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Nutritional quality of improved varieties of cowpea (*Vigna unguiculata* (L). Walp)

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ABSTRACT

The present study was undertaken with the objective of evaluating the nutritional composition in seed such as proximate principles, mineral, amino acid and dietary fibre content plus antioxidant properties of two varieties of crop released by G. B. Pant University of Agriculture & Technology, Pantnagar, (Uttarakhand), India of the seven proximate quality parameters evaluated, *'Pant lobia-3'* seeds proved to be statistically superior to *'Pant lobia-5'* seeds in two parameters whereas the other five parameters were high in *'Pant lobia-5'*. *'Pant lobia-5'* seeds per 100 gram seed wt. had a higher iron (7.81mg), calcium (76.03mg) which magnesium (155.8mg) and zinc content (4.70mg) where higher in *'Pant lobia-3'*. *'Pant lobia-3'* had 24.51% protein contents and its tryptophan and methionine content were higher than those in *'Pant lobia-5'*. It had higher dietary fibre content (33.40 mg/100g) showed good antioxidant properties such as total flavonoid content (175.20 mg R.E. / 100 g of flavonoid) and total antioxidant activity (95.19 T.E./ 100g of antioxidant). The total phenolic content (79.43 mg GAE/100g of phenol) of *'Pant lobia-5'* was high. The study inferred that cowpea seeds can act as nutritional equipment strengthening the nutritional security in our country.

Keywords: Antioxidants, Cowpea, Nutritional composition

Cowpea (*Vigna unguiculata* (L). Walp) is recognized as a good source of protein, minerals, vitamins and other nutrients such as Fe, Ca, Mg and Zn being originated in Africa. It is widely grown in Latin America, South East Asia and in the Southern United States (Sasanam *et al*. 2011). Cowpea was introduced to the Indian subcontinent from Africa about 2000 to 3500 years back and India appears to be a secondary centre of diversity since significant genetic variability moreover, because of its good nutritional value it has a positive impact on the health of poor people especially children. Cowpea is rich in protein, vitamins, minerals, unsaturated fatty acids, antioxidants, phenolic compounds and soluble and insoluble fiber (Khalid and Elharadallou *et al.* 2011). Also cowpea seeds contain certain phenolic compounds such as ferulic acid, cinnamic acid, syringic acid and gallic acid (Mokgope 2007). Regular intake of such polyphenols can help in reducing chronic diseases such as coronary heart diseases, diabetes, obesity and certain cancers and also improves endothelial function and reduce blood pressure (Liu 2007). Keeping in view the need for a nutrient dense food in the human diet and possibility of its evopromational cowpea was taken in the present study for their nutritional composition.

MATERIALS AND METHODS

Procurement of sample: Seed samples of two indigenous varieties of cowpea (*Vigna unguiculata* (L). Walp*) viz.*, *'Pant lobia-3'* and *'Pant lobia-5'* were procured from the cowpea field of breeder seed production centre (BSPC), G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand (India).

Samples were analysed in triplicate for proximate composition such as per cent moisture, crude protein, total ash, crude fat and crude fibre, carbohydrate and physiological energy. Proximate composition was determined by AOAC (2000) method. Moisture content was estimated by oven dry method at (130±3°C for 20 min) and the loss in weight was taken as moisture content. Crude protein content was analysed by kjeldahl method of total nitrogen. Crude protein content was calculated by multiplying total nitrogen with suitable conversion factor. Crude fat content was extracted using petroleum ether (40-60° C) by using soxhlet apparatus. Total ash content was analysed by ignition of the sample in hot plate and then placing the sample in muffle furnace at 550°C until all carbon in the sample has been burnt. Total ash content represents the total mineral content of the food. Crude fibres was determined as the organic residue, by treating defatted sample successively with dilute sulphuric acid and sodium hydroxide solution in refluxing systems. The carbohydrate percentage was determined by the difference method by subtracting per cent moisture, crude protein, crude fat, total ash and crude fibre from hundred. The physiological energy (kcal/100g) of sample was calculated by summing up the product of multiplication of per cent carbohydrate, crude protein and crude fat in the sample by 4, 4 and 9 respectively Mudambi *et al.* (1989).

