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Development of high fiber products by using different leaves

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Abstract
The present study was done on different green leaves which are rich source of fibre 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 fibre rich value added products. Two commonly consumed products namely Pakora and Appe were developed from leaves. Beetroot leaves, Radish and Taro leaves were taken 40 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 (Pakora and Appe) prepared by adding 40 gm leaves in which beetroot leave product were acceptable when compared to product developed by Radish and Taro leaves. This study concluded that these innovative value-added products can supplement fibre to a wide range of population with effective utilization of low cost leaves. The result of the Nutritive value indicated that Taro leaves had appreciable amount of Protein, Energy and fibre. Therefore, it can be concluded that products developed from Beet root was acceptable by the panel member but nutritive value was found in taro leaves.

Keywords: Higher fiber, different leaves, products

1. Introduction

In recent years, epidemiological evidence as suggested that a reduction in dietary fiber is related to an increase in certain diseases such as diverticulosis and colonic cancer Dietary fiber acted as a bulking agent that increased intestinal motility and moisture content of feces. It was postulated that those effects were important in preventing disease of the colon. Other studies showed evidence that plant fiber could decrease serum cholesterol level and improved oral glucose tolerance in humans. In view of the recently proposed physiological role and medical advantage of dietary fiber, along with the increasing interest demonstrated in the scientific and consumer world, it was the interest of food research and product development to examine more closely the application of fiber ingredients in commercial formulations the ingredients [1].

Dietary fiber is a heterogeneous mixture of carbohydrate polymers found in plant raw materials. It refers to a large number of substances that exhibit a wide variety of physicochemical properties, with a general division into water-soluble and insoluble compounds. However, the way of processing, e.g., cereals, reduces its content in products. There is a need to make preparations that can be added to enrich various products. In addition, DF has important health and technological functions in food production. The raw materials for the production of DF preparations are industrial fruit and vegetable waste (apple pomace, blackcurrant pomace, waste from the processing of carrots, tomatoes) as well as bran, corn cobs, chaff and straw, and legumes (mainly soybeans and peas) [2].

In this era of global industrialization and advancement of technologies, the life style of the people has changed a lot. In this changing life style, the demand for ready to eat foods like extruded foods has increased. Among ready to eat foods, junk foods form an important part of Indian diet. These products are rich in starch, fat and energy but depleted in fiber. Various epidemiological studies have shown that the diet lacking in fiber may be the cause of various gastrointestinal and cardiovascular diseases. Dietary fiber is currently considered a critical ingredient in food products. Present study deals with the development of fiber rich recipes [3].

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Appe and Pakora are one of the most common consumed food in the world. The affordable cost, good nutritional quality, availability in different tastes and long shelf-life are the main reasons for wide consuming [4]. Currently, different types of cereals such as oat bran, wheat bran, rice bran are utilized in bakery production to increase the fibre content [5]. However, the nutritional quality of dietary fibers in vegetables and fruits have higher proportion of soluble dietary fibre and bioactive compounds than the cereals [6]. Therefore, developing snacks rich in fibre content by utilizing waste by-product is a healthy-promising approach and could decrease the negative environment effect. The aim of the present research is to develop fibre rich products from different leaves like beetroot leaves, radish leaves, and taro leaves and to evaluate their physiochemical, biochemical and sensory characteristics.

2. Material and Method
The study was conducted to develop products using different leaves. A list of different leaves with high fiber content was using food consumption and exhaustive literature. Three leaves selected from the list were beet root leaves, Radish leaves and Taro leaves. All these three leaves were collected from vegetable market of Pilibhit city. Then the leaves were wash under running tap water and cut in fine chops 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 five phase.

Phase I: Collection of high fiber leaves like Beetroot leaves, Radish leaves and Taro leaves.

Phase II: Formulation of high fiber products

Phase III: Sensory evaluation by using 9 point hedonic scale.

Phase IV: Calculation of nutritive value of most accepted

Phase V: 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 high fiber, Three leaves were selected on the basis of high fiber content.

Beet root   **Taro**   **Radish**

Plate 1: Collection of raw material

2.2 Formulation of food products
2.2.1 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, Appe and Pakora were selected. The standardized recipes for these preparations were taken.

The selected product was developed to enrich them with different high fiber 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: Devloped Appe

Plate 3: Developed Pakora

2.2.2 Standardization of products

The selected preparations *viz. A*ppe and Pakora were standardized in the laboratory for their portion size, cooking characteristics and organoleptic characteristics. Leaves were added incorporated at different level. Ingredients used in the preparations were carefully balanced along with a procedure by repeated trial to obtain standard product.

2.3 Sensory evaluation and acceptability of developed products

Sensory evaluation is considered to be an important analytical tool in the present day competitive environmental to judge the acceptability of food among the potential consumer. In the present study the sensory evaluation was done by 9 point Hedonic scale presented in table 1.

