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Product development and sensory evaluation of value added food products made by basella alba (Mayalu) Leaves

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Abstract
Basella alba (Mayalu) is one of the most common and popular vegetable grown in South India, but neglected by people in their consumption pattern. In view of this, an attempt was made to utilize (Mayalu leaves) to develop low cost nutrient rich products for people suffering from micronutrient deficiency and to assess the sensory quality of developed products. The freshly collected *basella* green leaves were washed and sun dried for 5-7 days to dry them. Five recipes namely (*Basella alba* parota, *Basella* herbal tea, *Basella* cookies, *Basella paneer* and *Basella* dosa) were prepared using whole *Basella* leaves and sensory evaluation was done with the help of 5 point rating scale with reference to appearance, taste, texture and flavour by 9 panels of semi trained judges. Biochemical analysis revealed moisture (90.8 g), protein (3 g), fiber (3.28 g) and iron (10.28 mg) (values as per 100 gm). The prepared recipes were found highly acceptable. *Basella alba* leaves due to its high iron, calcium and fibre content can be used as supplement to make low cost nutrient rich recipes.

Keywords: *Basella alba*, hedonic scale, biochemical analysis

Introduction
In the present days of globalization and industrialization, the life style of the people has changed. In this changing life style, the demand for ready to eat foods are increasing day by day. Various epidemiological studies have shown that the diet lacking in fiber and antioxidants may be the cause of various gastrointestinal and cardiovascular diseases. Multiple micronutrient deficiencies are very common than single deficiency mainly in developing countries. There is a need to encourage people for supplementation of green leafy vegetables in nutritional recipes to combat with these micronutrient deficiencies. Green leafy vegetables are good source of micronutrients. There are many varieties of green leafy vegetables, which are richest source of iron and other important nutrients, but they are discarded and not used properly for human consumption. *Basella* leaves are also come in this category which are often neglected.

Basella alba (Family: Basellaceae); Synonym: *Basella cordifolia* Linn. *Basella lucida* Linn. is a perennial climber. It is also known as Malabar spinach, Indian spinach. The stem is succulent with tender leaves. Both stem and leaves are used in Culinary practice in Southern parts of India. It is found to be a good source of calcium, iron, vitamin A and Vitamin C (Palada and Chang, 2003; Glassgen WE, *et al* (1993) [9, 10]. There are a various health benefits of *Basella alba like*, *Basella* is one of versatile leaf green vegetable and revered in some East Asian cultures for its wholesome phyto-nutrients profile. *Basella* is very low in calories and fats (100 g of raw leaves provide just 19 calories). Fresh leaves, particularly of Basella alba, are rich sources of several vital carotenoid pigment anti-oxidants such as ß-carotene, lutein, zea-xanthin. Together, these compounds help act as protective scavengers against oxygen-derived free radicals and reactive oxygen species (ROS) that play a healing role in aging and various diseases. Its thick, fleshy leaves are a good source of non-starch polysaccharide, mucilage. In addition to regular fiber (roughage) that found in the stem and leaves, mucilage facilitates in smooth digestion, bring reduction in cholesterol absorption and help prevent bowl movement problem.

Overviewing the importance and significance of the *Basella alba* the present study was carried out to focus more on use of *Basella alba* on daily routine. As it is evident that, it has the tremendous benefits but practical usage of *Basella alba* in cooking is very limited by the local population. Hence the present study was under taken with the following objectives, To study the chemical composition of *Basella alba*. To standardize and prepare the food products by using *Basella alba*. To evaluate the prepared products by trained judges.

Materials and methods
Collection of sample of the *Basella alba*
The malbar spinach (Mayalu) was collected from Dharwad city, Karnataka. Avoided sunken, dry, bruised, and discoloured leaves. The leaves were free from dust particle, stems were cleaned by washing under running clean water. Basella were dried and placed in air-tight zip-pouch plastic bag tightly and stored inside the refrigerator set at high relative humidity. The leaves were stored inside the refrigerator for up to four days, fresh leaves were used for the preparation of products. Before preparation of the product the leaves were fried/boiled with small quantity of water and oil which helps to reduce the smell of leaves. Sun drying method was used for 1 week to dry leaves. After that, dry matter was crushed by hand or grinded in the mixer to get a fine powder and packed in air tight container for nutrient analysis.

Nutrient analysis

The dried *Basella* leaves sample was analyzed for proximate composition of moisture, protein and crude fibre, iron,calcium and vitamin A, respectively.

Formulation of recipes

Five recipes namely *Basella alba* parota, *Basella* herbal tea, *Basella* cookies, *Basella* paneer and *Basella* dosa were selected and supplemented wholly with *Basella alba* fresh leaves.

