

REPORT

Soyabean: A Nutritive Food Source

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Soyabean has come to be regarded as all purpose complete food. Its rich protein content of high PUFA, oil and other nutritive values make it a total food.

Soyabean is an important legume crop in the Far East. The seeds have been used for centuries as an article of food in China, Japan and Korea and constitute a valuable protein supplement to the cereal diet. Other Asian countries in which soyabean is grown are India, Philippines, Indonesia and Thailand. Other American countries in which soyabean cultivation has been taken up are Canada, Brazil and Argentina. It is also cultivated in USSR.

Soyabean (*G. max*) is essentially a sub-tropical plant (52° N latitude). It has been classified into two groups: light coloured seeds and flattened dark coloured seeds. The plant thrives best in rich sandy or clayey loam or well drained alluvial soil. Soyabean is very sensitive to changes of soil and climate and shows different behaviour. Among types grown in India are yellow, chocolate and black.

Soyabean is grown in India mainly for food or forage. It is generally raised as a Kharif crop sown at the outbreak of monsoon in June or July and harvested in December-January. It thrives well in moist climate but can also be grown in dry parts under irrigation. Early types of soyabean mature in 75-110 days while late ones take 100-200 days. The plants are cut, dried in the sunshine and seeds threshed out as in the case of other pulses.

Soyabean ranks high among the leguminous crops of the world. It is mainly grown as a food crop in China, Japan and other countries of East Asia including India. The seeds are consumed green, dry or sprouted, whole or split. Green seeds are used as vegetable too. The dry seeds are ground into flour and used as food in the form of noodles. These are also used as milk, curd and cheese. A variety of fermented product is prepared from soyabean which gives the basic flavour to Chinese and Japanese food preparations. Soyabean oil is very widely used in India due to its unsaturated fatty acids (PUFA). Soya seeds contain: moisture, 5.0-9.4%; protein, 29.6-50.3%; fat, 13.3-24.2%; fibre, 2.8-6.27%; carbohydrates, 14.1-23.9%. The composition varies according to the type cultivated, soil and climatic conditions.

Soyabean contains a higher percentage of proteins than many other food stuffs. The chief protein is a globulin, glycinine, which accounts for ca. 80-90%

of the total protein nitrogen of the seeds. Another globulin, phaseoline, and an albumin, legumelin, are also present. The amino acid composition of glycine is as follows: cysteine, 1.1%; methionine, 1.8%; lysine, 5.4%; tryptophan, 1.7%; threonine, 2.1%; leucine, 9.2%; isoleucine, 2.4%; phenylalanine, 4.3%; tyrosine, 3.9%; histidine, 2.2%; valine 1.6%; aspartic acid, 5.7%; glutamic acid, 19.0%; and proline, 4.3%.

TABLE-1
PROTEIN CONTENTS OS SOME FOOD STUFFS %

Food stuff	(%)
Soyabean (raw)	43.2
Groundnuts (raw)	26.7
Bengal gram (without husk)	22.5
Green gram (without husk)	24.0
Black gram (without husk)	24.0
Red gram (without husk)	22.3
Lentils	25.1
Mutton (muscle)	18.5
Beef (muscle)	22.6
Fish	21.0
Egg	13.3

Soyabeans can rightfully claim the honour of being one of the most concentrated and nutritive foods known to man. In the Indian context, soya assures even greater significance. To make the best use of agricultural land, here are some facts which are really interesting.

One hectare of land used for different purposes will produce protein as given in Table-2.

TABLE-2

Food stuff	kg
Soya	500
Wheat	150
Meat	20
Milk	50
Corn	180

Soyabeans after processing by heat treatment or germination render it useful in different forms. SoyafLOUR is prepared from high quality beans and is available in full fat flour, low fat flour and defatted flour prepared from solvent extracted cakes. SoyafLOUR can be mixed up to 25% with wheat, bajra and other grain flours for making chappati.

