DOI: *10.15613/fijrfn/2023/v10i2/223416*
ISSN (Print) : 2349-8897
***FoodSci*: Indian Journal of Research in Food Science and Nutrition,** *Vol 10(2), 64-69, July-December 2023* *ISSN (Online) : 2350-1006*

Value Addition of Processed Red Banana Flour in Wheat Pasta and its Acceptability

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Abstract

The world's largest producer of fruits and vegetable is India. Bananas are a major crop in terms of global agricultural production and marketing It is a famous fruit among all socioeconomic groups owing to its year-round availability, low cost, wide variety, flavour, and nutritional and therapeutic benefits. The Red banana is one of the important varieties among different banana varieties with reddish-purple skin. It is a good source of minerals, such as potassium, magnesium, phosphorus, and folate, and also contains vitamins A, B6, and C. Food dehydration is a technique that adds one or more kinds of energy to food to reduce moisture levels to low levels and increase shelf life. Pasta is one of most popular cereal-based food in the world. Due to their nutrient profiles, extended shelf life, market availability, low prices, ease of preparation, and ease of transportation, pasta products are quite popular. The banana was cut into slices approx. 2mm thick, and the slices of pulp were dipped in 0.5% citric acid solution for 10 min and dried under sun drying and made into fine flour.The flour of banana is used for the preparation of pasta by replacing wheat. When subjected to sensory evaluation, variation D 10% of incorporation of RBF was highly accepted by 30 semi trained panel members. On analyzing the nutritional composition RBF incorporated pasta has 362 Kcal of energy, 10.73g protein, 66.21g of carbohydrate and 65mg of potassium. The shelf life of the standard and best product which were packed in airtight container stored at room temperature were subjected to sensory and microbial analysis on 1st,7th and 14th day and the result showed that product has extended shelf life days when stored in airtight container packaging. The cost of the standard was Rs.30 and the selected best productwas Rs.45. The formulated product was popularized among the adolescent girls.

Keywords: Availability, Dehydration and Sensory Evaluation, Fruits, Red Banana

1. Introduction

The world's largest producer of fruits and vegetable is India. It has a distinct place in production in many nations and is home to a vast variety of fruits and vegetables. After China, India is the world's second-largest producer of fruits and vegetables. India produced 204.61 million metric tonnes of vegetables and 107.10 million metric tonnes of fruits in the years 2021 to 2022. The economic importance of fruits and vegetables has been increasing because of their domestic as well as international demand[1]. High fruit and vegetable intake has significant association between diet and health[2]. Numerous micronutrients found in fruits and vegetables are important to both physical and mental health[3]. It is believed that antioxidants, such as vitamin C and carotenoids, are essential for protecting the body against oxidative stress, which is linked to the development and progression of neurological illnesses, chronic inflammatory disorders, atherosclerosis, certain malignancies, and depression[4]. Additionally, for optimum cognitive and emotional functioning, water-soluble vitamins (vitamins C and B) and several minerals (calcium, magnesium, and zinc) are crucial[5].

Bananas are an important source of economic growth, revenue, food security, and nutrition in rural areas of many developing nations. Although intensive growing on small household plots undervalues banana yield and demand, the research now available suggests that their importance in the world's food production has greatly expanded in recent years[6]. Bananas are the second-most significant fruit crops in India. It is a

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popular fruit in all countries owing to its year-round availability, low cost, variety, flavor, and nutritional and medicinal benefits, making it a popular fruit of all socioeconomic groups[7].

Red banana (*Musa acuminata*) is an important variety among different banana varieties with reddish-purple skin and is grown in a few countries, such as Australia and Central America. It mostly grows in Kerala and in some regions of Tamil Nadu in India. Compared to typical Cavendish bananas, they are both smaller and firmer. According to their level of maturity, red bananas can range in color from purple to brown. They are available throughout the year; they are affordable, nutritious, and tasty, and have potent medicinal properties, making them one of the most demanding fruits. Banana is a major staple crop in millions of developing countries and is a rich energy source, with carbohydrates accounting for 22-32 % of the fruit weight. It is a good source of minerals, such as potassium, magnesium, phosphorus, and folate, and contains vitamins A, B6, and C[8]. Bananas are also a good source of antioxidant polyphenols, which have been shown to be highly effective in protecting against a number of illnesses, including cancer, rheumatoid arthritis, and cardiovascular disease[9]. Owing to their high moisture content, fruits have a relatively short shelf life. After harvest, 20-30 % of fresh fruits are lost. One of the earliest methods for food preservation is drying. Food dehydration is one of the first unit activities in the food processing sector. Food dehydration is a technique that adds one or more kinds of energy to food to reduce moisture levels to low levels and increase shelf life[10].

