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Development of Iron rich value-added products from locally available underutilized leaves

Neha Kumar and Shivani Sharma

Abstract

The present study was done on underutilized green leafy vegetables which are rich source of iron and other micronutrients. Moreover there are varieties of green leafy vegetables rich in iron and other micronutrients whose consumption is very less in general population due to lack of awareness or ignorance. Therefore, the effort was made to develop iron rich value added products. Two commonly consumed products namely Idli and Appe were developed from underutilized dry leaves. Curry leaves, Fenugreek leaves, Cauliflower leaves, Turnip leaves and Beetroot leaves were taken 5 gm each. Acceptability evaluation of prepared recipes was performed by semi trained panel through 9 point Hedonic rating scale test. The result revealed that among the recipes (Idli and Appe) prepared by adding 5 gm Powder of dried leaves in which beetroot leaf product were acceptable when compared to product developed by Curry leaves, Fenugreek leaves, Cauliflower leaves and Turnip leaves. This study concluded that these innovative value-added products can supplement iron to a wide range of population with effective utilization of low cost underutilized leaves.

Keywords: Micronutrients, underutilized, awareness, ignorance, supplement

1. Introduction

The commonly observed public health concern that affects mostly infant, children and women both in developing and developed countries is anemia. The primary cause of anemia is rarely found in isolation rather it is more frequently associated with a number of other causes such as malaria, parasitic infection, nutritional deficiencies and low level of hemoglobin etc ^[1]. Nutritional anemia is defined as a condition that results from the inability of the erythropoietic tissue to maintain a normal hemoglobin concentration on account of inadequate supply of one or more nutrients leading to reduction in circulated hemoglobin. Anemia is a pathologic deficiency in oxygen-carrying hemoglobin in red blood cells ^[2]. It impairs health and well-being mostly in women and increases the risk of maternal and neonatal adverse outcomes.

Anemia affects half a billion women of reproductive age worldwide. WHO estimates suggest that over 1/3rd of the world's population suffer from anemia mostly iron deficiency anemia.

Green Leafy Vegetables (GLV) are treasure house of nutrients, specially micronutrients in particular, are available at low cost during the seasons. Owing to high moisture content, green leafy vegetables are highly perishable and are sold at throwaway prices in the peak season resulting in heavy losses to the growers due to non-availability of sufficient storage, transport and proper processing facilities at the production point ^[3]. Augmenting utilization and avoiding wastage calls for employing suitable preservation techniques that are user-friendly and sustainable at the household level. Dehydration is one of the traditional methods of preservation, which converts the food in to light weight, easily transportable and storable product. Advantage of this method, if employed for vegetables, is that it can be easily converted in to fresh-like form by rehydrating and can be used throughout the year. It facilitates the utilization of the dried leaves in other parts of the country or world where this vegetable is unavailable in plenty. In addition to increasing variety in the menu, reducing wastage, labour and storage space, dehydrated vegetables are simple to use and have longer shelf life than fresh vegetables ^[4]. In order to place the GLVs in to the routine diets and to break monotony of the meals, it becomes essential to convert the traditional products in to attractive, value added acceptable products. The present investigation is an attempt to dehydrate the commonly consumed GLVs and to extend the utility of dehydrated vegetables in traditional recipes for micronutrient security.

Therefore, in the present study the efforts was made to use the underutilized green leafy vegetables such as cauliflower leaves, fenugreek leaves, beet green leaves, turnip leaves and curry leaves etc., which are mostly not utilized by general mass for human consumption rather used for cattle feed due to lack of awareness about their nutritional value. These leaves are rich in iron, calcium, phosphorus and carotene and have a little amount of fat and protein. As the dried leaves contain higher proportion of nutrient than fresh leaves because of concentration of the nutrient upon moisture evaporation^[5], the present investigation made use of dried powder of underutilized leaves to develop and standardize iron rich value added products.

2. Material and Methods

The study was conducted to develop products using underutilized leaves for solving the condition of anemia and to evaluate its organoleptic characteristics. A list of underutilized plant leaves with rich iron content was prepared using food consumption and exhaustive literature.

