline hot flash frequency did not impact efficacy. The percent reduction in hot flash frequency was similar regardless of whether women had two hot flashes per day at baseline or 10 hot flashes per day. Second, hot flashes were reduced to a greater extent in studies >12 weeks in duration versus shorter-term studies. This finding indicates the effects of isoflavones are not transient. Third, and most important, supplements that provided higher amounts of the isoflavone genistein were considerably more efficacious than supplements low in genistein. This finding is important because the two primary types of supplements that are commercially available and that have been used in the clinical trials have markedly different isoflavone profiles. One is high in genistein and daidzein but low in glycitein, which is similar to the isoflavone profile of soyfoods, whereas the other is very low in genistein and high in daidzein and glycitein.⁷²

In studies that intervened with supplements providing ≥ 18.8 mg genistein (the median for all studies), hot flash frequency was reduced by almost 27% beyond the placebo effect whereas in trials providing less than this amount, frequency was reduced by only about 12.5% (difference between groups, $P = 0.03$). The greater reduction in response to genistein-rich supplements is consistent with several lines of evidence including relative ER binding and transactivation, indicating that genistein is more potent than the other two soybean isoflavones.^{73, 74}

Collectively, these data make a convincing case that isoflavones can be of help to women who experience hot flashes. Several trials published subsequent to the 2012 meta-analysis are supportive of efficacy although a few others are not. However, the unsupportive trials are not consistent with guidelines for conducting trials evaluating hot flashes.

The level of relief provided by isoflavones is consistent with the degree of benefit deemed satisfactory by women seeking non-hormonal treatments for hot flashes.⁷⁵ The amount of isoflavones providing symptom relief is found in approximately two servings of traditional soyfoods.



OSTEOPOROSIS

In response to declining estrogen levels, women can lose substantial amounts of bone mass in the decade following menopause, which markedly increases their fracture risk.⁷⁶ Estrogen therapy reduces postmenopausal bone loss and hip fracture risk by approximately one-third.⁶ Recent data show that the protective effects against hip fracture are lost within two years of cessation of estrogen therapy.⁷⁷ Initial speculation that soyfoods might promote bone health in postmenopausal women was based on the estrogen-like effects of isoflavones and early research showing that the synthetic isoflavone, ipriflavone, exerted skeletal benefits.⁷⁸

The relatively low hip-fracture rates in Asian countries have also been cited as evidence for the skeletal benefits of isoflavones, but other factors may help explain these rates.⁷⁹ For example, Asians have a shorter hip axis length, which reduces risk for fracture.^{80, 81} Also, Japanese women are less likely than Western women to fall, the precipitating event for hip fracture.^{82, 83} However, spinal bone mineral density (BMD) and spinal fracture rates are similar between Asians and Caucasians.⁸⁴⁻⁹¹ Nevertheless, the available evidence shows that, among women of Chinese ethnicity, high soy consumers are less likely to report having a fracture.

Two prospective Asian epidemiologic studies have evaluated the relationship between soy intake and fracture risk. In both, risk was reduced by approximately one-third when women in the highest soy intake quintile or quartile were compared to women in the lowest. This degree of protection is similar to that noted for estrogen therapy.⁶ In one of the studies, approximately 1,800 fractures of all types occurred in the 24,000 postmenopausal Shanghai women who were followed for 4.5 years.⁹² In the other study, there were almost 700 hip fractures (the only site studied) among the 35,000 postmenopausal Singaporean women during the seven-year follow up period.⁹³

The American Cancer Society concluded that soyfoods can be consumed by breast cancer patients.

In a third prospective epidemiologic study involving Seventh-day Adventists, a religious denomination that includes a high proportion of vegetarians, soymilk intake was significantly inversely related to osteoporosis.⁹⁴ In this study, which involved 337 postmenopausal women, participants had their bone health assessed using broadband ultrasound attenuation of the calcaneus two years after completing a lifestyle and dietary questionnaire at enrollment. Compared with women who did not drink soymilk, women drinking soymilk once a day or more had 56% lower odds of osteoporosis (defined as defined as a T-score < -1.8). However, the protective effect of soymilk may

have been due to its calcium rather than isoflavone content since dairy product intake was similarly protective. Although the results of these three studies are intriguing, definitive conclusions about the skeletal effects of soyfoods can only be based on the results from appropriately designed clinical studies.



