



DEVELOPMENT AND FORMULATION OF VALUE ADDED PRODUCTS FROM *Musa paradisiaca* L

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Abstract: Some fruits offer greater medicinal benefits, one such fruit is banana. They are a great source of energy. Banana, plantain, or *Musa paradisiaca* L is a very good source of antioxidants, vitamin C and vitamin B6. The natural fibre in bananas also contribute to many health benefits. They are-healthy bowels, cardiovascular health, protection from strokes, protection from ulcers, improve blood pressure, may boost mood, boost energy, help reduce water retention. Dietary fibre in banana is found to decrease colorectal cancer risk. From the study, it was found that dried plantain banana pulp powder act as a potential herbal drug for the treatment of peptic ulcer. Value addition in food products will result in nutrient-rich products which have a higher degree of quality. The main aim of the study is to develop various value added products which is ready to eat and preferred for people of all age groups and to observe the shelf life of the *Musa paradisiaca* L pulp flour.

There were six value added products develop from *Musa paradisiaca* L pulp flour and three formulations of each value added product were developed and one product developed from *Musa paradisiaca* L pulp. Acceptability trials were conducted by semi trained panelists consisting of 20 numbers from the Department of Food, Nutrition and Dietetics. Scoring was done on 9-point hedonic scale. The developed value added products were sensorily evaluated. The results of the sensory evaluation test revealed that the sample 1(40% banana) formulation of biscuit, cheela, steam cake, noodles and baked nimki and sample 3(60% banana) formulation of muffin were acceptable by the semi trained panelists. Chips were also liked by the semi trained panelists. The shelf life of the *Musa paradisiaca* L pulp flour was studied by storing them in different packaging materials at room temperature for a period of two months. Over a period of 2 month, the *Musa paradisiaca* L pulp flour was checked to see which packaging materials prevented the spoilage of the flour. The different packaging materials for shelf life study were plastic container and glass container. The packaging materials like plastic container and glass container stored the flour without spoilage and without the loss of the flour colour, aroma and taste period of 60 days. This may be due to the airtight property of these packaging materials.

Keywords- *Musa paradisiaca* L , value addition, sensory evaluation, storage.

INTRODUCTION

Banana is the second largest produced fruit after citrus, adding about 16% of the world's total fruit production. India is largest producer of banana, contributing to 27% of world's banana production[1]. Banana (*Musa spp.*) is tropical fruit belonging to the Musaceae family. It gets the fourth rank in world's most important food crop after rice, wheat and corn [9]. In Assam, percentage contribution of banana to total fruit production has remained highest in the state over 2001-02 to 2010-11 [10].

Some fruits offer greater medicinal benefits, one such fruit is banana. Bananas are also an excellent source of vitamins like- vitamin A, B6, C, D, B9, B2 and minerals (P, K, Ca, Mg, Na, Fe, Mn, Zn, Cu & B). They are a great source of energy. Bananas can be used for the treatment of intestinal disorders like ulcers. Medicinal benefits of bananas include aiding in constipation and diarrhea relief, treatment of arthritis, treatment of anaemia [3,15]. Bananas act as food medicines for treatment of diseases like- diabetes, hypertension, cancer, ulcers, diarrhoea, urolithiasis, Alzheimer's and infections[13]. Bananas have various antioxidants and phytonutrients [4]. Bananas are a source of minerals namely-Fe, Zn, Co, Na, Ca, K, Mg, Cu, Mn [6].

Banana, plantain, or *Musa paradisiaca* L, is a large, herbaceous plant native to India and Southeast Asia. It is a very good source of antioxidants, vitamin C and vitamin B6 in addition to manganese [7]. Banana is rich in fructose and sucrose [8]. They also contain vitamin A and high levels of potassium. The natural fibre in bananas also contribute to many health benefits. They are-healthy bowels, antidiabetic, antiulcerogenic properties, cardiovascular health, protection from strokes, protection from ulcers, improve blood pressure, may boost mood, boost energy, help reduce water retention. The nutrient rich banana may benefit people who are at risk of certain cancers. Green banana has anticancer, anti-ulcerogenic, antidiarrheal properties[14,16]. Dietary fibre in banana is found to decrease colorectal cancer risk. It has been thought that the banana pectin soluble polymer can help normalize bowel movement and ease constipation [3,12,].