Five underutilized leaves selected from the list were cauliflower leaves, Fenugreek leaves, beetroot leaves, turnip leaves and curry leaves. All these five leaves were collected from vegetable market of Pilibhit city. Then the leaves were dried in shade for 15 days and then value added products were made and sensory evaluation was done by panel members in the laboratory of department of Home Science, Pushp Institute of Science & Higher Studies Pilibhit. The whole methodology was divided into three phase.

- Phase I- Collection of Raw material
- Phase II- Formulation of Iron rich Product
- Phase III- Sensory evaluation by using 9 point hedonic scale.
- Phase IV- Statistical Analysis and report writing

2.1 Collection of raw material

On the basis of the preliminary screening of locally available green leafy vegetables were used for micronutrients: Five green leaves were selected on the basis of higher Iron content.



Plate 1: Collection of Raw Material

2.2 Formulation of Iron rich Product

2.2.2 Processing of Leaves

Fresh leaves were dried under shadow for 10 days at normal temperature and then the dry leaves were grinded to powders. Both leaves were packed separately in airtight zip lock pouches.

2.2.3 Development of Products

For the value added iron rich product development, a list of daily consumed food items was prepared from the

magazines and recipes books. Out of them two commonly consumed preparations, Idli and Appe were selected. The standardized recipes for these preparations were taken. The selected products were developed to enrich them with different iron rich dry leaf powder incorporated in basic recipe respectively. Developed preparations were standardized in the laboratory of Home Science, Pushp Institute of Science & Higher Studies Pilibhit and were evaluated using 9 point hedonic scale.



Plate 2: Developed Appe



Plate 3: Developed Idli

2.2.4 Standardization of Products

The selected preparations viz. Idli and Appe were standardized in the laboratory for their portion size, cooking characteristics and organoleptic characteristics. Leaf powder was incorporated at 5% level. Ingredients used in the preparations were carefully balanced along with a procedure by repeated trial to obtain standard product.

2.3 Sensory evaluation by using 9 point hedonic scale

Iron enriched value added products were served to the selected group of 30 panel members for evaluation of their sensory attributes. Organoleptic evaluation of standard and iron enriched products was done using 9 point hedonic scale (Table 1). Experiments were carried out in triplicate. One way Analysis of Variance (ANOVA) was performed

using standard statistical package (SPSS 20.0) and the significance of difference was defined at $P < 0.01$.

Table 1: Hedonic Scale for Organoleptic Evaluation

Quality description	Score
Liked extremely	9
Liked very much	8
Liked moderately	7
Liked slightly	6
Neither liked nor disliked	5
Disliked slightly	4
Disliked moderately	3
Disliked very much	2
Disliked extremely	1

2.4 Statistical Analysis and report writing

The data was collected and presented in results. Average nutritional and sensory scores values of the enriched products were statistically analyzed by using mean and standard deviation.

3. Result and discussion

The result of the study have been discussed under the following heads.

3.1 Development of greens mixture incorporated recipes

3.2 Sensory Evaluation of developed products

3.1 Development of greens mixture incorporated recipes

underutilized green leaves can be utilized in multiple ways by incorporating into existing products and formulation of nutrient rich value added products. It is essential to look for sustainable, culturally acceptable, cost effective strategy by which consumption of greens can be increased and thereby combating micronutrient deficiencies. The selection of

recipes was done by keeping in mind the consumption pattern and changes in life-style of modern households. The recipes were selected with the purpose to combat micronutrient deficiencies as well as to increase consumption of green leafy vegetables. In addition, it is also aimed to break monotony, provide satisfaction and add variety to the diet.

The selected recipes were consumed by almost all of the age groups of Indian population and can be prepared with fewer ingredients and in less time. Though children and adolescents are at risk for micronutrient deficiency, they mostly prefer snacks and fast food items. Therefore, by enriching the snack items such as Appe with Green leafy vegetables, micronutrient content of the diet can be ensured and Idli provided as a breakfast item as well as can be consumed as meal. Hence, fortification of these common foods with Green leafy vegetables can be a way to incorporate micronutrients in the diet without much effort. This food based strategy is much safer than medicated supplementation.

