

*Original Research Article***Product development and Sensory analysis of recipes enriched with Moringa leaves powder****Priya Sen¹ & Shivani Laddha²***Department of Food & Nutrition,
Smt. Sushila Devi Mathur PG Girls College, Bhilwara***Abstract**

The existing study was performed with the objective of studying the nutritive value and acceptability of different products prepared using drumstick leaves. Selection and procurement of leaves was done by a nearby market. The present piece of research was an attempt to develop some Indian recipes enriched with drumstick leaves powder. Two recipes namely Fried Idli and Besan laddoo were prepared with incorporation of drumstick leaves powder. These were evaluated for their sensory characteristics using a composite score scale. It was clear from the acceptability scores of all samples of Fried idli and Besan laddoo with drumstick leaves powder. Acceptability scores for the Fried idli Sample A was 4.8 ± 0.447 , Sample B 4.4 ± 0.894 , Sample C 2.4 ± 1.516 and for Besan Laddoo, scores were given to different samples as ahead - Sample A 4.66 ± 0.577 , Sample B 4.66 ± 0.577 and Sample C 4.33 ± 1.154 . Hedonic score ranked the fried idli in the range of “liked slightly” to “liked very much” and besan laddoo were ranked between “liked moderately” to “liked extremely”.

Keywords

Drumstick leaves powder, hedonic scale, composite scale, sensory evaluation

Introduction

Drumstick is also known as “Moringa oleifera” that is widely cultivated for its seeds, leaves, flowers used in form of vegetables or powder traditionally ^[1]. It is also useful for purifying the water.



Figure 1: Moringa leaves

Moringa is becoming popular and an upcoming crop from the viewpoint of research. It is economic and originated from South Asia. It is also grown in Ethiopia, Kenya, Somalia and other interior regions of Africa. Majority parts of the Moringa tree are edible [2].

Seed Pods

Moringa oleifera is a fast growing plant. Its seed oil is sweet, non-sticky, rancidity proof, while the seed cake is a water purifying agent. The seeds are consumed in different ways as fresh, roasted, powdered added in tea or curries.



Figure 2: Seed Pods

Flowers

Moringa flowers are often mixed into different recipes. These can be mixed in salads or fried and consumed as a snack due to its fragrance. It is used in tea also. Moringa flowers are rich sources of calcium and potassium.



Figure 3: Flowers

Leaves

These are very nutritious in comparison to other greens. These can be added to juices or can be consumed as a vegetable. Moringa leaves powder is also known to be useful in asthma, diabetes, milk production, menopausal and malnutrition.



Figure 4: Leaves

Powder

Drumstick powder is a great immune booster and a powerhouse of minerals. Moringa, also known as the drumstick, when crushed into a powder gives a range of natural benefits for the human body. Moringa powder is thought to provide numerous health and cosmetic benefits, as well as the ability to help prevent and treat ailments.



Figure 5: Powder

Ayurveda in drumstick

As per Ayurveda, moringa has heating and pungent properties. It has a bitter taste. It has been known to have detoxifying effects in the human body. It is also known to relieve kapha and vata dosha ^{[3] [4] [5]}.

Nutritive value of Moringa leaves powder

Nutrients	Value	% of RDA
Energy	64 Kcal	3.2
Carbohydrate	8.28 gm	6
protein	9.4 gm	17%
Total fat	1.4 gm	7 %

Cholesterol	0 mg	0 %
Dietary fiber	2 gm	5 %
Vitamins		
Folate	40 ug	10 %
Niacin	2.22 mg	14 %
Pantothenic acid	0.125 mg	2.5 %
Pyridoxine	1.2 mg	9%
Riboflavin	0.66 mg	5 %
Thiamine	0.257 mg	21 %
Ascorbic acid	51.7mg	57 %
Vitamin A	7560 IU	252 %
Minerals		
Calcium	185 mg	18.5 %
Copper	0.105 mg	12%
Iron	4 mg	50 %
magnesium	42 mg	10.5 %
manganese	1.06 mg	46 %
phosphorus	112 mg	16 %
Zinc	0.60 mg	5.5 %
Electrolytes		
Sodium	9 mg	0.6 %
Potassium	337 mg	7 %

Table 1: Moringa leaves raw, nutrition value per 100 gm.