Extrusion is a system that pushes mixed ingredients out through a die to form and shape materials. It is used in the modern food industry because of its product quality, multifunctionality, versatility, low-cost, high-energy productivity, and environmental friendliness[11].

Huge quantities of bananas are wasted during their commercialization and post-harvest processing. The processing of dried red bananas into flour and the incorporation of the flour into a variety of creative products is a new economic strategy designed to increase the consumption of bananas and, in turn, promote their therapeutic benefits for people[12]. Pasta is one of the most popular cereal-based foods in the world. Owing to their nutrient profiles, extended shelf life, market availability, low prices, ease of preparation, and ease of transportation, pasta products are quite popular. Pasta is made using flours made of many types of grains. Wheat pasta has a richer golden color than products produced from other flours[13].

Therefore the objectives of the study was, dehydration of Red banana to prepare red banana flour, value addition of Red banana flour in different proportions in wheat pasta and identifying the best acceptable variation, analyse the nutrient content of standard and best product, cost analysis of standard and sample, assessing its shelf life and popularization.

2. Materials and Methods

2.1 Selection of Ingredient

The identified ingredient for the study was Red banana *(Musa acuminata)*. The ingredients were procured from a local market and used for processing Red banana flour.

2.2 Processing of Banana Flour

The red banana was processed as per the Figure 1.

2.3 Formulation and Standardisation of Red Banana Flour Incorporated Wheat Pasta

The Red Banana Flour (RBF) was incorporated for production of wheat pasta with varying quantities as given in Table 1. Plate 2 shows the standard and red banana flour incorporated wheat pasta.

Plate 1. Red Banana.

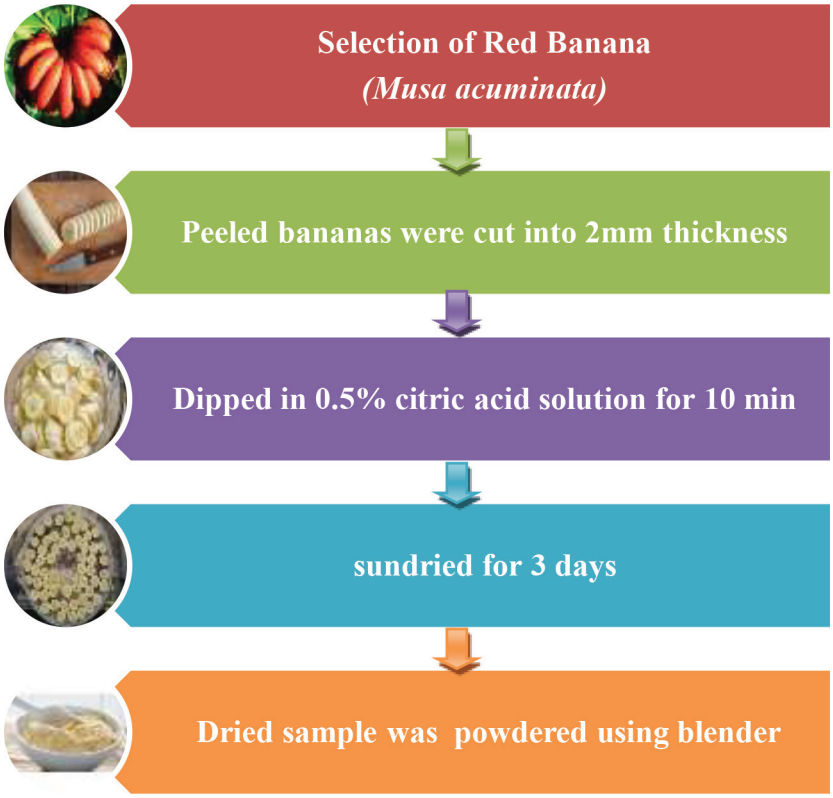

Figure 1. Processing of banana flour.

