History and Health Concerns of Soybeans

HISTORY OF SOYBEANS

SOYBEANS COME TO US from the Orient. During the Chou Dynasty (1134-246 BC) the soybean was designated one of the five sacred grains, along with barley, wheat, millet and rice. However, the pictograph for the soybean, which dates from earlier times, indicates that it was not first used as a food; for whereas the pictographs for the other four grains show the seed and stem structure of the plant, the pictograph for the soybean emphasizes the root structure. Agricultural literature of the period speaks frequently of the soybean and its use in crop rotation. Apparently the soy plant was initially used as a method of fixing nitrogen. The soybean did not serve as a food until the discovery of fermentation techniques, sometime during the Chou Dynasty. Thus the first soy foods were fermented products like tempeh, natto, miso and shogu (soy or tamari sauce). At a later date, possibly in the 2nd century B.C., Chinese scientists discovered that a puree of cooked soybeans could be precipitated with calcium sulfate or magnesium sulfate (plaster of Paris or Epsom salts) to make a smooth pale curd—tofu or bean curd.

The use of fermented and precipitated soy products soon spread to other parts of the Orient, notably Japan and Indonesia. Although the highly flavored fermented products have elicited greater interest among scientists and epicures, it is the bland precipitated products that are most frequently used, accounting for approximately 90% of the processed soybeans consumed in Asia today. The increased reliance on bean curd as a source of protein, which occurred between 700 A. D. and the present time, has not necessarily been a beneficial change for the populations of the Orient and Southeast Asia.

The information in this article was abstracted from an article written by Sally Fallon and Mary Enig, Ph.D. (an international expert renown in the field of lipid chemistry) for Health Freedom News *in September of 1995. The reader should make allowance for the fact that the authors were writing for a public that is not exclusively vegetarian.*

FIT FOR HUMAN CONSUMPTION?

The Chinese did not eat the soybean as they did other pulses (legumes) such as the lentil, because the soybean contains large quantities of a number of harmful substances. First among them are potent enzyme inhibitors which block the action of trypsin and other enzymes needed for protein digestion. These"antinutrients" are not completely deactivated during ordinary cooking and can produce serious gastric distress, reduced protein digestion and chronic deficiencies in amino acid uptake. In test animals, diets high in trypsin inhibitors cause enlargement and pathological conditions of the pancreas, including cancer. The soybean also contains hemaglutinin, a clot-promoting substance that causes red blood cells to clump together. Trypsin inhibitors and hemaglutinin have been rightly labeled growth depressant substances. Fortunately they are deactivated during the process of fermentation. However, in precipitated products, enzyme inhibitors concentrate in the soaking liquid rather than in the curd. Thus in tofu and bean curd, these enzyme inhibitors are reduced in quantity, but not completely eliminated.

Soybeans are also high in phytic acid or phytates. This is an organic acid, present in the bran or hulls of all seeds, which blocks the uptake of essential

minerals—calcium, magnesium, iron and especially zinc—in the intestinal tract. Although not a household word, phytates have been extensively studied. Scientists are in general agreement that grain and legume based diets high in phytates contribute to widespread mineral deficiencies in third world countries. Analysis shows that calcium, magnesium, iron and zinc are present in the plant foods eaten in these areas, but the high phytate content of soy and rice based diets prevents their absorption. The soybean has a higher phytate content than any other grain or legume that has been studied. Furthermore, it seems to be highly resistant to many phytate reducing techniques such as long, slow cooking. Only a long period of fermentation will significantly reduce the phytate content of soybeans.

Illustrated by Akiko Aoyagi

The production of shoyu or soy sauce originally involved the fermentaion of soy beans in natural salt and water in huge cedar vats, generally between 12 to 18 months. Now defatted soybean meal is brewed in large tanks for about 4 to 6 months at a set temperature and humidity.