Value-addition is the process of taking a raw commodity and changing its form to produce a high quality end product. Value-added is defined as the addition of time, place and form utility to a commodity in order to meet the taste preferences of consumers. In other words, value-added is figuring out what consumers want, when they want it, and where they want it- then making it and providing it to them. Thus, value addition in food products will result in nutrient-rich products which have a higher degree of quality, meet the standards set by different authorities and are safer for consumption [5]. Presently, having long shelf life, nutritious and easily digestible foods made from different agricultural products are readily available in the market [2].

Value addition help in nutrient enhancement and reducing the post production losses. Considering the nutritional importance and consumer acceptability, banana flour is used to develop value added products which is ready to eat and preferred for people of all age groups.

OBJECTIVES

1. Formulation of different value added products using *Musa paradisiaca* L pulp flour and pulp.
2. To observe the shelf life of the *Musa paradisiaca* L pulp flour.

MATERIALS AND METHODOLOGY

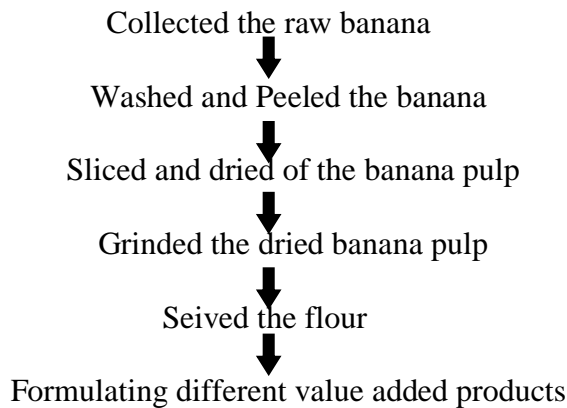
This chapter includes the materials and methods used for the "Development and formulation of value added products from *Musa paradisiaca* L", followed by sensory evaluation and storage study of the *Musa paradisiaca* L pulp flour.

- 3.1 Collection of samples
- 3.2 Preparation of *Musa paradisiaca* L pulp flour
- 3.3 Sample identification
- 3.4 Sample preparation
 - 3.4.1 Formulation of Biscuit
 - 3.4.2 Formulation of Cheela
 - 3.4.3 Formulation of Steam cake
 - 3.4.4 Formulation of Muffins
 - 3.4.5 Formulation of Noodles
 - 3.4.6 Formulation of Baked nimki
 - 3.4.7 Formulation of Chips
- 3.5 Storage of *Musa paradisiaca* L pulp flour
- 3.6 Sensory evaluation of value added products
- 3.7 Shelf life study
- 3.8 Statistical analysis

3.1 Collection of samples

For carrying out the present study required samples were collected from the local market of Guwahati.

3.2 Preparation of *Musa paradisiaca* L pulp flour



3.3 Sample identification

For sample identification S1, S2, S3 were the codes given for identification of products. S1 contain 40% of banana flour, S2 contain 50% of banana flour and S3 contain 60% of banana flour.

3.4 Sample preparation

3.4.1 Formulation of biscuit

FORMULATIONS	INGREDIENTS USED (%)		ADDITIONAL INGREDIENTS(gm/ ml)		
	Wheat flour	Banana flour	Sugar	Butter	Milk
FORMULATION 1	60	40	30	30	40
FORMULATION 2	50	50	30	30	40
FORMULATION 3	40	60	30	30	40

The required amount of butter and sugar are taken and mixed together until blended well. The wheat flour and banana flour was added. Then milk was added and all the ingredients were mixed and dough of the biscuit was prepared. The dough is rolled out and cut into desired pieces using cutter. Preheating of oven at 150 degree Celsius for 5 minutes was done. The biscuits were baked at 150 degree Celsius for 20-25 minutes or until they were light brown. Then biscuits were cooled and kept in a airtight container.