Since the first clinical study to examine the effects of an isoflavone-rich product on BMD in postmenopausal women was published in 1998,⁹⁵ since then more than 25 trials have been published (for reviews, see references) although many involved small numbers of participants and were conducted for relatively short durations.^{96, 97} Ideally, studies of bone health should be at least two to three years long. The results from the clinical research thus far have been mixed. Meta-analyses of the data concluded that isoflavones reduce bone breakdown⁹⁸ and increase both bone formation⁹⁸ and spinal BMD^{2, 99} in postmenopausal women; however, a very rigorously conducted meta-analysis failed to provide support for the skeletal benefits of isoflavones.¹⁰⁰

Four large and long-term (≥ 2 years duration) trials have evaluated the effects of isoflavone supplements on BMD in postmenopausal women. Two were conducted in the United States,^{101, 102} one in Italy,¹⁰³ and one in Taiwan.¹⁰⁴ Three of the four trials failed to show favorable effects on BMD. The one trial that did find that in osteopenic Italian women consuming 54mg/d genistein, BMD at the spine and hip

increased markedly over a three-year period whereas in the placebo group there were marked decreases. The differences between groups at both sites were highly statistically significant. In contrast, in trials intervening with supplements that provided 80 or 120mg/d,¹⁰¹ 200mg/d¹⁰² or 300mg/d¹⁰⁴ isoflavones, no benefits were observed. While the results of these three trials are discouraging, research from Purdue University using novel methodology highlights the potential skeletal benefits of isoflavones and possibly provides at least a partial explanation for the lack of effect in the longer-term clinical trials.¹⁰⁵

For this cross-over study, 24 healthy postmenopausal women were administered different isoflavone supplements or risedronate, a bisphosphonate anti-osteoporotic drug, receiving each treatment for 50 days.¹⁰⁵ Prior to the intervention, each woman had been injected with ⁴¹Ca, a rare isotope of calcium that has an exceptionally long half-life which makes it possible to precisely detect changes in bone calcium content.

Soyfoods may offer protection against heart disease, as they are low in saturated fat and high in polysaturated fats.

Risedronate increased bone calcium content by a statistically significant 15.3 percent. Hence, the methodology employed in this study identified the bone-protective effects of this drug. Risedronate is known to reduce risk of developing both vertebral and hip fractures by approximately 50 percent.¹⁰⁶ In response to a daily supplement containing 105mg isoflavones, bone calcium content statistically significantly increased by 7.6 percent. Therefore, at this dose level, isoflavones were about half as potent as a well-established drug used to treat osteoporosis. The authors of this study concluded that "... the use of soy isoflavones presents minimal to negligible risk to postmenopausal women ... and can be used long term for some protection against postmenopausal bone loss."

In addition to showing the efficacy of isoflavones, a fascinating finding from this study is that in response to larger amounts of isoflavones, the effects on bone calcium content were actually greatly diminished. This finding may provide an explanation for why in the long-term clinical trials intervening with 200 and 300mg/d isoflavones, no effects on BMD were observed. Although more research is needed, the results from Purdue University attest to the potential skeletal benefits of isoflavones.

Finally, soyfoods provide high-quality protein,¹⁰⁷ which may promote bone health.^{108, 109} In addition, some soyfoods are good sources of calcium as well as vitamin D.¹¹⁰ Importantly, the absorption of calcium from calcium-set tofu¹¹¹ and calcium-fortified soymilk^{110, 112} is comparable to the absorption of this mineral from cow's milk. Therefore, for several reasons, soyfoods can contribute to a bone-healthy diet.





HEART HEALTH

Soyfoods potentially offer protection against heart disease through several mechanisms. Soyfoods are low in saturated fat and high in polyunsaturated fat.¹¹³ In addition, soy protein directly lowers blood cholesterol levels, an attribute that was formally recognized by the U.S. Food and Drug Administration in 1999.¹¹⁴ Estimates are that via the fatty acid profile and soy protein content, when soyfoods replace commonly consumed sources of protein in Western diets, blood LDL-cholesterol levels will be lowered by about 8 percent.¹¹⁵ In theory, over a period of years, this decrease may reduce risk of coronary heart disease (CHD) by 8-16 percent.¹¹⁵

There is also evidence that independent of effects on blood cholesterol, soyfoods may reduce CHD risk. For example, four recently published meta-analyses found that soy lowers blood pressure.¹¹⁶⁻¹¹⁹ Furthermore, isoflavones improve systemic arterial compliance¹²⁰ and flow mediated dilation^{121, 122} in postmenopausal women. Also, a three-year study, which involved 350 healthy postmenopausal women ages 45-92, found that isoflavone-rich soy protein inhibited the progression of subclinical atherosclerosis as assessed by changes in carotid intima media thickness.¹²³ (For more extensive discussion on heart health, see the Soy Connection *Soy & Heart Health* fact sheet.)

