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Whole Soy Story:
The Dark Side of America's Favorite Health Food

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Over the past decade, soy foods have become America's favorite health food. Newspapers, magazines, and best-selling health writers have proclaimed the "joy of soy" and promoted the belief that soy food is the key to disease prevention and maximum longevity.

The possibility that an inexpensive plant food could prevent heart disease, fight cancer, fan away hot flashes, and build strong bodies in far more than 12 ways is seductive. The truth, unfortunately, is far more complex. Soy foods come in a variety of forms, including many heavily processed modern products. Even good forms of soy foods must be eaten sparingly – the way they have been eaten traditionally in Asia. Most important, many respected scientists have issued warnings stating that the possible benefits of eating soy should be weighed against the proven risks. Indeed, thousands of studies link soy to malnutrition, digestive distress, immune-system breakdown, thyroid dysfunction, cognitive decline, reproductive disorders and infertility – even cancer and heart disease.

Americans rarely hear anything negative about soy. Thanks to the shrewd public relations campaigns waged by Archer Daniels Midland (ADM), Protein Technologies International (PTI), the American Soybean Association, and other soy interests, as well as the Food and Drug Administration's (FDA) 1999 approval of the health claim that soy protein lowers cholesterol, soy maintains a "healthy" image.

This article is written for parents who need to know the risks of feeding soy formula to infants, or soy milk and other soy foods to growing children. It's designed for prospective mothers and fathers who need to know the links between soy foods, infertility, and birth defects. Finally, it will serve anyone considering soy as a preventive for menopausal symptoms, osteoporosis, cancer, heart disease, or other ills.

How Much Soy Do Asians Really Eat?

Those who dare to question the benefits of soy tend to receive one stock answer: Soy foods couldn't possibly have a downside because Asians eat large quantities of soy every day and consequently remain free of most western diseases. In fact, the people of China, Japan, and other countries in Asia eat very little soy. The soy industry's own figures show that soy consumption in China, Indonesia, Korea, Japan, and Taiwan ranges from 9.3 to 36 grams per day. [1] That's grams of soy food, not grams of soy protein alone. Compare this with a cup of tofu (252 grams) or soy milk (240 grams). [2] Many Americans today think nothing of consuming a cup of tofu, a couple glasses of soy milk, handfuls of soy nuts, soy "energy bars," and veggie burgers. Infants on soy formula receive the most of all, both in quantity and in proportion to body weight.

In short, there is no historical precedent for eating the large amounts of soy food now being consumed by infants fed soy formula and vegetarians who favor soy as their main source of protein, or for the large amounts of soy being recommended by Dr. Andrew Weil, Dr. Christiane Northrup, and many other popular health experts.

What's more, the rural poor in China have never seen-let alone feasted on-soy sausages, chili made with Textured Vegetable Protein (TVP), tofu cheesecake, packaged soy milk, soy "energy bars," or other newfangled soy products that have infiltrated the American marketplace.

The Right Stuff

The ancient Chinese honored the soybean with the name "the yellow jewel" but used it as "green manure" – a cover crop plowed under to enrich the soil. Soy did not become human food until late in the Chou Dynasty (1134-246 B.C.), when the Chinese developed a fermentation process to make soybean paste, best known today by its Japanese name, miso. [3] Soy sauce – the natural type sold under the Japanese name shoyu – began as the liquid poured off during the production of miso. Two other popular fermented soy foods, natto and tempeh, entered the food supply around 1000 A.D. or later in Japan and Indonesia, respectively.

Tofu came after miso. Legend has it that, in 164 B.C., Lord Liu An of Huai-nan, China-a renowned alchemist, meditator, and ruler – discovered that a purée of cooked soybeans could be precipitated with nigari (a form of magnesium chloride found in seawater) into solid cakes, called tofu. In Japan, as in China, tofu was rarely served as a main course anywhere except in monasteries. Its most popular use was – and is – as a few bland little blocks in miso soup or fish stock.

