Is it a superpowered health booster or a dangerous health risk? Does it prevent cancer or cause it? SELF combed through years of research to understand the controversy surrounding this plant protein. What we learned actually surprised us.

By Melinda Wenner Moyer
Few foods are as divisive as soy. Is it healthy or harmful? Depends on who you talk to. Think of that glowy-skinned woman you know who brunches on tofu-kale scrambles and takes her iced soy latte with a spoonful of Zen. Then picture that other friend, the one who swore off soy completely after reading up on its reproductive risks. Who is right? It’s far from obvious. Clean-eating and paleo blogs tend to be antisoy; author and part-time vegan Mark Bittman embraces it.

One of the most studied foods in recent history—researchers have looked at its effect on everything from memory to sex drive—soy has become a spongy white canvas onto which so many of us project our hopes and fears about food. “Soy has certainly generated a lot of confusion,” says Heather Patisaul, Ph.D., a biologist at North Carolina State University who studies it and other sources of environmental estrogen. “People went from embracing soy to fearfully avoiding it.”

In any case, soy is almost everywhere. Americans spent $4.5 billion on soy foods in 2013, up from $1 billion in 1996. Soy protein derivatives are used to boost things like texture and shelf life in hundreds of supermarket foods, such as cereal and nutrition bars. Meanwhile, fast-food restaurants like Chipotle are serving up veggie mains like tofu sofritas.

So what’s the real story—can soy harm us or heal us? To find some clear answers, we dug deep into the research and talked to scientists who have been studying soy for decades.

PHOTOGRAPHED
BY RYAN LIEBE
THE RISE OF SOY

If your grandparents look at you strangely when you talk about tofu, it’s because soy foods are relatively new to the United States. Farmers have grown soybeans in America for decades to make animal feed, but it wasn’t until vegetarianism became trendy in the 1970s that soy became a popular people food, too. Then it caught on quickly, and for good reason. Tofu and other soy foods—like edamame, soymilk, tempeh and miso—contain all of the essential amino acids, which the body needs to build complete proteins. Soy foods are also cholesterol-free and low in saturated fat.

Soy’s popularity exploded in the 1980s and ’90s, after research suggested it could significantly reduce the risk for chronic diseases. Large population-based studies showed that Asian women, who consume a lot of soy protein, had much lower rates of heart disease, diabetes and obesity than U.S. women. (The Japanese eat around 9 grams a day, versus about 1 gram for Americans.) In 1995, researchers at the University of Kentucky zeroed in on soy’s heart-healthy potential after closely analyzing 38 clinical studies. Their conclusion? Eating 50 grams of soy protein a day—the equivalent of 2½ cups of tofu or 7 cups of soymilk—reduced “bad” LDL cholesterol levels by an impressive 12.9 percent. Partly because of these findings, in 1999 the FDA began allowing manufacturers to put labels on soy foods touting that 25 grams of soy protein could reduce the risk for heart disease. A year later, the American Heart Association got on board, announcing: “It’s prudent to recommend including soy protein foods in a diet low in saturated fat and cholesterol.” Soy products began flying off supermarket shelves.

Meanwhile, soy was getting buzz for another reason: its possible role in preventing cancer. Those same population studies were showing that Asian women had a fivefold lower breast cancer risk than American women. Mind-blowingly, it was reported that when young Asian women moved to the United States and began to eat like Americans, their risk for cancer went up about 30 percent.

Eager to understand why, researchers focused on compounds called isoflavones. More than a century earlier, scientists had discovered that certain plants—notably some legumes, or beans—produced these compounds to ward off pests such as fungi and bacteria. Soybeans are by far the richest source: They have 50 times more isoflavones by weight than split peas. Could isoflavones also protect humans?

It certainly seemed possible. Scientists have spent decades trying to understand how isoflavones act inside our bodies. But generally, after you eat a soy burger, its isoflavones travel from your intestines into your bloodstream. There, they chemically look a lot like the female hormone estrogen. Back in the early ’90s, scientists weren’t sure whether isoflavones fooled the body into thinking they were estrogen, thereby cranking up estrogen activity, or whether they somehow interfered with estrogen activity and turned it down. It’s an important question, since some reproductive cancers, including certain types of breast cancer, are “estrogen-receptor-positive,” meaning the tumors grow when exposed to estrogen.

The low cancer rates in Asian women suggested an answer: that these estrogen doppelgängers— iso-flavones—protected against cancer by somehow blocking estrogen activity inside breast cells. Backing this up, studies on lab mice showed that isoflavones like genistein, found in soy, could inhibit breast cancer development.

And so, as America embraced pink ribbon campaigns and nationwide walks for a cure, soy was looking like something of a miracle food.

A GROWING CONCERN

But like most nutritional stars, soy soon fell off its pedestal. Research began to emerge suggesting that soy foods didn’t improve heart health as much as earlier studies had suggested. “The evidence wasn’t nearly as robust as people had hoped,” recalls Mark Messina, Ph.D., a former program director at the National Cancer Institute who is now the executive director of the Soy Nutrition Institute, which works with the soybean industry to collect nutrition data.

