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Development of Banana (*Musa balbisiana*) Flour and Its Utilization in Preparation of Cookies

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Abstract

The present study aimed to utilize and develop cookies from banana waste (peel and stem) flourwith high calcium content and to check the nutritional profile and the sensory attributes of the cookies to make value-added products. Bhimkol banana (*Musa balbisiana)* is a wild banana with multiple health benefits. The wheat flour constituted bakery products lose few nutrients during the preparation process. Therefore, the need arises to incorporate the lost nutrients, hence banana waste particularly the peel and the stem flour are added to bakery products to enrich with nutrients. All-purpose flour is replaced withbanana (*Musa balbisiana*) stem and peel flour in formulations and is examined for its compatibility resource for the value addition in food products and to check its nutritional profile along with changes in nutritional content and its acceptability.

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Keywords

Musa balbisiana, Banana, Bhimkol, Fortified Cookies, Banana stem, Peel.

Introduction

The increase in several consumers towards healthy eating habits and health consciousness led to the rapid growth of the health food industry. The market place of the food industry is getting flooded with new health-claim food products to meet consumer requirements. To enhance the nutritional content value additions to existing food can be done to increase the health benefits. As such the nutritional content of cookies can be enhanced using nutritionally rich ingredients both qualitatively and quantitatively (Greeshma *et al*., 2018; Candra Irawan, *et al.,* 2021).

Cookies are confectionary products that are popular among all age groups and are convenient as well as easy to prepare. Cookies make up one of the largest consuming snacks all over the world. Cookies come in a variety of shapes, flavors, and ingredients. It has less moisture content and a longer shelf life. The main ingredient in cookies is all-purpose flour however the fortification of cookies with banana (*Musa balbisiana*) waste flour can improve the nutritional composition of the cookies which is lost in standard cookies during processing (Bunty *et al*., 2020; Himakshi *et al*., 2022)..

Musa balbisiana locally known as Bhimkol or Athiyakol in Assam belongs to the family Musaceae mostly found in the Northeastern region of India and is both cultivated as well as available in the wild (Borboral *et al.,* 2015). The Bhimkol banana bears a large number of fruits that are seeded and giant in size. It is a tall herbaceous plant with medicinal importance and is also used in traditional practices (Swargiary *et al.,* 2023). The fruit of the banana has been consumed as food since ancient times. The flower and pseudo stem are consumed as vegetables by

the local inhabitants of Assam and other Northeastern states (David *et al.,* 2020). The plant holds importance in the pharmacological industry due to its medicinal properties to cure a few diseases.

It is said to be a high source of carbonate, calcium, potassium, and chloride. The plant's increased alkalinity due to potassium and chloride accumulation led to the justification of their medicinal application (Mudoi *et al.,* 2011). It is an excellent source of nutrients with fruits high in dietary fiber, Vitamin B6, and Vitamin C. *Musa balbisiana* in comparison to other breeds of banana is slightly different due to its robust size and seeded fruit. It is also one of the underutilized horticultural crops since it has higher seeds than pulp. The fruit is used by industries to produce powder for food products and also in baby foods as it is a good source of nutrients. In the Northeastern part of India, Bhimkol is typically fed to infants as it is nutrient-dense food that is high in proteins, carbohydrates, and minerals. Additionally, it is efficient in treating conditions like jaundice and dysentery (Ravishankar Kundapura, *et al.,* 2015; Priyanka Das, *et al.,* 2016).

The other unutilized leftovers after harvesting of the banana can also be utilized and can be used as a value addition to food products for enrichment with essential nutrients. It also serves to control the environmental problems that are caused by to lack of treatment of the banana leftovers leading to environmental hazards Swargiary *et al.,* (2021). Numerous investigations have revealed that certain parts of *Musa balbisiana* have anticancer and anti-proliferative properties Borborah *et al.,* (2016). The antiperoxidative and antioxidant qualities of fresh ripe *Musa balbisiana* fruit pulp can help prevent disorders linked to oxidative stress.

The dietary fiber and phytochemicals lost during the processing of wheat flour bakery products can be replenished by the addition of it. Gout can be treated with tree bark. Studies prove that the dried peels were used as a health tonic or to treat gastritis and cough.

Young tender banana pseudo-stem is a very rich source of iron and fibres (Kalita *et al.,* 2004). Banana pseudo stem is beneficial for diabetes because they have a low glycaemic index, high dietary fiber, and antioxidants. Further, it is proven beneficial for kidney stones. Similar to the fruit, its stem also contains high potassium as well as Vitamin B6 which aid in the synthesis of insulin and haemoglobin.

