Proximates and Mineral Composition Profiling in Cowpea ((*Vigna unduiculata* LWalp.)

ABSTRACT

Micronutrients are most important growth promoting elements for crops as well as for human. As per some reports more than two billion of the global populations are malnourished. Micronutrient malnutrition among the people of every age is very common in developing countries like India, Cowpea one of the vital grain legume is the cheapest sources of proteins, vitamins and micronutrients and can be supplied to the people through daily diet. In this regard profiling of the proximate composition and mineral contents in seeds of diverse cowpea genotypes was studied at Seed Unit, UAS, Dharwad. A total of thirteen nutritional parameters were recorded across five genotypes. The results revealed significant difference for different of proximate and mineral contents. Highest protein content of 21.12% and fibre content of 11.30 % was observed. Fe content in cowpea varietiess was found to be the highest (99.1ppm) than the rest of minerals *viz.*, Zinc (56.3 ppm) and manganese content (9.8 ppm) among the genotypes indicating that cowpea is good sources for these micronutrients *viz.*, iron, zinc and manganese. Thus, identifying cowpea genotypes that could enhance protein accumulation and micronutrient density in seed through genetic improvement by breeders has the potential to overcome protein-calorie malnutrition and trace element deficiency in rural India.

Keywords: Cowpea, minerals, proximate composition, malnutrition, cowpea, food, sustainability,

Introduction

Report of the World Health Organization (WHO) estimates that over 820 million people are hungry, two billion have micronutrient deficiencies and nearly another two billion are obese or overweight, indicating a paradigm shift toward nutritional security (UNEP 2021). Further during the COVID-19 pandemic period also, the importance of micronutrients in maintaining and well-functioning immune system was well established. Efforts to increase bioavailability of micronutrients through dietary supplementation, food fortification and dietary diversification have been made and is going on to reduce micronutrient malnutrition.

However, the potential and effective way for reducing global micronutrient deficiency is being anticipated through the production of nutri-rich staple food crop cultivation.

Arid legumes are the most important group of crops having special significance in sustainable farming and nutritional security as they provide excellent source of protein, minerals, vitamins and crude fiber. They are considered as healthy vegetable food as well as offer nutritional security to millions of people, especially in South Asia and Africa (Ali, 2007) and are most valued as relatively cheaper source of protein and energy as compared to animal proteins. Legumes do also contain several nutritional factors whose beneficial effects on human health need to be fully exploited. Cowpea is one of the food legume mainly cultivated in Asian and African countries as a dual purpose crop. It is considered one of the best climate resilient legumes and has suitable agronomic features for cultivation on dry lands under low input condition of marginal lands (Gowda et al., 2007). Its nutritional value is comparable with other commonly consumed pulses and serves as a cheap source of nutrition for unprivileged rural communities residing in inaccessible areas.

Cowpea have a nutritional profile similar to other pulses with a relatively low fat content and a 25 percent total protein level, which is two to four times higher than cereal and tuber crops. The same as other pulses, the protein in cowpea grain is rich in lysine and tryptophan which are limiting amino acids in cereal crops. Besides being a rich source of protein, cowpea grain has a good profile of vitamins and minerals (Timko et al., 2007). Cowpea is oftenly called as “black-eyed pea” due to its black or brown ringed hilum and also as “vegetable meat” or “poor man’s meat” as it serves a major role in human nutrition. In India, cowpea is grown over an area of 4 m ha with a production of 2.7 m t and with productivity of 567 kg/ha (FAOSTAT, 2020).

In India traditionally it is (whole grains) used for preparing various region specific dishes. Across the country efforts are being made by scientists to study grain nutritional and biochemical composition in promising varieties of cowpea to expedite the genetic genetic improvement of this indigenous food legume. The aim of the study was to assess the protein content and micronutrients in important cowpea genotypes.

Material and Methods:

The experiment was carried out with five cowpea genotypes collected from diverse sources (Table 1.) in a randomized complete block design with three replications during the year *kharif* 2020-21 and 2021-22 at Seed Unit, University of Agricultural Sciences, Dharwad. Each genotype was sown in a plot size of 4 x 2.25 m^2 area having 6 rows. Row to row and plant to plant distance were maintained at 45 and 10 cm respectively. All the recommended agronomic practices were followed to raise healthy crop. At maturity recorded observations on yield and its component traits and further cleaned seeds were subjected to nutritional parameter analysis.

