Preparation of Value-Added Product *Laddoo* from Dehydrated Mixed Leaves Powder.

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Abstract- ***The present study was under taken to develop value added products by incorporating dehydrated leaves powder mix, and to assess the organoleptic attributes of the prepared food products as well as to determine the nutritive value and cost of the prepared products. Product namely laddoo was made by incorporation with green leafy powder (bathua, beetroot and fenugreek leaves) incorporation level refer as T_1 (96:4), T_2 (93:7) and T_3 (90:10) laddoo with incorporation level of green leafy powder (bathua, beetroot and fenugreek leaves). Sensory evaluation of prepared product was done by using 9 points hedonic scale. Nutritive value of the prepared product was estimated and the experiment were replicated for three times data obtained during investigation were statistically analyzed using analysis of variance (ANOVA) and critical difference (CD) techniques. On the basis of finding it is concluded that bathua, beetroot and fenugreek leaves can be suitably incorporated in laddoo. On the basis of sensory evaluation 96 percent other ingredients (potatoes, onion and peas) and 4 percent of green leafy powder (bathua, beetroot and fenugreek leaves) (T_1) was most acceptable for laddoo. Cost of the prepared products per 100g of raw ingredients for laddoo Rs 8.***

I. INTRODUCTION

In developing countries like India where maximum population is vegetarian, liberal amount of green leafy vegetable should be incorporated in the diet as important source of several nutrients especially iron and beta- carotene. Green leafy vegetables are easily available and produced in large amount. According to the latest estimates of the National Horticultural board, the national production of vegetables stood at 72.83 million from a cropped area of 5.6 million hectare in 1997, with India taking second position (next only to China) in the world (Manmohan, 2000).

Beetroot or "garden beet" (*beta vulgaris var. esculanta L.*) used as vegetable. It is closely related to the sugar beet and naturally has high sugar content. Beetroot leaves which are generally thrown away as waste are rich sources of iron, calcium and beta-carotene and can contribute these nutrients to the diet at low cost. Beetroot leaves are a good source of iron and contain about 16.2mg of iron per 100g leaves. They also contain a good amount of calcium, 380mg per 100g leaves.

Fenugreek (*Trigonella foenum-graecum L.*) is an annual plant in the family Fabaceae with leaves consisting of three small obviate to oblong leaflets. It is cultivated worldwide as a semi-arid crop, and its seeds are a common ingredient in dishes from the Indian Subcontinent. Fenugreek is known as methi in Hindi. Fenugreek is used as an herb (dried or fresh leaves), spice (seeds), and vegetable (fresh leaves, sprouts, and micro greens). Sotolon is the chemical responsible for fenugreek's distinctive sweet smell, Cuboids- shaped, yellow- to- amber coloured fenugreek seeds are frequently encountered in the cuisines of the Indian subcontinent, used both whole and powdered in the preparation of pickles, vegetables dishes, daals, and spice mixes such as panch phoron and sambar powder. They are often roasted to reduce bitterness and enhance flavor. It contains a mucilaginous fibre (20%) and has a total fibre content of 50%. It is a very rich source of calcium, beta-carotene. The lower glycemic load after fenugreek leaves supplementation could be due to fibre which diminishes the absorption of carbohydrate to a point lower in the gut after colonic conversion. Fenugreek is known to have hypoglycaemic, and hypocholesterolaemic, effects. Recent research has identified fenugreek as a valuable medicinal plant with potential for multipurpose uses and also as a source for preparing raw materials of pharmaceutical industry, especially steroidal hormones. (Mehrafarin *et al.* 2012).