Recipes

Name of the product	Ingredients
2. *Basella alba* tea	• water • *Basella alba* powder 2 tspn. • Cardamom 1. • Black pepper 2or 3 crushed. • Cinamom 1. • Lemon 2 tspn. • Sugar.
3. B*asella* paneer	• Water • *basella alba* powder 2 tspn. • cardamom 1. • black pepper 2or 3 crushed. • cinamom 1. • lemon 2 tbl spn. • sugar 5 t spoon.
6. *Basella alba* cookie	**Ingredients:** • All Purpose Flour / Maida - 1 cup. • *Basella* leaves/basella leaves powdered. • Wheat Flour / Atta - 1/2 cup. • Sugar - 2 tblspn Powdered. • Salt - 1 tsp. • Whole Jeera - 2 tsp. • Coarse Pepper Powder - 2 tsp. • Sesame Seeds / Ellu - 2 tblspn. • Butter or Ghee - 1/2 cup. • Milk- 1 tsp if needed.
Basella alba Dosa	• *Basella* leaves 200 gms • Rice 1 ½ cup • Turmeric powder ½ tspn. • Cumin seeds ½ tsppn. • Salt to taste
Basella alba parota	• 1 cup wheat atta. • basale leaves 100 gms. • salt as needed. • ⅛ tsp ajwain powder or ¼ tsp garam masala. • ⅛ tsp chilli powder or 1 green chili chopped. • ½ tsp oil for kneading. • 1 tsp oil for greasing layers. • warm water for kneading.

Sensory analysis

The recipes (*Basella alba* parota, *Basella* herbal tea, *Basella* cookies, *Basella* paneer and *Basella* dosa) were evaluated to find out the overall acceptability. The sensory evaluation was carried out by semi trained nine judges by using 5 point scale. The selected recipes were standardized before and after the supplementation and acceptability was evaluated with respect to the following: appearance, texture, taste and flavour. After that data was compiled and analyzed.

Statistical analysis

Statistical analysis was done with the help of SPSS software.

Results and discussion

Nutritional composition of *Basella alba* green leaves

The nutrient composition like moisture, total protein, crude fiber, calcium, vitamin A and iron were determined (Table 1).

Table 1: Nutrient analysis of *Basella alba* leaves

Sl no	Nutrient content	Test results
1	Fibre	3.28 gms/100gms
2	Vitamin A	743.154 microgm/100gms
3	Iron	10.28 mg/100 gms
4	Calcium	220 mg/100 gms
5	Protein	3 gm/gms
6	Moisture	90.8 g

The moisture content of the sample was found to be 90.8 g. The total protein content of *basella* was found to be 3 g. The fibre content of leaves found to be 3.28 g. The iron content of the leaves was found to be10.28 mg. The calcium content of the leaves was found to be 220 mg. The vitamin A content of the leaves was found to be 743.154 microgm.

Organoleptic evaluation of the developed products

The supplemented recipes were subjected to sensory evaluation using 5 point rating scale such as appearance, odour, taste and flavour to find the overall acceptability. The recipes were evaluated by a panel of 9 expert judges. Sensory evaluation of standard recipes on 0-9 point scale: The data regarding sensory acceptability of *Basella alba* based products given in below tables.

As evident from data, there was no significant difference in the acceptability of appearance, odour, taste and flavor of the products. All the developed products were rated as acceptable by panel of judges. The sensory evaluation of the developed products given in the Table 2. And, data revealed were significantly acceptable.

Table 2: Sensory evaluation of the developed products

	Appearance	Colour	Taste	Texture	Over all
BasellaMasala tea					
Average	3.9	3.9	4.3	3.9	3.8
Variance	0.1	0.1	0.45556	0.1	0.177778
F – 2.035714 P -0.105413 F crit – 2.578739					
BasllaParota					
Average	4.9	5	4.2	3.5	4.1
Variance	0.1	0	0.177778	0.72222	0.1
F -17.4090 P -1.07 F crit -257879					
BasellaDosa					
Average	5	5	4.9	5	5
Variance	0	0	0.1	0	0
F – 1 P -0.417531 F crit – 2.578739					
Cookies					
Average	4.9	5	4.9	4.7	5
Variance	0.1	0	0.1	0.23333	0
F - 1.730769 P - 0.159857 F crit – 2.578739					
Basella Paneer					
Appearance	4.9	4.9	5	5	5
Variance	0.1	0.1	0	0	0
F - 0.75 P - 0.563241 F crit – 2.578739					

Basella alba tea had scored very good for its taste about 4.3 out of 5 all most had a slight masala taste which facilitated different from common tea. And the colour was not accepted for the product.

Basella alba parota had scored more in colour 5 out of 5, 4 for its appearance and about 3.5 for its texture. The product was significant (17.04) for its colour and the product was acceptable (1.07).

Basella alba dosa had scored excellent in all the attributes like appearance, colour and texture, 5 out of 5 and very good 4.9 out of 5 for the taste. The product was non-significant (1) for its taste, and the product was acceptable for overall attributes (0.4).

Basella alba cookies had excellent scores for colour, texture, appearance, taste and overall the product was acceptable about 5 out of 5. The product was acceptable (0.1).

Basella alba paneer had highly excellent scores for its taste, texture and overall of the product about 5 out of 5. The product was acceptable (0.56).

Conclusion

Basella alba leaves are good source of dietary fiber and minerals. The present study was carried out with the aim to find out the acceptability of these recipes with the supplementation of *Basella alba*. The study concluded that use of *Basella alba* could be done on daily basis just like spinach. This study will help people to generate awareness for the supplementation of iron and calcium in their daily diet to control anemia and increase nutritional status in a better way.

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