

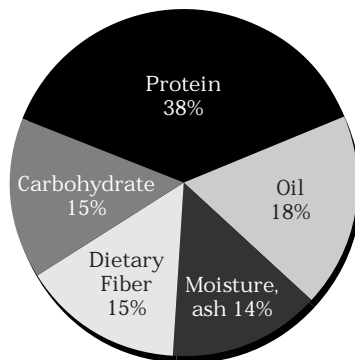
SOY

& HEALTH

The Healthful, Balanced Nutrient



Nutrient Profile of a Whole Soybean



The World Health Organization has established that soy protein contains enough of all the essential amino acids to meet human requirements when consumed at the recommended level of protein intake, and is considered equivalent to animal proteins in quality.³ Soybeans are high in protein, containing 38% by weight, and have a favorable amino acid profile.^{1,3} Other types of legumes have an average of 20% to 30% protein. Most plant proteins are low in certain essential amino acids. Grains are usually low in lysine, and beans are typically low in the sulfur amino acids, methionine and cysteine. These sulfur amino acids

are also limiting in soybeans, but are present in higher quantities in soy than in other beans.¹ The World Health Organization has established that soy protein contains enough of all the essential amino acids to meet human requirements when consumed at the recommended level of protein intake, and is considered equivalent to animal proteins in quality.³

Soybeans are the world's leading edible oil crop.⁴ Oil makes up about 18% of the weight in a soybean. Soy oil is 85% unsaturated, and is very high in the essential fats, linoleic and linolenic acids.^{4,5} The oil also contains phospholipids which are typically separated out in the refining process, creating the valuable byproduct, lecithin.⁵

The carbohydrate fraction of the soybean makes up about 30% of the weight, with 15% fiber and 15% sugars.⁵ Soy is an excellent source of fiber. The fiber is often separated out in the process of creating various soyfoods. It is then used as an additive to enhance the fiber content of other foods, such as enteral nutrition products.⁶ The sugars in soybeans are largely indigestible by humans.⁵

Forms of Soyfoods

Soybeans are extremely versatile, and are made into an astounding variety of foods.⁷ Whole soybeans are not often eaten in the United States, but are popular in Asian countries. Fresh, immature soybeans can be cooked as a vegetable, either in or out of the pod. They can also be sprouted before cooking. Mature, dry soybeans can be cooked and added to all kinds of soups, stews or casseroles. Roasted soynuts are a nutritious snack and are similar to roasted peanuts.⁷

Soyfoods have been used in Asian countries for hundreds of years. Tofu, a curd made from cooked, pureed soybeans, is a traditional Asian food which is now gaining popularity in the United States. It has a bland flavor which allows it to blend well with all kinds of foods. It can easily take the place of eggs or dairy products in recipes, as well as being used in traditional recipes. Miso is a fermented paste of soybean combined with a grain such as rice or barley. It is a staple in Chinese and Japanese cuisine. Natto is fermented, cooked whole soybeans. Tempeh is a combination of whole cooked soybeans and grains, cultured with an edible mold. It is a traditional Indonesian food. Soy sauce is a combination of soybeans, wheat, yeast, and salt, which is fermented for over a year. However, most American soy sauce is made by a different, faster process. Soy milk is the liquid expressed from cooked, pureed soybeans. It can be used in the same ways as cow's milk.⁷

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There are some soy products which are very familiar to U.S. consumers. Soybean oil has been used in the United States for decades. It is found in numerous products such as margarine, mayonnaise, salad dressing and shortening. Soy-based infant formulas have been used since the 1920s, and have gone through many changes and improvements. At first soy flour was used as the protein source, but now isolated soy protein is used. Soy flour is made by grinding and screening defatted soy flakes. It is used in baked products to increase protein levels and to improve baking characteristics. Some soy products are designed to be used as additives to enhance other foods. Soy isolates are almost pure protein, which is extracted from soybeans by means of a chemical process. Soy concentrates contain both the protein and fiber from soy. Textured soy protein is made from defatted soy flour, or from a mixture of