Bathua (*Chenopodium album* Linn.) leaves, rich in micronutrients were selected for dehydration. Leaves were tray dried at 50-60ºC for three to four hours till the moisture reached to 6-7 per cent. These dehydrated leaves were incorporated at 3-15 per cent levels in two conventional foods namely green gram *dal* and *paratha*. Organoleptic properties of products were judged by nine point hedonic scale. Green gram *dal* and *paratha* incorporated with 7 and 5 per cent dehydrated *bathua* leaves were liked most. Iron content of green gram *dal* (8.8mg/100g) and *paratha* incorporated with dehydrated *bathua* leaves was higher than their respective control. In comparison to control enriched *paratha* (4255.66±0.6µg/100g) and Green gram *dal* (984 ±1.8µg/100g) had many fold greater carotene content. Therefore, it can be concluded that incorporation of dehydrated *bathua* leaves in various conventional food items can improve the nutritional quality of the products as well as add variety in the diet.

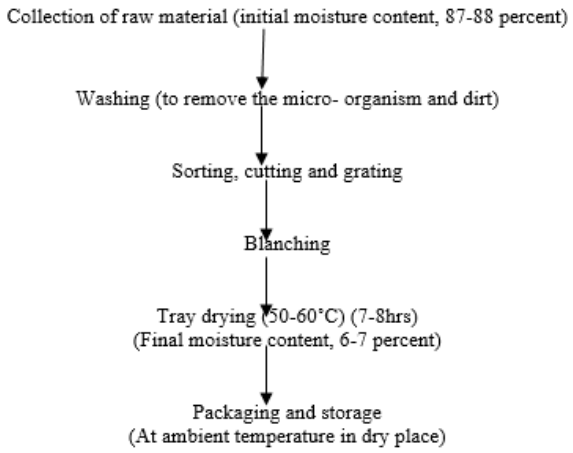
Beetroot leaves contain the following nutrients per 100g of edible portion: carbohydrates: 4.3g, protein: 2.2g, fat: 0.1g, calcium: 117mg, phosphorus: 41mg, iron: 2.57mg, total energy: 22kcal.

Fenugreek leaves contain the following nutrients per 100g of edible portion: carbohydrates: 6.0g, protein: 4.4g, fat: 0.9g, minerals: 1.5g, calcium: 395mg, phosphorus: 51mg, iron: 1.93mg, total energy: 49kcal. *Bathua* leaves contain the following nutrients per 100g of edible portion: carbohydrates: 2.9g, protein: 3.7g, fibre: 0.8g, calcium: 15.0g iron: 4.2mg, energy: 150g. (Gopalan *et al.* 2007)

II. MATERIALS AND METHODS

The study entitled "Preparation of value-added products from dehydrated mixed leaves powder" was conducted in the Nutrition Research Laboratory, Department of Foods and Nutrition, Ethelind School of Home Science, Sam Higginbottom Institute of Agriculture, Technology & Sciences, and (Deemed to be University), (Formerly Allahabad Agricultural Institute) Allahabad.

Dehydration process of *Bathua*, Fenugreek and Beetroot leaves. Source: Srivastava and Kumar (2009)
The standard procedure was slightly modified for the dehydration of *Bathua*, Fenugreek and beetroot leaves:



Details of treatments- In all recipes the amount of dehydrated *bathua*, fenugreek and beetroot leaves powder was mixed and used in value addition in all recipes of the products.

(1) *Laddoo* -

Control (T_0): *Laddoo* prepared from *besan* only.

Treatment (T_1): *Laddoo* prepared from mixture of *besan* and dehydrated *bathua*, fenugreek and beetroot leaves powder in a ratio of 96:4.

Treatment (T_2): *Laddoo* prepared from mixture of *besan* and dehydrated *bathua*, fenugreek and beetroot leaves powder in a ratio of 93:7.

Treatment (T_3): *Laddoo* prepared from mixture of *besan* and dehydrated *bathua*, fenugreek and beetroot leaves powder in the ratio of 90:10.

Replications – Control and each of the treatments for each product were replicated three times.

PROXIMATE COMPOSITION:

Methods described by AOAC (2005) were used for determination of chemical composition of selected products. This included estimation of moisture, ash, fat, fibre, protein and carbohydrate was calculated by difference method.