“A lot of studies came out not showing an effect or showing a very small effect” on heart health, explains American Heart Association spokeswoman Penny Kris-Etherton, Ph.D., a nutrition scientist at Penn State University. In 2006, Kris-Etherton coauthored a new report by the AHA, which concluded that 50 grams of soy protein a day reduced LDL levels by only about 3 percent—not the celebrated 12.9. Some even wondered if lower cholesterol was a side benefit of a better diet in general: As Patisaul puts it, “Was it really the isoflavones in soy lowering cholesterol or the fact that people who start eating soy then start eating less meat?” At any rate, a 3 percent drop is probably not a big deal. “If you’re already a young, healthy person with reasonable cholesterol levels, soy may not do a lot,” Patisaul adds. In its 2006 report, the AHA revised its position, stating that earlier...
research on soy’s remarkable heart benefits had “not been confirmed” (though it still recommends soy as a healthy low-fat plant protein).

There was more bad news to come. In the early 2000s, news spread about a series of studies published by William Helferich, Ph.D., a nutrition scientist at the University of Illinois, and his colleagues. Their work showed that genistein—again, one of those isoflavones found in soy—caused human breast cancer cells to multiply in a petri dish and breast cancer tumors to grow in mice. Helferich also found that genistein made these tumors less responsive to anticancer drugs like tamoxifen. Because soy was still such a nutritional darling, Helferich’s findings were initially met with derision. But with further research, Helferich says, “the tide started to shift.”

What changed? Scientists had come to see that these isoflavones were fickle Jekyll and Hyde-like characters. The big question was which persona they took on in breast cancer cells: Did they prevent tumor growth by thwarting estrogen activity, as the population studies seemed to suggest? Or did they fuel tumor growth by boosting estrogen-like effects, as Helferich’s studies reported?

Nobody seemed to know. One 2006 paper in the Journal of the National Cancer Institute came to two apparently contradictory conclusions. On the one hand: “We cannot recommend widespread use of high-dose isoflavone supplements by women at high risk for breast cancer or by breast cancer survivors.”

But, on the other hand: “There are no data to suggest that consumption of soy foods in amounts consistent with an Asian diet is detrimental to breast health.”

Many physicians began warning breast cancer patients to avoid soy entirely—especially isoflavone supplements, which had become popular, because they can contain highly concentrated doses.

Soon, doctors began raising additional concerns about soy. Estrogen controls a lot of bodily processes, including menstrual cycles and fertility. In fact, this was something that farmers and zoologists had known for a long time. In the 1940s, Australian farmers noticed that their sheep became infertile after they grazed extensively on clover; scientists discovered it was because the type of clover the sheep grazed on is rich in isoflavones. Then, in the 1980s, researchers struggled to understand why zoo cheetahs kept becoming infertile and developing liver problems. Again, isoflavones from their high-soy diets were thought to be one of the major culprits.

People don’t eat clover or dine exclusively on soy—but some research suggested that even a few servings of isoflavones could affect human fertility. A 2009 review of 47 studies revealed that premenopausal women who eat more than two servings of soy a day tend to have lower blood levels of follicle stimulating hormone and luteinizing hormone, responsible for releasing eggs from the ovaries. These changes, they wrote, can delay the release of an egg by about one day in each menstrual cycle. Though it sounds dramatic, experts tend to downplay this finding. A one-day delay in ovulation doesn’t affect a healthy woman’s overall fertility, says Carmen Williams, M.D., a reproductive and developmental biologist at the National Institute of Environmental Health Sciences, an arm of the National Institutes of Health. She adds: “It should be of no concern.”

THE BOTTOM LINE

The biggest unresolved question about soy is whether it protects against or fuels breast cancer. Recent studies point to a fascinating answer: It may actually depend on when you start to eat it. Helferich was feeding genistein to adult mice that already had breast tumors. But new research by Leena Hilakivi-Clarke, Ph.D., professor of oncology at Georgetown University, and others suggests that when rats are fed isoflavones earlier in life, or before they develop tumors, their breast cells actually develop differently. These differences protect them against cancer. And the isoflavones may even help breast cells fight cancer if it does develop.

Hilakivi-Clarke says it’s ideal to start consuming soy before puberty, but that young women could start drinking a cup of soymilk a day “so that one day, if you get breast cancer, you may have better odds of beating it.” That said, you shouldn’t think of soy “as a magic bullet that protects against breast cancer,” says Daniel Doerge, Ph.D., a research chemist with the FDA’s

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**DO YOU KNOW YOUR SOY?**

**EDAMAME** These whole green soybeans are picked before they’re mature. Full of fiber and protein, they’re as unprocessed as it gets.

**SOYMILK** Its creamy taste comes from soaking soybeans in water, then grinding, cooking and filtering them. Soymilk is a protein-rich dairy replacement, but keep an eye out for hidden or added sweeteners.