Materials and Methods

Banana (*Musa balbisiana)* was procured from Assam in which the stem and peel were utilized and made into flour. The other major ingredients were procured from the local market of Lucknow, Uttar Pradesh, India.

Extraction of peel and stem flour

The Banana (*Musa balbisiana)* peel and stem were cleaned and washed. It is then cut into small pieces and arranged in trays separately to sundry. Then it is ground in a grinder and the flour obtained is sieved and the final obtained flour is stored in an air-tight container.

Preparation of Cookies (Standard)

The standard cookies were prepared using all-purpose flour and other ingredients. The prepared cookies were considered a control.

Preparation of Fortified Cookies

The cookies were prepared using banana (*Musa balbisiana*) waste flour in formulations along with all-purpose flour and other ingredients. The banana flour cookies were served as treatment.

Sensory Evaluation

A composite scoring test of a hundred points was employed to a panel of trained and untrained members to perceive the sensory characteristics. The panelists were from different departments of Babasaheb Bhimrao Ambedkar University, Lucknow, India.

Results and Discussion

The results obtained after composite scoring test of 100 points were assessed and the outcome was computed using the average to interpret reactions by panel members. Twenty-five judges evaluated the sensory evaluation according to colour, appearance, flavour, and absence of defects using a total score of hundred composite measures. Among the treatment samples, T_1 scored highest in its quality attributes and was acceptable by panel members.

Sensory Analysis of Standard Cookies

Sensory evaluation of 25-panel members including both trained and untrained was taken to assess the overall acceptability of the standard cookies in terms of colour, texture, flavour, and absence of defects. They were asked

to mark the score of different attributes and the average score found is plotted on a graph.

Graphical representation of sensory evaluation of Standard cookies

The following graph represents the average score obtained from the composite scoring test by a 25-panel member.

Sensory Analysis of Fortified Cookies

The fortified cookies (T_1 and T_2) were evaluated based on colour, flavour, texture, and absence of defects by a panel of 25 members. Table 3.2 shows the average score obtained by treatment cookies after assessing the composite scoring test.

Graphical representation of sensory evaluation of Fortified Cookies (T_1 & T_2)

The average score of treatment cookies obtained from the composite scoring test was plotted in a graphical representation based on its quality attributes.

Comparison of the Sensory Profile of Standard Cookies and Fortified Cookies (T_1)

The results obtained after comparison of the sensory profile of standard cookies and the most acceptable fortified cookies (T_1) show overall almost equal acceptability in terms of color, texture, flavor, and absence of defects by panel members. There is a slight minor increase in acceptability of fortified cookies than that of standard cookies.

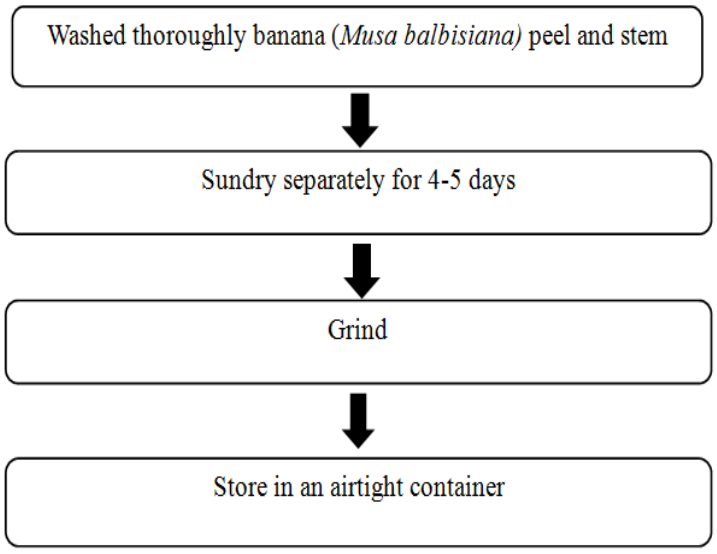
Table.1 Sensory scores of standard cookies by panel members.