Cowpea seeds of *'Pant lobia-5'*

Cowpea seeds of *'Pant lobia-3'*

Table 1. Proximate composition of cowpea seeds

Proximate compositions	*'Pant lobia-5'*	*'Pant lobia-3'*
Moisture (%)	13.86^{a}±0.30	13.19 ^{a}±0.47
Total ash (%)	3.48^{a}±0.02	3.41^{a}±0.05
Crude fibre (%)	4.85^{a}±0.02	4.50^{a}±0.04
Crude fat (%)	1.15^{a}±0.01	1.10^{a}±0.02
Crude protein (%)	22.62^{a}±0.01	24.51^{b}±0.02
Carbohydrate by difference (%)	54.04^{a}± 0.15	53.29^{a}±0.85
Physiological energy value (kcal/100g)	316.99^{a}±2.02	321.41^{b}±2.51

Means in each column for each form of cowpea followed by the different letter (a & b) are significantly different (P d" 0.05)

Minerals Composition: Mineral content (Calcium, Iron, Zinc and Magnesium) were estimated using Atomic Absorption Spectrophotometer by AOAC (2000) standard method. Ash solutions were prepared using wet ashing procedure using tri-acids (Nitric acid, Per chloric acid and Sulphuric acid) as described by Raghuramulu (2003). Besides these the amino acids composition (Methionine, Lysine and tryptophan) was analyzed by method given by Sadasivam and Manickam (1992). Total dietary fibre content of sample was estimated by the method of Asp and Johanson (1981). Antioxidant activity such as total flavonoid content (Zhishen *et al.* 1999, Singleton *et al*. 1999 and Brand *et al*. 1995).

Statistical Analysis: The statistical tools used for the analysis of the above data were Mean ± S.D and One-way ANOVA (Snedecor and Cochran 1980). The data was subjected to FORTRAN 95 software for statistical analysis for identifying the significant difference in the nutrient content of the different forms of cowpea seeds used in present study.

RESULTS AND DISCUSSION

***Proximate composition*:** Proximate composition in seed related that *'Pant lobia-5'* seeds had 13.86% moisture, 22.62% crude protein, 3.48% total ash, 1.15% fat, 4.85% fibre, 54.04% carbohydrate and 316.99 kcal/100g physiological energy. On the other hand, *'Pant lobia-3'* had 13.19% moisture, 24.51% crude protein, 3.41% total ash, 1.10% fat, 4.50% fibre and 70.19% carbohydrate 321.41 Kcal/100g. The protein content (Gopalan *et al*. 2004) of *'Pant lobia-3'* seeds was significantly higher than the comparative result for cowpea (24.1 %). The protein content of cowpea seeds was 20.36±0.59 per cent reported (Longvah *et al*. 2017) was less than that reported in the present study. Higher protein content had its importance in tissue synthesis and body building. The total ash content of cowpea seeds was 3.2 per cent Uriyo (2001) which was lesser than that in *'Pant lobia-5'* (3.48%) estimated in the present study. This signified than a towards a higher mineral content in *'Pant lobia-5'* seeds. The total physiological energy was recorded as 321.41 kcal in *'Pant lobia-3'* (which was rich source of fibre too significantly higher than that of *'Pant lobia-5'* seeds).