DETERMINATION OF TOTAL CAROTENE

Carotene is estimated by extraction of the total pigment with alcohol and partitioning it with petroleum ether after saponification. The other

pigments were removed by treatment with sodium sulphate. Carotenoids are then determined by finding out absorbance of sample as indicated by O.D by spectrophotometer Ranganna, (2001).

DETERMINATION OF PHYTATE

The phytate is extracted with trichloroacetic acid and precipitated as ferric salt. The iron content of the precipitate is determined calorimetrically and the phytate phosphorus content was calculated from this value assuming a constant, 4 Fe: 6 P molecular ratio in the precipitate.

DETERMINATION OF OXALATE CONTENT

The oxalates are extracted from plant material, deproteinized and precipitated as calcium oxalate. The precipitate is filtered, washed and dissolved in hot dilute sulphuric acid and titrated the formed oxalic acid with standard $KMnO_4$ solution (Gupta, 2007).

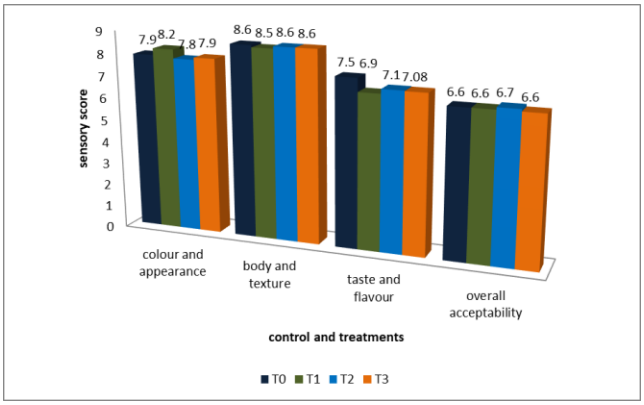
III. RESULT AND DISCUSSION

The results obtained by analysis of data are given below:

Table 1 Average sensory score of different parameters in control and treated sample of *laddoo*.

Parameters	T_0	T_1	T_2	T_3	Result
	Mean± SE	Mean±SE	Mean±SE	Mean±SE	
Color and appearance	7.9±0.28	8.2±0	7.8±0.23	7.9±0.08	S
Body and texture	8.6±0.41	8.5±0.08	8.6±0.26	8.6±0.11	NS
Taste and flavor	7.5±0.30	6.9±0	7.1±0.23	7.08±0.17	S
Overall acceptability	6.6±0.28	6.6±0	6.7±0.12	6.6±0.12	S

Fig. 1 Average sensory scores of *laddoo* of different treatments with incorporation of green leafy powder (*bathua*, beetroot& fenugreek leaves)



AVERAGE NUTRIENTS CONTENT IN PREPARED PRODUCTS

Table 2 Percentage of nutrients in control and treated sample of *laddoo* per 100g.

Treatment	Moisture (g)	Energy (kcal)	Protein (g)	CHO (g)	Fat (g)	Fibre (g)	Calcium (mg)	Iron (mg)	Total carotene (µg)
T_0	5.15	565.0	10.45	79.6	22.8	0.6	34.0	3.6	164.5
T_1	3.91	472.0	7.93	64.2	22.12	0.65	35.8	4.5	165.15
T_2	3.74	461.0	7.62	58.04	22.04	0.7	37.8	4.9	167.08
T_3	3.6	449.5	7.37	55.72	21.96	0.72	39.8	5.0	169.02

Table 2 shows that the T_0 contained highest amount of moisture (5.15), energy (565), protein (10.45), carbohydrate (79.6), and fat (22.8). The T_3 contained the least amount of these nutrients in comparison to other treatments. However, as the incorporation level increased the fiber, calcium, iron and toal carotene levels are also increased.

The result is supported by findings of Navale, and Harpale, (2013) which shows the comparative nutritive value of moisture (12.7g), energy (49kcal), carbohydrate (6.0), fibre (4.7g), mineral (calcium (395mg), phosphorus (51mg), sodium (76.1mg), potassium(31.0mg).

Table 3 Anti- Nutrients in control and treated sample of *laddoo* per 100g.

