

“Soybean”-A Versatile Golden Nugget of Nutrition

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ABSTRACT:

The soya bean (*Glycine max*) is a native of China, where it has been part of the diet for several thousand years. It has also been important in Japan and Korea for almost as long and now in India. The start of commercial exploitation of soybean in India is nearly four decades old. Soybean has established itself as a major rainy season crop in the rainfed agro-ecosystem of central and peninsular India. Soybeans are legumes and part of the pea family that is the world's major food crop today. They are also processed into oil, milk, tofu, and soy protein. The two major variety of soybeans cultivated are the yellow and black. Soybeans are low in fat and calories and are a rich source of protein, fibre and many other essential vitamin and mineral. Soybeans are useful in many medical conditions and symptoms too. So, based upon this background the present study discuss and review the Nutritional Importance of soy

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What are Soybeans?

Soybeans, which are also known as soya beans, are a species of legume that has become one of the most widely consumed foods in the world. They are extremely useful for human health and they are easy to cultivate as well. These legumes are produced in greatest numbers in the United States and South America, but they are actually native to East Asia. Their scientific name is *Glycine max*, and they are classified as an oilseed, rather than a pulse, like most legumes. Soy popular in recent decades because of the rise in soy food's popularity, including soy milk and textured vegetable protein. The high levels of protein make these soy products an ideal protein source for vegetarians and the variety of soy has created a massive new market altogether.

One of the reasons soybeans are widely cultivated is because they contain more protein per acre of land than any other crop. They grow up to 2 meters in height and are a green, low-lying plant. Furthermore, soybeans are packed with other essential nutrients, making them extremely important for people on diets, those who need to improve their overall health, and vegetarians and vegans throughout the world.

Soybeans Nutrition Facts

The health benefits of soybeans come from the nutrients, vitamins, and organic compounds including a significant amount of dietary fiber and a very large amount of protein. In terms of vitamins, soybeans contain vitamin K, riboflavin, folate, vitamin B6, thiamine, and vitamin C. As for minerals, soy contains significant amounts of iron, manganese, copper, potassium, magnesium, zinc, selenium, and calcium. They are also a good source of organic compounds and antioxidants, which further help in boosting your health.



Nutritional value of soybeans:100 gms

Energy 446 Kcals

Total Fat 20 g

Saturated fat 2.9 g

Polyunsaturated fat 11 g

Monounsaturated fat 4.4 g

Cholesterol 0 mg

Sodium 2 mg

Potassium 1,797 mg

Total Carbohydrate 30 g

Dietary fibre 9 g

Sugar 7 g

Protein 36 g



Energy

100 grams of raw soybeans supply 446 calories and are 9% water, 30% carbohydrates, 20% total fat and 36% protein.

Soybeans are an exceptional source of essential nutrients, providing in a 100-gram serving (raw, for reference) high contents of the Daily Value (DV) especially for protein (36% DV), dietary fibre (37%), iron (121%), manganese (120%), phosphorus (101%) and several B vitamins, including folate (94%) (table). High contents also exist for vitamin K, magnesium, zinc and potassium.

For human consumption, soybeans must be cooked with "wet" heat to destroy the trypsin inhibitors (serine protease inhibitors).

Protein

Soy protein is a relatively heat-stable storage protein. This heat stability enables soy food products requiring high temperature cooking, such as tofu, soy milk and textured vegetable protein (soy flour) to be made.

Soy is a good source of protein, amongst many others, for vegetarians and vegans or for people who want to reduce the amount of meat they eat, according to the US Food and Drug Administration:

Soy protein products can be good substitutes for animal products because, unlike some other beans, soy offers a 'complete' protein profile. Soy protein products can replace animal-based foods-which also have complete proteins but tend to contain more fat, especially saturated fat-without requiring major adjustments elsewhere in the diet.

The Protein Digestibility Corrected Amino Acid Score (PDCAAS) of soy protein is the nutritional equivalent of meat, eggs, and casein for human growth and health. Soybean protein isolate has a biological value of 74, whole soybeans 96, soybean milk 91, and eggs 97.