Thus fermented products such as tempeh and miso provide nourishment that is easily assimilated, but the nutritional value of tofu and bean curd, both high in phytates, is questionable. When precipitated soy products are consumed with meat, the mineral blocking effects of the phytates are reduced. The Japanese traditionally eat tofu as part of a mineral-rich fish broth. Vegetarians who consume tofu and bean curd as a substitute for meat and dairy products risk severe mineral deficiencies. The results of calcium, magnesium and iron deficiency are well known, those of zinc are less so. Zinc is called the intelligence mineral because it is needed for optimal development and functioning of the brain and nervous system. It plays a role in protein synthesis and collagen formation. It is involved in the blood sugar control mechanism and thus protects against diabetes; it is needed for a healthy reproductive system. Zinc is a key component in numerous vital enzymes and plays a role in the immune system. Phytates found in soy products interfere with zinc absorption more completely than with other minerals. Literature extolling soy products tends to minimize the role of zinc in human physiology, and to gloss over the deleterious effect of diets high in phytic acid. Milk drinking is given as the reason second generation Japanese in America grow taller than their native ancestors. Some investigators postulate that the reduced phytate content of the American diet—whatever maybe its other deficiencies—is the true explanation, pointing out that Asian and Oriental children who do not get enough meat and fish products to counteract the effects of a high phytate diet, frequently suffer rickets, stunting and other growth problems.

Marketing the Soybean

The truth is, however, that most Americans are unlikely to adopt traditional soy products as their principle food. Tofu, bean curd and tempeh have disagreeable texture and are too bland for the Western palate; pungent and tasty miso and natto lose out in taste; only soy sauce enjoys widespread popularity as a condiment. The soy industry has therefore looked for other ways to market the superabundance of soybeans now grown in the United States. Large scale cultivation of the soybean in the United States began only after the Second World War, and quickly rose to 140 billion pounds per year. Most of the crop is made into animal feed, soy oil for hydrogenated fats, margarine and shortening.

During the past 20 years, the industry has concentrated on finding markets for the byproducts of soy oil manufacture, including soy "lecithin", made from the oil sludge, and soy protein products, made from defatted soy flakes, a challenge that has

involved overcoming consumer resistance to soy products, generally considered tasteless poverty foods. “The quickest way to gain product acceptability in the less affluent society," said a soy industry spokesman, "...is to have the product consumed on its own merit in a more affluent society." Hence the proliferation of soy products resembling traditional American foods—soy milk for cow’s milk, soy baby formula, soy yogurt, soy ice cream, soy cheese, soy flour for baking, and textured soy protein as meat substitutes, usually promoted as high protein, low-fat, no cholesterol "health foods" to the upscale consumer increasingly concerned about his health. The growth of vegetarianism among the more affluent classes has greatly accelerated the acceptability and use of these artificial products. Unfortunately they pose numerous dangers.

Processing Denatures and Dangers Remain

The production of soy milk is relatively simple. In order to remove as much of the trypsin inhibitor content as possible, the beans are first soaked in an alkaline solution. The pureed solution is then heated to about 115 degrees Centigrade in a pressure cooker. This method destroys most (but not all) of the anti-nutrients but has the unhappy side effect of so denaturing the proteins that they become very difficult to digest and much reduced in effectiveness. The phytate content remains in soy milk to block the uptake of essential minerals. In addition, the alkaline soaking solution produces a carcinogen, lysinealine, and reduces the cystine content, which is already low in the soybean. Lacking cystine, the entire protein complex of the soybean becomes useless unless the diet is fortified with cystine-rich meat, eggs, or dairy products. Most soy products that imitate traditional American food items, including baby formulas and some brands of soy milk, are made with soy protein isolate, that is the soy protein isolated from the carbohydrate and fatty acid components that naturally occur in the bean. Soy beans are first ground and subjected to high-temperature and solvent extraction processes to remove the oils. The resultant defatted meal is then mixed with an alkaline solution and sugars in a separation process to remove fiber. Then it is precipitated and separated using an acid wash. Finally the resultant curds are neutralized in an alkaline solution and spray dried at high temperatures to produce high protein powder. This is a highly refined product in which both vitamin and protein quality are compromised. Moreover, some trypsin inhibitors remain, even after such extreme refining. Trypsin inhibitor content of soy protein isolate can vary as much as 5-fold. In rats, even low level trypsin inhibitor soy protein isolate feeding results in reduced weight gain compared to controls. Soy product producers are not required to state trypsin inhibitor content on labels, nor even to meet minimum standards, and the public, trained to avoid dietary cholesterol, a substance vital for normal growth and metabolism, has never heard of the potent anti-nutrients found in cholesterol-free soy products.