Table 1. Formulation and Standardisation of Red Banana Flour Incorporated Wheat Pasta

Product	Wheat Flour (g)	Rbf (g)
Standard	100	-
A	90	10
B	80	20
C	70	30
D	60	40

(Note: RBF – Red Banana Flour)

2.4 Sensory Evaluation

The pasta prepared by replacing wheat flour was cooked and subjected to sensory evaluation by a panel of thirty semi trained panel members and products were evaluated by 9 point hedonic scale and the best product was selected based on overall acceptability.

2.5 Nutrient Analysis

Nutrient analysis was carried out to find the nutritional composition of the prepared standard and RBF incorporated

Plate 2. Standard and red banana flour incorporated wheat pasta.

wheat pasta. Standard procedure was used to analyse nutrients like Energy, Protein, Carbohydrate and Potassium.

2.6 Shelf Life Evaluation

The shelf life of the standard and highly accepted pasta variation were packed in air tight container and stored at room temperature. Further it was subjected to sensory and microbial analysis on 1st, 7th and 14th day of the study period to evaluate the shelf life of the product.

2.7 Cost Calculation and Product Popularizarion

The cost of the standard and the selected best product were calculated and compared. Cost calculation was done for standard and best product of red banana flour incorporated wheat pasta.

The highly accepted Red banana flour incorporated pasta variation was popularized among 30 adolescent girls.

3. Results and Discussion

3.1 Comparison of Mean Sensory Score of Standard and Variations

The mean sensory scores of the formulated product and the different variations is tabulated as below in Table 2

Variation D received the highest mean score for taste and colour when compared to other variation A, B and C and the other sensory scores were nearest to the standard. Thus, variation D was selected for further study.

3.2 Nutrient Composition of Pasta

Nutrient analysis refers to the process of determining the nutritional content of foods and food products. The best variation was compared with standard and tabulated as below in Table 3

It was observed that the energy, protein, carbohydrate, and potassium content of the formulated and selected red banana flour incorporated wheat pasta was 362kcal/100g, 10.73g/100g, 66.21g/100g, and 65mg/100g, respectively, which was higher than the energy, protein, carbohydrate, and potassium content of the standard product, which was 340kcal/100g, 9.70g/100g, 60.34g/100g, and 27mg/100g. Further, it was concluded that there was a drastic increase in energy, protein, carbohydrate, and potassium content with the incorporation of banana flour.

3.3 Shelf Life Evaluation of Standard and Best Product

The shelf life of a food is the length of time that a product is acceptable and meets consumer expectations regarding its quality. The purpose of shelf-life analysis is to offer a measurement of the food's quality characteristics and assess the period at which spoilage starts to occur consistently. Spoilage of food exhibits physical, chemical, microbiological changes which in turn alters the sensory characteristics and consumer acceptance. The standard and selected products

Table 3. Nutrient analysis of standard and selected product

S. No.	Nutrient	Standard (S)	Selected Product (D)
	Ash (%)	1.68	1.87
	Moisture (%)	2.5	3.79
	Energy(kcal)	340	362
	Protein (g)	9.70	10.73
	Carbohydrate (g)	60.34	66.21
	Potassium (mg)	27	65

Table 2. Mean acceptability scores of standard and variations

Sl. No.	Products	Score	Appearance	Colour	Flavor	Texture	Taste
1.	Standard	9	8.0 ± 1.5	8.6 ± 0.67	8.8 ± 0.6	8.7 ± 0.7	8.7 ± 0.5
2.	Variation A	9	7.6 ± 1.0	7.2 ± 1.21	6.9 ± 1.2	7.0 ± 1.1	7.4 ± 1.1
3.	Variation B	9	7.7 ± 0.9	7.3 ± 0.88	7.2 ± 1.0	7.3 ± 1.2	7.6 ± 1.2
4.	Variation C	9	7.6 ± 0.71	7.5 ± 0.93	7.2 ± 0.8	7.2 ± 1.1	7.2 ± 1.1
5.	Variation D	9	7.9 ± 1.7	8.7 ± 0.50	8.7 ± 0.6	8.6 ± 0.71	8.8 ± 0.4