The Chinese almost never ate boiled or baked soybeans or cooked with soy flour except in times of famine. Modern soy products such as soy protein isolate (SPI), TVP, soy-protein concentrate, and other soy-protein products made using high-tech industrial processes, were unknown in Asia until after World War II. [4]

Contrary to popular belief, neither soy milk nor soy infant formula is traditional in Asia. Soy milk originated as a byproduct of the process of making tofu; the earliest reference to it as a beverage appeared in 1866. [5] By the 1920s and 1930s, it was popular in Asia as an occasional drink served to the elderly. 6-8 The first person to manufacture soy milk in China was actually an American – Harry Miller, a Seventh Day Adventist physician and missionary. [9]

The first soy infant formulas in China were developed in the 1930s and have never been widely used.[10-14] Today, babies in Asia are almost always breastfed for at least the first six months, then switched to a dairy-based infant formula. Orphans and others who cannot be breastfed by a wet nurse are fed from birth on dairy formulas. [15]

Claims that soybeans have been a major part of the Asian diet for more than 3,000 years, or from "time immemorial," are simply not true.

Processing Matters

Soy in the West has been a product of the industrial revolution – an opportunity for technologists to develop cheap meat substitutes, to find clever new ways to hide soy in familiar food products, to formulate soy-based pharmaceuticals, and to develop a renewable, plant-based resource that could replace petroleum-based plastics and fuels.

For years, the soy protein left over from soy-oil extraction went to animals and poultry. Now that food scientists have discovered inexpensive ways to improve or disguise the color, flavor, "bite characteristics," and "mouth feel" of soy protein-based products, soy is being aggressively marketed as a "people feed." Although the newer refining techniques yield blander, purer soy proteins than the "beany," hard-to-cover-up flavors of the past, the main reason that soy foods now taste and look better is the lavish use of unhealthy additives such as sugar and other sweeteners, salt, artificial flavorings, colors, and monosodium glutamate (MSG).

Soy now lurks in nearly 60 percent of the foods sold in supermarkets and natural food stores. Much of this is "hidden" in products where it wouldn't ordinarily be expected, such as fast-food burgers and Bumblebee canned tuna. Soy is also a key ingredient in ersatz products with names like Soysage,

Not Dogs, Fakin Bakin, Sham Ham, and TofuRella, which have been named after and made to look like the familiar meat and diary products they are intended to replace.

There's nothing natural about these modern soy protein products. Textured soy protein, for example, is made by forcing defatted soy flour through a machine called an extruder under conditions of such extreme heat and pressure that the very structure of the soy protein is changed. Production differs little from the extrusion technology used to produce starch-based packing materials, fiber-based industrial products, and plastic toy parts, bowls, and plates. [16]

The process of making soy protein isolate (SPI) begins with defatted soybean meal, which is mixed with a caustic alkaline solution to remove the fiber, then washed in an acid solution to precipitate out the protein. The protein curds are then dipped into another alkaline solution and spray-dried at extremely high temperatures. SPI is then often spun into protein fibers using technology borrowed from the textile industry. These refining processes remove "off flavors," "beany" tastes, and some of the worst flatulence-producing components. They improve digestibility, but vitamin, mineral, and protein quality are sacrificed, and levels of carcinogens such as nitrosamines are increased. [17-22] SPIs appear in so many products that consumers would never guess that the Federation of American Societies for Experimental Biology (FASEB) decreed in 1979 that the only safe use for SPIs was for sealers for cardboard packages. [23]

Antinutrients and Toxins in Soy

Scientists who have studied the use of soy protein in animal feeds over the years have discovered a number of components in soy that cause poor growth, digestive distress, and other health problems. [24-27] To list just a few of these: Protease inhibitors interfere with protein digestion and have caused malnutrition, poor growth, digestive distress, and pancreatitis. [28] Phytates block mineral absorption, causing zinc, iron, and calcium deficiencies. [29-34] Lectins and saponins have caused leaky gut and other gastrointestinal and immune problems. [35-36] Oxalates-surprisingly high in soy may cause problems for people prone to kidney stones and women suffering from vulvodynia, a painful condition marked by burning, stinging, and itching of the external genitalia. [37, 38] Finally, oligosaccharides give soy its notorious reputation as a gas producer. Although these are present in all beans, soy is such a powerful "musical fruit" that the soy industry has identified "the flatulence factor" as a major obstacle that must be overcome for soy to achieve full consumer acceptance. [39, 40]