Health benefits of Moringa leaves powder

- It is very nutritious as well as rich in antioxidants^[3]
- Moringa leaf extract may also be used as a food preservative
- It is also known to reduce blood pressure and cholesterol level of our body. It has anti inflammatory properties as well
- A protective effect of Moringa leaves has been observed in reducing heavy metal poisoning

Side effects of drumstick leaves powder

- In large quantities, it can cause stomach upsets, heartburn, nausea and also risk of miscarriage in pregnancy
- As it is rich source of vitamin K, therefore patients on blood thinner warfarin need to avoid it
- Hypothyroidism. It might worsen the condition of hypothyroidism^[6]

Objectives of the study

- To develop products from drumstick leaves powder
- To conduct sensory evaluation of the developed food products
- Nutritional analysis of developed food products

Research Methodology

The present work was divided into 3 phases

Phase 1: Includes development of food products based on drumstick leaves powder as an ingredient

Phase 2: Sensory evaluation and nutritive value analysis of the products prepared by drumstick

Phase 3: Statistical data analysis and report writing

Work Plan

Phase 1	Phase 2	Phase 3
Development of food product using drumstick as an ingredient	Development of food product Fried idli Besan laddoo Sensory evaluation 5-point composite scoring Texture Appearance Taste Flavour Colour Overall acceptability 9- point hedonic scale	Statically data analysis and report writing Mean Standard deviation T- test

Procurement of Moringa leaves powder (MLP)

It was ordered online from Amazon (www.amazon.in) and other ingredients were purchased from the local market of Bhilwara city, Rajasthan.

Ingredients In this process of development of food product that has Moringa oleifera as main ingredient and other ingredients like - semolina, gram flour, buttermilk, sugar, eno, green chilly, tomato, onion, carry leaves, ghee and spices^{[10] [11]}.

Product development

Products were developed using different proportions of Moringa leaves powder. The levels of incorporation was based on preliminary trials that were performed to know the suitability of different percentages of MLP in the product development. The selected recipes for value added product development were fried idli and besan laddu that were enhanced with a percent of MLP of 5%, 10%, and 15% in fried idli and besan laddoo was developed using 2%, 4%, and 6% of MLP. They are sensory evaluated through 5-points composite score and 9-points hedonic scale^[12].

Development of fried idli

S.No.	Ingredients	Control (g)	Sample A (g)	Sample B (g)	Sample C (g)
1	Samolina	50	45	40	35
2	MLP	-	5	10	15
3	Curd	70	70	70	70
4	Tomato	5	5	5	5
5	Onion	5	5	5	5
6	Green chilly	5	5	5	5
7	Oil	10	10	10	10
8	Salt	5	5	5	5
9	Eno	-	-	-	-
	Total	150	150	150	150



Process

1. Firstly, in a large pan roast 1 cup semolina for 5 minutes or till it turns aromatic
2. Allow it to cool completely, and transfer roasted semolina to a mixing bowl
3. Add in 1 cup curd, $\frac{1}{2}$ tsp salt and combine well without forming any lumps
4. Allow to rest for 1 hours or till semolina absorbs water
5. Again add $\frac{1}{4}$ cup water or as required to prepare idli batter consistency
6. Just before steaming the idlis, add in $\frac{1}{4}$ tsp eno or pinch of baking soda and give a gentle mix
7. Pour the batter immediately onto a greased idli plate
8. Steam them on medium flame for 15 minutes or till the idli are cooked completely
9. Finally, serve soft semolina idli along with chutney and sambhar^[7]

Frying method

- To make the idli fry, first cut small pieces of idli in a vessel
- Now take a work and put some oil in it and keep it to heat on medium flame
- Now in that mustard seeds, cumin seeds, chopped onion, curry leaves, and green chillies and fry them all well for about a minute
- Now put the prepared idli in the mixture and let it cook for some time. Switch off gas after 1-2 minutes. Your delicious fried idli is ready. Garnish it with green coriander leaves before serving^[8].

