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## Phytonutrients characteristics of soybean cultivars for processing

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### Abstract

The present study was done on phytonutritional characteristics in popular soybean cultivars. Seeds have % carbohydrates ranged from 28.03- 29.70. Crude fiber% 13.51- 15.83, total soluble sugars% 8.71- 10.51, non-reducing sugars 7.18- 8.70, reducing sugars% 1.38- 1.81, oil content% 19.03-20.83, and ash content 5.10- 5.22% estimated in seeds. Proteins 37.45- 41.27% and have all essential amino acids with superior quality beside energy value from 442.35- 456.19 Kcal/100g in full fat soy seeds flour. Polysaccharides starch content mg/100g ranged from 1050- 1150, amylose 234.35- 247.93 and amylopectin 802.07- 904.14 respectively in seeds dry matter. Minerals matter which is essential for bone formation an ideal skeleton as K mg/100g ranged from 1713- 1831, P 630-640, Ca 291- 319, Mg 242- 291, Na 2.91-3.41, Mn 2.48- 3.70, Fe 12.35-14.90, Cu 1.20-1.52 and Zn 4-4.33 mg/100g, N 6051-6736 mg/100g respectively. These super quality as cheaper soy phytonutrients are targeted for malnourished or under malnourished community suffering about thirty percent of total population in India. Therapeutic used as whole food source for communities' traditional and modern kitchen system.

**Keywords:** Therapeutic, Phytonutrients, Malnourished

### 1. Introduction

Soybean [*Glycine max* (L.) Merrill.] growing for oils and belongs legume crops. Seeds owing to its great food label phytochemicals profile, proteins are considered to be among the most abundant cell components and except for storage proteins composed of various elements including C, H, N, O and S which formed all essential amino acids as studied by several research as Lucia *et al.* (2009) fig.1& fig.2 an approximately 16 percent total essential amino acids and 26 percent other non-essential in soy proteins which are linked together by peptide bonds to form proteins is essential to biological functions for healthy various types of human body. Carbohydrates are present which are beneficial as prebiotic, anticonstipation, helps in absorption of minerals and act as lowering factor in colon cancer which is majority of soluble and insoluble type polysaccharides, non-digestible dietary fibers have important role in nutritional security by chemically and protects from most of the chronic diseases great deal of medicinal potential with pharmacological effects such as antiarrhythmic, anticholinergic. Present study have been conducted on varietal chemical composition variations of phytochemical nutrients in soybean seeds.

### Materials

Five popular cultivars were selected as JS-20-29 (V<sub>1</sub>), JS-20-34 (V<sub>2</sub>), JS-97-52 (V<sub>3</sub>), JS-93-05 (V<sub>4</sub>) and JS-95-60 (V<sub>5</sub>) purchased from BSP Unit, JNKVV, Jabalpur (MP).

### Methods

Seeds were dried in cabinet type dryer at 55°C till the equilibrium moisture content, cooled and grinded by mini-mill, pack into airtight plastic containers and then chemical analysis were carried out. Protein, in-vitro protein digestibility obtained by calculating with pepsin kjeldahl nitrogen factor 6.25 obtains, fat, carbohydrate, crude fiber, moisture and ash were determined by AOAC. Starch was determined by Lane and Eynon method, amylopectin was calculated the formula given by Juvan *et al.* and amylose were estimated according to method as described by Sadasivam & Manickam. Energy value was calculated by Mudambi and Rajagopal method. The 100 seeds were kept in wet muslin cloths rolled and kept in BOD seed germinator at 25±1 °C and 90-92% humidity for 96 hours sprouted seed counted and calculated % of germination. Bulk density weight/volume of 1000 seed in diesel at temp 20 °C was calculated. Seed size estimated using a weight of number ratio 100 seed randomly was used to evaluate size and water weight increase ratio (WIR) was calculated by Wei and Chang. The in-vitro starch digestibility was determined by Singh and Jambunathan method. Soluble sugars and minerals

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Ca, P and Fe were estimated by Ranganna,S procedure. Mg, Cu, Zn and Mn was determined by ASS following the digestion in ternary acid mixture (HNO<sub>3</sub>:H<sub>2</sub>SO<sub>4</sub>:HCl<sub>4</sub>;10:1:4 v/v), Na and K by flame photometry method. Statistical analysis was done in triplicates and mean of each was used in analysis.

