

Is It Safe to Eat Soy?

By Virginia Messina, MPH, RD & Mark Messina, PhD

No doubt you've heard lots of good things about soyfoods. According to a health claim sanctioned by the FDA, they can help to fight heart disease.¹ They may also make your bones stronger.^{2,3} And the biggest news about soyfoods over the past decade has been that they contain cancer-fighting compounds.⁴

But just as it seemed that things couldn't get any better for soy, articles began to pop up on the internet saying that the pro-soy stories are nothing more than hype--and that the real scoop on soy is not nearly as positive. In fact, the stories say, eating soy could endanger your health. These claims against soy include allegations that it raises cancer risk, and causes nutrient deficiencies, osteoporosis, thyroid problems, reproductive difficulties, and Alzheimer's Disease.

Making your way through the controversy can be confusing, especially since some of what the soy naysayers claim is based on some scientific data--although this doesn't mean that their conclusions are right. And it's true that some soy proponents may overstate the benefits of soy. Hopefully, we can tread a more even path here and convince you that, while soyfoods may not be the answer to all your problems, and while there certainly are a few unanswered questions, you can include soyfoods in a balanced and healthful vegan diet.

In making our way through this quagmire, it is important to recognize some important facts about scientific research. It's true that there have been studies showing negative effects associated with soy consumption. But it is a rare situation where every single study on a subject is in agreement. There are always a few that sit in direct contrast to the majority of the studies. So it is never a good idea to suggest broad conclusions or recommendations based on one or two studies. By picking and choosing individual studies carefully enough, you can prove just about anything you would like about nutrition. That's why health experts look at all the research and pay attention to the totality of the evidence, not just to a few studies. Many of the studies that have concluded that soy is unhealthy have used animals as subjects. Drawing conclusions about human health from animal research can be very misleading. For example, broccoli and other cruciferous vegetables contain a compound (called indole-3 carbinol) that is an anticarcinogen in humans. But in some other species, it causes cancer.⁵ If we looked only at the results of the studies in those species, the FDA would no doubt ban broccoli and cabbage from grocery stores.

Even so, soyfoods are significant in the diets of many vegans and it is worth taking a look at some of the claims against them.

Soyfoods and Thyroid

Many foods contain goitrogens, compounds that interfere with thyroid function (and in extreme cases can cause an enlarged thyroid, called a goiter). Along with soyfoods, millet, cruciferous vegetables and other foods contain goitrogens. Generally, these foods cause problems only in areas where iodine intake is low since this mineral is important for thyroid function. The effects of iodine deficiency can be made worse if the diet is high in goitrogens.

Although a concern about soy and thyroid function may be news to many vegans, it has actually been a focus of research for more than 70 years.⁶ Between 1951 and 1961, this research took on a special importance when about 10 cases of goiter were diagnosed in infants who had been fed infant formula made from soy flour. These old studies form some of the basis for arguments that soy is dangerous for infants. However, the situation for today's soy formula-fed infant is very different. Since the 1960's, soy-based infant formula has been made from soy protein isolate (which does not contain the goitrogen component; soy flour formulas did) and it is fortified with iodine. No cases of goiter have been diagnosed in infants fed this formula in the past 40 years.

Nor is there any evidence that consuming soy causes thyroid problems in healthy, well-nourished people who have adequate iodine in their diet.⁷⁻¹⁰ However, it is possible that eating a diet with generous amounts of soyfoods could be a problem for people whose iodine intake is marginal. And that might just include some vegans, since the main sources of iodine in western diets are fish and milk. But the appropriate response to this is not to limit healthful soyfoods; it's to get enough iodine. Vegetables have varying amounts of iodine depending on where they are grown. In some parts of the world--specifically northern Europe--vegans may have low intakes of iodine. Foods that can supply iodine to vegan diets are sea vegetables, although contents vary quite a bit. Fortified foods are also a good source. Iodized salt is about the most reliable source. Vegans should be sure that, when they season foods with salt, it is iodized. If this isn't a regular part of your diet, use an iodine supplement.

Conclusion: Soyfoods may contain goitrogenic compounds as do other foods. There is no evidence that eating soyfoods regularly causes thyroid problems in people who eat a balanced diet. Vegans should make an effort to include adequate sources of iodine in their diet.

Soyfoods and Cognitive Function

A study conducted in Hawaii called the Honolulu Heart Study came up with a surprising finding. The study looked at Japanese men residing in Hawaii and aimed to compare diet to risk of dementia. The researchers found that those men who ate tofu most frequently during their mid-40's to mid-60's showed the most signs of mental deterioration in their 70's to early 90's.¹¹ In this study of over 3000 men, intake of 26 foods, including tofu, was recorded between 1965 and 1967 and again in 1971 to 1974. Cognitive test performance was assessed between 1991 and 1993 and the researchers also looked at brain shrinkage through autopsy data of the men who died during the

study. Tofu consumption of just two to four servings per week was associated with poorer test performance and more brain loss. Not only that, but the wives of men who ate tofu also showed more signs of dementia.