3.4.2 Formulation of cheela

FORMULATIONS	INGREDIENTS USED(%)		ADDITIONAL INGREDIENTS(gm/ml)					
	Besan	Banana Flour	Onion	Carrot	Corrainder Leaves	Salt	Refine oil	Water
FORMULATION 1	60	40	10	10	8	4	10	100
FORMULATION 2	50	50	10	10	8	4	10	100
FORMULATION 2	40	40	10	10	8	4	10	100

The required amount of besan, banana flour and salt was added. Ingredients were then mixed properly. Further onion, carrot and coriander leaves were added, water was poured and thus the batter was prepared. The pan was heated and then greased lightly with oil. The pan was allowed to turn hot and then flame was reduced to medium. The prepared batter was poured in the pan and spread to a round cheela. It was allowed to cook until the edges leave the pan and then cheela was flipped to the other side. It was fried until cooked completely.

3.4.3 Formulation of Steam cake

FORMULATIONS	INGREDIENS USED(%)		ADDITIONAL INGREDIENT(g/ml)			
	Rice flour	Banana flour	Coconut	Curry leaf	Salt	Milk
FORMULATION 1	60	40	50	10	1	50
FORMULATION 2	50	50	50	10	1	50
FORMULATION 3	40	60	50	10	1	50

The required amount of rice flour and banana flour was added in a bowl and mixed together. Then grated dried coconut, salt, curry leaf and milk were added to the mixture and cake batter was formed. The batter was transferred in a cake mould. The mould was covered with aluminium foil to prevent entry of water while steaming. The cake was then placed in the steamer with enough water for about 1 hour. Grated coconut and curry leaf was also used in garnishing.

3.4.4 Formulation of muffins

FORMULATIONS	INGREDIENTS USED(%)		ADDITIONAL INGREDIENTS(gm/ml)				
	Refined flour	Banana flour	Sugar	Egg	Baking Powder	Oil	Milk
FORMULATION 1	60	40	50	25	5	20	75
FORMULATION 2	50	50	50	25	5	20	75
FORMULATION 3	40	60	50	25	5	20	75

The required amount of milk, oil and sugar were taken in a bowl. Ingredients were beaten till it turned into smooth paste. Egg was added and beaten well. Further, banana flour, refined flour and baking powder were added and all ingredients were mixed until it became a smooth batter. Preheating of oven was done at 105 degree Celsius for 5 minutes. The muffin cases were greased with oil. Then batter was poured into the muffin cases and filled the muffin cases two-thirds full and baked for 25 minutes at 150 degree Celsius.

3.4.5 Formulation of noodles

FORMULATIONS	INGREDIENTS USED(%)		ADDITIONAL INGREDIENTS(gm/ml)		
	Refined flour	Banana flour	Salt	Refine oil	Water
FORMULATION 1	60	40	2	10	50
FORMULATION 2	50	50	2	10	50
FORMULATION 3	40	60	2	10	50

The required amount of refined flour, banana flour and salt were added in a bowl and mixed well. Then oil was poured and lukewarm water was added slowly. Further stirring of the flour was done. Then dough was kneaded until the bowl was clean and the dough was smooth, forming the dough into a ball. It was floured into a flat surface and rolled. Then dough was cut into thin and long strips, which was dropped into boiling water and removed when fully cooked. Then noodles were kept at 65 degree Celsius for 5 hours. After that noodles were boiled in water and ready to eat.

3.4.6 Formulation of Baked nimki

FORMULATIONS	INGREDIENTS USED(%)		ADDITIONAL INGREDIENTS(gm/ml)		
	Refined Flour	Banana flour	Salt	Refine oil	Water
FORMULATION 1	60	40	2	20	60
FORMULATION 2	50	50	2	20	60
FORMULATION 3	40	60	2	20	60

The required amount of refined flour and banana flour were taken in a bowl and mixed well. Salt was added and mixed thoroughly. Refined oil was added and stirred well. Water was sprinkled on the mixture and dough was prepared. Then, dough was flattened into equal small pieces. Preheating of oven was done at 150 degree Celsius for 5 minutes. Then, nimki were baked in 150 degree Celsius for 25 minutes. Nimki were cooled and then kept in a air tight container.