Table 2: Development of greens incorporated recipe (Appe) for Calcium and Iron security

Name of the Product	Ingredients used	Incorporation of green mixture (gm)
Beetroot Leaves Appe	Beetroot leaf powder, Suji, Curd, Tomato, Onion	5
Turnip Leaves Appe	Turnip leaf powder, Suji, Curd, Tomato, Onion	5
Fenugreek Leave Appe	Fenugreek leaf powder, Suji, Curd, Tomato, Onion	5
Curry Leave Appe	Curry leaf powder, Suji, Curd, Tomato, Onion	5
Cauliflower Leave Appe	Cauliflower leaf powder, Suji, Curd, Tomato, Onion	5

Table 3: Development of greens incorporated recipe (Idli) for Calcium and Iron security

Name of the Product	Ingredients used	Incorporation of green mixture (gm)
Beetroot Leaves Idli	Beetroot leaf powder, Suji, Curd	5
Turnip Leaves Idli	Turnip leaf powder, Suji, Curd	5
Fenugreek Leave Idli	Fenugreek leaf powder, Suji, Curd	5
Curry Leave Idli	Curry leaf powder, Suji, Curd	5
Cauliflower Leave Idli	Cauliflower leaf powder, Suji, Curd	5

3.2 Sensory Evaluation of developed products

Product 1: Appe

Appe is a snack consumed mostly in India. It is an extruded product with a good texture and appearance; colours adds to the qualities of food whether it is acceptable or refutable by the consumers. Beetroot Appe (with 5% of dried powder of beetroot leaves) was liked very much while Turnip and curry leaf Appe (with 5% of dried powder of Turnip and curry leaves) was liked moderately. Where as Fenugreek and Cauliflower Appe (containing 5% of dried powder of Fenugreek and cauliflower) was neither liked nor disliked. A significant difference was found in the taste among five prepared at different types of leaves powder. Beetroot leaf Appe was most acceptable to more than other leaf powder made the recipe unacceptable due to taste. Texture of Appe

was most accepted among five developed iron rich Appe . A difference was found in appearance among all the Appe. A particular food should have a particular flavor and it should not be overlapping with another products. The Standard (9.02 ± 0.05) was liked extremely while beetroot Appe (8.5 ± 0.05) was liked very much by the panelist. Standard (8.86 ± 0.05) and Beetroot Appe (8.5 ± 0.05) were acceptable and the recipes were liked very much. Overall acceptability score revealed that Beetroot leaf Appe was liked very much by the panelist (Table 4).

These data suggest that incorporation of dried underutilized leaf powder up to 5% to enrich the Appe with iron found acceptable by the judges. Moreover, over all acceptability of beetroot Appe was maximum in comparison with another products.

Table 4: Sensory acceptability score of developed product (Appe)

Attribute	Standard (Appe)	Product-I Beet root (5g)	Product-II Turnip (5gm)	Product-III Fenugreek (5gm)	Product-IV Curry leaf (5gm)	Product-V Cauliflower (5gm)
Leaf powder (Appe)						
Colour	9.33 ± 0.47	8.56 ± 0.49	7.93 ± 0.72	5.63 ± 1.22	7.76 ± 0.76	4.3 ± 0.82
Taste	9.13 ± 0.33	8.53 ± 0.49	7.8 ± 0.70	4.76 ± 0.84	8.03 ± 0.75	3.8 ± 0.65
Texture	9.1 ± 0.3	8.5 ± 0.5	7.96 ± 0.75	4.63 ± 0.91	7.76 ± 0.76	4.2 ± 0.73
Appearance	9.03 ± 0.17	8.5 ± 0.5	7.8 ± 0.70	4.83 ± 0.81	7.06 ± 0.81	3.8 ± 0.74
Over all	9.14 ± 0.12	8.5 ± 0.05	7.87 ± 0.02	4.96 ± 0.18	7.65 ± 0.02	4.02 ± 0.06

