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Cowpea leaf powder : A cheap nutritional supplement for the vulnerable population

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Cowpea leaves are a good source of some amino acids, vitamins, minerals and proteins. Beside this cowpea leaves are known to be rich in iron, calcium and vitamin C. Their content in cowpea leaves is 20.1 mg, 290 mg and 410 mg, respectively per 100 g. The leaves thus have a potential to be used to combat anemia in cowpea growing areas. Cowpea is cultivated on 12.5 million hectares of land worldwide and has a production of 3 million tones. Cowpea leaves are consumed in 18 countries in Africa, 7 countries in Asia and the pacific. India is the largest cowpea producer in Asia. Products have already been formulated to some extent in India by some researchers. The present work attempts to take this work further. For this purpose leaves of four cowpea varieties (Pant Lobia 1, Pant Lobia 2, Pant Lobia 3, Pant Lobia 4 and PGCP 12) were taken up for the study. Cowpea Leaf concentrates have been developed by cleaning washing and oven drying the leaves at 45- 50^{0}C. The concentrate have been evaluated for their nutritional content. The analysis revealed the moisture content to range from 6 per cent to 12 per cent. For fat it ranges from 0.5 per cent to 4.5 per cent. For fibre the values range from 9.22 per cent to13.6 per cent. Mean total ash content was found to be 10.82 per cent in the present study, highest being 11.21 per cent in Pant Lobia 3 and lowest being 9.88 per cent in PGCP 12. For total carbohydrates the values ranges from 46.35 per cent to 30.05 per cent. physiological energy ranged from 283.3 kcal/ 100g to 304.78 Kcal/100 g. cow pea leaf varieties were found to be nutritionally rich in protein, fibre, total ash, physiological energy and less in fat and therefore can be used for combating and reducing the Protein energy malnutrition (PEM), lifestyle related disease, heart related diseases. Among all the varieties PGCP 12 appears to be the nutritionally rich in most of nutrients therefore may be used to develop nutritionally rich food supplements.

Key Words : Cowpea leaves, Genotypes, Nutritional supplement

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INTRODUCTION

Cowpea leaves are a good source of some amino acids, vitamins, minerals and proteins. The protein in cowpea seed is rich in the amino acids, lysine and tryptophan, compared to cereal grains; however, it is deficient in methionine and cystine when compared to animal proteins. Beside this cowpea leaves are known to be rich in iron, calcium and vitamin C. Their content in cowpea leaves is 20.1 mg, 290 mg and 410 mg per 100 g, respectively (Bisla *et al.*, 2012).

Young cowpea leaves are consumed in at least 18 countries in Africa, and 7 countries in Asia and the Pacific (Duke, 1981 and Barret, 1987). In many parts of Africa, cowpeas are among the top three or four leaf vegetables marketed and consumed. In Uganda, cowpea leaves are reported to be more popular than the seeds. Bubenheim *et al.,* 1990 documented that, low fat, high complex carbohydrate and moderate protein are characteristics of edible portion that is suitable for vegetarian diet in a space-deployed bio-generative life support system. These qualities make cowpea a candidate crop for controlled ecological life support systems (CELSS) (Ahenkora *et al.,* 1996 and Bubenheim *et al.,* 1990). Recently, the nutrient composition of cowpea leaves for human consumption was extensively re-viewed. Cowpea leaves are a good source of some amino acids, vitamins, minerals and proteins, with higher nitrogen content in the younger leaves. The total dietary fibre content of cowpea leaves increases with leaf age, but fat and ash contents are less affected (Nielsen *et al.,* 1997). A study was conducted at Banasthali University, Rajasthan to develop low cost nutrient dense supplementary products for children by using locally available cereals, soy flour, Bengal gram leaves and cowpea leaves. Ten products *viz.,* - *Bhakar wadi, Bhakri, Halwa, Namakpara, Pua, Rings, Vegetable pakodi, Chana murmura premix, Murmura moong dhal premix, Suji groundnut premix, Suji ki kheer* premix were standardized and developed.

Earlier reports on the nutritional composition of cowpea leaves have been limited to a small number of lines. (Bittenbender, 1992 and Leung, 1968). However, the International Institute of Tropical Agriculture (IITA) in Ibadan, Nigeria, has developed and distributed a range of improved cowpea breeding lines to over 60 countries for further systematic evaluation and general release (Singh and Sharma, 1996). In northern Ghana, cowpeas are among the top four leaf vegetables sold in fresh or dried forms and are consumed boiled, fried or fresh in relish (Ahenkora *et al.,* 1996). The differences in palatability of cowpea leaves have apparently not been studied, but farmers sometimes complain that 'improved' varieties have bitter or tough leaves that do not make good food (Rowland, 1992).