Table 2. Mineral composition of cowpea seeds

Minerals	*'Pant lobia-5'*	*'Pant lobia-3'*
Calcium (mg/100g)	76.03^{a}±0.05	72.89^{b}±0.01
Iron (mg/100g)	7.81^{a}±0.07	7.50^{b}±0.05
Magnesium (mg/100g)	154.2^{a}±0.05	155.8^{a}±0.15
Zinc (mg/100g)	4.50^{a}±0.03	4.70^{b}±0.05

Means in each column for each form of cowpea followed by the different letter (a & b) are significantly different (P d" 0.05)

Table 3. Amino acids composition of cowpea seeds

Amino acids	*'Pant lobia-5'*	*'Pant lobia-3'*
Methionine (mg/g Nitrogen)	80.03^{a}±0.02	82.50^{b}±0.03
Tryptophan (g/16g Nitrogen)	0.950^{a}±0.20	0.983^{b}±0.03
Lysine (g/16g Nitrogen)	5.47^{a}±0.2	5.39^{b}±0.03

Means in each column for each form of cowpea followed by the different letter (a & b) are significantly different (P d" 0.05)

Minerals Composition: *'Pant lobia-3'* seeds were found to be a rich source of minerals (7.042 mg) as it had 155.8 mg/100g magnesium and 4.70 mg/100g zinc. The zinc content of cowpea seeds (Gopalan *et al*. 1989) (4.6 mg/100g) was slightly lower than the comparative result for cowpea (4.7 mg/100g) estimated in the present study. *'Pant lobia-5'* was found to have 7.81 mg iron and 76.03 mg calcium in 100g of sample. A high magnesium content in *'Pant lobia-3'* seeds play an important role in the diet of heart disease patients, especially those related to elevated cholesterol level and hypertension.

Amino acids composition: The results of amino acids composition are presented in Table 3. Methionine (82.50 mg/g Nitrogen) and Tryptophan (0.983 g/16g Nitrogen) content of *'Pant lobia-3'* seeds was found to be higher than *'Pant lobia-5'* seeds. Methionine assists with metabolic function of the body and also breaks down fat. It is the primary source of sulfur in the body. Tryptophan is a precursor for vitamin B_3 or Niacin. The body uses tryptophan for the synthesis of niacin and serotonin. Therefore it can be reported that *'Pant lobia-3'* seeds contains good quality protein as compared to 'Pant lobia-5' seeds. The lysine content of *'Pant lobia-5'* seeds was significantly higher *i.e.* 5.47(g/16g Nitrogen) than 'Pant lobia-3'seeds.

Total dietary fibre content: The results of total dietary fibre composition are presented in Fig.1. The total dietary fibre content of *'Pant lobia-3'* was found to be 33.40mg/100g which was significantly higher than the 'Pant lobia-5' seeds. Hemalatha *et al*. (2007) reported that the cowpea seeds contain total dietary fibre content of 22.5 ± 0.80mg/100g. Phillips and Mc Watter (1991) reported that the cowpea seeds contain 27g/100g dietary fibre. Dietary fibres are the non-digestible carbohydrates. Consumption of dietary fibre is associated with reducing the risk of certain diseases such as cardiovascular disease, colon cancer and obesity (Chau and Huang, 2004). Soluble fibre lowers serum cholesterol and helps to reduce the risk of heart attack and colon cancer. Soluble and insoluble dietary fibres decrease the absorption of carbohydrates and reduce post-prandial serum glucose levels (Ou *et al*. 2001). The risk of obesity,

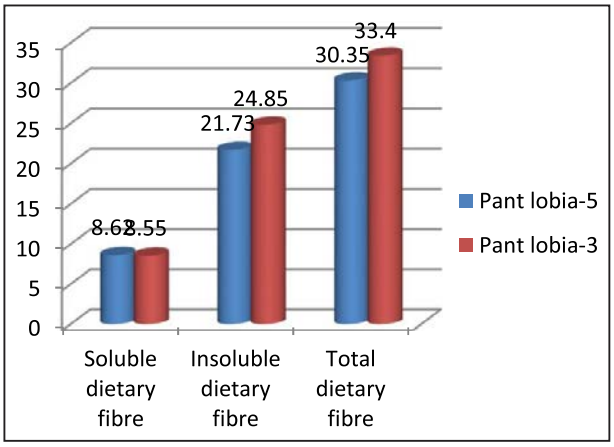

Fig 1. Total dietary fibre content (mg/100g) of cowpea seeds

blood pressure, appendicitis and many other diseases can be reduced by optimal intake of dietary fibre.