Table1: 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

3.2 Sensory Evaluation of developed products
3.2.1 Product

1 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 leaves Appe (with 40gm of fresh beetroot leaves) was liked very much while Radish leaves Appe (with 40gm of fresh leaves) was liked moderately. Where as Taro leaves Appe (With 40gm of leaves) was neither liked nor disliked. A significant difference was found in the taste among these products. Beetroot leaf appe was most acceptable to more than other leaf appe due to taste. Texture of Beetroot appe was most accepted among other leaf Appe such as Radish and Taro. 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 beetroot leave appe was liked extremely (8.56 ± 0.50) while Radish leave (6.56± 0.50) was liked modetarly by the panelist. Overall acceptability score revealed that Beetroot leaf appe was liked very much by the panelist (Table No. 3). These data suggested that incorporation of fresh leaf up to 40gm to enrich the appe with high fibre found acceptable by the judges. Moreover, a overall acceptability of beetroot appe was maximum in comparision with another products (Figure No. 1).

2.4 Nutritional analysis of food products

Nutritional analysis was done by using food value Table of ICMR.

2.5 Statistical Analysis of the Data and Interpretation

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

3. Result and Discussion
3.1 Development of greens mixture incorporated recipes

Dehydrated greens 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. The selected formulation of the green mixture was used in preparation of various recipes was furnished in table 2.

Table 2: Development of high green mixture in corporate recipes

Name of the Product	Ingredients used	Incorporation of green mixture (gm)
Beetroot leaves Appe	Beetroot leaves, Semolina, Curd	40
Radish leaves Appe	Radish leaves, Semolina, Curd	40
Taro leaves Appe	Taro leaves, Semolina, Curd	40
Beetroot leaves Pakora	Beetroot leaves, Besan	40
Radish leaves Pakora	Radish leaves, Besan	40
Taro leaves Pakora	Taro leaves, Besan	40

Table 3: Sensory acceptability score of developed Appe

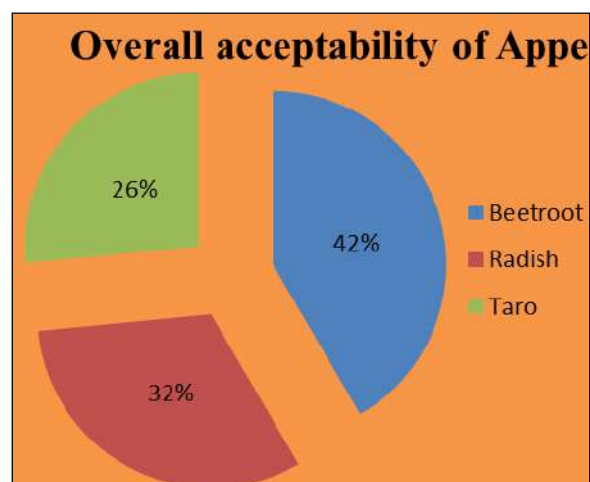| Attributes	Beetroot's Appe	Radish's Appe	Taro's Appe
Colour	7.96 ± 0.55	6.5 ± 0.50	5.83 ± 0.87
Taste	8.73 ± 0.44	6.76 ± 0.67	5.5 ± 0.50
Texture	8.46 ± 0.50	6.50 ± 0.50	22.5± 0.50
Appearance	8.33± 0.54	6.53 ± 0.50	7.46± 0.50
Flavour	8.43 ± 0.50	6.46 ± 0.50	5.56± 0.50
Overall	8.56 ± 0.50	6.56 ± 0.50	5.46± 0.50

Fig 1: Sensory Evaluation of overall acceptability of developed Appe

3.2.2 Product 2: Pakora

Pakore is one of the traditional South Indian dish made by gram flour. Overall acceptability was judged to evaluate the overall sensory quality of the product. The mean acceptability score of Pakora (Table No. 4) prepared from Beetroot (8.56 ± 0.50), Radish (6.6 ± 0.49) and Taro (5.53 ± 0.50) respectively. Table No. 4.2.2 also indicated that the product developed by using beetroot leaves was liked very much, product developed from radish was liked moderately and products developed by using taro leaves was disliked moderatly. Significant differences were found in all sensory attributes. Overall acceptability score revealed that Beetroot leaf product was liked very much by the panelist (Figure 2).