India is a largest producer of cowpea in Asia. Per capita availability of pulses in India is constantly declining due to stagnant production of pulses and increasing rate of population. Therefore, concerted efforts are being made to increase pulse production by introducing short duration high yielding varieties as a niche crop in the rice-wheat system. Cowpea is one of the potential crops for this system because a number of high yielding cowpea varieties have recently been developed which mature in 60-70 days and require less irrigation and fertilizers (Singh *et al.,* 1997).

The cowpea (*Vigna unguiculata*) is one of several species of the widely cultivated genus *Vigna*. Unguiculata is Latin for "with a small claw", which reflects the small stalks on the flower petals.(Ernest, 2009). All cultivated cowpeas are found within the universally accepted *V. unguiculata* subspecies *unguiculata* classification, which is then commonly divided into four cultivar groups : *Unguiculata, Biflora, Sesquipedalis* and *Textilis* (Singh *et al.,* 1997). Cowpeas are one of the most important food legume crops in the semiarid tropics covering Asia, Africa, southern Europe and Central and South America. A drought-tolerant and warm-weather crop, cowpeas are well-adapted to the drier regions of the tropics, where other food legumes do not perform well. It also has the useful ability to fix atmospheric nitrogen through its root nodules, and it grows well in poor soils with more than 85 per cent sand and with less than 0.2 per cent organic matter and low levels of phosphorus. Estimates of the amount of N fixed biologically by cowpea range from 73 to 354 kg N/ha per year (FAO, 2012). In addition, it is shade tolerant, so is compatible as an intercrop with maize, millet, sorghum, sugarcane and cotton.

Some of the more well known common names for cultivated cowpeas include black-eye pea, southern pea, yard long bean, catjang and crowder pea (Perrino *et al.,* 1993). The classification of the wild relatives within *V. unguiculata* is more complicated, with over 20 different names having been used and between 3 and 10 subgroups described (Singh *et al.,* 1997). The original subgroups of *stenophylla, dekindtiana and tenuis* appear to be common in all taxonomic treatments, with the earlier described variations *pubescens* and *protractor* being raised to sub species level by a 1993 charactisation. (Singh *et al.,* 1997).Nutritional content revealed in a study in Nigeria has been shown in the Tables 1 to 4 (Chikwendu *et al.,* 2014).

Keeping in consideration the nutritional quality of cowpea leaves, the present investigation analyzed the nutrient composition of five varieties which are grown

Table A : Proximate composition of fresh and dried cowpea leaves per 100g

Sample	Protein (%)	Fat (%)	Ash (%)	Fibre (%)	Carbobydrate (%)
LF.	21.98±0.01	9.00 ±0.01	4.80 ±0.01	25.11±0.01	39.11 ±0.01
DL	39.24±0.02	1.31 ±0.01	14.80±0.03	14.26 ±0.04	30.39±0.04

FL= fresh leaves, DL= Dried leaves of cowpea .Means ± SEM of two determinations values at the same vertical column with different superscripts were significantly different (P<0.05)

Table B : Proximate composition of dried cowpea leaves powder

Author	Moisture (%)	Crude protein (%)	Crude fibre (%)	Crude fat (%)	Total ash (%)
Mamiro, P.S. *et al.*	3.97	26.12	17.2	11.18	-
Mosha, T.C. *et al.*	-	20.64--46.56	-	2.57--4.34	8.92--15.69
Leung *et al.*	10.6	22.6	-	3.2	-

Table C : Macronutrient composition of fresh and dried cowpea leaves per 100gm (Chikwendu *et al.*, 2014)

Sample	Fe(mg)	Zn(mg)	Ca (mg)	Iodine(µg)	P(mg)	β-carotene(RE)	Vit.C(mg)
FL	77.29±0.01	12.91±0.04	39.87 ±0.01	519.47±0.01	383.20±0.03	9.10 ±0.01	59.24±0.01
DL	7.50±0.00	1.66±0.01	1.40±0.01	136.35±0.01	135.60±0.01	0.25±0.00	1.39±0.01

FL= fresh leaves, DL= Dried leaves of cowpea. Means ± SEM of two determinations values at the same vertical column with different superscripts were significantly different (P<0.05).

Table D : Phytochemical composition of fresh and dried leaves of cowpea per 100g (Chikwendu *et al.*, 2014)

Sample	Tannins (mg)	Saponins (mg)	Flavonoids (%)	Polyphenols (mg)
FL	4.12	0.23	26.72	32.56
DL	2.75	0.06	3.77	9.55

FL= fresh leaves, DL= Dried leaves of Cowpea. Means of two determinations values in the same vertical column with different superscripts were significantly different (P<0.05).

and available in Pantnagar, Uttarakhand. These are namely Pant Lobia 1, Pant Lobia 2, Pant Lobia 3, Pant Lobia 4 and PGCP 12.