The study raised lots of questions. For one thing, how could this be when it is known that dementia rates are lower in Asian countries than in western countries and when Japanese lifestyle has actually been associated with better cognition in old age? Many have used this as an argument to show that the Hawaii study results must be wrong. But comparing rates of dementia across cultures doesn't really tell us much in this regard because there are too many differences between the lifestyle in Japan and the lifestyle in Europe and North America. And criteria for diagnosing dementia vary across cultures. To get the real story, we would need to compare frequent tofu consumers in Japan to people in Japan who don't eat tofu. And that study hasn't been done yet.

Furthermore, there is a possible biological explanation for the findings. Soybeans contain isoflavones, which are weak estrogens. They fall into the category of estrogen-like compounds known as SERMS--selective estrogen receptor modulators.¹² This means that they have estrogenic effects in some tissues and anti-estrogenic effects in others. Estrogen may have a positive effect on brain tissue but the researchers of the Hawaii study suggested that isoflavones may have antiestrogenic effects on the brain. Of course, we can't know this from the Hawaii study. This was an epidemiological study, so it doesn't show cause and effect. It merely shows that two things occur together. Since the researchers measured intake of only 27 foods and were not able to control for every single lifestyle factor, it is possible that tofu consumption is a marker for some other factor that affects cognitive function. This would make tofu an innocent bystander. Results of other studies suggest this is true.

Results of three clinical studies, only one of which has thus far been published in full manuscript form, suggest soy and isoflavones have beneficial effects on cognition. In the published study, young adult men and women who consumed a high soy diet for 10 weeks experienced significant improvements in short-term and long-term memory and in mental flexibility.¹³ The other two studies which have been presented at scientific meetings, found that isoflavone supplements, when taken by postmenopausal women, improve cognitive function. Even with these findings, we really have very little information on how soyfoods consumption might affect cognitive function. It's important to note though that studies of Seventh-day Adventists, many of whom have consumed soyfoods all of their lives, suggest that this group experiences less dementia in old age than the general population.¹⁴ This may reflect an overall healthier lifestyle or higher education (which is linked to better cognitive function in old age). We simply don't know.

We do know that there are ways to protect cognitive function as we age. Eating a diet high in antioxidants (which means a plant-based diet), engaging in regular exercise, and stimulating the brain through learning and problem-solving activities, all seem to be associated with better cognitive aging.¹⁵⁻¹⁹

Conclusion. One study has suggested a link between tofu consumption and poorer cognitive function in old age, but this is an epidemiological study. Therefore it doesn't show cause and effect. It did not look at diet extensively enough to draw firm conclusions. And there are no other studies to support it and three clinical studies suggest soy and isoflavones have beneficial effects on cognition. At this point, there is no reason to believe that eating soyfoods is harmful to brain aging.

Soyfoods and Mineral Absorption

Critics of soyfoods say that soy is high in phytates which inhibit absorption of iron, zinc, and calcium. But the absorption of calcium from soyfoods is actually surprisingly good given the phytate content of those foods.^{20, 21} Not only that, but a number of studies have shown that the isoflavones in soyfoods protect bone health,² and that soy protein when substituted for animal protein decreases urinary calcium excretion.³ So getting calcium from soyfoods that are either naturally rich in this nutrient or are fortified with it, seems like a very good idea.

However, there is certainly some research showing that vegan women have low calcium intakes. Contrary to popular opinion, there is little evidence that vegans have better bone health than people eating other types of diets and there is some evidence that links their lower calcium intake with poorer bone health. While this is a potential problem, it has nothing to do with any shortcomings of soyfoods. And it is an easily resolved problem. Vegans simply need to make sure they meet recommendations for calcium (1,000 mg a day for adults age 19-50) either through natural food sources of this nutrient, fortified foods or supplements. It is also important to make sure that your diet is well-balanced with adequate protein and with adequate vitamin D. While too much protein may be detrimental to bones, so is too little. And, while it is possible to make adequate vitamin D through sun exposure, it isn't a sure thing in many parts of the world so supplements or fortified foods are a good idea.

But it is true that, all other things being equal, phytates inhibit the absorption of iron and zinc. Soybeans are rich in phytate and vegan diets are especially high in phytate. It is very well documented that vegetarians absorb iron less well than meat eaters and have lower stores of iron in their bodies. But the implications of this aren't clear. Vegetarians don't appear to be any more likely to actually develop iron deficiency.²² And, because high levels of iron may raise risk for heart disease, it may be that having lower but adequate stores as vegetarians do is the ideal situation.²³

Soy protein also inhibits absorption of iron, making soyfoods a poor source of available iron even though they contain this nutrient. So the critics are correct that people should not depend very much on soyfoods to meet their iron needs. And it may also be that the protein in soy inhibits absorption of iron from other foods. But this is not a reason to avoid soy. Rather, vegans should make sure that their diets are rich in good sources of iron--grains, beans, dried fruits, nuts, seeds, and many vegetables--and they should also make sure they get

adequate vitamin C at meals. Vitamin C boosts absorption of iron from many plant foods. However, it is not enough to have a diet high in vitamin C. If you take a vitamin C supplement in the morning or consume a couple glasses of orange juice between meals, this won't affect your iron absorption. The vitamin C must be consumed at the same time as the iron.