Apologists for soy dismiss such claims, saying that food processing and home cooking remove most of these antinutrients. In fact, modern processing removes most of them, but not all. The levels of heat and pressure needed to remove all protease inhibitors, for example, severely damage soy protein and make it harder to digest. The trick is to eliminate the most antinutrients while doing the least damage to the soy protein. Success varies widely from batch to batch. [41-44]

For years, the soy industry tried to improve the quality of animal feeds by finding better ways to get rid of these undesirable antinutrients. Having failed, they routinely supplement animal feeds heavily with vitamins, minerals, and methionine, a sulfur-containing amino acid that is low in soy. Even so, makers of animal chows are still limited in the amount of soy they can add without causing growth and fertility problems. Food processors making soy-protein products for people may or may not add these supplements. Generally, calcium and vitamin D are added to soy milk so it can compete with dairy products.

Today, the soy industry has switched tactics – from trying to remove unwanted antinutrients to trying to convince people that they are actually a good thing. Protease inhibitors, saponins, and lectins are being touted as curers of cancer or lowerers of cholesterol, while phytates are being recommended for their ability to remove toxic minerals such as cadmium and excess iron from the body. [45-51]

Although some of these uses look promising, it is important to note that researchers are not achieving these successes using regular soy foods. Most take carefully extracted components and administer them in carefully measured and monitored pharmaceutical doses. News headlines to the contrary, there is no reason to think that just eating a lot of soy foods will do the trick.

Soy Allergens

Soy is one of the top eight allergens that cause immediate hypersensitivity reactions such as coughing, sneezing, runny nose, hives, diarrhea, difficulty swallowing, and anaphylactic shock. Delayed allergic responses are even more common and occur anywhere from several hours to several days after the food is eaten. These have been linked to sleep disturbances, bedwetting, sinus and ear infections, crankiness, joint paint, chronic fatigue, gastrointestinal woes, and other mysterious symptoms. [52, 53]

Soy allergies are on the rise for three reasons: the growing use of soy infant formula (now 20 to 25 percent of the formula market), the increase in soy-containing foods in grocery stores, the possibility of the greater allergenicity of genetically modified soybeans. [54] Although severe reactions to soy are rare compared to reactions to peanuts, tree nuts, fish, and shellfish, soy has been underestimated as a cause of food anaphylaxis. Recently, after a young girl in Sweden suffered an asthma attack and died after eating a hamburger that contained only 2.2 percent soy protein, Swedish researchers looked into a possible soybean connection. They concluded that the soy-in-the-hamburger case was not a fluke, and that minute amounts of soy "hidden" in regular food had caused four of the total of five deaths caused by allergic reactions in Sweden between 1993 and 1996. Of the children who suffered fatal attacks, all had been able to eat soy without any adverse reactions right up until the dinner that caused their deaths. [55] According to the Swedish Ministry of Health and Social Affairs, children at highest risk are those who suffer from peanut allergies and asthma; parents of such children should make every effort to eliminate all soy from their children's diets. [56]

Soy and the Thyroid: A Pain in the Neck

More than 70 years of human, animal, and laboratory studies show that soybeans put the thyroid at risk. The chief culprits are the plant hormones in soy known as phytoestrogens or isoflavones. [57-59] The United Kingdom's Committee on Toxicology has identified several populations at special risk: infants on soy formula, vegans who use soy as their principal meat and dairy replacements, and men and women who self-medicate with soy foods and/or isoflavone supplements in an attempt to prevent or reverse menopausal symptoms, cancer, or heart disease. [60]

Infants with congenital hypothyroidism need 18 to 25 percent higher doses of thyroxine drug than usual if they are bottle-fed with soy formula. [61] Likewise, adults who boost their thyroid with drugs such as Synthroid while also eating thyroid-inhibiting foods such as soy put extreme stress on their thyroids. Toxicologist Michael Fitzpatrick, Ph.D., points out that this is the way that researchers induce thyroid cancers in laboratory animals. [62]

Soy and Reproduction: Breeding Discontent

Scientists have known since the mid-1940s that phytoestrogens can impair fertility. Fertility problems in cows, sheep, rabbits, cheetahs, guinea pigs, birds, and mice have all been reported. [63, 64]