NUTRIENT CONTENT OF SOYFOODS

SOYFOOD	Kcal	Protein	Fat	CHO	Crude Fiber	Calcium	Iron	Zinc	Thiamin	Riboflavin	Niacin	Vit B6	Folate
(100 grams)		(g)	(g)	(g)	(g)	(mg)	(mg)	(mg)	(mg)	(mg)	(mg)	(mg)	(mcg)
MISO	206	11.8	6.1	28.0	2.5	66	2.74	3.32	0.10	0.25	0.86	0.22	33.0
NATTO	212	17.7	11.0	14.4	1.6	217	8.6	3.03	0.16	0.19	0	N/A	N/A
SOY FLOUR, defatted	329	47.0	1.2	38.4	4.3	241	9.24	2.46	0.70	0.25	2.61	0.57	305.4
SOY FLOUR, full-fat, raw	436	34.5	20.6	35.2	4.7	206	6.37	3.92	0.58	1.16	4.32	0.46	345.0
SOY PROTEIN concentrate	332	58.1	0.5	31.2	3.8	363	10.78	4.40	0.32	0.14	0.72	0.13	340.0
SOY PROTEIN isolate	338	80.7	3.4	7.4	0.3	178	14.5	4.03	0.18	0.10	1.44	N/A	176.0
SOY SAUCE, tamari	60	10.5	0.1	5.6	0	20	2.38	0.43	0.06	0.15	3.95	0.20	18.2
SOYBEANS, boiled	173	16.6	9.0	9.9	2.0	102	5.14	1.15	0.16	0.29	0.40	0.23	53.8
SOYBEANS, roasted	474	35.2	25.4	33.6	4.6	138	3.9	3.14	0.10	0.15	1.41	0.21	211.0
SOY MILK	33	2.8	1.9	1.8	1.1	4	0.58	0.23	0.16	0.07	0.15	0.04	1.5
TEMPEH	199	19.0	7.7	17.0	3.0	93	2.26	1.81	0.13	0.11	4.63	0.30	52.0
TOFU, raw, firm	145	15.8	8.7	4.3	0.2	205	10.47	1.57	0.16	0.10	0.38	0.09	29.3
TOFU, raw, regular	76	8.1	4.8	1.9	0.1	105	5.36	0.80	0.08	0.05	0.20	0.05	15.0

Source: Composition of Foods: USDA Handbook #8-16.

soy flour and soy concentrate, which is compressed and dehydrated. When rehydrated it has a texture similar to ground meats, and is commonly used as a meat extender or substitute.⁷

Nutrients in Different Soyfoods The nutrient contents of different soyfoods vary considerably, depending on how they have been processed and what parts of the soybean are included.^{1,5} Virtually all soyfoods are heat treated in some way before being consumed. Heat treatment is necessary to decrease the activity of trypsin inhibitors and improve the digestibility of the proteins.^{5,8} Soy protein isolates and concentrates are subjected to even more processing by means of chemicals, which further reduces trypsin inhibitor activity. Both phytic acid and saponins are stable to heat treatment. However, fermentation partially breaks down the phytates and saponins.⁸

Soybean oil is traditionally "degummed" by removing the phospholipids. The resulting byproduct is lecithin, which is widely used as an emulsifier in food products. Soy oil has a very high vitamin E content, but about 30% is lost during refining.⁴ However, the vitamin E is preserved as another valuable byproduct. It is also common to partially hydrogenate soy oil to increase its stability. This process changes the fatty acid profile, decreasing the amount of polyunsaturated fats in the oil.^{4,5}

Foods made from whole soybeans, such as tempeh, miso and natto, are high in fiber. Soy milk and tofu contain only small quantities of soy fiber. Soy fiber which is separated out during processing is used as an additive in foods such as enteral nutrition products.⁶

Soybeans are high in iron, calcium and zinc.¹ The bioavailability of these minerals from soyfoods is under investigation. It is known that phytates bind minerals, particularly zinc and iron, and can therefore decrease absorption.^{9,11} It is possible that mineral absorption is better from fermented soyfoods because of their reduced phytate content. Another factor which can decrease zinc absorption is the presence of large amounts of calcium, as in tofu which has been processed using calcium salts.⁵ Calcium absorption

from soyfoods has been shown to be similar to that of milk.^{10,11} In the case of iron, research has shown that iron absorption is increased when a vitamin C source is eaten with soyfoods. More research is needed to clarify the overall picture on mineral absorption. However, when soy is eaten as part of a varied diet, mineral status is not likely to be a problem.⁵

Soyfoods are good sources of the B vitamins, especially thiamin, B6 and folate.¹ Whole soybeans contain large amounts of the fat soluble vitamin E. A recent review of the literature concluded that after degumming, refining, bleaching and deodorizing, soy oil retains an average of 68.3% of its vitamin E.⁴ One tablespoon of soy oil provides about a third of our daily requirement for vitamin E.^{2,4}

Versatility of Soyfoods The highly flavored Asian soyfoods are probably best when cooked in traditional recipes, such as miso soup or stir-fried tempeh with vegetables.

Soy products like tofu, textured soy protein, or isolated soy protein work well when added to standard American recipes. When isolated soy protein is added to muffins and other baked goods, the resulting products are well accepted by consumers in taste tests.¹² Textured soy protein can take the place of some or all of the meat in sloppy joes or chili. Tofu can replace milk, eggs, cheese, cream or meat in a wide variety of both main dishes and desserts.⁷

Conclusion Soyfoods are nutritious, versatile and can easily be incorporated into a varied diet.

For more information, call 1-800-TALK SOY or visit our Web site at www.talksoy.com

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