### Results and discussion

Proteins content was found significantly differed among cultivars in V<sub>5</sub> 41.27% highly significant followed by V<sub>4</sub> 40.65% plant origin proteins are wonderful natural product and tremendous nutritional gift of nature's Ali(2005) and Gandhi (2009)Table-1. Oil content in cultivar V<sub>1</sub> has 20.83% significantly higher, followed by V<sub>2</sub> 19.87%, V<sub>3</sub> 19.40% and V<sub>5</sub> 19.22% a rich source of PUFA (ω-3) and MUFA (ω-6) fatty acids (Fig.3) as Ghaly and Sutherland (1982). Total carbohydrates content ranged from 28-32% in raw seeds similarly by Yadav and Chauhan (2005). The crude fiber in seeds variety V<sub>2</sub> has 14.83% significantly higher as Geater *et al.* (2000).Total soluble sugars in cultivar V<sub>1</sub> was 10.51% significantly higher(Fig.4) similarly analyzed by Hymowitz and Collins (1974). Nitrogen free extract (NFE) in variety V<sub>3</sub> was calculated by 21.23% significantly higher as Bewley(2006). Reducing sugars content in V<sub>1</sub> was analyzed 1.81% performed significantly high. Non- reducing sugars were in variety V<sub>1</sub> was 8.70% recorded significantly superior among the cultivars. The *in vitro* protein digestibility (IVPD) found significantly differed among the cultivars however, variety V<sub>3</sub> recorded 67.57% was significantly higher similarly by Kayamben and Rensburg(2013). Whereas *in vitro* starch digestibility (IVSD) also found significantly differed in

between cultivars variety V<sub>4</sub> was recorded 65.37% significantly higher in raw seed flour of soybean. Starch content in variety V<sub>3</sub> was estimated by 1150 mg/100g significantly higher as Geater *et al.*2000). Amylose content found differed and amylopectin were found significantly also differed among the cultivars.

Value of energy Kcal/100g seed weight g/thousand seeds and bulk density g/cc, water weight increase ratio (WIR) of cultivars ml/100g were differed significantly.Germination percentages significantly differed among themselves of fresh seeds. Seed size is important character for processing are weight to number ratio as g/100 seeds differed significantly as Wei and Chang (2004)Table-2. Organic N is major and pro elements for life differed significantly, Ca was higher in V<sub>4</sub> 319,mg/100g, Na content maximum in V<sub>2</sub> 3.41 mg/100g, K was higher in V<sub>4</sub> 1831 mg/100g. However, variety V<sub>4</sub> P was 640 mg/100g insignificantly in varieties. Minor minerals Cu was 1.52 mg/100g higher in V<sub>2</sub> and Zn 4.33 mg/100g in V<sub>2</sub> was higher, Mn in variety V<sub>3</sub> was 3.70 mg/100g. The most essential Fe estimated in V<sub>4</sub> 14.90 mg/100g was higher than V<sub>2</sub>& V<sub>3</sub> were 12.35 mg/100g have satisfactory quantity as Hendrick (1998). However, Mg in variety V<sub>3</sub> 291mg/100g was higher with non-significantly calculated in seeds among the cultivarsTable-3.

### Conclusion

The basis of phytonutrients composition, physical and biological characteristics of soybean cultivars seeds is used in different food industries for making full-fat soy flour, protein isolate, fermented and non-fermented traditional food products such as snack food, cookies and tempeh etc.

**Table 1:** Chemical and Nutritional Characteristics of Soybean Cultivars (g/100g).

Cultivars	Protein	Oil	Total Carbo- hydrates	Crude fiber	Moisture	Ash	Total Soluble Sugars	NFE	Reducing Sugars	Non- Reducing Sugars
V <sub>1</sub>	38.81	20.83	28.09	13.43	11.00	5.10	10.51	19.97	1.81	8.70
V <sub>2</sub>	37.45	19.87	28.43	14.83	10.00	5.12	9.91	20.4	1.69	8.21
V <sub>3</sub>	39.93	19.41	29.57	12.51	9.00	5.10	9.75	21.23	1.43	8.32
V <sub>4</sub>	40.66	19.03	29.70	13.31	9.66	5.46	8.79	20.13	1.38	7.40
V <sub>5</sub>	41.27	19.22	29.53	13.17	10.00	5.2	8.71	19.46	1.53	7.18
SEm±	0.217	0.050	0.142	0.230	0.372	0.046	0.037	0.303	0.390	0.034
CD at 5%	0.627	0.146	0.411	0.665	1.083	0.032	0.108	0.877	0.003	0.099