Standard cookies	Average Score			
	Colour	Texture	Flavour	Absence of defects
	18.44	17.75	36.76	17.64

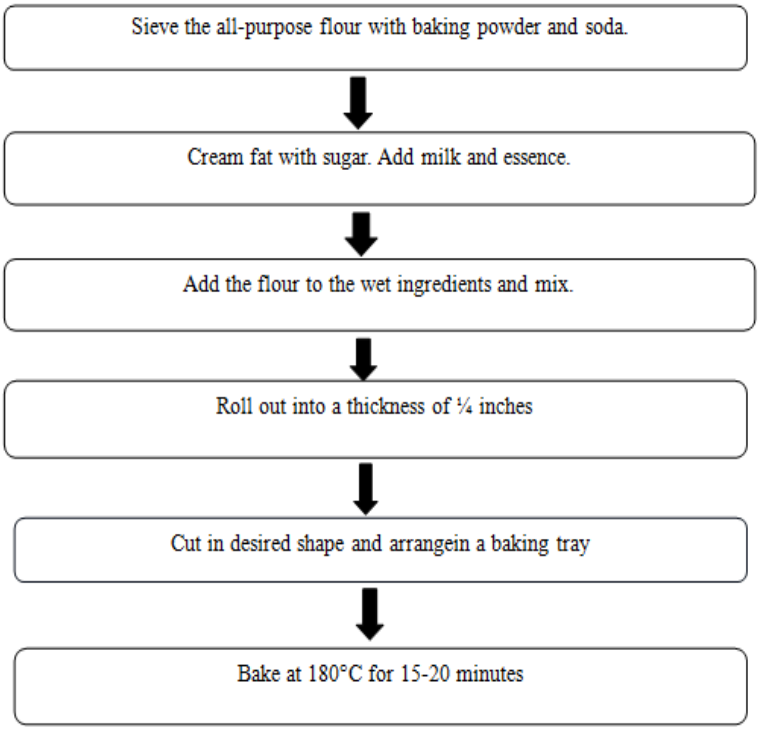
Table.2 Sensory scores of fortified cookies by panel members.

Treatment	Average Score			
	Colour	Texture	Flavour	Absence of defects
T_1	18.76	18.12	37.68	18.24
T_2	17	15.44	32.66	17.5

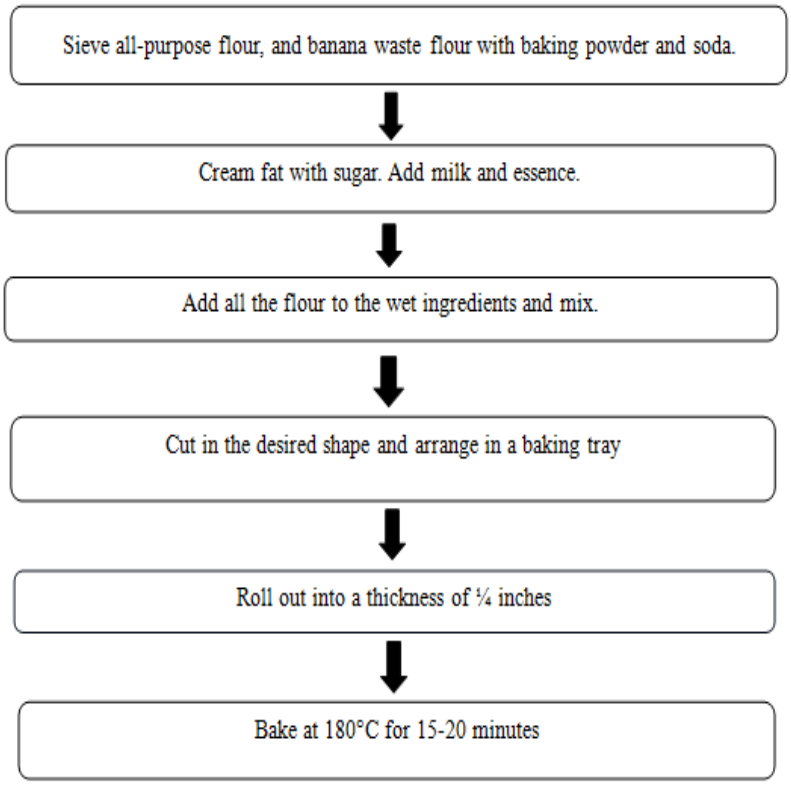
Flowchart.1 Flowchart of preparation of Banana (*Musa balbisiana)* stem and peel flour



Flowchart.2 Flowchart of preparation of Standard cookies



Flowchart.3 Flowchart of preparation of Fortified cookies



Flowchart.4 Composite Scoring test for sensory evaluation

Composite Scoring Test

Name: ..... Date: .....

Product: .....