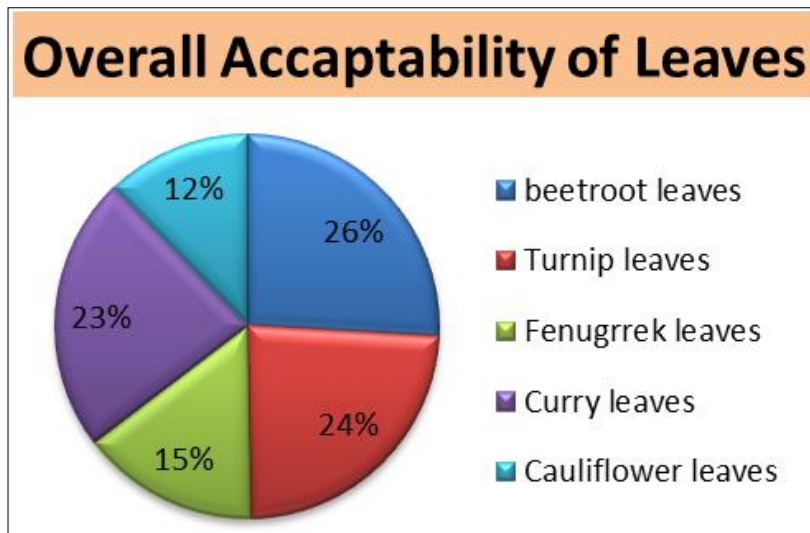


Fig 1: Sensory Evaluation for overall Acceptability of developed product (Appee)

Product 2: Idli

Idli is one of the traditional South Indian dish made by Wheat, semolina and some amount of curd. Overall acceptability was judged to evaluate the overall sensory quality of the product. The mean acceptability score (table 2) of standard (S), (P-i) , (P-ii) , (P-iii), (P-iv) and (P-v) were 9.28 ± 0.11 , 8.35 ± 0.09 , 4.6 ± 0.16 , 6.0 ± 0.07 , 7.88

± 0.07 and 3.9 ± 0.12 respectively indicating that the product (i) was liked very much, (ii) was disliked slightly, (iii) was liked slightly, (iv) was liked moderately and (v) was disliked moderately. Significant differences were found in all sensory attributes. Overall acceptability score revealed that Beetroot leaf Idli was liked very much by the panelist (Table 5).

Table 5: Sensory acceptability score of Developed Product (Idli)

Attribute	Standard (idli)	Product-i Beet root (5gm)	Product-ii Turnip (5gm)	Product-iii Fenugreek (5gm)	Product-iv Curry leaf (5gm)	Product-v Cauliflower (5gm)
Colour	9.47 ± 0.47	8.5 ± 0.50	5.03 ± 0.75	6.4 ± 0.55	7.96 ± 0.75	4.1 ± 0.74
Taste	9.19 ± 0.34	8.33 ± 0.64	4.4 ± 0.95	4.7 ± 0.69	8.03 ± 0.65	3.2 ± 0.76
Texture	9.28 ± 0.18	8.4 ± 0.61	4.76 ± 1.14	4.8 ± 0.70	7.96 ± 0.60	4.4 ± 0.98
Appearance	9.2 ± 0.30	8.2 ± 0.74	4.46 ± 1.02	4.2 ± 0.61	7.6 ± 0.60	3.96 ± 0.70
Over all	9.28 ± 0.11	8.35 ± 0.09	4.6 ± 0.16	6.0 ± 0.07	7.88 ± 0.07	3.9 ± 0.12



Fig 2: Sensory Evaluation for overall Acceptability of developed product (Idli)

4. Conclusion

All the Two iron rich value-added products namely Idli and Appee were most acceptable at 5gm level of incorporation of underutilized dried leaves powdered In which beetroot leave product were more acceptable. These innovative value added products can supplement iron to a wide range of population with effective utilization of low cost underutilized leaves. Thus, the development and use of these iron rich value added products from underutilized leaves can serve as a dietary approach to prevent iron

deficiency anemia.

5. References

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