

## Soybean A Versatile Plant- Food, Health and Nutrition

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Received: November 14, 2019; Published: November 20, 2019

DOI: 10.31080/ASNH.2019.03.0556

Figure 1: Source: PCOS Diet, 2016.

In the world's oilseed cultivation soybean hold an important place, due to its high productivity, profitability and vital contribution towards maintaining soil fertility. The soybean additionally features an outstanding place because the world's most significant seed legume, that contributes 25% to the worldwide oil production, concerning 2/3<sup>rd</sup> of the world's protein concentrate for farm animal feeding and a valuable ingredient in developed feeds for poultry and fish. Out of the total annual produced soybean around the world, 85% of it is processed into oil and meal. Approximately 98% of the soybean meal which is generated during oil production further utilized as animal feed and also been utilized in the form of soy flour as well as the protein source. The major portion of soy oil (approx. 95%) is utilized for consumption purposes, a minor amount of soy oil also been utilized in the cosmetic industry and biodiesel.

Soybean is relatively high in protein content even though it's a plant produced not the animal. Just because soybean having high protein as the case with meat or animal protein and also knowing the fact that it is being grown in the field, it is even referred to as "meat of the field". With the advancement of science, a closer look at the protein profile of soy protein concluded that soy protein is not a complete protein. Although this conclusion is based on the amino acid profile that is absence or presence of essential amino acid but still when it comes to the protein quality which is decided by the digestibility and other metabolic factors soy protein is comparable with egg and milk protein. Soy proteins also found to be a rich source of many bioactive peptides such as lunasin, glysinins and defensins and many more. These bioactive peptides have numerous health benefits which include blood pressure, blood sugar and also immunity improvement.

### Soybean as food

In India soybean is hardly consumed in its natural forms which are having high nutritious value. Mainly in India soybean is cultivated and even consumed as an oilseed crop, not the vegetable which is just opposite to south Asian country. After oil extraction through various techniques such as cold press and solvent extraction method leftover defatted soy flour either utilized as animal feed or soy protein concentrate. Soy protein concentrate is further processed to utilized it into various forms and purposes. One such process is extrusion through which we get TVP, or textured soy protein and another process which leads to the production of more solubilized protein concentrates or SPI. Due to high solubility, solubilized protein concentrates mainly utilized to increase the protein concentration in liquid food such as low- fat soy milk.

Processing of raw soybean leads to the production of numerous products that are either fully or partially different in texture, taste, appearance. One such process of soybean seeds is conversion to full-fat soy milk, which simply involves cooking of soy seed with water and later separate out liquid i.e soy milk and fibrous part i.e okara. Further, full-fat soy milk is coagulated by using salts or acids into curds that can be pressed into "cakes and utilizes as Tofu." Natto, another whole food form of soybean, making of natto from the whole soy seed involve the process of fermentation with the help of *Bacillus subtilis*. Tofu, natto, and full-fat soy milk all are considered whole food forms of soybean which are different from processed products such as TVP and SPI. In India, all the whole food forms of soybean as not widely consumed due to various reason but one major reason is acceptability to the taste and smell.

### Soybean as health

Soybeans have many varietal differences which lead to a variety of colors of seed coats such as green, yellow, brown or black. Recently due to the increase in health-consciousness, mass population start looking for nutritious food and one such food is soybean as a whole. Soybean products contain a list of bioactive phytochemicals such as isoflavones, saponins, phytic acids, phytosterols, trypsin inhibitors, and peptides. Many past research has suggested that soybean phytochemicals functioning in cholesterol reduction, cardiovascular disease prevention, diabetic symptoms prevention, bone loss prevention, and cancer prevention. At the same time, some bioactive compounds in soybean are reported to have some adverse effects on health also. But, the benefits of soybean bioactive components exceed by far their potential adverse effects.

Consumption of soybeans leads to various health benefits that include prevention of heart disease, fighting against cancer, aid to the digestive system, preventing osteoporosis, better blood circulation, treating insomnia, reduce menopausal symptoms such as hot flushes and supporting the pregnancy by providing vital vitamin B complex and folic acid. Although many research has supported the wide utilization of soybean due to numerous health benefits that are listed above but still there is a scope of deep understanding of these health benefits before landmarking.