Soy protein is essentially identical to the protein of other legume seeds and pulses. Moreover, soybeans can produce at least twice as much protein per acre than any other major vegetable or grain crop besides hemp, five to 10 times more protein per acre than land set aside for grazing animals to make milk, and up to 15 times more protein per acre than land set aside for meat production.

Carbohydrates

The principal soluble carbohydrates of mature soybeans are the disaccharide sucrose (range 2.5–8.2%), the trisaccharide raffinose (0.1–1.0%) composed of one sucrose molecule connected to one molecule of galactose, and the tetra saccharide stachyose (1.4 to 4.1%) composed of one sucrose connected to two molecules of galactose.[39] While the oligosaccharides raffinose and stachyose protect the viability of the soybean seed from desiccation (see above section on physical characteristics) they are not digestible sugars, so contribute to flatulence and abdominal discomfort in humans and other monogastric animals, comparable to the disaccharides. Undigested oligosaccharides are broken down in the intestine by native microbes, producing gases such as carbon dioxide, hydrogen, and methane.

Since soluble soy carbohydrates are found in the whey and are broken down during fermentation, soy concentrate, soy protein isolates, tofu, soy sauce, and sprouted soybeans are without flatus activity. On the other hand, there may be some beneficial effects to ingesting oligosaccharides such as raffinose and stachyose, namely, encouraging indigenous bifidobacterial in the colon against putrefactive bacteria.

The insoluble carbohydrates in soybeans consist of the complex polysaccharides cellulose, hemicellulose, and pectin. The majority of soybean carbohydrates can be classed as belonging to dietary fibre.

Fats

Raw soybeans are 20% fat, including saturated fat (3%), monounsaturated fat (4%) and polyunsaturated fat, mainly as linoleic acid (table).

Within soybean oil or the lipid portion of the seed is contained four phytosterols: stigmasterol, sitosterol, camp sterol, and brassicasterol accounting for about 2.5% of the lipid fraction; and which can be converted into steroid hormones. Additionally, soybeans are a rich source of sphingolipids.

Health Benefits of Soybeans

The health benefits of soybeans include the following:

Improves Metabolic Activity

As mentioned above, soybeans are an extremely important source of protein. When you have enough proteins in your body, your metabolic functioning and the overall system will get a major boost. Proteins are the building blocks of cells and blood vessels and basically every essential part of the human body. Proteins from soybeans ensure proper health and regrowth of cells if they need to be repaired or replaced. It can be difficult to get enough protein when you follow a vegetarian or vegan lifestyle, so soybeans provide an excellent replacement for proteins that are normally acquired from red meat, chicken, eggs, dairy products, and fish.

Healthy Weight Gain

Soybeans and soy-based products have been associated with appetite suppression to eliminate overeating, which can lead to obesity and other related risks. However, soybeans also provide a decent amount of fibre and protein, which can help in weight gain, if eaten in large quantities. Therefore, soybeans are beneficial for people who want to lose weight as well as the ones who want to gain some. Furthermore, the weight they provide to your body is not unhealthy high-fat or high cholesterol in nature, which protects you from dangerous conditions like diabetes and cardiovascular diseases.



Prevents Cancer

The levels of antioxidants in soybeans make them good for preventing the onset of various cancers. Antioxidants seek out and neutralize free radicals, which are the dangerous by-products of cellular metabolism. These free radicals can cause healthy cells to mutate into deadly cancerous cells. Furthermore, the high fibre content in soybeans has been connected to a reduction in colorectal and colon cancer, since fibre helps ease the digestive process and thus putting far less strain on the gastrointestinal system.

Boost Heart Health

Soybeans are a source of healthier, unsaturated fat, which helps you lower your total cholesterol. This allows you to prevent conditions like atherosclerosis, which can easily lead to heart attack and stroke. Furthermore, there are some specific fatty acids that are necessary for a healthy system. Two of those fatty acids are linoleic acid and linolenic acid. These two fatty acids, found in significant amounts in soybeans, regulate smooth muscle function in the body and help maintain appropriate blood pressure levels. Finally, the fibre in soybeans has actually been shown to reduce cholesterol levels in the body by scraping excess cholesterol off the walls of blood vessels and arteries.