BREAST CANCER

For more than two decades the role of soyfoods in reducing breast cancer risk has been rigorously investigated. A meta-analysis of epidemiologic studies published in 2013 that included 12 Asian studies found higher soy intake was associated with a 29% decreased risk of nearly one-third reduction in breast cancer risk.³ However, there is intriguing evidence indicating that to derive this benefit, soy consumption must occur during childhood or adolescence.¹²⁴⁻¹²⁶ In animal studies, when very young rodents are exposed to isoflavones for just a few weeks, chemically induced mammary cancer is markedly reduced;¹²⁴ cells in the developing mammary gland appear to undergo a change that makes them permanently less likely to be transformed into cancer cells later in life.^{124, 127-129} The protection against breast cancer afforded by isoflavones may be similar to the observed protective effect of early pregnancy.¹³⁰

Clinical evidence indicates that neither soyfoods nor isoflavones adversely affect breast tissue.

However, despite the results of the epidemiologic studies noted above³ and the low breast cancer incidence rates in Japan,¹³¹ the relationship between soyfoods and breast cancer has been controversial due to concern (based almost exclusively on in vitro and rodent data) that isoflavones may be contraindicated for women with breast cancer or who are at high risk of developing this disease.¹³² However, as discussed, the clinical and epidemiologic data show that soyfoods are safe for women with breast cancer and may even be of benefit to them.



Although no clinical trials evaluating the effects of soy or isoflavones on breast cancer recurrence have been conducted, many studies have investigated effects on markers of breast cancer risk including mammographic density^{133, 134} and in vivo breast cell proliferation.^{52, 135-139} Prospective epidemiologic data show that post-diagnosis soy intake improves prognosis. To this point, a meta-analysis of five prospective studies, two from the United States and three from China, involving over 11,000 women with breast cancer, found consuming soy after a diagnosis of breast cancer was associated with reductions in both breast cancer recurrence (hazard ratio, 0.85; 95% confidence interval: 0.77, 0.93) and mortality (hazard ratio, 0.79; 95% confidence interval: 0.72, 0.87). Importantly, soy consumption was similarly beneficial in Asian and non-Asian women. Also, in contrast to studies in mice, the epidemiologic data suggest that soy consumption may actually enhance the efficacy of chemotherapeutic agents used to treat breast cancer.^{140, 141}

Given the above data, it is not surprising that after a multi-year comprehensive review, the European Food Safety Authority concluded that isoflavone supplements do not increase breast cancer risk when taken by postmenopausal women.¹⁴² Also, both the American Cancer Society¹⁴³ and the American Institute for Cancer Research¹⁴⁴ have concluded that soyfoods can be safely consumed by breast cancer patients and the World Cancer Research Fund International concluded there is a possible link between consuming soyfoods and improved survival from breast cancer.¹⁴⁵

EMERGING RESEARCH AREAS

Two research areas that have only fairly recently begun to be investigated are mental health and skin health. Although it is not possible to reach definitive conclusions about the impact of soy on either outcome, the existing evidence is sufficient to justify continued research.



MENTAL HEALTH

Depression is a commonly occurring disorder associated with diminished quality of life and increased morbidity and mortality.^{146, 147} Strikingly, there is an approximate two-fold female-male disparity in the prevalence of depression.¹⁴⁸ The higher prevalence of depression among women compared to men suggests that reproductive hormones may be involved in the etiology of this disease. Also, longitudinal studies suggest that menopause is a period of risk for new onset or recurrent depression for some women.¹⁴⁹⁻¹⁵¹ It is also notable that a group of academics recently concluded that “diet is as important to psychiatry as it is to cardiology, endocrinology, and gastroenterology.”¹⁵²

