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Research Paper

Organoleptic evaluation, nutritional quality and storability of iron rich supplement based on green leafy vegetable

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ABSTRACT : Green leafy vegetables offer a moderate but natural source of iron. In the present study, Bengal gram leaf powder was used with *amla* powder, jaggary, coconut powder, rice flake powder and milk powder in different proportions for development of a product (*laddu*) to combat the problem of anemia as it can be easily consumed by vulnerable groups. Out of four trials (A, B, C and D) of *laddu*, iron rich *laddu* (A) was liked very much with the score of 8 on nine point Hedonic scale. Iron content and in *vitro* iron bioavailability were 17.5mg per cent and 2.85 per cent, respectively. However, 19.87 mg and 2.83 per cent, respectively on dry weight basis of iron rich supplements. The content of iron, vitamin C and *in vitro* iron bioavailability were found to be decreased during storage. Storage study revealed that the iron rich *laddu* (A) was acceptable upto two months of storage in air tight jar at room temperature (29^0-34^0).

KEY WORDS : Green leafy vegetables,Bengal gram, Iron, Iron rich supplement, Iron bioavailability

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Anemia is a major public health problem in India. Prevalence of anemia is disproportionately high in developing countries due to poverty, inadequate diet, high levels of malaria and other infectious diseases; frequent reproductive cycling that decreases body iron stores and poor access to health services (Florentino, 2003). Study of National Nutritional Monitoring Bureau (NNMB) on the prevalence of micronutrient deficiency indicates that prevalence of anemia was highest (78 %) among lactating women followed by pregnant women with 75 per cent.

Anemia among adolescent girls and school children was found to be 70 per cent and 67 per cent, respectively (Babu, 2006). Targeted three main strategies existing are education, combined with dietary modification or diversification or both, to improve iron intake and bioavailability, iron supplementation and iron fortification of foods for correcting iron deficiency in population. A new approach is biofortification *via* plant breeding or genetic engineering (Zimmermann and Hurrell, 2007). Green leafy vegetables (GLV) offer a cheap but rich source of a number of micronutrients and phytochemicals having antioxidant properties. India having a variety of natural surroundings and varying climates and seasons, has a numbers of species of edible leafy vegetables such as spinach, amaranth, Bengal gram leaves, cauliflower leaves, mint and coriander (AVRDC, 1996).

Chana (*Cicer arietinum*) known as Bengal gram or chickpea is a major pulse crop in India and accounts for 40 per cent of total pulse production (Oudhia, 2003). Bengal gram leaves are less commonly used in saag and dal preparations in rural areas. They are relatively inexpensive, easily and quickly cooked and rich in several micronutrients such as beta-carotene, vitamin C, vitamin E, zinc, selenium and iron. Hence, the present study was undertaken to develop an iron rich supplement *laddu* and determine the proximate composition, vitamins, minerals and *in vitro* iron bioavailability on as in basis and dry weight basis. Sensory quality and storage stability were also studied.

RESEARCH METHODS

Procurement of raw materials:

The Bengal gram leaves for the investigation were procured from the Vegetable Research Centre of the G.B. Pant

University of Agriculture and Technology, Pantnagar, whereas, rice flake, *amla*, jaggery, coconut powder and milk powder were purchased from local market of Pantnagar as per the requirement.

Sample preparation:

Bengal gram leaf powder and *amla* powder were prepared by drying fresh Bengal gram leaves and *amla* at 50-55^{0}C in hot air oven for six to eight hours and then grinding in an electric grinder. The samples were stored in clean double sealed polyethylene bags.

Standardization and preparation of iron rich supplements:

The preliminary trials were conducted to standardize the level of ingredients in iron rich supplement. Bengal gram leafy powder, *amla* powder, jaggery, coconut powder, rice flakes powder, and milk powder were taken in the varied ratio of 5:2:38:45:5:5 (iron rich *laddu* A), 10:2:38:40:5:5 (Iron rich *laddu* B), 15:2:38:35:5:5 (Iron rich *laddu* C), 5:2:28:45:15:5(Iron rich *laddu* D). All above mentioned ingredients in varied ratio were mixed to jaggery syrup of two threads consistency and small round balls (*laddu*) were made.