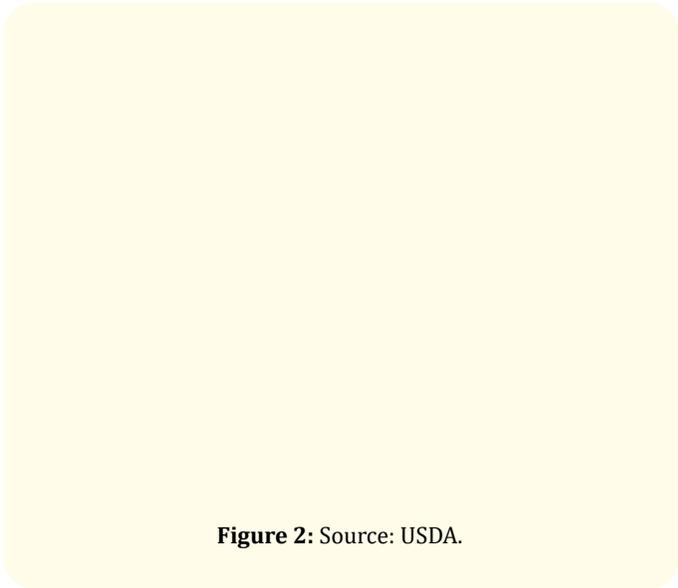
### Soybean as nutrition

Soybeans are mainly composed of protein, but also contain good amounts of carbs and fat. The protein content of soybeans ranges from 36 to 56% on the dry weight so can be put into best re-

source of plant-based protein. 80% of the soy protein content two types of protein that are glycinin and conglycinin.

### Soya fat

Soybean is classified as oilseed and often used to make soybean oil. Soybean oil in soybean is approximately 18% of the dry weight, mainly composed of polyunsaturated and monounsaturated fatty acids, with small amounts of saturated fat. Linoleic acid, the predominant type of fat in soybeans, accounting for approximately 50% of the total fat content.



**Figure 2:** Source: USDA.

### Soya carbs

Whole soybeans are very low on the glycemic index due to low in carbs, which is a measure of how foods affect the rise in blood sugar after a meal. The low glycemic index, which makes soybeans particularly suitable for people with diabetes. Soybeans contain both soluble and insoluble fibers. The insoluble fibers are mainly alpha-galactosides, such as stachyose and raffinose. Alpha-galactosides belong to a class of fibers called FODMAPs, which may exacerbate the symptoms of irritable bowel syndrome (IBS). Soluble fibers of soybeans are generally considered to be healthy. In the colon these soluble fiber fermented by bacteria, leading to the formation of short-chain fatty acids, such as butyrate, which may improve colon health and cut the risk of colon cancer.

### Vitamins and minerals

Soybeans are a good source of multiple vitamins and minerals.

Nutrient	Amount	DRI/DV (%)	Nutrient Density	World's Healthiest Foods Rating
Molybdenum	129.00 mcg	287	17.3	excellent
Copper	0.70 mg	78	4.7	excellent
Manganese	1.42 mg	62	3.7	very good
Phosphorus	421.40 mg	60	3.6	very good
Iron	8.84 mg	49	3.0	good
Vitamin B2	0.49 mg	38	2.3	good
Vitamin K	33.02 mcg	37	2.2	good
Magnesium	147.92 mg	35	2.1	good

Table 1

### World's healthiest foods rating rule

**Excellent:** DRI/DV $\geq$ 75% OR, Density $\geq$ 7.6 AND DRI/DV $\geq$ 10%

**Very good:** DRI/DV $\geq$ 50% OR, Density $\geq$ 3.4 AND DRI/DV $\geq$ 5%

**Good:** DRI/DV $\geq$ 25% OR, Density $\geq$ 1.5 AND DRI/DV $\geq$ 2.5%

### Other plant compounds

Soybeans are rich in various bioactive plant compounds

- **Isoflavones:** A family of antioxidant polyphenols with a variety of health effects. Often referred to as phytoestrogens.
- **Phytic acid:** Found in all plant seeds, **phytic acid** (phytate) impairs the absorption of minerals, such as zinc and iron. It can be reduced by boiling, sprouting, or fermenting the beans.
- **Saponins:** One of the main classes of plant compounds in soybeans. Soy saponins have been found to reduce cholesterol in animals [1-5].

### Conclusion

As of whole soybean is full of all the essential nutrients and minerals which are considered to be basic requirements to maintain a healthy lifestyle. However, the amount should be chosen carefully as soybeans can also increase the risk of developing kidney stones and cause allergic reactions.

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### Volume 3 Issue 12 December 2019

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