Soy & Men's Health

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MUCH OF THE POPULAR DISCUSSION ABOUT SOYFOODS and chronic disease prevention has focused on the estrogen-like properties of soy isoflavones, and therefore on their role in the diets of post-menopausal women. Not surprisingly, surveys show that women are more likely to consume soyfoods than men. However, the past 20 years of research has shown that men also stand to benefit from incorporating soyfoods into their diet.

Understanding Isoflavones

Soyfoods are essentially unique sources of isoflavones,[1] compounds referred to as phytoestrogens because they have some estrogen-like properties.[2] The two primary soybean isoflavones are genistein and daidzein; a third isoflavone, glycitein, is present in relatively small amounts.[3] In soybeans and unfermented soyfoods, isoflavones are naturally present as the glycosides genistin, daidzin and glycitin.[3]

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Despite their chemical similarity to the hormone estrogen, isoflavones and estrogen are very different molecules and have different physiologic effects. For example, conjugated equine estrogens and/or estradiol are known to increase levels of C-reactive protein, sex hormone binding globulin, triglycerides, high-density-lipoprotein and thyroid stimulating hormone, and to increase endometrial thickness.[4-14] In contrast, isoflavones have no impact on these biological measures.[14-24]

Soyfoods as Sources of Protein

Although typical protein intake among most American men meets or exceeds the recommended dietary allowance for protein (RDA, 0.8 m/kg body weight) this is not the case for about 40 percent of older men.[25] Furthermore, recent data suggest that the current RDA is too low[26] and increasing evidence suggests that consuming protein in excess of the RDA may be advantageous for weight loss,[27] reducing risk of osteoporosis,[28] enhancing the benefits of vigorous physical activity[29] and possibly for lowering blood pressure.[30] Also, in older men, dietary protein intakes above the RDA may help to prevent age-related loss in skeletal muscle.[31]

Health organizations such as the American Institute for Cancer Research recommend obtaining a higher percentage of dietary protein from plant foods as a means of reducing cancer risk.

Soyfoods can play important roles in helping men meet protein needs while maintaining a healthful diet since, unlike many animal sources of protein, typically soyfoods are low in saturated fat.[32-36] Health organizations such as the American Institute for Cancer Research recommend obtaining a higher percentage of dietary protein from plant foods as a means of reducing cancer risk.[37] Since the protein in soyfoods is equal in quality to that of meat and milk, soyfoods can be recommended as protein-rich additions to the diet.[33]

Soyfoods protect against heart disease in the following ways:

- *Modestly raising HDL-cholesterol*
- *Lowering LDL-cholesterol*
- *Making LDL-cholesterol less atherogenic*
- *Directly improving the health of coronary arteries, via isoflavones*

Coronary Heart Disease

An estimated 16 million Americans (8.7 million men and 7.3 million women) suffered from coronary heart disease (CHD) in 2005, which includes heart attack and angina pectoris.[38] In 2004, the most recent year for which statistics are available, approximately 451,000 Americans died of CHD; this represents about 20 percent of all deaths, making CHD the number one killer of Americans. The number of deaths for men and women are approximately equal; however, the average age at which a first heart attack occurs is 64.5 years old for men and 70.4 for women.[38]

Soyfoods offer three-way protection against heart disease. First, because they are low in saturated fat, soyfoods can help reduce blood cholesterol when they replace more traditional sources of protein in Western diets.[39, 40] In addition, soy protein directly lowers blood cholesterol levels. Although the effect is much smaller than for cholesterol-lowering medications, the 3 to 5 percent reduction in LDL-cholesterol (LDLC) observed in response to soy protein[41-44] can reduce heart disease risk by as much as 5 to 20 percent over a period of years.[45, 46] Furthermore, evidence suggests that the hypocholesterolemic effects of soy protein may be greater in men than in women.[44]

In 2004, heart disease caused 20 percent of all deaths in the U.S., making it the lead cause of death in this country.

