DEVELOPMENT AND STANDARDIZATION OF IRON RICH *PAPAD* MADE USING THREE FOOD GROUPS ENRICHED BY GREEN LEAFY VEGETABLE

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ABSTRACT

Objective of the present study was to develop Iron rich *papad*, using three food groups (Cereal, Pulse & oil seed) and enriched with Green leafy vegetable (GLV), its Sensory evaluation and Iron estimation. The study was conducted with selection and processing of GLV, preparation of iron rich *papad* and its sensory evaluation. They were tested for different attributes (Taste, after taste, flavor, appearance, color, texture and overall acceptance). Estimation of iron content in processed GLV and most acceptable product was done by Acid Digestion method. Iron rich *papad* were prepared by using three food groups (Rice flakes, Soyabean and Niger seeds) and enriched by Cow pea leaves. *Papads* were prepared in three proportions of rice flakes: cow pea leaves viz code I (3:1), code II (4:0) and code III (2:1). Code I scored highest viz taste, flavor, appearance, color, overall acceptance and the differences were statistically significant (P<0.05). Iron content of processed cow pea leaves and iron *rich papad* was found to be 161mg/100g and 47.29mg/100g respectively. It was concluded that cow pea leaves is a good source of iron and its product "Iron Rich *Papad"* is highly acceptable.

KEY WORDS: Enrichment, Green leafy vegetables, Cow pea leaves, Iron rich *papad,* Sensory evaluation and Iron estimation.

INTRODUCTION

India is a country with diverse agro-climatic conditions which favours the cultivation and availability of wide array of foods specially fruits and vegetables. The country is the second largest producer of vegetables next to China, accounting for about 10 per cent of the world production (1). Green leafy vegetables (GLVs) are the least expensive sources of a number of protective nutrients. They are readily available throughout the year, and are grown in sufficient quantities throughout India. Consumption of locally available GLVs is an important means to overcome deficiencies (2).

Iron Deficiency Anaemia (IDA) is one of the major public health problems of the country among women of reproductive ages. Iron being an essential element in formation of haemoglobin. It is possible to combat IDA using a combination of key intervention strategies viz., supplementation, fortification, enrichment and also by increasing consumption of foods rich in iron in substantial amounts. Now the time has come to look for long term sustainable, culturally acceptable, rational, applicable, feasible, cost effective and suitable natural means to attain nutritional security and eliminate IDA. The strategy of synthetic supplementation in the form

of pharmaceuticals provide only the specific nutrients whereas, the food based approach provides a package of both macro and micro nutrients in addition to the antioxidants and neutraceuticals including dietary fiber (3).

The young and tender cowpea leaves are picked and consumed as relish along with the main staples. The leaves are the source of carbohydrates, proteins, fats, iron, calcium, phosphorus, ß-carotene, and vitamins B and C, which are necessary for maintaining good health (4). Young cowpea leaves are consumed in seven countries in Asia and the Pacific (5).

The time has come to put the array of iron rich foods like GLVs to effective use not just for combating anaemia but for achieving all round improvement in health. In order to place the GLVs in to the routine diets of population and to break monotony of the meals, it becomes essential to convert the traditional products in to attractive, value added acceptable products with enhanced content of blood forming nutrients. Hence the present investigation is an attempt to developed Cow pea leaves based value added products by using three food groups (Cereal, Pulse & oil seed) for iron security. *Papad* is one of the Indian traditional food items of India,

which is a thin crispy wafer like dish that goes well with meals and snacks. It is also eaten as an appetizer, or served as an accompaniment to a meal in India. They are staple in every Indian's home.

Specific objectives of the study are as follows:
1. To develop a product using ingredients from three food groups (Cereal, Pulse & oil seed), enriched by cow pea leaves.
2. Sensory evaluation of developed products and nutritional analysis of developed product for its iron content.

MATERIALS AND METHODS
The study was conducted at Food Science Laboratory, Department of Nutrition, Isabella Thoburn College, Lucknow. The Cow Pea leaves were processed to make powder by using Sun drying method. The three food group formulated product which is enriched by cow pea leaves i.e. Iron rich *papad* were developed (Figure-1)*.* Three types of *papad* (Table-1) were prepared by different proportions of rice flakes: Cow Pea leaves viz Code I (Proportion 3:1), Code II (Proportion 1:0) i.e. Control and Code III (Proportion 2:1).

Sensory evaluation of the prepared product was done by Composite scoring test (6). Then they were tested for Different attributes (Taste, after taste, flavor, appearance, color, texture and overall acceptance). A mixed panel of 51 Trained and Semi-trained judges were selected for sensory evaluation. The nutrient analysis of sun-dried Cow Pea leaves and its most acceptable product i.e. Iron rich *papad* was done in Indian Toxicology Research Centre Laboratory, Lucknow. Total Iron was anlysed in triplicates using AOAC method (7). The nutrient composition of the iron rich *papads* (per 100g & per serving) was calculated using values as given in "Nutritive Value of Indian Foods" by C.Gopalan (8). Statistical analysis was done using SPSS 16.0 version.

RESULT AND DISCUSSION
Sensory scores of developed papad enriched with cowpea leaves
The mean taste of code I, code II & code III was 7.372$\pm$0.13, 7.862$\pm$0.15 and 6.294$\pm$0.17 respectively. The differences were very highly significant between code I & code II, code II & code III and code I & code III. It was observed from the data that code I was the best in taste among all three codes. However, the mean after

taste of code I, code II and code III was 7.372$\pm$0.13, 7.862$\pm$0.15 and 6.294$\pm$0.17 respectively. The difference between code I & code II was significant whereas the difference between codes II & III and codes I & III were very highly significant. Hence after taste of code II was best. Among the three codes, code I had highest i.e. 12.980$\pm$0.17, code II had medium i.e. 12.098$\pm$0.21 and code III had lowest i.e. 11.745$\pm$0.22 mean flavor difference between code I & II and I & III were very highly significant, but there was no significant difference between code II & III hence flavor of code I was best.