Antioxidant activity: The results of antioxidant activity are presented in Fig. 2. The total flavonoids and total antioxidant activity (DPPH Scavenging activity) of *'Pant lobia-3'* was found to be 175.20 mg R.E./100 gm and 95.19 mg T.E./100 gm respectively. Nassourou *et al*. (2016) stated that the 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging activity of cowpea seeds ranged between 70.98–266.93 mg Trolox equivalent per 100 g. The *'Pant lobia-3'* falls in the range and showed a DPPH activity of 95.19mgT.E./100g. On the other hand, the total flavonoids and total antioxidant activity content of *'Pant lobia-5'* seeds were found to be 164.6 mg R.E. /100 gm and 91.4 mg T.E./100 gm. The total phenol content of *'Pant lobia-5'* was 79.43mg/G.A.E., which was found to be higher than that of *'Pant lobia-3'*. Gutierrez *et al*. (2011) reported total

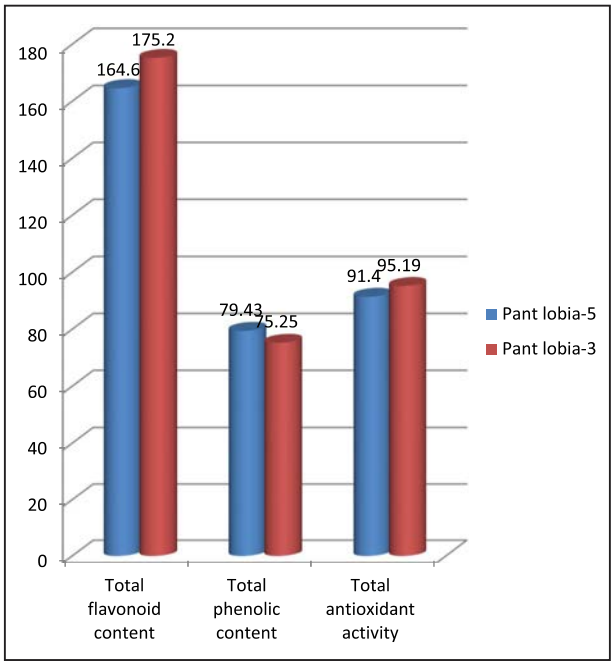

Fig 2. Antioxidant activity of cowpea seeds

phenolic composition of 75.57±2.29 mg G.A.E. /100mg total phenolic content in whole seeds.

CONCLUSION

The present study evaluated the nutritional quality of two cowpea varieties (*'Pant lobia-5' and 'Pant lobia-3'*). Thus *'Pant lobia-3'* seeds had a higher content of crude protein specifically methionine and tryptophan, minerals and antioxidants than *'Pant lobia-5'*. *'Pant lobia-3'* had a high magnesium, and zinc content as compared to *'Pant lobia-5'*. A high magnesium content in *'Pant lobia-3'* seeds plays an important role in the diet of heart disease patients, especially those related to elevated cholesterol level and hypertension. Also *'Pant lobia-3'* seeds also showed excellent antioxidant properties, such as total flavonoid content (164.6 mg R.E. /100 gm of flavonoid) and total antioxidant activity (DPPH scavenging activity) (91.4 mg T.E./100 gm of antioxidant). This antioxidant activity along with its high dietary fibre content makes it good for the diet of obese people. Consuming dietary fibre in the regular diet reduces the risk of certain diseases such as cardiovascular disease, colon cancer and obesity. *'Pant lobia-3'* seeds have multifaceted nutritional qualities which makes it a nutrinacy superior pulse of the country. *'Pant lobia-5'* seeds had higher iron and calcium content as well as many proximate principles. The lysine content of *'Pant lobia-5'* is higher than *'Pant lobia-3'*. Looking into their nutritional properties, both the varieties can be encouraged for commercial production. Consumption of cowpea can contribute towards alleviating the problem of under nutrition among the vulnerable population.

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