Table 4: Sensory acceptability score of developed Pakora

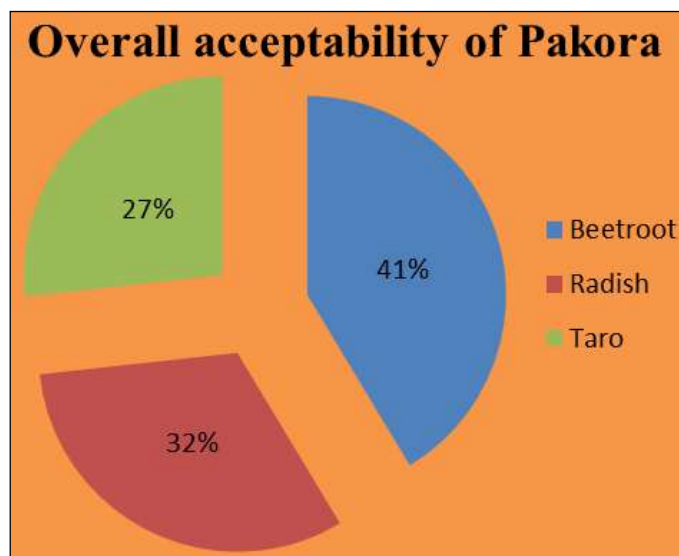| Attributes	Beetroot's Pakora	Radish's Pakora	Taro's Pakora
Colour	8.13 ± 0.81	6.63 ± 0.49	5.9 ± 0.95
Taste	8.63 ± 0.49	6.6 ± 0.49	5.56± 0.50
Texture	8.43 ± 0.50	6.4 ± 0.49	7.53 ± 0.50
Appearance	8.13 ± 0.73	6.5 ± 0.50	7.53 ± 0.50
Flavour	8.7 ± 0.46	6.4 ± 0.50	5.6 ± 0.49
Overall	8.56 ± 0.50	6.6 ± 0.49	5.53 ± 0.50

Fig 2: Sensory Evaluation of overall acceptability of developed pakora

3.3 Nutritive value of accepted Appe and Pakora

Data shown in Table No. 5 showed that the calculative Nutritive value of Energy, Protein and Fiber by using value from Food composition Table of ICMR result revealed that Products developed by using Taro leaves was highest in all the attributes in comparison with product developed by using Radish and Beetroot leaves i.e. Energy (227.4kcal), Protein (4.26gm) and fiber (1.46gm). Data shown in Table No. 5 showed that the calculative Nutritive value of Energy, Protein and Fiber by using value from Food composition Table of ICMR result revealed that Products developed by using Taro leaves was highest in all the attributes in comparison with product developed by using Radish and Beetroot leaves i.e. Energy (293.3 kcal), Protein (17.24gm) and fiber (8.72 gm).

Table 5: Nutritive value of developed Appe using different leaves

Name of products	Ingredients	Amount (gm)	Energy (kcal)	Protein (gm)	Fiber (gm)
Standard Appe	Semolina	70	243	2.08	0.14
	Curd	20	12	0.64	0.16
	Total	90	225	2.72	0.3
Beetroot Appe	Semolina	70	243	2.08	0.14
	Curd	20	12	0.64	0.16
	Beetroot Leaves	40	1.84	1.36	0.28
	Total	130	256.84	4.06	0.58
Radish Appe	Semolina	70	243	2.08	0.14
	Curd	20	12	0.64	0.16
	Radish Leaves	40	11.2	1.52	0.4
	Total	130	266.2	4.22	0.7
Taro leaves	Semolina	70	243	2.08	0.14
	Curd	20	12	0.62	0.16
	Taro Leaves	40	22.4	1.56	1.16
	Total	130	277.4	4.26	1.46

Table 6: Nutritive value of developed Pakora using different leaves

Name of Products	Ingredients'	Amount (gm)	Energy (kcal)	Protein (gm)	Fiber (gm)
Standard Pakora	Besan	70	270.9	15.68	7.56
	Total	70	270.9	15.68	7.56
Beetroot	Besan	70	270.9	15.68	7.56

Pakora	Beetroot Leaves	40	1.84	1.36	0.28
	Total	110	270.74	17.04	7.84
Radish Pakora	Besan	70	270.9	15.68	7.56
	Radish Leaves	40	11.2	1.52	0.4
	Total	110	282.1	17.2	7.96
Taro Pakora	Besan	70	270.9	15.68	7.56
	Taro Leaves	40	22.4	1.56	1.16
	Total	110	293.3	17.24	8.72

4. Conclusion

Biodiversity, a human managed natural ecosystem consisting of habitat of species diversity and species richness. In order to create more robust and resilient production system, we have to depend upon biodiversity. Green leafy vegetables can strength our nutritional security and commercial cultivation of these lesser known underutilized greens will not only help in improving the economic and nutritional condition of people but also help in conserving the valuable and endangered bio diversity. The chemical composition of different products prepared by using different leaves provide a good source of phytochemicals and dietary fibers. Thus addition of different leaves purchase from the local market could be utilized for preparation of other products with improved functional and nutraceuticals properties.

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