Soy protein also lowers triglyceride levels from 5 to 10 percent.[41-44] Although experts debate the value of triglyceride level as an independent predictor of CHD risk,[47] recent evidence suggests that the role of triglyceride levels in the etiology of CHD has been underestimated.[48, 49] In contrast to some interventions that lower both LDLC and high-density lipoprotein cholesterol (HDLC), thereby attenuating the coronary benefits, soy protein intake leads to very modest increases (1 to 3 percent) in HDLC.[41-44] Although small, each 1 percent or 1 mg increase in HDLC lowers CHD risk by 2 to 3 percent.[50, 51]

Finally, preliminary research suggests that soyfoods may affect CHD risk factors unrelated to lipid levels. For example, in a study involving both men and women, soy protein intake led to an increase in LDL particle size, shifting LDL particle distribution to a less atherogenic pattern.[52] Over a period of 5 years, this change is estimated to result in a 5 percent reduction in risk of ischemic heart disease.[52] Small dense LDLC particle size is considered an emerging cardiovascular risk factor.[53-55] Smaller particles may be more atherogenic because they can more easily make their way into the intima of the arterial wall.

Another study found that the consumption of 3 soy flour-containing scones per day led to a decrease in oxidative stress markers in men, reflecting a decreased risk of coronary heart disease. More specifically, in comparison to scones made with wheat flour, soy flour inhibited LDLC oxidation induced by myeloperoxidase (MPO). MPO is a heme protein secreted from leukocytes in response to an inflammatory stimulus; there is evidence that MPO is the primary initiator of oxidative damage to lipoproteins in the arterial intima.[56]

Although limited, recently published epidemiologic data provide support for the non-lipid coronary benefits of soyfoods. In a Chinese cross-sectional study involving middle-aged (40 to 65 years) adults (N=406; 134 males, 272 females), habitual soy intake was associated with dose-dependent decreases in mean bifurcation intima-media thickness.[57] The effect was more apparent in men than women. Non-invasive assessment of intima–media thickness of the carotid arteries is widely used as an intermediate or proxy measure of generalized atherosclerosis.[58]

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Prostate Cancer

Cancer of the prostate is the most common cancer among U.S. men and the second most common cause of cancer deaths.[59] There is considerable speculation that an overall healthy diet, as well as specific nutrients and phytochemicals, can reduce prostate cancer risk and perhaps even help treat this disease.[60-62] Because prostate cancer is typically diagnosed at an older age and prostate tumors are generally slow-growing, even modestly delaying the onset, and/or slowing the growth of these tumors may dramatically reduce the number of deaths caused by this disease.[63-66]

In 2000, the International Prostate Health Council suggested that soyfoods, because they contain isoflavones, may be one factor contributing to the low Japanese prostate cancer rates.[67] More recently, researchers at the University Hospital in Bonn concluded that genistein holds the potential to prevent prostate cancer.[68] Research in animals supports this conclusion, as do the epidemiologic data overall.[69-73]

Epidemiologic evidence suggests that men who eat soyfoods daily are less likely to develop prostate cancer than those who do not.

In rodents, an especially intriguing finding is that equol is able to bind and sequester 5ααdihydrotestosterone from the androgen receptor without affecting serum testosterone levels.[74] Equol is an isoflavan synthesized by intestinal bacteria in some individuals from the soybean isoflavone daidzein. This sequestering action of equol led to a decrease in mouse prostate tissue growth, suggesting a reduction in prostate cancer risk. Furthermore, recently in mice the isoflavone genistein was found to inhibit prostate tumor metastasis to the lung by 96 percent without affecting growth of the primary tumor.[75]

Supporting this finding, an epidemiologic study found the proportion of equol producers among Asian men was significantly smaller in those with prostate cancer than in the cancer-free control group. Also, fewer equol producers were found among patients with poorly differentiated adenocarcinoma than in those with well or moderately differentiated adenocarcinoma.[76]

To examine the potential role of soy in reducing prostate cancer risk, numerous investigators have focused on the impact of isoflavone-rich products on prostate specific antigen (PSA). PSA is the most common clinical test for the detection of prostate cancer and is a measure by which treatment efficacy can be assessed.[77] In men with prostate tumors, serum PSA concentration is proportional to prostate tumor volume[78] and successful treatments for prostate cancer lower PSA levels.[79-87]