3.4.7 Formulation of chips

Ingredients used	Amount
Banana	100
Chips	30

For preparation of banana chips, unripe raw banana was taken. Proper washing and peeling of banana pulp was done. Banana pulp was cut into thin slices. Slices were placed in muslin cloth and dipped into salt solution and boiled for 15 minutes. Then the slices were kept for drying up to 20 minutes. After that dried slices were fried in oil. When the slices were turned to golden yellow colour, the chips were put out from saucepan.

3.5 Storage of *Musa paradisiaca* L pulp flour

Storage studies of the banana pulp flour was carried out for a period of three months. Two types of bottles were sterilized, plastic and glass bottles were selected to check the shelf-life of the sample by keeping the same in room temperature.

3.6 Sensory evaluation of value added products

Sensory evaluation of the products was carried out by 20 panelists of the age group 20-35 from the Department of Food, Nutrition and Dietetics, Assam down town University. It was done for the sensory perception and the score card that consisted of a table of hedonic scale of nine points from like extremely to dislike extremely. The properties that examined were colour, texture, taste, appearance, flavour and overall acceptability.

3.7 Shelf life study

The Shelf life of the banana pulp flour were studied by storing them in different packaging materials at room temperature for a period of 2 months.

Over a period of 2 months, the banana pulp flour was checked to see which packaging materials prevented the spoilage of the banana pulp flour.

Since banana can easily be contaminated with fungus and attracted to moisture, the packaging was done in an airtight condition maintaining proper hygiene and sanitation to prevent further contamination during packaging. Each packaging material was properly sealed at the same temperature and humidity to prevent loss of flavor, leakage and moisture absorption. The different packaging materials for shelf life study were plastic container and glass container.

3.8 Statistical analysis

The data of sensory evaluation were statistically analyzed and the methods applied for the analysis of the recorded data are enumerated below-

A) Mean: It is sum of all the X scores divided by the number of scores(N).

B) Standard deviation: Standard deviation is the dispersion of data in a normal distribution. In other words, SD indicates how accurately the mean represents sample data.[11]



Fig: Musa paradisiaca L fruit



Fig: Musa paradisiaca L pulp slices



Fig: Musa paradisiaca L pulp flour

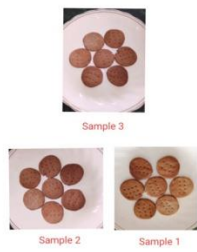


Fig: Biscuits



Fig: Cheela



Fig: Steam cake



Fig: Muffins



Fig: Noodles before preparation



Fig:Noodles after preparation



Fig:Baked nimki



Fig: Chips

RESULT AND DISCUSSION

This chapter includes the result and discussion of “Development and formulation of value added products from *Musa paradisiaca* L” presented under the following heads:

- 4.1 Formulation and standardization of value added products
- 4.2 Acceptability trials of formulated value added products
- 4.3 Shelf life storage of the *Musa paradisiaca* L pulp flour.

4.1 Formulation and standardization of value added products

Musa paradisiaca L was used to develop different value added products by different formulations to enhance the quality, taste and flavor. There were six value added products developed from *Musa paradisiaca* L pulp flour and three formulations of each value added product were developed and one product developed from *Musa paradisiaca* L pulp in the laboratory of the Department of Food, Nutrition and Dietetics, Assam down town University. The products were biscuit, cheela, steam cake, muffin, noodles, baked nimki, chips.

4.2 Acceptability trials of formulated value added products

Acceptability of a product is determined by sensory evaluation. Sensory evaluation was done by using 9 point hedonic scale. The evaluation was done by the semi trained panel of Food, Nutrition and Dietetics department of Assam down town University. An acceptability test was conducted for the value added products by evaluating by semi trained panel consisting of 20 panelists.