**SOY PROTEIN ISOLATE** This powdered form of soy adds protein to processed foods. You’ll find it in everything from soy burgers and cereal to shakes and energy bars.

**TEMPEH** A cooked, fermented soybean cake that’s firmer and less processed than tofu. It’s usually mixed with other grains or seeds.

**TOFU** A spongy block made by coagulating soymilk into curds. Soft or firm, it’s a healthy meat substitute.
Square meal
The type of soy you eat does matter. The less processed the food is, the better for your health.

MORE ON THE FOOD WARS Read part one of our series, on gluten, at Self.com/go/foodwars.
National Center for Toxicology Research. It may lower cancer risk slightly, but it’s not a guarantee.

How much soy is OK to eat? The FDA’s recommendation of 25 grams of soy protein is under review and has yet to be revised. Most experts agree that one to two servings a day is healthy and safe—after all, most Japanese consume that amount throughout their lives. The serving suggestion is a range because soy foods contain different amounts of isoflavones—generally, processed forms contain less, though it can differ among brands. Put another way: A good daily amount for a 135-pound woman is about 50 milligrams of isoflavones—equal to roughly 1 cup of tofu, 2 cups of soymilk or two nutrition bars. (Remember, though, that soy is hidden in many packaged foods and would count toward the total.) “Quadruple that amount and you might start running into problems,” Dr. Williams says. (These guidelines apply to men, too, by the way. Research suggests that a few servings a day of soy won’t “feminize” guys or affect their fertility.)

Certain women—notably, those with fibroid tumors or endometriosis—may want to be careful not to exceed these recommendations. Estrogen fuels the growths that lead to fibroids and endometriosis pain, so it’s possible, though not very well studied, that consuming a lot of estrogenic-type foods could make estrogen-driven disease worse,” Patisaul explains. For everyone else, the American Cancer Society’s stance is that “moderate consumption of soy foods appears safe for both breast cancer survivors and the general population, and may even lower breast cancer risk.” However, it’s smart to avoid soy supplements until more research is done.

To that point, the type of soy food you eat does matter. As a rule, the less processed, the better. “In Asia, people just eat real food,” Patisaul explains—think handmade tofu and bowls of edamame. While processing doesn’t seem to affect soy’s nutrition—and can actually bump up its protein content—soy protein powders are often used in foods like cereals, shakes and bars that may be high in sugar and other less nutritious ingredients.

It seems, then, that the pro- and antisoy camps might both be right. Soy is good for you, but it depends on when, how much and what types you eat. As is the case with so many claims in nutrition, the devil is in the details. With soy, some of these details haven’t been worked out yet. Even so, Helferich—who work, remember, tarnished soy’s image in the first place—agrees that soy can definitely be a good thing. “Soy is a healthy food, but it should be a food consumed as part of a varied healthy diet,” he says. So bring on the tofu and the soy lattes and the tempeh. But make room for other healthy foods—and, OK, occasional indulgences—too.

### TOP 5 SOY MYTHS

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<td><strong>SOY CAUSES BREAST CANCER</strong></td>
<td>Most experts agree that one to two servings of soy foods (or roughly 50 milligrams of isoflavones) a day is healthy. Even the American Cancer Society maintains that “moderate consumption of soy foods appears safe for both breast cancer survivors and the general population.” (However, the jury is still out on soy supplements, which are highly concentrated.)</td>
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<td><strong>SOY ALLERGIES ARE COMMON</strong></td>
<td>Studies show only four of every 1,000 children develop allergies to soy; most grow out of it by age 10 (though it’s not unheard of for adults to develop it later). Rarely, people will tolerate soy but react poorly to soy protein isolate, found in some processed foods.</td>
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<td><strong>EATING SOY IS GREAT FOR YOUR HEART</strong></td>
<td>Although earlier research suggested that soy could reduce “bad” LDL cholesterol by almost 13 percent, recent studies have shown it to be more like 3 percent. According to the American Heart Association, “the direct cardiovascular health benefit of soy protein or isoflavone supplements is minimal at best.”</td>
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<td><strong>SOY CAN MESS WITH YOUR FERTILITY</strong></td>
<td>The hormonelike isoflavones in soy have the potential to affect fertility, but only if you’re consuming more than about eight servings a day. “A normal diet that’s rich in soy foods is going to be fine,” says Carmen Williams, M.D., a reproductive and developmental biologist at the National Institute of Environmental Health Sciences.</td>
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<td><strong>GENETICALLY MODIFIED SOY IS BAD FOR YOU</strong></td>
<td>Most U.S. soybean crops (90 percent) are genetically modified to resist agricultural herbicides. “But genetic engineering doesn’t affect the composition of the proteins or nutritional content of the seeds,” explains Bob Goldberg, Ph.D., a molecular, cell and developmental biologist at the University of California in Los Angeles. “There have been hundreds of papers in the peer-reviewed literature that conclude soybeans and other genetically modified foods on the market are safe.”</td>
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