Soyamilk is a rich source of easily digestible vegetable proteins. It is not only cholesterol-free but helps in reducing cholesterol if used regularly. It is lactose free and hence most suitable for children who cannot digest dairy milk (lactose intolerants). Soyamilk is free of starch. It also contains absorbable iron and hence beneficial for anemic women. It can be used as curd, butter-milk. Soyamilk is also used as tafu—soy-cheese (paneer).

The most important product obtained from soyabean is the fatty oil extensively used for edible purposes. Yellow seeded types are most suitable for the production of oil and meal, as the seeds contain not only high percentage of oil but also yield meal of a very attractive colour. Soya oil is produced by an expeller and by solvent extraction method from cakes. The colour of oil varies from yellow to dark depending upon the quantity of seeds and the type of seeds processed. A notable feature is the percentage ratio of saturated and unsaturated acids, irrespective of total amount of oil present in the seeds and the iodine number of extruded oil. Table-3 shows the percentage composition of saturated and unsaturated oils.

TABLE-3

Iodine value of oil	102.9	124.0	130.4	132.6	139.4	151.4
Oleic, (%)	60.0	34.0	28.9	23.5	24.7	11.5
Linoleic, (%)	25.0	49.1	50.7	51.2	55.4	63.1
Linolenic, (%)	2.9	3.6	6.5	8.5	8.0	12.1
Total unsaturated	87.9	86.7	86.6	84.2	88.1	86.7
Total saturated	12.0	13.2	13.4	15.9	11.9	13.5

Soyabean meal is the meal or cake left after extraction of oil and is used as food in the form of small pieces. This is considered as vegetable meat because of its texture after preparation.

Table-4-6 show the composition of natural soyamilk: amino acids composition, proteins and vitamins.

TABLE-4
COMPOSITION OF NATURAL SOYAMILK

	(per 250 mL)
Proteins	7.5 g
Fats (of which more than 60% are poly-unsaturated fats)	5.25 g
Carbohydrates	7.85 g
Fibre	0.575 g
Calcium	128 mg
Iron	4.6 mg
Calories	100 kcal

TABLE-5
% AMINO ACID COMPOSITION OF SOYABEAN PROTEINS

(Average of imported seeds)	
Isoleucine	4.5
Leucine	7.8
Lysine	6.4
Methionine	1.3
Cysteine	1.3
Phenylalanine	4.9
Tyrosine	3.1
Threonine	3.9
Tryptophan	1.3
Valine	4.8
Arginine	7.2
Histidine	2.5
Alanine	4.3
Aspartic acid	11.7
Glutamic acid	18.7
Glycine	4.2
Proline	5.5
Serine	5.1

TABLE-6
VITAMIN CONTENT OF SOYABEAN

	($\mu\text{g/g}$)
Thiamine	11.0–17.5
Riboflavin	3.4–3.6
Niacin	21.4–23.0
Pyridoxine	7.1–12.0
Biotin	0.8
Pantothenic acid	13.0–21.5
Folic acid	1.9
Choline	3400
Inositol	2300
β -carotene (as provitamin A)	0.18–2.43
Vitamin E	1.4
Vitamin K	1.9

REFERENCES

1. Steve Chen, "Nutrition and production of soya milk", in: High Protein in Low Cost Food, 10th ASEAN Workshop, Bangkok, Thailand.
2. Shurtleff and Aoyag, The Book of Tofu.
3. (a) Jean Carper, Everyday foods that fight cholesterol, *Reader's Digest* (July 1989); (b) Walter S. Ross, At last, an anti-cancer diet, *Ibid.*; (c) Maya Pines, What you eat can affect your brain, *Ibid.*
4. C.W. Miles, *J. Amer. Oil Chemists Soc.*, **66** (1989).
5. Byuna Paul Yu, *J. Amer. Oil Chemists Soc.*, **64** (1987) (details in *Food Chemical News*, April 6, 1987).
6. Nutritional Aspects of Isolated Soy Protein, American Soyabean Association, Singapore, Vol. 1, HN 3 (1985).
7. The Wealth of India: Raw Materials, Vol. IV, CSSR, New Delhi.

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