Estimation of nutritional parameters:

The different nutritional parameters were estimated by performing biochemical analysis as per the standard protocols given by the Association of Official Analytical Chemistry (AOAC), 2005 by using analytical grade chemicals and reagents. Protein, carbohydrates, ash, fat and minerals were estimated in seed samples of five diverse cowpea genotypes grown during 2020-21. Statistical analysis was performed for 13 nutritional parameters and minimum, maximum, range and mean were calculated for each nutritional trait and variation within group.

Results and Discussion:

The result obtained for 13 different nutrient components in five genotypes and minimum, maximum, mean and range are presented in the Table 1. The results revealed the presence of variation for each one of the nutrient components. Among the genotypes evaluated, protein content ranged from 17.52 % to 21.12 % and highest protein content was recorded in PL-2 (21.12 %) while, DC-15 (17.52 %) recorded lowest value. Fibre content is very important in the digestion process of human being. Highest fibre content of 11.30 % was recorded in PL-5 however no much variation in the fibre content was observed among the genotypes. Carbohydrate concentration was showed range of variation (51.13 % - 55.67%) the genotype PL-3 recorded highest value of 55.67 %. Ash content varied from 2014 % to 3.75 % with highest ash content in PL-3 (3.75%). Similar results were obtained by Massey and Nautiyal. (2020), Belane and Dakora. (2019).

Cowpea seeds in addition to protein also contain high levels of important dietary nutrients which are highly are required for human nutrition and health, especially for overcoming trace element deficiency and promoting brain development (Belane and Dakora., 2011). Present study also exhibited a wide range of variation for these nutrients in cowpea seeds. In this study, micronutrients distribution in cowpea seed also differed markedly among the genotypes under study with a range of 26.2-56.3ppm for Zinc (Zn), 47.1-99.1ppm for Fe, 3.3-9.8 ppm for Manganese (Mn) and 0.12-0.78 % for magnesium the most abundant minerals in cowpea grains. The report by Dakora and Belane. (2019), Bolbhat and Dhumal. (2014) supported such wide variation observed in the present investigation.

From the results of this study had shown that the concentrations of Fe and Zinc content was highest in seeds of cowpea genotypes. However, among the trace elements analysed Fe was found to be the highest (99.1 ppm) followed by Zinc (56.3 ppm) and manganese content (9.8 ppm) indicating that cowpea is good sources for these micronutrients and identification of genotypes with high amounts of Fe and Zn could contribute significantly to improve the micronutrient status of the diet of consumers. These results are in accordance with the findings of Belane and Dakora. (2019), Bolbhat and Dhumal. (2014). The genotype PL-2 recorded highest value for more than one mineral components together namely, carbohydrates, protein, Fe and Zn for more than one nutrient components (fig 1) indicating there is huge scope for genetic enhancement of cowpea genotypes for nutritional parameters.

Conclusion:

The present study has showcased the presence of wide range of variation for different nutritional parameters in the cowpea genotypes studied. Presence of high concentration of protein, Fe and Zn in different cowpea genotypes implies ample opportunity for its genetic improvement. Thus, in the present climate change scenario, to meet the nutritional security along with food security, genetic enhancement in cowpea is of appropriate choice.

Our approach towards "more nutrition per bite" might join the hands to combat the protein-calorie malnutrition and hidden hunger. The nutrition rich genotypes identified in the present study will be a promising genetic material for plant breeders in feature. Furthermore, there are still immense possibilities exist for cowpea crop to be explored for its many undiscovered photo-chemicals to make the most use of this indigenous legume to address food and nutritional security issues.

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Table 1. Proximate profile in diverse cowpea genotypes.