Sensory evaluation:

Sensory quality of iron rich supplements was evaluated by a semi-trained panel of 10 members by nine point hedonic scales as well as by score card method (Amerine *et al*., 1965).

Nutrient analysis:

Nutritional evaluation of the most accepted iron rich supplement was done. In the present study, iron rich supplement was analyzed in triplicate for moisture, crude protein, crude fat, crude fibre and total ash by AOAC (1995). Carbohydrate was estimated by difference. Ascorbic acid content in the fresh samples was determined using method given by AOAC (1995). The total ash obtained was used to prepare ash solution for the estimation of calcium (AOAC, 1995). Total iron and ionizable iron were determined according to the procedure given by Pranati (2005). All nutrients were estimated in triplicates.

Storage studies:

The best accepted supplement was stored for 90 days at room temperature in air tight jar. Observations were recorded at intervals of 1 month for microbial and sensory characteristics during the storage period.

■ RESEARCH FINDINGS AND DISCUSSION

The results obtained from the present investigation have been discussed under following heads:

Organolaptic evaluation:

Results on sensory quality presented in Table 1 show that iron rich *laddu* (A) was liked very much with the score of 8 on nine points Hedonic scale. Iron rich supplements were analyzed for colour, flavor, taste, texture and overall acceptability. Sensory score for each parameter has been presented in Table (2). The overall acceptability of iron rich supplement A, B, C, and D were 7.5, 6.6, 5.3 and 7.1, respectively. The result showed that iron rich supplement (A) attained the highest score.

Nutrient composition of the iron rich supplements:

The nutrient composition of the most accepted iron rich supplement (A) per 100 g basis and on dry matter basis are presented in Table 3 and 4, respectively. Iron rich *laddu* (A) had moisture 11.95 g, crude protein 11.16 g, crude fat 30.55 g, crude fibre 2.05 g, total ash 2.85 g, carbohydrate by difference 41.44, energy 485.00 kcal, calcium 160.0 mg, iron 17.5 mg, vitamin C 10.8 mg per 100 gram and ionizable iron 2.85 per cent. Nutrient composition of iron rich *laddu* (A) on dry weight

Table 1 : Mean value for sensory evaluation of iron rich supplements by nine point hedonic scale

Sr. No.	Name of the product	Mean score	Preferance
1.	Iron rich *laddu* (A)	8.0	Like very much
2.	Iron rich *laddu* (B)	6.0	Like slightly
3.	Iron rich *laddu* (C)	5.0	Neither like nor dislike
4.	Iron rich *laddu* (D)	7.0	Like moderately

Table 2 : Mean value for sensory evaluation of iron rich supplements by score card method

Sr. No.	Name of the product	Colour	Flavour	Taste	Texture/ consistency	Overall acceptability
1.	Iron rich *laddu* (A)	6.6	6.8	7.1	7.1	7.5
2.	Iron rich *laddu* (B)	6.7	6.1	7.0	7.0	6.6
3.	Iron rich *laddu* (C)	6.2	5.2	6.4	6.4	5.3
4.	Iron rich *laddu* (D)	6.4	7.0	7.0	7.0	7.1
	S.E.±	0.20	0.17	0.14	0.21	0.21
	C.D. (P=0.05)	0.57	0.48	0.40	0.59	0.60

basis showed crude protein, crude fat, crude fibre, total ash, carbohydrate by difference, energy, calcium, iron, vitamin C and ionizable iron content of 12.67 g, 34.52 g, 2.32 g, 3.22 g, 46.82 g, 548.00 kcal, 180.80 mg, 19.87 mg, 12. 20 mg per 100 g, and 2.82 per cent, respectively.

Storage studies of iron rich supplement:

The result of sensory quality of stored iron rich *laddu* is presented in Table 5. The result revealed that there were no significant differences between scores of fresh and stored iron rich *laddu*. This indicated that stored iron rich *laddu* was acceptable upto two months of storage in air tight jar at room temperature (29^0-34^0C).