4.2.1 Mean acceptability scores of various value added products

Name of the product	Sample	Colour	Appearance	Taste	Texture	Flavour	Overall Acceptability
Biscuit	Sample 1	8.5±0.5	8.5±0.5	8.65±0.47	8.3±0.45	8.35±0.47	8.4±0.48
	Sample 2	8.45±0.49	8.45±0.48	7.8±0.4	7.6±0.48	7.5±0.5	7.9±0.3
	Sample 3	8.4±0.48	8.4±0.48	6.55±0.49	6.85±0.35	6.3±0.45	6.65±0.47
Cheela	Sample 1	8.8±0.4	7.9±0.62	8.4±0.48	8.65±0.47	8.6±0.48	8.8±0.4
	Sample 2	8.65±0.47	7.9±0.62	8±0.44	8.3±0.47	7.8±0.4	8±0.44
	Sample 3	7±0.54	7.55±0.49	6.7±0.45	7.9±0.3	6.65±0.47	7.05±0.49
Steam cake	Sample 1	8.35±0.47	8.3±0.45	8.45±0.49	8.4±0.48	8.25±0.43	8.25±0.43
	Sample 2	8.35±0.47	8.25±0.43	8.2±0.4	8.2±0.4	8.2±0.4	8.15±0.35
	Sample 3	8.35±0.47	8.2±0.4	8.15±0.35	8.35±0.47	8.1±0.3	8.15±0.35
Muffins	Sample 1	8.45±0.49	7.65±0.47	7.6±0.48	7.25±0.43	7.8±0.6	7.85±0.57
	Sample 2	8.5±0.5	7.6±0.48	8.2±0.4	7.75±0.43	8.1±0.76	7.9±0.3
	Sample 3	8.5±0.5	7.55±0.49	8.35±0.47	8.3±0.45	8.15±0.65	8.25±0.43
Noodles	Sample 1	7.75±0.76	7.65±0.72	8.45±0.73	8.1±0.62	8.2±0.50	8.25±0.43
	Sample 2	7.9±0.53	7.55±0.67	7.95±0.66	7.65±0.65	7.85±0.65	7.85±0.57
	Sample 3	7.7±0.64	7.6±0.66	7.8±0.74	7.35±0.47	7.9±0.62	7.65±0.65
Baked Nimki	Sample 1	7.7±0.45	7.25±0.43	8.4±0.48	8.4±0.48	8.3±0.45	8.15±0.47
	Sample 2	7.5±0.5	7.3±0.64	7.9±0.62	7.8±0.4	8.2±0.50	7.75±0.43
	Sample 3	7.5±0.49	7.25±0.43	7.6±0.48	7.4±0.66	7.75±0.43	7.55±0.49

Chips		7.6±0.48	7.4±0.48	8.7±0.45	8.8±0.4	8.8±0.4	8.65±0.47
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For Biscuit

From the table, it can be seen that sample 1 got maximum scores in terms of all its attributes as compared to sample 2 and sample 3 and also it revealed that scores are gradually decreasing from sample 1 to sample 3.

For Cheela

From the table, it can be attributed that sample 1 got maximum scores in terms of all its attributes as compared to sample 2 and sample 3 and also it revealed that scores are gradually decreasing from sample 1 to sample 3. While considering the mean taste score, the difference between the sample 1 and sample 2 are less as compared to sample 1 and sample 3.

For Steam cake

From the table, it can be seen that sample 1 got maximum scores in terms of appearance, taste, texture, flavour and overall acceptability as compared to sample 2 and sample 3. While considering mean colour score, all samples got the same score.

For Muffins

From the table, it can be seen that sample 3 got maximum scores in terms of taste, texture, flavour and overall acceptability as compared to sample 2 and sample 1.

For Noodles

From the table, it can be attributed that sample 1 got maximum scores in terms of all attributes as compared to sample 2 and sample 3.

For Baked nimki

From the table, it can be seen that sample 1 got maximum scores in terms of all attributes as compared to sample 2 and sample 3 and also seen that scores are gradually decreasing from sample 1 to sample 3.