**Table 2:** Physical and Chemical Qualitative Characteristics of Soybean Cultivars.

Cultivars	1000 seed wt(g)	Density (g/cc)	Seed Size (mm)	Energy (Kcal/100 g)	WIR (ml/100g)	Germination (%)	IVPD (%)	IVSD (%)
V <sub>1</sub>	159.86	1.18	6.25	455.05	241	87	64.63	53.04
V <sub>2</sub>	124.28	1.13	8.04	442.35	248	89	63.84	55.62
V <sub>3</sub>	91.58	1.22	10.92	447.34	255	91	67.57	52.74
V <sub>4</sub>	121.33	1.21	8.23	452.60	265	89	66.73	65.37
V <sub>5</sub>	80.87	1.16	12.36	456.19	246	88	65.86	52.37
SEm±	0.052	0.014	0.012	2.693	0.910	0.632	0.294	0.122
CD at 5%	0.145	0.040	0.035	7.776	2.620	1.826	0.850	0.352

**Table 3:** Mineralogical Characteristics of Soybean Cultivars (mg/100g).

Cultivars	N	P	K	Na	Ca	Mg	Fe	Cu	Zn	Mn
V <sub>1</sub>	6233	636	1826	3.34	295	281	12.70	1.45	4.17	2.48
V <sub>2</sub>	6051	633	1816	3.41	291	242	12.35	1.52	4.33	2.61
V <sub>3</sub>	6555	635	1713	2.91	317	291	12.35	1.29	4.10	3.70
V <sub>4</sub>	6584	640	1831	3.34	319	259	14.90	1.20	4.00	3.43
V <sub>5</sub>	6736	630	1828	3.08	297	278	13.43	1.40	4.30	3.65
SEm±	5.092	2.323	7.952	0.059	1.465	9.006	0.019	0.014	0.020	0.016
CD at 5%	14.706	6.710	22.965	0.172	4.232	26.009	0.055	0.042	0.060	0.047