Zinc is also poorly absorbed from soyfoods. Vegans generally have a lower intake of zinc and lower absorption than meat eaters and probably than lacto-ovo vegetarians. It's a nutrient that deserves some attention in vegan diets. But again, avoiding soyfoods is not the way to ensure adequate amounts of bioavailable zinc. Rather, making sure that your diet is rich in zinc-rich foods--nuts, seeds, whole grains, and legumes--is important.

Conclusion: Soyfoods can be good sources of well-absorbed calcium whether they are natural sources of this mineral or are fortified with it. They may also provide other factors that help to improve bone health. Vegans should make sure their diets are adequate in calcium and vitamin D and are generally well-balanced with adequate protein. Iron deficiency does not appear to be a problem for vegans--at least no more so than for people eating other kinds of diets. But, given that it is a common world-wide deficiency, everyone should make sure they eat plenty of iron-rich foods and vegans should consume good sources of vitamin C at meals. Likewise, it is important to eat plenty of zinc-rich foods every day.

Soy and Breast Cancer

All of the popular discussion surrounding soy actually started out because of evidence suggesting that soy, likely because of the isoflavones, reduced breast cancer risk by inhibiting the effects of estrogen.²⁴ Some of the evidence for this comes from the observation that breast cancer rates are lower in Asian countries than among western women. However, many factors that differ among cultures might affect breast cancer risk. And it is interesting to note that, within Asian cultures, there is little epidemiological evidence that shows soy consumption is protective against breast cancer.

A few short term clinical studies have suggested that soy consumption has estrogenic effects in the breast tissue of young--that is, premenopausal--women.^{25, 26} This would suggest a possible increased risk for cancer. The significance of these short term studies isn't clear however. For example, the drug tamoxifen, used to treat breast cancer, actually has estrogenic effects when used for the short term, but antiestrogenic effects over the long term.

There are also a number of other considerations. First, research in laboratories on breast cancer cells has shown that small doses of the soy isoflavone genistein cause cells to replicate whereas large doses inhibit cell growth. Furthermore, there is some evidence that eating soy early in life--especially during puberty--helps to protect girls from breast cancer later in life.^{27, 28} This would help explain why Asian women--most of whom grow up on soyfoods--have lower rates of breast of cancer than even western vegetarians, who might not begin eating soy until adulthood.

Finally, soy isoflavones have a number of effects that are possibly protective against cancer and that have nothing to do with their estrogenic or antiestrogenic effects. For example, genistein may inhibit the growth of the blood vessels that support tumor growth and may also inhibit enzymes that promote cell growth. Soy may alter estrogen metabolism in a way that protects against cancer. Also, year-long studies have found that soy or isoflavones either have no harmful effect or favorably affect breast tissue density, which is an indicator of breast cancer risk.²⁹

For women who have already had breast cancer and whose cancer is estrogen positive (meaning it is stimulated by estrogen) it is difficult to know whether to recommend restricting soy. The anti-cancer effects of soy may outweigh any possible estrogenic effects of isoflavones.

Conclusion: At this time, there seems no reason for women who have had breast cancer to avoid moderate consumption of soy. And for women who have never had cancer, there seems no reason to restrict soy.

Soy Intake and Reproduction

Scientists became aware of a potential link between isoflavone consumption and reproductive problems because of breeding problems among female sheep that grazed on a particular type of isoflavone-rich clover in Australia.³⁰ The amounts of isoflavones being ingested by these animals were extremely high compared to typical consumption of Asians. In addition, species vary in their response to biologically-active compounds and sheep are especially sensitive to isoflavones.

Although environmental estrogens, such as PCBs in fish, have been cited as possibly lowering sperm count and possibly interfering with fertility,³¹ a recently published study showed that consumption of 40 mg of isoflavones per day had no effect on male reproductive function parameters.³² And while one study has shown that soy consumption delayed ovulation in women, it did not prevent ovulation and several other studies have not found this effect.³³ Finally, a recent study of adults aged 20 to 34 years who were enrolled in controlled feeding studies at the University of Iowa as infants, found no difference in a wide range of reproductive and physiological measures between those who were fed soy formula and those fed cow milk formula as infants.³⁴ There have also been no observed widespread reproductive problems in populations where regular soy consumption is the norm.

Conclusion: Although soy isoflavones have weak estrogen-like effects, there is no evidence of reproductive problems in those who eat these foods.

Should You Eat Soy?

Based on the bulk of the evidence soy appears to be perfectly safe for nearly all healthy individuals when it is consumed in reasonable amounts. We would say that a reasonable amount of soy is two to three servings per day. Women who have had estrogen-positive breast cancer may want to be somewhat more restrictive in their soy intake but, if they are already eating and enjoying soyfoods, there is not enough evidence of any harmful effects to suggest that they need to avoid all soy.

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