Quality	Possible scores	Sample scores		
		Reference sample	Test sample 1	Test sample 2
Colour	20			
Texture	20			
Flavour	40			
Absence of defects	20			
Total score	100			

Comments:

Signature

Figure.1 Sensory profile of Standard cookies

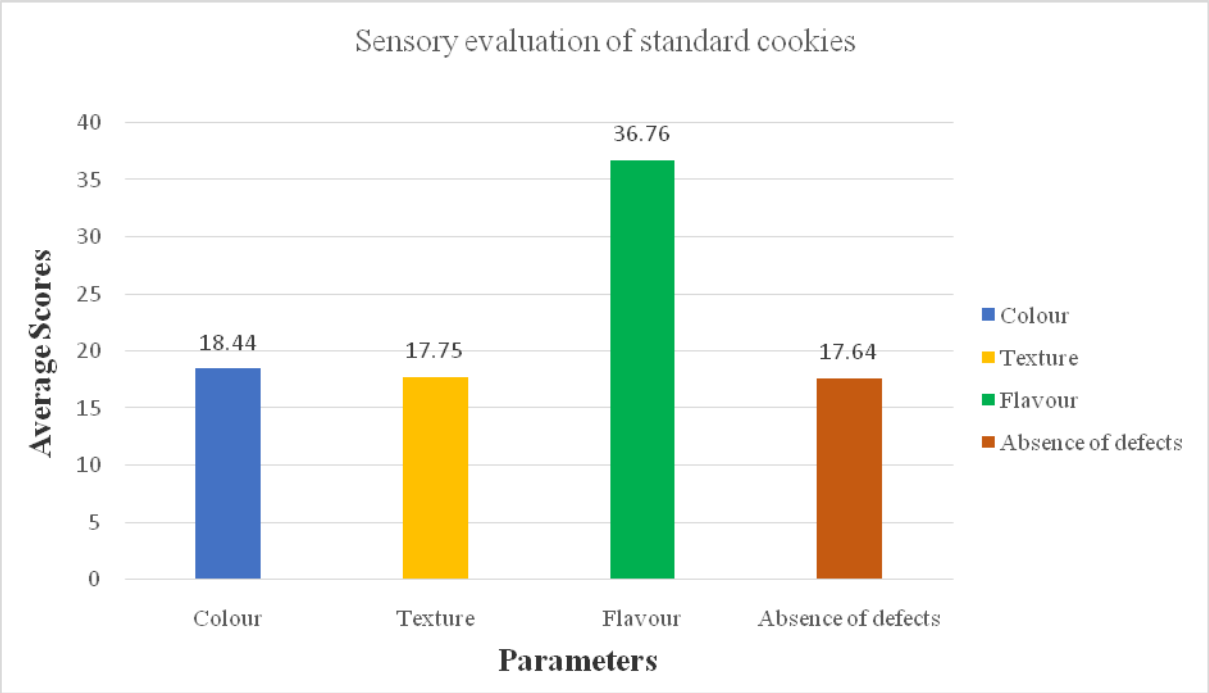


Figure.2 Sensory evaluation of fortified cookies

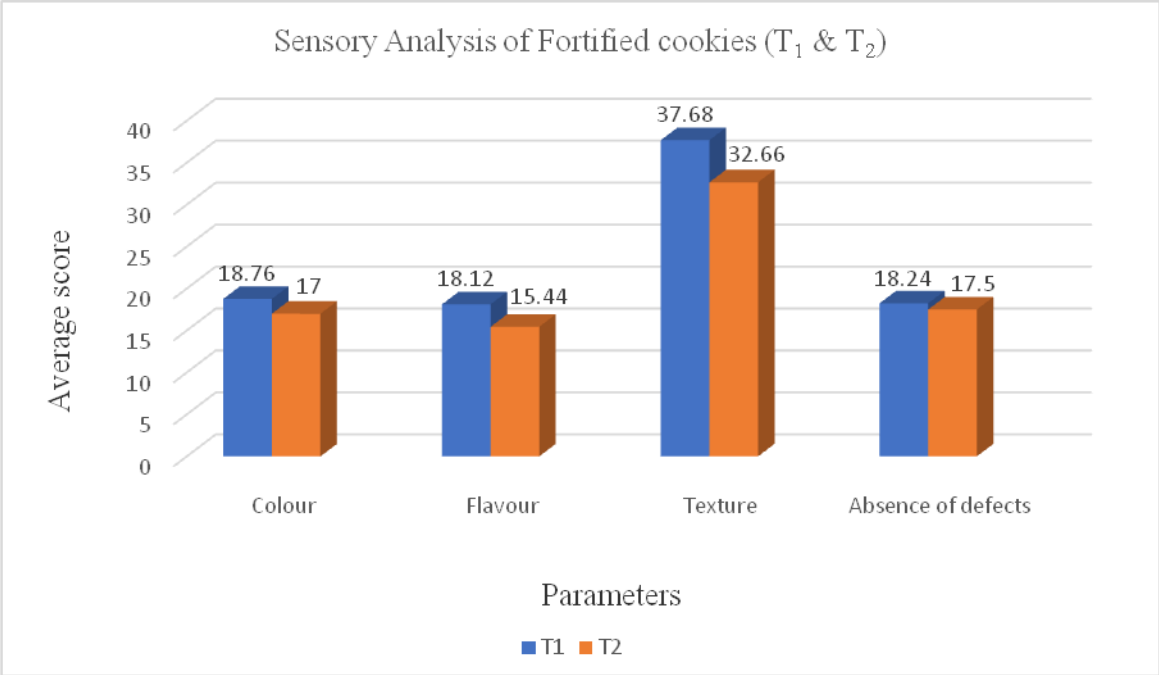
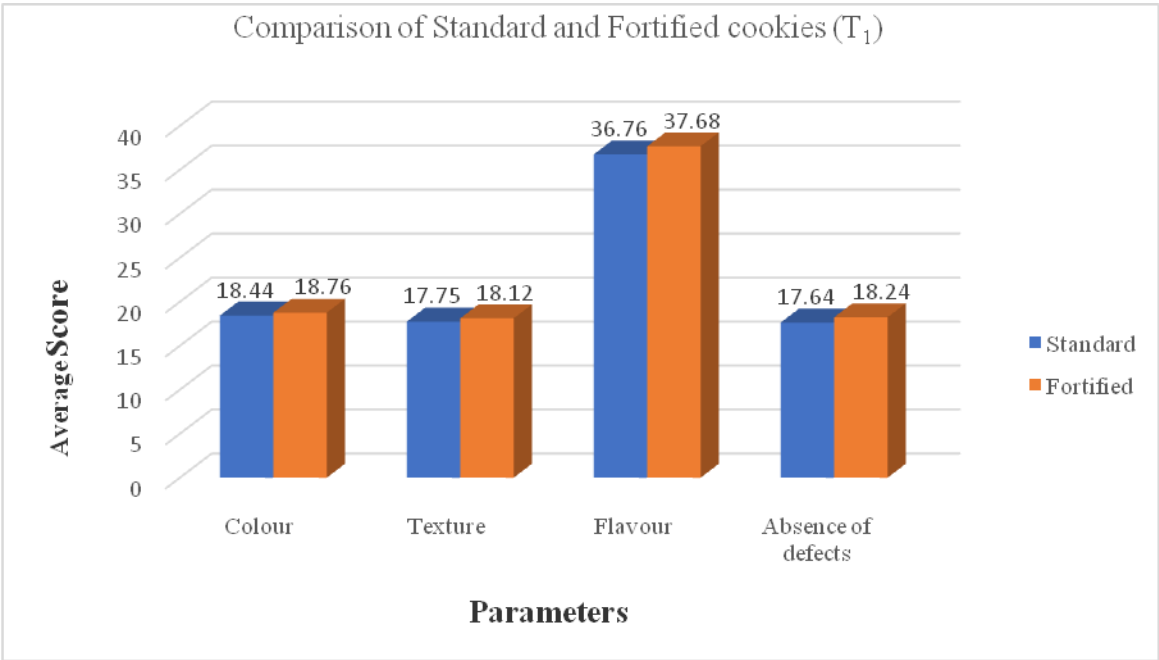


Figure.3 Comparison of the sensory profile of Standard and Fortified cookies



Conclusion

The incorporation of Bhimkol banana peel and stem flour in wheat flour-based cookies will result in substantial health benefits and will provide pharmacological properties along with taste and value. The addition of banana waste flour may be a healthier alternative for the food processing industries as a result of the increased urbanization that has diminished the importance of incorporating healthy foods like bananas and others into eating patterns. The addition of banana waste flour to all-purpose flour increases the anti-oxidant

content. In response to market demands, a large number of studies have been conducted in which all-purpose flour was replaced by banana waste flour to make baked goods like cookies and muffins. Owing to specific dietary patterns, shifting consumption patterns, financial constraints, and market demands; the banana waste-incorporated bakery products are getting tremendously popular.

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Conflict of Interest

There is no conflict of interest.

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