Soy Formula Is Not the Answer

Soy protein isolate is the main ingredient of soy-based infant formulas. Along with trypsin inhibitors, these formulas have a high phytate content. Use of soy formula has caused zinc deficiency in infants. Aluminum content of soy formula is 10 times greater than milk-based formula, and 100 times greater than unprocessed milk. Aluminum has a toxic effect on the kidneys of infants, and has been implicated as cause in Alzheimer's in adults. Soy milk formulas are often given to babies with milk allergy; but allergies to soy are almost as common as those to milk. Soy formulas lack cholesterol which is absolutely essential for the development of the brain and nervous system; they also lack lactose and galactose, which play an equally important role in the development of the nervous system. I would strongly discourage the use of soy formulas.

Nitrosamines, which are potent carcinogens, are often found in soy protein foods, and are greatly increased during the high temperature drying process. Not surprisingly, animal feeding studies show a lower weight gain for rats on soy formula than those on whole milk, high-lactose formula Similar results have been observed in children on macrobiotic diets which include the use of soy milk and large amounts of whole grains. Children brought up on high-phytate diets tend to be thin and scrawny.

Fabricated Soy Foods

A final indignity to the original soy bean is high-temperature, high-pressure extrusion processing of soy protein isolate to produce textured vegetable protein (TVP). Numerous artificial flavorings, particularly MSG, are added to TVP products to mask their strong "beany" taste, and impart the flavor of meat. Soy protein isolate and textured vegetable protein are used extensively in school lunch programs, commercial baked goods, diet beverages and fast food products. They are heavily promoted in third world countries and form the basis of many food give-away programs. These soy products greatly inhibit zinc and iron absorption. In test animals they cause enlarged organs, particularly the pancreas and thyroid gland, and increased deposition of fatty acids in the liver. Human feeding tests to determine the cholesterol lowering properties of soy protein isolate have not shown them to be effective. Nevertheless, they are often promoted as having beneficial effects on cholesterol levels.

Cancer Preventing or Cancer Causing?

The food industry also touts soy products for their cancer preventing properties. Isoflavone aglycones are anticarcinogenic substances found in traditionally fermented soybean products. However, in non-fermented soy products such as tofu and soy milk, these isoflavones are present in an altered form as beta-glycoside conjugates, which have no anti-carcinogenic effect.

Some researchers believe the rapid increase in liver and pancreatic cancer in Africa is due to the introduction of soy products there. The fatty acid profile of the soybean includes large amounts of beneficial omega-3 fatty acids compared to other pulses (legumes); but these omega-3 fatty acids are particularly susceptible to rancidity when subjected to high pressures and temperatures. This is exactly what is required to remove oil from the bean, as soybean oil is particularly difficult to extract. Hexane or other solvents are always used to extract oil from soybeans, and traces remain in the commercial product.

While fermented soy products contain protein, vitamins, anti-carcinogenic substances and important fatty acids, they can under no circumstances be called nutritionally complete. Like all pulses, the soybean lacks vital sulfur-containing amino acids cystine and methionine. These are usually supplied by rice and other grains in areas where the soybean is traditionally consumed. Soy should never be considered as a substitute for animal products like meat or milk. Claims that fermented soy products like tempeh can be relied on as a source of vitamin B12, necessary for healthy blood and nervous system, have not been supported by scientific research. Finally, soybeans do not supply all-important fat-soluble vitamins D and preformed A (retinol) which act as catalysts for the proper absorption and utilization of all minerals and water soluble vitamins in the diet. These "fat- soluble activators" are found only in certain animal foods such as organ meats, butter, eggs, fish and shellfish. Carotenes from plant foods and exposure to sunlight are not sufficient to supply the body's requirements for vitamins A and D. *[The existence of many healthy long-time vegetarians contradicts this assertion—Ed.*] Soy products often replace animal products in third world countries where intake of B12 and fat soluble A and D are already low. Soy products actually increase requirements for vitamins B12 and D.

Are soy products easy to digest, as claimed? Fermented soy products probably are, but unfermented products with their cargo of phytates, enzyme inhibitors, rancid fatty acids and altered proteins most certainly are not. Pet food manufacturers promote soy free dog and cat food as "highly digestible."

Only Fermented Soy Products Are Safe

To summarize, traditional fermented soy products such as miso, natto and tempeh, which are usually made with organically grown soybeans, have a long history of use that is generally beneficial when combined with other elements of the Oriental diet including rice, sea foods, fish broth, organ meats and fermented vegetables. The value of precipitated soybean products is problematical, especially when they form the major source of protein in the diet. Modern soy products including soy milks and artificial meat and dairy products made from soy protein isolate and textured vegetable protein are new to the diet and pose a number of serious problems. ❒