For Chips

From the table, it can be seen that only one sample was prepared. While considering the taste mean score, it got maximum scores as compared to the products present in the table.

From the table, it can be attributed that sample 1 formulation of biscuit, cheela, steam cake, noodles and baked nimki was acceptable as compared to sample 2 and sample 3. But in case of muffin, sample 3 was acceptable as compared to sample 2 and sample 1. In chips, only one sample was formulated and it was found to be acceptable by the panelists.

4.3 Shelf life storage of the *Musa paradisiaca* L flour.

The shelf life of the *Musa paradisiaca* L pulp flour were studied by storing them in different packaging materials at room temperature for a period of two months.

Over a period of 2 months, the *Musa paradisiaca* L pulp flour was checked to see which packaging materials prevented the spoilage of the flour.

The different packaging materials for shelf life study were plastic container and glass container.

Shelf life	Packaging materials	
	Plastic container	Glass container
15	No change	No change
30	No change	No change
45	No change	No change
60	No change	No change

SUMMARY AND CONCLUSION

The present investigation was carried out to develop value added products from *Musa paradisiaca* L and to perform their sensory evaluation on a 9-point hedonic scale by semi trained panelists. The shelf life of the *Musa paradisiaca* L pulp flour was evaluated.

In this chapter, salient findings of the present study were summarized in brief and finally concluded.

SUMMARY

5.1 Formulation of value added products from *Musa paradisiaca* L

A present study aimed to develop and formulation of value added products from *Musa paradisiaca* L. There were six value added products developed from *Musa paradisiaca* L pulp flour and three formulations of each value added product were developed and one product developed from *Musa paradisiaca* L pulp.

5.2 Acceptability trials of the formulated value added products

Acceptability trials were conducted by semi trained panelists consisting of 20 numbers from the Department of Food, Nutrition and Dietetics, Assam down town University. Scoring was done on nine point hedonic scale. The various product formulations were followed to develop value added products. The developed value added products were sensorily evaluated. The results of the sensory evaluation test revealed that the sample 1(40% banana) formulation of biscuit, cheela, steam cake, noodles and baked nimki and sample 3(60% banana) formulation of muffin were acceptable by the semi trained panelists. Chips was also liked by the semi trained panelists.

5.3 Shelf life of the *Musa paradisiaca* L pulp flour

The shelf life of the *Musa paradisiaca* L pulp flour were studied by storing for two months in various different packaging materials like plastic container and glass container.

Over a period of 2 months, the *Musa paradisiaca* L pulp flour was checked to see which packaging materials prevented the spoilage of the *Musa paradisiaca* L pulp flour.

The packaging materials like plastic container and glass container stored the flour without spoilage and without the loss of the flour colour, aroma and taste period of 60 days. This may be due to the airtight property of these packaging materials.

CONCLUSION

It is concluded that *Musa paradisiaca* L is nutrient rich fruit and it is found abundantly in Assam. There are six value added products developed from *Musa paradisiaca* L pulp flour and three formulations of each value added product were developed and one product developed from *Musa paradisiaca* L pulp. Among the value added products developed from *Musa paradisiaca* L, the sample 1(40% banana) formulation of biscuit, cheela, steam cake, noodles and baked nimki and sample 3(60% banana) formulation of muffin were acceptable by the semi trained panelists. Chips was also liked by the semi trained panelists. These value added products have high nutrient value than the normal one and it can be easily prepared at home by using *Musa paradisiaca* L pulp flour and pulp. The *Musa paradisiaca* L pulp flour can be stored for a period of 60 days at room temperature and further can be used for preparing various value added products at home. These value added products will further accelerate the growth of banana market and open roads to export business. It also reduces the post harvest losses during storage.

RECOMMENDATION

During the process of this study, some constraints had been faced. Based on those constraints following recommendations are determined-

1. Further study should be done to determine the antioxidant property in these value added products.
2. Chemical analysis of value added products should be carried out.

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