METHODOLOGY

Procurement of raw material:

For the present investigation, five varieties of cowpea leaves namely Pant Lobia 1, Pant Lobia 2, Pant Lobia 3, Pant Lobia 4 and PGCP 12 were selected from breeders seed production centre, G.B. Pant University of Agriculture and Technology, Pantnagar. All the genotypes were grown under similar agro climatic conditions. The leaves at third and fourth position from the apex of plant were plucked.

Sample preparation:

Cowpea leaves powder was prepared by washing and drying fresh cowpea leaves at 45-50° C for 8 – 10 hours and then grinding in an electric grinder to a fine powder (Fig. A). The samples were stored in clean double sealed polyethylene bags. The prepared powder was used for analysis of nutrients, micronutrients, anti nutrients and antioxidant activity.

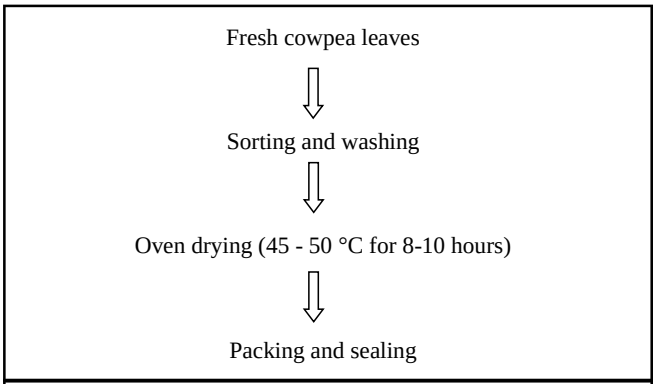

Fig. A : Flow chart of preparation of cowpea leaves powder

Biochemical analysis :

This involves the determination of the per cent of moisture, crude protein, total ash, crude fat and crude fibre in the food. Carbohydrate by difference and physiological energy are also included in the proximate analysis. Proximate composition was determined by (AOAC, 1995) standard method. Proximate composition

of dried cowpea leaves powder as reported in literature has been shown in a table (Table A and B).

OBSERVATIONS AND ASSESSMENT

Proximate compositions of dried cowpea leaves of five varieties namely Pant Lobia 1, Pant Lobia 2, Pant Lobia 3, Pant Lobia 4 and PGCP 12 were evaluated. The results are shown in Table 1. The highest moisture content (11.75%) was recorded in the leaves of genotype PGCP 12 and the lowest (5.55%) in the genotype Pant Lobia 1. The results were compared with the results obtained by (Leung, 1968). Mean moisture content of five genotypes of dried cowpea leaves was 7.99 per cent which was found to be lesser than comparative results *i.e.* 10.6 per cent.

Mean value for fat was 2.52 per cent, highest being 4.9 per cent in PGCP 12 and lowest 0.82 per cent in Pant Lobia 1. Mean fat content from the present study *i.e.* 2.52 per cent was lesser than comparative results *i.e.* 3.2 per cent but the fat content in variety Pant Lobia 4 (4.5%) and PGCP 12 (4.9%) was higher than comparative study by (Leung, 1968).

For protein mean content was 29.09 per cent highest being 31.5 per cent in Pant Lobia 2 and lowest being 28 in Pant Lobia1 (Leung, 1968) found crude protein in dried leaves of cowpea genotypes and reported to be around 27.6 per cent which is lower than estimated in present study of six genotypes of cowpea leaves powder per cent. The protein content of CLP in comparison to common cereals and pulses was quite higher.

For fibre mean value was 11.07 per cent, highest being 13.6 per cent in PGCP 12 and lowest being 8.22 per cent in Pant Lobia 2. For fibre mean content was 11.07 per cent which was lesser than reported by Chikwendu *et al.* (2014) *i.e.* 14.26 per cent.

Mean total ash content was found to be 10.82 per cent in the present study, highest being 11.21 per cent in Pant Lobia 3 and lowest being 9.88 per cent in PGCP 12. The results were compared with the results obtained by Chikwendu *et al.* (2014) Mean ash content of five

Table 1 : Proximate composition of dried cowpea leaves powder from different genotypes