Microbial studies of stored iron rich laddu:

The data presented in Table 6 reveal that bacteria were not detected initially before storage. However, the bacterial count increased significantly upon storage for three months. Total bacterial count increased significantly up to 3.05×10^4 bacteria per gram sample after three months of storage at room temp (29^0-34^0C). However, the total bacterial count of iron rich *laddu* during storage has been found to be quite low as

Table 3 : Mean value for nutrient composition of Iron rich supplement (per 100 g as is basis)

Product	Moisture (g)	Crude protein (g)	Crude fat (g)	Crude fibre (g)	Total ash (g)	CHO (g)	Energy (Kcal)	Ca (mg)	Iron (mg)	Vit C (mg)	Ionizable iron (%)
Iron rich *laddu* (A)	11.95	11.16	30.55	2.05	2.85	41.44	485.00	160.00	17.5	10.8	2.85
SD	0.055	0.015	0.017	0.015	0.10	0.015	0.021	2.65	0.15	0.10	0.015

Table 4 : Mean value for nutrient composition of Iron rich supplements (per 100 g dry weight basis)

Product	Crude protein (g)	Crude fat (g)	Crude fibre (g)	Total ash (g)	CHO (g)	Energy (Kcal)	Ca (mg)	Iron (mg)	Vit C (mg)	Ionizable iron (%)
Iron rich laddu (A)	12.67	34.52	2.32	3.22	46.82	548.00	180.80	19.87	12.20	2.82 %

Table 5 : Mean sensory score of stored iron rich *laddu*

Storage period (months)	Colour	Taste	Flavour	Texture	Overall acceptability
0	6.6	7.1	6.8	7.1	7.5
1	6.2	6.9	6.5	6.4	6.1
2	6.0	6.0	5.9	6.0	6.0
S.E.+	0.17	0.20	0.29	0.22	0.16
C.D. (P=0.05)	0.49	0.61	0.85	0.64	0.48

Table 6 : Microbial study: mean value for total bacterial and mould count of stored iron rich *laddu*

Product	Storage period (months)	Total bacterial count/g	Mould could per g
Iron rich *laddu*	0	ND	ND
	1	ND	ND
	2	0.96×10^3	ND
	3	3.05×10^4	0.75×10^1

* ND=Not detectable Temperature: 29-34^0C RH=71-72%

Table 7 : Mean value of iron content of iron rich *laddu* on as is basis during storage

Storage period (months)	Fe mg/100 g	Vit. C mg/100 g	Ionizable iron(%)
0	17.50	10.8	2.85
1	16.42	8.64	2.79
2	16.34	5.64	2.73

Table 8 : Mean value of iron content of rich *laddu* on dry weight basis during storage

Storage period (months)	Fe (mg/100 g)	Vit. C (mg/100 g)	Ionizable iron(%)
0	19.87	12.20	2.82
1	18.79	10.4	2.76
2	18.71	7.88	2.71

compared to the permissible limit of 10^5 given by Indian Standards (IS: 7463, 1988). Results on mould count revealed that iron rich *laddu* did not have any mould initially. However, the mould count had been found to be 0.75×10^1 during storage up to for three months at room temperature. Iron, Vit. C and *in vitro* iron bioavailability content were decreased during storage (Table 8).

Conclusion:

Thus, based upon the results obtained from the present investigation, it is concluded that Bengal gram leaves were rich in iron and also contained vitamin C which enhances absorption of iron. Bengal gram leafy powder with *amla* powder, jaggery, coconut powder, rice flakes powder and milk powder were successfully used in formulating a highly acceptable iron rich supplement with high *in vitro* bioavailability of iron. The supplement also had good storage life.

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■ REFERENCES

AOAC (1995). *Official methods of analysis of the assoication of official analytical chemists*. Homiz, W.Ed.

AVRDC (1996). Combating micronutrient deficiency through vegetables. Center point. pp. 4-5.

Babu,S.C. (2006).Economic reform: challenges, options. *The Hindu Survey of Indian Agiculture*. pp. 36 -39.

Florentino,R.F.(2003).The burden of iron deficiency and anemia in Asia: Challenges in prevention and control. Nutrition goals for Asia–vision 2020; Proceeding IX Asian Congress of Nutrition, pp. 313 - 318.

Oudhia, P. (2003). Traditional medical knowledge about chickpea (*Cicer arietinum*) in Chattishgarh, India.

Pranati, D. (2005). Determination of in *vitro* availability of iron from common foods. *J. Human Ecol.*, **18**(1) : 13-20.

Zimmermann,M.B. and Hurell, R.F. (2007). Nutrtional iron deficiency. *Lancet*., **370** : 511-520.

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