The mean appearance of code I, code II & code III was 12.823$\pm$0.20, 12.49$\pm$0.21 and 11.588$\pm$0.20 respectively. Difference between code II & code III and code I & III was very highly significant whereas there was no significant difference between code I & II. Code I score highest but the difference was not significant between code I and Code II, hence both codes were equally good in appearance. The mean of color of code I, code II & code III was 12.607$\pm$0.20, 12.019$\pm$0.19 and 11.411$\pm$0.23 respectively. There was no significant difference between code I & code II and there was significant difference between code II & III where as the difference between code I & code III was very highly significant. Similarly, to above both code I and code II were equally good in color. The mean texture of code I, code II & code III was 13.019$\pm$0.16, 12.509$\pm$0.17 and 13.333$\pm$0.92 respectively. There was no significant Variation between code I & III, difference between code I & II is significant whereas between code II & III very highly significant variation. It was opined from the data that code III was good in texture but difference was not found significant.

Table 1: Amount and ratio of ingredients of Developed Product

INGREDIENTS	Code I	Code II	Code III
Rice Flakes	75g	100g	66g
Cow pea leaves powder	25g	-	33 g
Soyabean Powder	20 g	20 g	20 g
Niger seeds	20 g	20 g	20 g
Cumin seeds powder	3 g	3 g	3 g
Black pepper	2.5 g	2.5 g	2.5 g
Salt	3 g	3 g	3 g

Table 2: Mean Sensory Attributes of the three codes

Sensory Attributes (Mean $\pm$SE)	Code I	Code II	Code III	't' Value
Mean Taste $\pm$SE	26.117$\pm$ 0.37	24.509 $\pm$ 0.37	23.392 $\pm$ 0.34	I & II 3.1778*** II & III 4.279*** I & III 5.6069***
Mean After Taste $\pm$SE	7.372$\pm$ 0.13	7.862 $\pm$ 0.15	6.294 $\pm$ 0.17	I & II 2.437* II & III 6.758*** I & III 4.9***
Mean flavour $\pm$SE	12.980$\pm$ 0.17	12.098 $\pm$ 0.21	11.745 $\pm$ 0.22	I & II 11.76*** II & III 1.146[#] I & III 5.02***
Mean appearance $\pm$SE	12.823$\pm$ 0.20	12.49 $\pm$ 0.21	11.588 $\pm$ 0.20	I & II 1.125 [#] II & III 3.068*** I & III 4.258***
Mean colour $\pm$SE	12.607$\pm$ 0.20	12.019 $\pm$ 0.19	11.411 $\pm$ 0.23	I & II 1.849 # II & III 2* I & III 3.861***
Mean Texture$\pm$SE	13.019$\pm$ 0.16	12.509 $\pm$ 0.17	13.333 $\pm$ 0.21	I & II 2.161* II & III 2.942*** I & III 1.158[#]
Mean overall acceptance $\pm$SE	84.921$\pm$ 0.92	81.490 $\pm$ 0.02	77.764 $\pm$ 1.10	I & II 2.579** II & III 2.474* I & III 4.973***

[#,]Non Significant,*Significant,**High Significant,***Very high Significant

Table 3: Iron Content of cow pea leaves Powder & Iron rich *Papad* by chemical analysis method

Product	Iron Content (mg/100g)
Cow pea leaves	161
Iron rich *Papad*	47.29

Among the all codes, code I had highest score i.e. 84.921$\pm$0.92, code II had medium i.e. 81.49$\pm$1.02, and code III had lowest i.e. 77.764$\pm$1.1 mean of Total over all acceptance of product. The difference between code II & III significant, between code I & II is highly significant & between code I & III is very highly significant. Code I was the best developed food product among all attributes of sensory evaluation (Table-2).

Estimation of Iron content
The iron content of sun-dried cow pea leaves powder was found to be 161mg/100g and iron rich *papad* was 47.29mg/100g (Table 3). The nutrient composition and cost of the Iron rich *Papad* based on cow pea leaves powder is shown in the table 4.

CONCLUSION
On the whole it can be concluded that the code I scored highest viz taste, flavor, appearance, color, overall acceptance and the most acceptable form of developed product. The iron content of sun-dried cow pea leaves powder was 161mg/100g and iron rich *papad* was 47.29mg/100g.

Table 4: Nutrient composition and cost of Iron *rich Papad* based on cow pea leaves powder

Nutrient	Per 100 g	Per Serving
Energy (Kcal)	307.31	53.65
Protein (g)	17.32	8.66
Fat (g)	10.07	5.03
Fibre (g)	4.82	2.41
Carbohydrate (g)	52.13	26.06
Calcium (mg)	526.92	263.46
Phosphorus (mg)	320.74	160.37
Iron (mg)		
Calculated Fe	47.07	23.535
Analysed Fe	47.29	23.645
Carotene (mg)	8344.2	4172.1
Thiamine (mg)	0.4003	0.1501
Riboflavin (mg)	.0467	0.2335
Niacin (mg)	4.493	2.246
Folic acid (mg)		
Free	1.1533	0.576
Total	13.333	6.666
Vitamin C (mg)	5.52	3.35
Chorine Mg	2.76	17.75

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