Relieves Menopausal Symptoms

Soybeans are a very good source of isoflavones, which are essential components of the female reproductive system. During menopause, oestrogen levels drop significantly. Isoflavones are able to bind to oestrogen receptor cells, so the body doesn't feel as though it is going through such a dramatic change. This can ease many of the symptoms of menopause, such as mood swings, hot flashes, and hunger pains. Menopause can be a traumatic time of life for many women and soybeans are a great way to ease that major life transition.

Boost Digestion

One of the most common elements lacking in many people's diet is fibre, which is present in high quantities in soybeans. Fibre is an essential part of a healthy body, particularly in terms of the digestive system. Fibre bulks up your stool, making it move through your digestive system smoothly. Furthermore, it stimulates peristaltic motion, which is the contraction of the smooth muscles that push food through your system. It is vital also because constipation can be a very serious condition that can lead to more serious conditions, including colorectal cancer.

Improve Bone Health

Soybeans have a high vitamin and mineral content and the impressive levels of calcium, magnesium, copper, selenium, and zinc are very important for a variety of processes in the body, most importantly for bones. All of these elements are essential for promoting orthotropic activity, which allows for new bones to grow and also speeds up the healing process of the bones. Eating soybeans can be a long-term solution for problems like osteoporosis, which commonly occurs as we age.

Prevent Birth Defects

The high levels of vitamin B complex and folic acid in soybeans are very important for pregnant women. Folic acid ensures the prevention of neural tube defects in infants, which ensures a happy and healthy baby.

Improves Blood Circulation

Copper and iron are two minerals found in abundance in soybeans and both of these are essential for the formation of red blood cells. With an appropriate amount of red blood cells in the body, extremities of the body and essential organ systems can get the blood flow and oxygen they need to function efficiently. This maximizes metabolic activity and increases energy levels, while also avoiding dangerous conditions like anaemia.

Control Diabetes

This dreaded disease has been on the rise among the globe for more than a decade. Soybeans are an effective method of prevention and management of this disease, primarily because soybeans have shown an ability to increase insulin receptors in the body, thereby helping manage the disease effectively or prevent it from occurring in the first place.

Relieve Sleep Disorders

Soybeans help in reducing sleep disorders and the occurrence of insomnia. However, soybeans also have a high content of magnesium, which is directly linked to increasing the quality, duration, and restfulness of your sleep.

The top 6 forms of SOY include:

1. Soy Milk

Soy milk is a major source of soy protein. It's made from soybeans that have been finely ground, cooked, and strained. It comes with various additives and in a variety of flavours. It's widely available in aseptic packages, which keep for a long time and don't need to be refrigerated until opened. As Lorna Sass says in her excellent *The New Soy Cookbook*, "not all soymilks are created equal. Tastes ranged from light, fresh and pleasantly sweet to musky, chalky, oily and intensely 'beany.' Colour ranged from creamy white to dark caramel, with lots of shades in between."



2. Edamame

Edamame are green soybeans still in their pods. Ideal because they're a whole food, they are available in the frozen food section of natural food markets and many supermarkets. Boil the pods in lightly salted water for a few minutes, then pop them right from the pods into your mouth. Edamame taste like slightly sweet lima beans. You can also find shelled soybeans frozen in bags and these are great to add to soups, pasta sauces, salads, and stews. One cup of shelled edamame has about 23 grams of protein.



3. Soy Protein Powder

There are two kinds of soy protein powder and it can be quite confusing when shopping for this popular additive to shakes and baked foods. Like with soy milk, check the label for unnecessary additives, then go with the brand that works best for you — whether you're using it in a shake, or baking it into a dish. Soy protein concentrate comes from detailed soy flakes. It contains about 70 percent protein, while retaining most of the bean's dietary fibre.

4. Soy Flour

Soy flour has been processed from whole ground soybeans. Use it to increase the protein content of breads, cakes, and cookies. Soy flour contains no gluten, so it cannot be used to replace the wheat flour in baking, but you can use it to supplement your other flour. In yeast-raised breads: use 2 tablespoons of soy flour per cup of wheat flour; with quick breads, you can replace up to one-quarter of the wheat flour with soy flour. You may notice that breads made with soy flour brown more quickly than those made with just wheat. One-quarter cup of soy flour has 8 to 12 grams of protein.