Sl no	Genotype	Carbohydrate (%)	Ash (%)	Fat (%)	Fibre (%)	Protein (%)	N (%)	P (%)	K (%)	Mg (%)	Ca (%)	Zn (ppm)	Fe (ppm)	Mn (ppm)
1	DC-15	52.13	3.14	0.19	10.9	17.52	2.80	4.15	1.07	0.12	0.12	26.2	47.1	19.8
2	PL-2	55.67	3.45	0.95	10.8	21.12	3.38	3.31	0.90	0.18	0.10	56.3	99.1	3.3
3	PL-3	55.26	3.75	0.97	11.1	18.72	2.99	3.87	1.04	0.18	0.10	180.2	76.9	9.8
4	PL-4	54.61	3.49	0.99	10.9	20.65	3.30	4.03	1.01	0.78	0.09	66.6	51.2	7.4
5	PL-5	51.13	3.56	1.002	11.3	18.53	2.97	2.83	0.099	0.48	0.06	86.2	60.4	4.6
MEAN		53.76	3.48	0.82	11.00	19.31	3.09	3.64	0.82	0.35	0.09	37.76	66.94	66.94
MINIMUM		51.13	3.14	0.19	10.80	17.52	2.80	2.83	0.10	0.12	0.06	26.20	47.10	47.10
MAXIMUM		55.67	3.75	1.00	11.30	21.12	3.38	4.15	1.07	0.78	0.12	56.30	99.10	99.10
RANGE		51.13-55.67	3.14-3.75	0.19-1.002	10.8-11.3	17.52-21.12	2.80-3.38	2.83-4.15	0.099-1.07	0.12-0.78	0.06-0.12	26.2-180.2	47.10-99.10	3.30-9.80

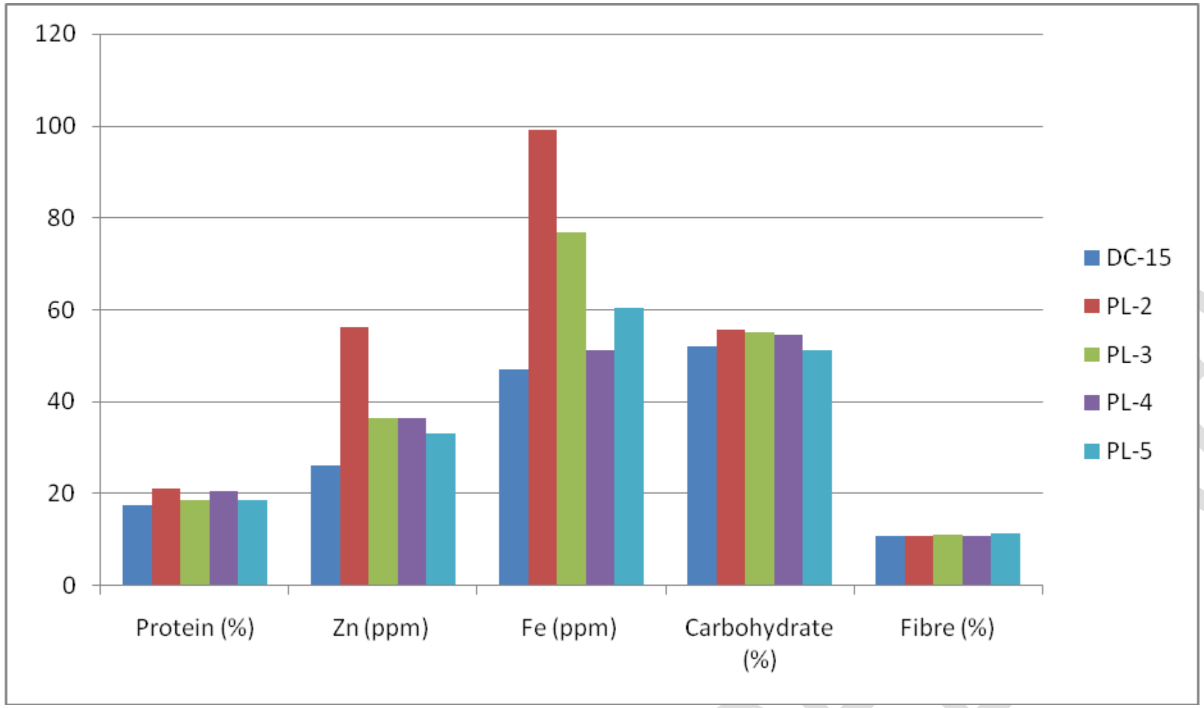

Fig 1. Protein, Iron, Zinc, carbohydrate and fibre content variation cowpea genotypes