Genotypes	Moisture (%)	Crude protein (%)	Crude fat (%)	Crude fibre (%)	Total ash (%)	Total carbohydrate	Physiological energy (kcal)
Pant Lobia 1	5.55±1.40	28.0± 0.94	0.82±0.25	8.22±0.33	11.00±0.28	46.35±1.95	304.78
Pant Lobia 2	7.35 ±0.35	31.5±0.63	0.5±0.28	10.53±0.53	11.06±0.30	38.98±0.62	286.42
Pant Lobia 3	6.52±0.17	28.00± 1.0	1.9±0.46	10.72±0.38	11.21±0.49	38.16±6.61	281.74
Pant Lobia 4	8.8±0.2	28.22± 1.2	4.5± 0.81	12.24±0.66	10.95±0.30	35.28±2.84	264.88
PGCP 12	11.75±0.26	29.75± 0.29	4.9± 0.91	13.66±0.42	9.88±0.39	30.05±0.5	283.3
Grand Mean	7.99	29.09	2.52	11.07	10.82	37.76	284.22

Values are mean of triplicate observation ± SD

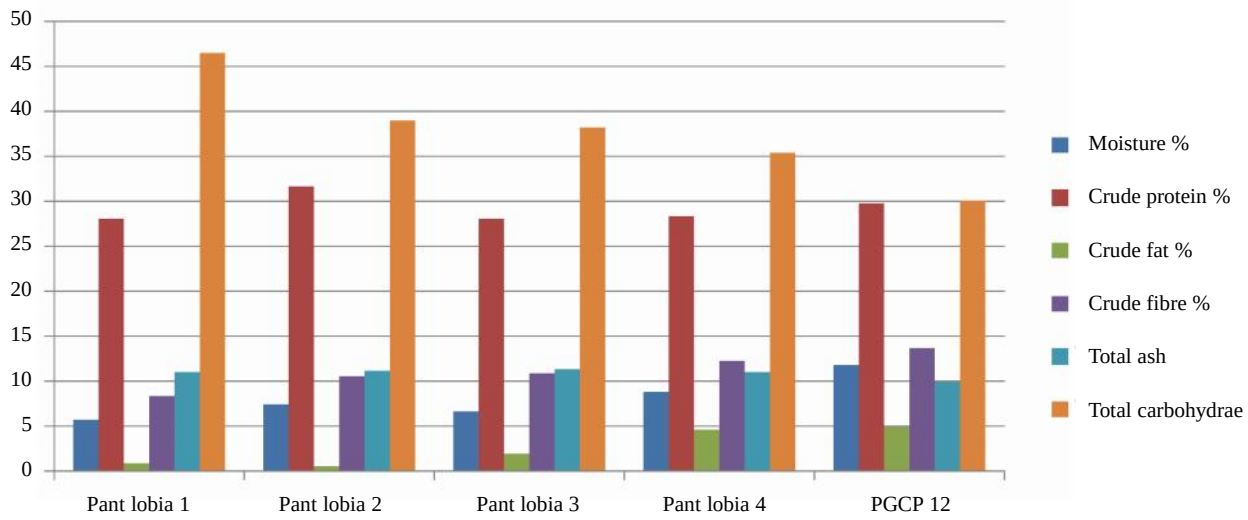

Fig. 1 : Proximate composition of dried cowpea leaves from different genotypes

genotypes of dried cowpea leaves were 10.82 per cent which was found to be lesser than comparative results *i.e.* 14.80 per cent.The ash content of CLP was found to be higher than wheat flour (1.5 to 2 %). Hence CLP is more mineral dense than wheat flour which is been consumed by most of the population.

Highest amount of carbohydrates were found in the genotype Pant Lobia 1 (46.35%) and lowest in PGCP 12 (30.05%). Chikwendu *et al.* (2014) reported the mean carbohydrate content to be 30.39 per cent which is lesser than the estimated grand mean carbohydrate content of present study *i.e.* 37.76 per cent. Major cereals and pulses are having higher carbohydrate content than CLP. Major cereals like wheat and rice contain carbohydrate in the range of 69 to 79 g per 100 g as reported by Gopalan *et al.* (2010).

The highest content of physiological energy was observed in the genotype Pant Lobia 1 (304.78 Kcal/100 g) and the lowest for Pant Lobia 2 (286.42 Kcal/ 100 g). For Physiological energy grand mean content was 284.22 Kcal/ 100 g which was little lesser than reported by Chikwendu *et al.* (2014) *i.e.* 290.31 Kcal/ 100 g.

According to the results revealed in the study cowpea leaf varieties were found to be nutritionally rich in protein and therefore can be used for combating the Protein energy malnutrition, rich in fibre and therefore can be helpful in reducing lifestyle related disease, have less amount of fat content and can be useful for combating heart related diseases. Among all the varieties Pant Lobia 2 appears to have highest content of protein, Pant Lobia 3 appears to have highest content of total ash content. And PGCP 12 found to be the nutritionally rich in most of nutrients therefore cowpea leaves may be used to develop nutritionally rich food supplements.

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