Table 4. Sensory analysis of the standard and best product stored in airtight container

S. No.	Criteria	Score	Day-1*		Day-7*		Day-14*	
			Standard	Sample	Standard	Sample	Standard	Sample
1	Appearance	9	8 ± 1.57	8.1 ± 1.57	7.8 ± 1.2	7.6 ± 1.1	6.5 ± 0.4	6.1 ± 0.5
2	Color	9	8.6 ± 0.6	8.5 ± 0.6	7.6 ± 0.2	7.2 ± 0.6	6.6 ± 0.2	6.1 ± 0.1
3	Flavor	9	8.8 ± 0.6	8.6 ± 0.6	7.2 ± 0.4	6.8 ± 0.6	5.8 ± 0.7	5.9 ± 0.6
4	Texture	9	8.7 ± 0.7	8.4 ± 0.7	7.0 ± 1.5	6.7 ± 0.7	6.7 ± 1.7	5.7 ± 1.5
5	Taste	9	8.7 ± 0.5	8.1 ± 0.5	7.3 ± 0.5	7.1 ± 0.5	5.7 ± 0.5	5.7 ± 1.2
Over all acceptability			8.56 ± 0.32	8.34 ± 0.23	7.36 ± 0.31	7.08 ± 0.35	6.26 ± 0.47	5.9 ± 0.2

*Mean ± SD

Table 5. Microbial load of the standard product and selected product on storage

Days	Variations	Total plate Count CFU/gram
DAY 1	Standard	< 10 CFU/g
	Sample D	< 10 CFU/g
DAY 7	Standard	< 10 CFU/g
	Sample D	< 10 CFU/g
DAY 15	Standard	< 10 CFU/g
	Sample D	< 10 CFU/g
Microbial load	On the 14th day after sampling NO contamination was found	
	No Bacterial growth was observed	

were analyzed for its shelf life for a period of 7 days by evaluating their sensory attributes and total microbial load after packing and stored in air tight container. The analysis was carried out every 7 days for a period of 14 days. The details regarding the sensory analysis of the standard and best product stored in airtight container is given in Table 4.

3.4 Microbial Analysis of Standard and Best Product

Microbial analysis is important to determine the safety and quality of food to testing any microbial activity occurred on the food product. To identify the pathogens which affect the shelf-life of a product. More recently advances in biotechnology have led to the development of 'rapid methods' that minimize manipulation, provide results in less time and reduce cost[14]. Table 5 shows the storage stability of standard and highly accepted red banana flour incorporated wheat pasta.

Table 4 revealed that the microbial growth in both standard and variation on 1st, 7th and 14th day. So, from the results it is evident that the product can be consumed safely on storage in airtight container under hygienic condition and proper handling.

3.5 Cost Calculation

The cost of 100g red banana Flour added wheat pasta was Rs 45 whereas the standard costs Rs.30. Incorporation of red banana flour wheat pasta increased the cost of by Rs15. Though the formulated red banana flour incorporated product costs slightly higher than the standard, the rich nutrients in the RBF flour might benefit the target population.

3.6 Popularization of the Selected Product

The RBF incorporated wheat pasta was popularized among thirty adolescent girls as the product was rich in energy and potassium. A questionnaire was administered before and after popularization and the results showed that after popularization 22 adolescent girls got awareness about the product. About 25 adolescent girls liked to eat pasta and 26 adolescent girls reported that they have not tasted pasta so far, further 26 adolescent girls reported to have consumed red banana-based recipes. About 27 adolescent girls knew that red banana helps to reduce cholesterol. From the study 17 adolescent girls know that the red banana incorporated wheat pasta is an alternate to normal pasta and about 29 of them were willing to buy the product.

4. Conclusion

The wheat pasta was highly acceptable at 40% incorporation of red banana flour. Nutrient analysis showed that the product was rich in energy, protein, carbohydrate and

potassium. The cost of the sample was slightly higher than the standard pasta. The popularization study showed that majority of them liked the pasta and were ready to buy it.

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