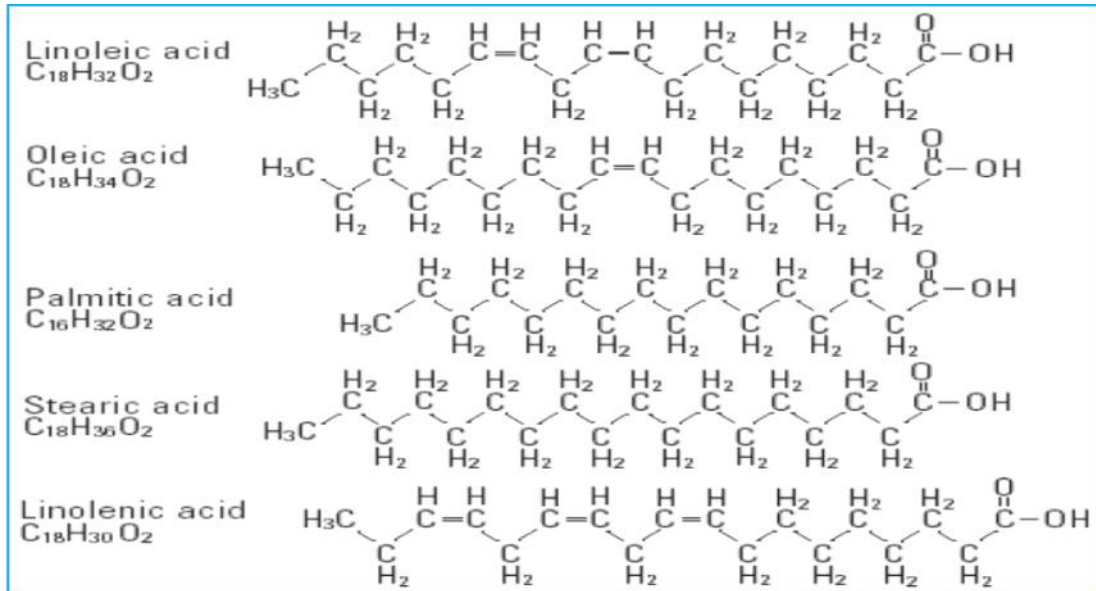


Fig 3: Some Pharmacological fatty acids in soybean

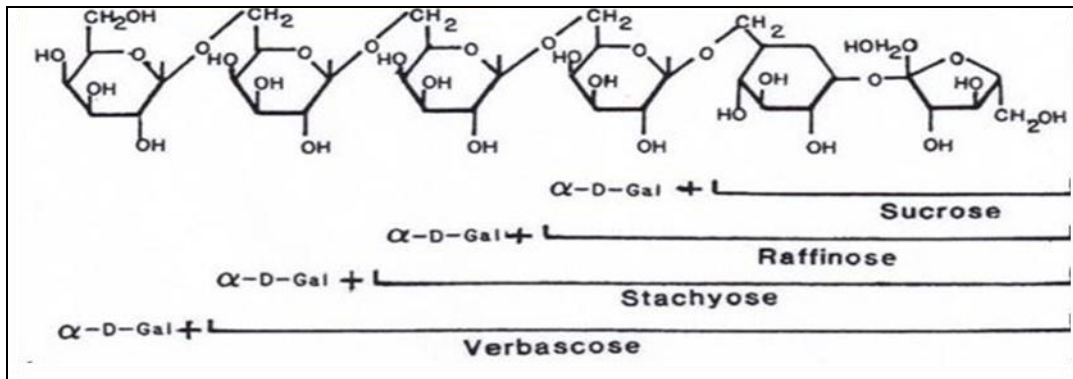


Fig 4: Major oligosaccharides soluble sugars in soybean

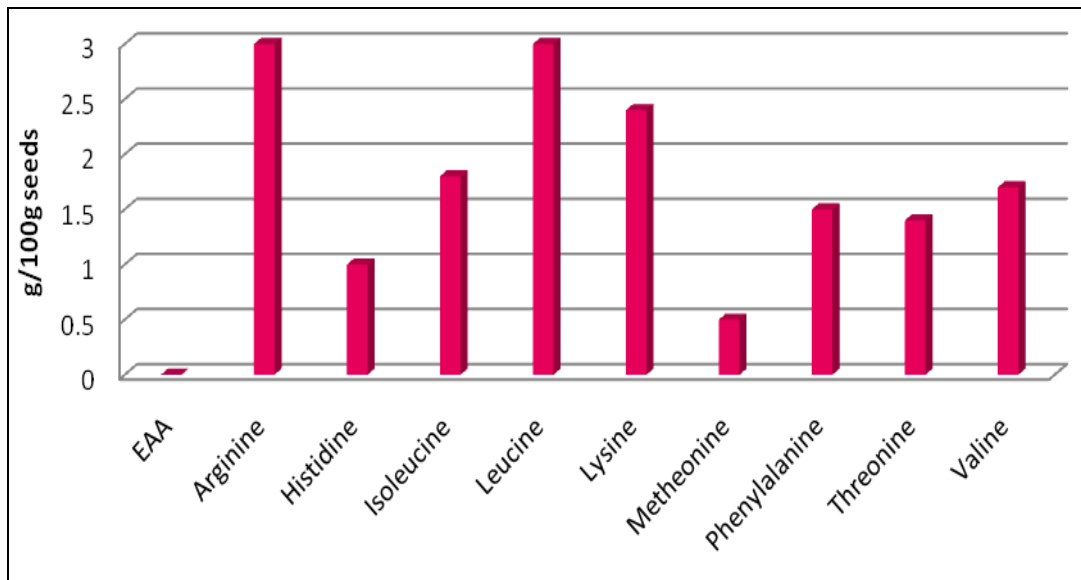
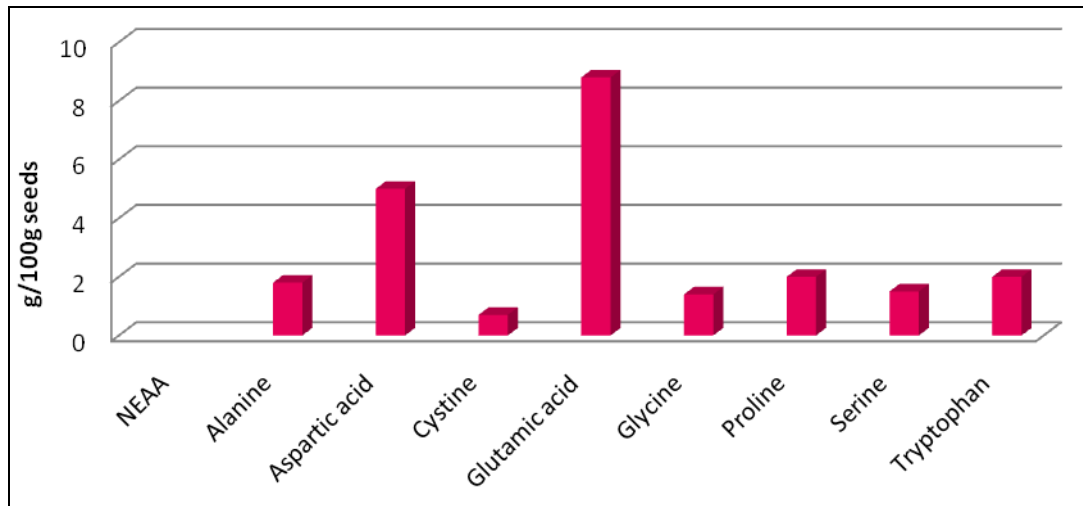


Fig 1: Essential amino acids in whole soybean seed



**Fig 2:** Non-Essential Amino Acids in whole soybean seed

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