With this background in mind the emerging evidence suggesting that isoflavones may function as antidepressants is particularly intriguing. For example, over a two-year period, an Italian study that was evaluating mood effects, found that postmenopausal women taking 54mg/d genistein showed a decline in depressive symptoms as measured by the Zung Self-rating Depression Scale whereas no change occurred in the placebo group.¹⁵³ Also, a Japanese study involving peri and postmenopausal women, found that a very moderate dose (25mg/d) of isoflavones consumed in aglycone form reduced depressive symptoms assessed by the Hospital Anxiety and Depression Scale and also reduced anxiety as assessed by the Athens Insomnia Scale.¹⁵⁴ In contrast to the benefit of this dose, this eight-week trial found that a very low dose of isoflavones (12.5mg/d) lacked efficacy.

Finally, Estrella et al.¹⁵⁵ found that over a three-month period 100mg/d isoflavones reduced depressive symptoms in clinically depressed postmenopausal women to a similar extent as Zoloft (50mg/d) and Prozac (10mg/d). In addition, the combination of Zoloft and isoflavones resulted in a greater reduction in symptoms than the other three individual treatments.



SKIN HEALTH

Interest in the effects of isoflavones on overall skin health is not surprising given that they bind to ERs, which are present in the skin^{156, 157} – and that estrogen therapy is thought to improve a number of skin parameters¹⁵⁸⁻¹⁶¹ including skin elasticity,¹⁶² water-holding capacity,¹⁶³ pigmentation¹⁶⁴ and vascularity.¹⁶⁵ Skin appendages, such as hair follicles, are also influenced by estrogens.¹⁶⁶

Several trials suggest that isoflavones help to reduce wrinkles. For example, in one study, two groups of 20 healthy postmenopausal women aged 50 to 65 years were instructed to consume their usual diet with or without 20g/d of an isoflavone-rich soy protein for three months.¹⁶⁷ There were statistically significant improvements in facial-skin wrinkling, discoloration and overall appearance in the supplement group. In another study involving 26 Japanese women in their late 30s and 40s, over a three-month period, use of supplements that provided 40mg/d isoflavones led to a statistically significant decrease in fine wrinkles, whereas no change occurred in the placebo group.¹⁶⁸

Finally, a 14-week trial conducted by Jenkins et al.¹⁶⁹ involving 159 postmenopausal women found that a beverage containing isoflavones statistically significantly reduced wrinkles by on average 10%; there was also a positive correlation between baseline wrinkles and the response to the isoflavone-containing beverage; that is, the greater the wrinkle depth at baseline, the greater the improvement. In addition to the effect on wrinkles, there was also a statistically significant increase in collagen synthesis.

SUMMARY AND CONCLUSIONS

Soyfoods are uniquely rich dietary sources of isoflavones, compounds classified as phytoestrogens but that differ from the hormone estrogen. Epidemiologic and clinical data suggest that soyfoods can make important contributions to the health of women, particularly postmenopausal women. Soyfoods potentially reduce CHD through multiple mechanisms. Clinical research indicates that isoflavones alleviate hot flashes although the evidence that they reduce bone loss is mixed. Irrespective of the skeletal effects of isoflavones, soyfoods can be part of a bone-healthy diet as they provide high-quality protein and many are good sources of well-absorbed calcium.

Adult soy intake does not appear to reduce breast cancer risk although evidence suggests that soy consumption during childhood and adolescence does. Claims that soyfoods are contraindicated for breast cancer patients are unsupported by the clinical and epidemiologic evidence; the former shows neither soy nor isoflavones adversely affect markers of breast cancer risk and the latter show that post-diagnosis soy intake reduces breast cancer recurrence and mortality. Finally, clinical research suggests soyfoods, because they contain isoflavones, may help to alleviate depression and reduce wrinkles although in regard to the latter, research is very limited.

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The 70 farmer-directors of USB oversee the investments of the soy checkoff to maximize profit opportunities for all U.S. soybean farmers. These volunteers invest and leverage checkoff funds to increase the value of U.S. soy meal and oil, to ensure U.S. soybean farmers and their customers have the freedom and infrastructure to operate, and to meet the needs of U.S. soy's customers. As stipulated in the federal Soybean Promotion, Research and Consumer Information Act, the USDA Agricultural Marketing Service has oversight responsibilities for USB and the soy checkoff. For more information, please visit SoyConnection.com.