Besan Ladoo

S.No.	Ingredients	Control	Sample A	Sample B	Sample C
1	Gram flour (g)	50	48	46	44
2	MLP	-	2	4	6
3	Ghee	10	10	10	10
4	Sugar	10	10	10	10
5	Elaichi	5	5	5	5
6	Dry fruits	5	5	5	5
	Total (g)	80	80	80	80



CONTROL



SAMPLE A



SAMPLE B



SAMPLE C

Process

Two cups of gram flour was roasted in half cup ghee in a kadhai at low flame. It was done for approximately 30 minutes until gram flour turned golden brown and start releasing ghee. Then the mixture was cooled. Meanwhile, 2 tbsp cashew and almond were dry roasted, crushed and added to the mixture. After it 1 cup of sugar and elaichi powder were

mixed in the mixture after cooling. Then the gram flour mixture was made into small balls of uniform size.

Sensory evaluation

It was done to assess acceptability of the products developed. Then Sensory evaluation was done using composite score test and a 9 point hedonic scale test.

Sensory evaluation by 5 points composite scale

In this, panellists were presented with one or more samples and asked to score multiple characteristics on a rating scale. In 5-points composite scale like appearance, texture, colour, taste, and consistency. Each of these attributes was rated on a 5-points scale, where 5 was considered excellent and 1 was considered poor^[9].

Statistical analysis of the data and interpretation was done using Mean and Standard Deviation.

Results and Discussion

The result & discussion part has been divided into 2 parts

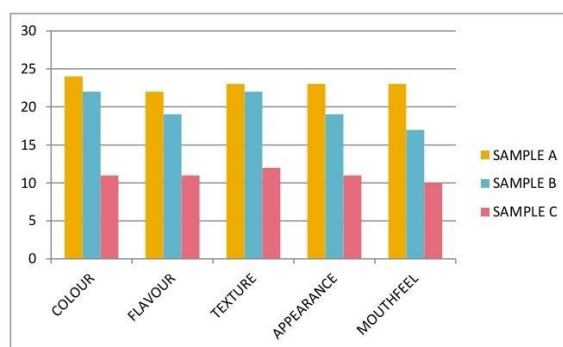
1. Organoleptic evaluation of Fried Idli
2. Organoleptic evaluation of Besan Ladoo

1. Organoleptic evaluation of fried idli: Sensory evaluation scores for the acceptability of "Fried idli" after incorporation of different levels of Moringa leaf powder was done using a composite scoring test and a 9 point hedonic scale test. Product was evaluated for different aspects like colour, flavour, texture, appearance, and mouthfeel.

Results have been shown below -

Sensory Evaluation of Fried Idli

Sensory characteristics	Sample A	Sample B	Sample C
Colour	4.8 ± 0.447	4.4 ± 0.894	2.2 ± 0.836
Flavour	4.4 ± 0.894	3.8 ± 0.447	2.2 ± 1.095
Texture	4.6 ± 0.547	4.4 ± 0.547	2.4 ± 1.516
Appearance	4.6 ± 0.547	3.8 ± 0.836	2.2 ± 1.095
Mouthfeel	4.6 ± 0.547	3.4 ± 0.547	2 ± 1.870

**FRIED IDLI**

Hedonic scale of fried idli: Acceptability of fried idli was assessed from a 9 point hedonic scale test and scores were given from 0 - 9, which meant disliked extremely to liked extremely. Scoring for the 3 variations was done as below -

Sample A: It was liked extremely by 2 panellists, liked moderately by 2 panellists and 1 panellist liked very much.

Sample B: Sample B was scored liked very much, 2 panellists scored it neither like nor dislike and 1 panellist liked moderately.