5. Tempeh

Tempeh is a soy food made from soybeans that have been cracked and inoculated with a beneficial bacterium. It is fermented and then formed into flat blocks. Sometimes grains like brown rice, barley, or millet are added. Tempeh has a meaty taste and is often used as a meat substitute in cooking. It can be marinated and grilled as well as added to stews and pasta sauces. High in protein, fibre, and isoflavones, it is usually found in the refrigerated dairy section of your natural food store or supermarket. Tempeh can be frozen and, once defrosted, must be refrigerated. It will keep for about ten days. Three ounces of tempeh, or about 1/2 cup, has approximately 16 ounces of protein.

6. Miso

Miso, like tempeh, is a fermented soy food. There is a wide range of miso's available, particularly if you search in Asian markets. Generally, a strong-tasting, salty condiment, miso is perhaps most familiar as miso soup. It does provide soy isoflavones but, like soy sauce, its sodium content is high and thus doesn't make a good general source of soy protein.

Other soy form uses

Soya beans have become widely used in the Indian diet, being used to produce a range of ingredients: soya flour and soya protein, which are used to make foodstuffs such as bread, other cereal products, meat products, and vegetarian alternatives; soya oil, which is widely



used as a vegetable oil both in domestic cooking and by the food industry and is also used in the manufacture of spreadable fats; soya lecithin, which is used as an emulsifier in many foods; and soya milk, a vegan alternative to cow's milk. Soya is also used to produce infant formulas for those infants who are intolerant to lactose or cows' milk protein.

Safety

Soybeans are a common allergen. Raw or sprouted soya beans contain substances called goitrogens, which can interfere with thyroid gland activity. Soya also contains oxalate. Individuals with a history of oxalate containing kidney stones should avoid overconsumption. Women who have or have had oestrogen-sensitive breast tumours should restrict their soya intake to no more than four servings per week.

CONCLUSION

Soybean production to be able to expand, an expanding market had to be developed. This involved the development of soy foods applications suited to that particular country and the training of soy foods teachers and extension workers. In both cases, outside soy foods "experts" usually provided the initial "spark," teaching food processing techniques (on commercial, village, and home levels), nutrition, recipe applications, and other basics, and hopefully communicating their enthusiasm and dedication to their students. Local students then began to apply what they had learned to their own country situation, developing recipes and simpler processing techniques, writing cookbooks, and the like. Next other interested people were invited to attend a variety of courses held at a centre, and attendees from villages or food groups were encouraged/inspired to return there and teach others. Emphasis was placed on in-depth, hands-on, practical person-to-person training that would help to solve real-life problems such as how to feed one's family better for less or how to create new occupation. Courses and outreach programs were also given for commercial food processors (such as bakers) and people in charge of institutional feeding programs (as at schools, hospitals, or prisons) to show them how soy foods might help them solve their problems, such as producing more nutritious foods or lowering costs while improving quality.

REFERENCES

- Null, Donald E, “Health Benefits of Soy ,” in Proceedings North Central Weed Science Society, 2016. [123]
- Gonzini, Lisa C., et al., “Nutritional Value of Soy” in Proceedings American Soybean Association, New Delhi, 2018 [124]
- Aldridge, Grant, et al., “Application of Soy in Food Industries,” in Proceedings American Soybean Association, New Delhi, 2015 [125]
- Mulugeta, Dawit and Chris M. Boerboom, “Critical Period of Weed Management in Glyphosate-Resistant Soybean Systems,” in Proceedings North Central Weed Science Society, 2016. [126]
- Ateh, Comfort M., and Robert G. Harvey, “Models Which Predict Soybean Yield Reduction from Postemergence Herbicide Injury,” in Proceedings North Central Weed Science Society, 2015 Allen, S.M., and T.J. Hartberg,
- Weed Control in Soybeans with Applications of Imazethapyr Postemergence Following Pendimethalin Preplant Incorporated.
- North Central Weed Science Society, 2018. [128] Nau, H.H., et al., “Imazaquin: Summary of 2016 EUP Results,” in Proceedings North Central Weed Science Society, 2016.