Although scientists discovered only recently that soy lowers testosterone levels,[65] tofu has traditionally been used in Buddhist monasteries to decrease the libido, and by Japanese women to punish straying husbands. Humans and animals appear to be the most vulnerable to the effects of soy estrogens prenatally, during infancy and puberty, during pregnancy and lactation, and during the

hormonal shifts of menopause. Of all these groups, infants on soy formula are at the highest risk because of their small size and developmental phase, and because formula is their main source of nutrient. [66, 67]

A crucial time for the programming of the human reproduction system is right after birth – the very time when bottles of soy formula are given to many non-breastfed babies. Normally during this period, the body surges with natural estrogens, testosterones, and other hormones that are meant to program the baby's reproductive development from infancy through puberty and into adulthood. For infants on soy formula, this programming may be interrupted. [68-70]

Male infants experience a testosterone surge during the first few months of life and produce androgens in amounts equal to those of adult men. So much testosterone at such a tender age is needed to program the body for puberty, the time when a male's sex organs should develop and he should begin to express male characteristics such as facial and pubic hair and a deep voice. If receptor sites intended for the hormone testosterone are occupied by soy estrogens, however, appropriate development may never take place. [71-74] To date, most of the evidence damning soy formula can be found only in animal studies, because investigations in which humans' sex hormone levels are lowered experimentally cannot ethically be done. However, in the years since soy formula has been in the marketplace, parents and pediatricians have reported growing numbers of boys whose physical maturation is either delayed or does not occur at all. Breasts, underdeveloped gonads, undescended testicles (cryptorchidism), and steroid insufficiencies are increasingly common. Sperm counts are also falling. [75-79]

Soy formula is bad news for girls as well. Natural estrogen levels approximately double during the first month of life, then decline and remain at low levels until puberty. With increased estrogens in the environment in the diet, an alarming number of girls are entering puberty much earlier than normal. [80-82] One percent of girls now show signs of puberty, such as breast development or pubic hair, before the age of three. By the age of eight, 14.7 percent of Caucasian girls and 48.3 percent of African American girls had one or both of these characteristics. [83] The fact that blacks experience earlier puberties than whites is not a racial difference but a recent phenomenon. [84, 85]

Most experts blame this epidemic of "precocious puberty" on environmental estrogens from plastics, pesticides, commercial meats, etc., but some pediatric endocrinologists believe that soy is a contributor. [86] Of all the estrogens found in the environment, soy is the likeliest explanation of why African American girls reach puberty so quickly. Since its establishment in 1974, the federal government's Women, Infants and Children (WIC) program has provided free infant formula to teenage and other low-income mothers while failing to encourage breastfeeding. Because of perceived or real lactose intolerance, black babies are much more likely to receive soy formula than Caucasian babies.

Early maturation in girls heralds reproductive problems later in life, including amenorrhea (failure to menstruate), anovulatory cycles (cycles in which no egg is released), impaired follicular development (follicles failing to mature and develop into healthy eggs), erratic hormonal surges, and other problems associated with infertility. Because the mammary glands depend on estrogen for their development and functioning, the presence of soy estrogens at a susceptible time might predispose girls to breast cancer, another condition that is on the rise and definitively linked to early puberty. [87]

Recently, a team of researchers headed by Brian L. Strom, MD, studied the use of soy formula and its long-term impact on reproductive health. They announced only one adverse finding: longer, more painful menstrual periods among women who'd been fed soy formula in infancy. [88] Dr. Strom's conclusion that the results were "reassuring" made newspaper headlines all over the world, though the data in the body of the report were anything but. Indeed, data left out of the headlines and buried in the report revealed higher incidences of allergies and asthma, and higher rates of cervical cancer,

polycystic ovarian syndrome, blocked fallopian tubes, and pelvic inflammatory disease. [89] Although thyroid damage from soy formula has been the principal concern of critics for decades, the researchers excluded thyroid function as a subject for study. Not surprisingly, this study was funded in part by the infant-formula industry.