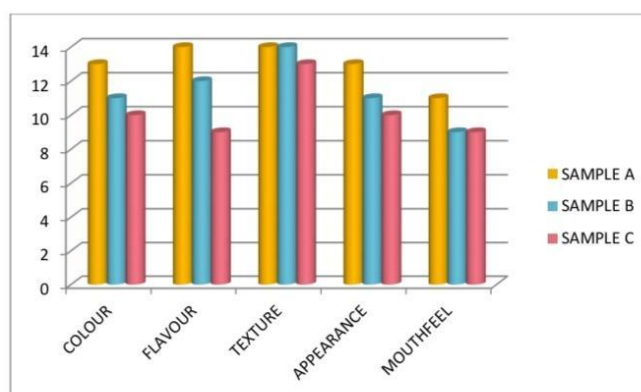
Sample C: It was scored differently by 5 panellists as like moderately, like slightly, dislike extremely, dislike very much, and dislike slightly.

Sensory evaluation of Besan laddoo

Sensory evaluation scores for the acceptability of “Besan laddoo” was also done after addition of Moringa leaf powder at different levels. The scores were obtained for various sensory attributes in the range of 3-4.6, that means satisfactory to Very good.

Sensory Evaluation of Besan Ladoo

Sensory characteristics	Sample A	Sample B	Sample C
Colour	4.33 ± 0.577	3.66 ± 0.577	3.33 ± 1.154
Flavour	4.66 ± 0.577	4 ± 0	3 ± 1
Texture	4.66 ± 0.577	4.66 ± 0.577	4.33 ± 1.154
Appearance	4.33 ± 0.577	3.66 ± 1.527	3.33 ± 2.081
Mouthfeel	3.66 ± 0.577	3 ± 1	3 ± 1



BESAN LADOO

Hedonic scale of besan laddoo: It was done by 3 panellists -

Sample A: 1 panellist ticked on like extremely, 2 panellists scored it as like very much

Sample B: It was liked very much by 1 panellist, liked slightly by 1 panellist and 1 panellist liked it moderately

Sample C: 3 panellists scored it differently as like moderately, like slightly, like very much

Traditional recipes of fried idli and besan laddoo were enhanced in their nutritive value by incorporating Moringa leaves at different levels. The sensory results indicated that these samples of fried idli and besan laddoos were as acceptable as control group when MLP was added to fried idli in proportion of 5% and 10% and in besan laddo at 2% and 4% levels. The acceptability of the developed products decreased above this level.

Fried Idli: Control sample of 100% semolina Sample A 95% semolina + 5% MLP Sample B 90% semolina + 10% MLP Sample C 85% semolina + 15% MLP

Besan Ladoo: Control sample of 100% gram flour Sample A 98% gram flour + 2% MLP Sample B 96% gram flour + 4% MLP Sample C 94% gram flour + 6% MLP

Conclusion

Drumstick leaf powder is very nutritious and beneficial for our body. In present study, two recipes namely fried idli and besan laddoo were prepared by incorporation of moringa leaf powder at different amounts and recipes were standardized. These samples were evaluated for their sensory characteristics such as colour, flavour, texture, appearance, mouthfeel and overall acceptability by a selected panel of judges using hedonic scale and composite scale. The data were statistically analyzed.

The mean score of the control-fried idli were 4.8, 4.4, 4.6, 4.6, and 4.6 for colour, flavour, texture, appearance, mouthfeel, and overall acceptability highly and these fell in the category of “like extremely”.

The mean score of the control Besan laddoo were 4.3, 4.6, 4.6, 4.3, and 3.6 for colour, flavour, texture, appearance, mouthfeel, and overall acceptability. All products were ranged in the category “like extremely”.

It was concluded that MLP can be incorporated in different recipes to avail it's maximum benefit. The fried idlis were acceptable at 5% and 10%, while besan laddoos were acceptable when MLP was added 2% and 4%. Beyond this level, acceptability decreased gradually. The research work identified the potential of Moringa in improved the nutritional status of the consumers by its incorporation into various recipes.

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