Treatment	Phytate (mg)	Oxalate (mg)
T0	--	--
T1	1.7	2.1
T2	2.1	2.5
T3	2.4	3.0

T_3 contained highest amount of phytate (2.4mg) and oxalate (3.0mg) in comparison to other treatments as the amount of green leafy vegetables powder mix was higher than other treatments.

Table 4 Comparison between nutrient content of control and best treatment of *laddoo* by using (t) test.

Nutrients	T_0	T_1	Difference (t_0-t_1=D)	T(Calculated)	T (Tabulated)	Result
Moisture (g)	5.15	3.9	1.2	4.00	2.45	S
Energy (kcal)	565	472.2	92.9	232.25	2.45	S
Protein (g)	10.45	7.9	2.5	8.30	2.45	S
Carbohydrate (g)	79.6	64.2	15.4	38.50	2.45	S
Fat (g)	22.8	22.1	0.7	2.30	2.45	NS
Fibre (g)	0.6	0.4	0.2	2.00	2.45	NS

Calcium (mg)	34	25.8	8.3	27.60	2.45	S
Iron (g)	3.6	4.5	0.9	4.5	2.45	S
Total carotene (µg)	164.5	169.2	4.7	11.75	2.45	S

The above table 4 shows the "t" values of between control and the best treatment for *laddoo*. The table indicates a non-significant difference between the nutrient content of the control (T0) and the best treatment (T1) as the calculated value of "t" which is found to be 232.25 for energy content, 8.30 for protein content, 38.50 for carbohydrate, 27.60 for calcium, and 11.75 for total-carotene content was higher than the tabulated value of "t" which is 2.45 at 5% probability level indicating that there is significant difference between the nutrients content of control (T0) and best treatment (T1) with regard to energy, protein, carbohydrate, calcium and total- carotene. However, a non-significant difference in the 2.30 and 2 for fat and fiber and content respectively was found.

Table 5 Cost of the prepared products namely *laddoo.*

Ingredients		T_0		T_1		T_2		T_3	
	Actual rate/Kg (Rs)	Amt. (g)	Cost (Rs)	Amt. (g)	Cost (Rs)	Amt. (g)	Cost (Rs)	Amt. (g)	Cost (Rs)
Besan	40Rs	50g	Rs. 2	38g	Rs. 1.5	36.5g	Rs. 1.46	35g	Rs. 1.4
Refined sugar	20Rs	50g	Rs. 1	38g	Rs. 0.76	36.5g	Rs. 0.73	35g	Rs. 0.7
Ghee	220Rs	20g	Rs. 4.4	25g	Rs.5.5	25g	Rs.5.5	25g	Rs.5.5
Green leafy powder (*bathua*, beetroot & fenugreek)	30Rs, 30Rs & 40Rs resp.			4g	0.4Rs	7g	0.7Rs	10g	1Rs
Total amount (Rs.)			Rs.7.4		Rs. 8.16		Rs. 8.39		Rs. 8.5

Table 5 shows that the total cost of *laddoo* per 100g for treatment T_0 is Rs.7.4, T_1 is Rs. 8.16, T_2 is Rs. 8.39 and T_3 is Rs. 8.5. It is therefore concluded that the treatment T_0 (*besan* and green leafy powder) has the lowest cost and T_3 (*besan* and green leafy powder) has the highest cost.

CONCLUSION

It is concluded that dehydrated *bathua*, beetroot and fenugreek leaves can be successfully incorporated in *laddoo.* For *Laddoo* T_1 (*besan* and *bathua*, beetroot and fenugreek leaves powder mixture) was found best. Nutrient content of T_3 (main ingredients**:** *bathua*,

beetroot and fenugreek leaves in the ratio 90:10) of *laddoo* was best. The nutrient content with regard to energy (449.5kcal), carbohydrate (55.72g), fibre (0.72g), iron (5mg), and total carotene (169.02 µg) were significantly higher in *laddoo*. The cost of products based on raw materials (Rs/ 100g) ranged between Rs. 7-9 for *laddoo*.

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