Most of the fears concerning soy formula have focused on estrogens. There are other problems as well, notably much higher levels of aluminum, fluoride, and manganese than are found in either breastmilk or dairy formulas. [90-96] All three metals have the potential to adversely affect brain development. Although trace amounts of manganese are vital to the development of the brain, toxic levels accrued from ingestion of soy formula during infancy have been found in children suffering from attention-deficit disorders, dyslexia, and other learning problems. [97, 98]

Soy apologists sometimes argue that the plant hormones in soy formula could not possibly be harmful because Japanese women eat a lot of soy products and so must have high levels of phytoestrogens in their breastmilk. Researchers, however, have measured the soy isoflavones in breastmilk and found them low even in vegetarian women who consume copious quantities of tofu, soy milk, soy protein shakes, and other soy foods. [99-101]

Limited evidence, however, suggests that vegetarian women who eat a lot of soy foods during pregnancy may put their infants at risk in terms of their future reproductive health, fertility, and possibly increased risk of breast cancer. All of the problems that have befallen infants on soy formula, as well as estrogen-related birth defects, have occurred (in animal studies, at least) to the offspring of mothers who were given high doses of soy during pregnancy. [102] One of these birth defects that has been linked to vegetarian diets in humans is hypospadias, a developmental disorder in which the opening of the penis is located on the underside of the shaft. [103]

Until soy estrogens are definitely linked to reproductive-tract abnormalities, infertility, and other health problems in humans, most health authorities recommend that we "wait and see". This could be a terrible mistake.

In the 1940s and 1950s, another estrogen, diethylstilbestrol (DES), was widely given to Western women early in their pregnancies in a misguided attempt to prevent miscarriage. That fact is relevant not only because DES bears a striking structural similarity to some plant estrogens – including soy isoflavones – but because it took more than 20 years before the full spectrum of harmful effects was observed. [104, 105]

DES is 100,000 times more potent than soy phytoestrogens. However, the large quantities of phytoestrogens in soy products are more than enough to counteract their lower potency. When the effects of isoflavones in fetal and neonatal animals have been studied, they have paralleled those observed in human infants exposed to DES. [106, 107] Recent studies indicate that the soy isoflavone known as genistein may be even more carcinogenic than DES. [108]

Yet the belief persists that soy hormones are "safe" because they are "weak" and "natural". Although the soy industry has claimed that soy estrogens are anywhere from 10,000 to 1,000,000 times weaker than the human estrogen estradiol, the correct figure is only 1,200 times as weak. [109] Though this still sounds quite weak, it is not-because of the quantity of these estrogens ingested by infants on soy formula, and by children and adults who eat soy every day. These individuals consume far more soy estrogens than were ever part of a traditional diet in Asia. The average isoflavones intake in China is 3 milligrams, or 0.05 mg per kilogram of body weight. In Japan, the figures range from 10 to 28 mg, or 0.17 to 0.47 isoflavones per kg of body weight. In contrast, infants receiving soy formula average 38 mg of isoflavones, which comes to a shocking 6.25 mg/kg of body weight. Compare that dose to the 0.47 mg/kg per day fed to healthy Japanese adult men and women who experienced thyroid suppression after just three months – or to the 0.75 mg/kg of isoflavones fed

to American women who experienced hormonal changes sufficient to skew their menstrual cycles after just one month. [110] Although children and teenagers are less vulnerable than infants, their young bodies are still developing, and highly vulnerable to endocrine-system disruption by soy. And soy has been shown to pass through the placentas of pregnant women to their unborn babies.

Meanwhile, the jury is still out on whether soy might help alleviate menopausal symptoms or prevent osteoporosis and breast cancer. The soy industry's top scientists, convened at the Fifth International Symposium on the Role of Soy in the Preventing and Reversing Chronic Disease (held in Orlando, Florida, September 21-24, 2003), conceded that the data are confusing and contradictory, with some studies suggesting that soy might be helpful, and others showing that soy contributes to osteoporosis and promotes breast cancer.

What's certain is that the levels of soy estrogens that might possibly have a beneficial effect on hormonally related diseases have been proven to jeopardize the health of the thyroid. Likewise, the 25 grams of soy protein per day touted by the FDA to lower cholesterol is very likely to harm the thyroid, and thus increase one of the risk factors for heart disease.

The bottom line is that the safety of soy foods has yet to be proven, and that human beings have become guinea pigs in what Daniel M. Sheehan, formerly senior toxicologist with the FDA's National Center for Toxicological Research, has called a "large, uncontrolled and basically unmonitored human experiment." [111]

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