The evidence that either soy or isoflavones affect PSA levels is mixed. In a recent review of 11 clinical trials, no effects were noted in healthy subjects with low PSA levels. However, in 4 of the 8 trials involving prostate cancer patients, isoflavones slowed the rise in PSA levels, although none of the 8 studies showed an absolute decrease in PSA.[88] These findings hold open the possibility that soyfoods may be useful in the treatment of prostate cancer. Furthermore, recent clinical trial data indicate that, in healthy men with low PSA levels, it is possible to reduce prostate cancer risk without affecting PSA.[89] Therefore, the lack of effect on PSA contradicts neither the animal[90] nor the epidemiologic data.[71]

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Isoflavone Effects on Reproductive Hormones

A large number of studies have examined the effects of isoflavone-rich soyfoods and isoflavone supplements on reproductive hormones in men, and testosterone levels in particular. Much of the research focused on determining if testosterone reduction is a possible mechanism for the proposed role of soy in reducing prostate cancer risk. Research also explored whether estrogen-like effects of soy/isoflavones cause hormonal disturbances. In both cases, the answer appears to be no.

Two studies show that soy lowers serum testosterone levels. In one, which was previously cited, 19 young men (average age, 35.6 years) consumed 3 scones per day made with either soy or wheat flour for 6 weeks in addition to their normal diet.[91] Although serum testosterone levels decreased by almost 6 percent in the soy group ($p=0.03$) compared to baseline values, the final value for the control (wheat) group was not presented, so it is not clear if the difference between the two groups was statistically significant. Furthermore, isoflavone exposure in this study was about 4 times the typical Japanese intake.

In the other study, much larger decreases in testosterone (average, 19 percent) occurred but only 12 men (average age, 32.2 years) were enrolled in this study and the decrease resulted primarily from the change in two subjects.[92] Furthermore, in 1 of the 2 subjects, baseline testosterone levels greatly exceeded the normal range and the decrease continued for several weeks even after discontinuation of soy protein (56 g/day).

In both of these studies, soy exposure, as judged either by isoflavone (120 mg/day) or protein (56 g/day) intake was markedly higher than typical Asian consumption[93] and exceeded recommendations from health professionals.[94] More importantly, the results are in contrast to the findings from all other studies.

According to a meta-analysis by Hamilton-Reeves et al.[95] that included 29 trials (including the two noted above) and 32 treatment groups, there were no significant effects of soy protein or isoflavone intake on levels of total testosterone, sex hormone binding globulin, free testosterone or the free androgen index, regardless of statistical models used to analyze the data. Furthermore, 3 additional studies not included in the meta-analysis because of their publication date also found no effects on testosterone.[96-98]

There has also been interest in the effects of isoflavones on sperm quality and quantity. This is due, in part, to reports that sperm count may have declined over the past few decades, although this is a matter of some debate.[99]

Only 1 intervention study has examined the impact of isoflavone intake on sperm count. In this study, healthy volunteers took a supplement containing 40 mg of isoflavones daily for 2 months and donated blood and semen samples monthly for 2 months before and 4 months after supplementation.[100] Semen samples were analyzed for ejaculate volume, sperm concentration, total sperm count, motility and morphology. In addition, testicular volume was measured using an orchidometer. As expected, plasma isoflavone levels increased quite markedly following supplementation, but there was no effect on hormone measurements, testicular volume or semen parameters over the study period.

Finally, reports of feminizing effects from soy that have appeared occasionally in the media are not supported by any research. In 1 study, 3 prostate cancer patients taking isoflavone supplements developed gynecomastia; however, it is important to note that all 3 were taking prostate cancer drugs that are known to cause this problem.[101]

Furthermore, the men consumed between 600 and 900 mg isoflavones daily, an amount found in 20 to 30 cups of soymilk.[102] These results are not relevant to people consuming typical dietary intakes of soyfoods. In fact, such excessive intake of many vitamins and minerals would be expected to produce overtly adverse effects. It is remarkable that these high doses of isoflavones did not produce problems.

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Summary and Conclusions

Soyfoods can play an important role in the diet of men. They provide high-quality protein and are low in saturated fat, making most soyfoods excellent choices for men wanting to increase protein intake from healthy foods. In addition, soy protein modestly lowers cholesterol levels and soyfoods may have a number of other coronary benefits. More speculative evidence indicates that soyfoods, perhaps because they contain isoflavones, help reduce risk of prostate cancer. Finally, overall, there is no meaningful clinical evidence that soy protein lowers serum testosterone levels or exerts any estrogen-like effects in men.

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