



“BANANA FLOUR EDIBLE SPOON”: A NOVEL APPROACH TO SUSTAINABLE UTENSILS.

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Abstract:

Cutlery plays a vital role in food consumption, yet plastic spoons, commonly used for their low cost, pose serious environmental and health risks due to harmful chemicals. This study explores the creation of edible spoons using green banana flour, sorghum flour, wheat flour, and jaggery as a sustainable alternative. Green banana flour, rich in nutrients and health benefits, is the primary ingredient. Three product variations were tested, with Variation II showing the best sensory attributes across appearance, taste, texture, and aroma. Nutritional analysis showed significant improvements in energy, carbohydrates, protein, fiber, and potassium, along with a reduction in fat. The spoons also exhibited antioxidant activity, decomposed within 10–12 days, and remained stable for 10 days in storage. These findings highlight the product's viability as a nutritious, biodegradable, and eco-friendly alternative to plastic cutlery.

Keywords: Edible spoon, Green banana, Sorghum, Antioxidant, Sustainable, Eco-Friendly.

INTRODUCTION:

Cutlery, though often taken for granted, is an essential component of daily food consumption worldwide. Its origins date back centuries, with spoons being the earliest known utensils, used as far back as 1259 in England and originally made from natural materials like wood, bones, and shells. Over time, forks and knives were introduced, and silver became a preferred material due to its non-reactive properties. With the rise of stainless steel in the 20th century, cutlery became more durable and easy to maintain. However, the advent of plastic revolutionized the industry by making cutlery cheaper and more accessible, particularly aiding urban households with limited time for cleaning and cooking. Despite its convenience, plastic cutlery poses severe environmental and health hazards. The plastic industry in India alone is worth thousands of crores, contributing significantly to daily waste—over 15,000 tons, of which 6,000 tons go unrecycled. Styrofoam and other plastics used in disposable utensils are difficult to recycle and often end up in landfills, oceans, or natural habitats. These plastics break down into microplastics over time, polluting ecosystems and being ingested by marine and terrestrial life, ultimately entering the human food chain and posing risks such as hormone disruption and cancer.

The environmental burden of plastic spoons is immense, especially as they are single-use and often excluded from recycling due to contamination and size. This has led researchers and innovators to explore sustainable alternatives like biodegradable and edible cutlery. Edible utensils made from wheat, rice, sorghum, and banana flour offer a promising solution. Not only are they eco-friendly and biodegradable, but they are also safe to eat, making them ideal for both everyday use and emergency scenarios such as natural disasters or wartime situations where food and hygiene resources are scarce. Among the promising ingredients for edible cutlery are green banana flour, sorghum flour, and wheat flour. Green banana flour, made from unripe bananas, is rich in resistant starch, dietary fiber, and essential nutrients, and can improve digestive health and blood sugar control. It also helps reduce food waste by utilizing bananas that would otherwise spoil. Sorghum, a drought-resistant crop rich in antioxidants and fiber, is highly sustainable and versatile. Its roasting improves antioxidant activity, making it nutritionally beneficial. Wheat flour, widely available and rich in gluten, offers structure and elasticity, making it a reliable material for forming durable edible spoons.

This study aimed to develop edible spoons using locally available green banana and sorghum flours as a sustainable alternative to disposable plastic cutlery. The use of these flours not only provides environmental benefits but also nutritional advantages, offering an innovative way to reduce plastic pollution. Promoting edible cutlery can encourage local food manufacturers and cutlery producers to adopt eco-conscious practices and explore new product designs. By tapping into sustainable, locally sourced materials, this approach supports the goals of responsible consumption and production, in line with global efforts to reduce plastic waste and promote environmental sustainability.

OBJECTIVES:

- To standardize and develop green banana flour edible spoon
- To evaluate the nutritional composition of developed edible spoon

SELECTION AND PROCUREMENT OF RAW MATERIALS:

Food ingredients namely green banana, sorghum flour, wheat flour, jaggery were selected for the development of the product. Green banana which is purchased from farmer and the sorghum flour, wheat flour, jaggery were purchased from departmental stores, Coimbatore.

PRE-PROCESSING OF GREEN BANANA FLOUR:

Selection of raw green banana



Peeling of banana



Cut into pieces



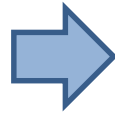
Drying in solar dryer



Grind them into fine powder



Green Banana



Peeled Banana



Cut into Pieces



Grind into fine powder



Solar Dryer

Pre-Processing of Green Banana Flour

PREPARATION OF EDIBLE SPOON USING BANANA FLOUR:

Weighing of green banana powder, sorghum flour, wheat flour and jaggery



Mixing all the ingredients



Making into smooth dough formation



Shaping using spoon mould



Bake the spoon at 180°C for 15 min



Allow it to cool



STANDARDIZATION OF THE DEVELOPED EDIBLE SPOON :

Ingredients	Variation 1	Variation 2	Variation 3
Banana flour	50 g	40 g	30g
Sorghum flour	15g	25g	35g
Wheat flour	25g	25g	25 g
Jaggery	10g	10g	10g

ORGANOLEPTIC EVALUATION OF DEVELOPED EDIBLE SPOON:

The developed edible spoons made from banana flour underwent sensory evaluation, where a 9-point hedonic scale was used to assess appearance, taste, texture, consistency, and overall acceptability. A panel of 30 semi-trained assessors evaluated the samples for these parameters.

PHYSIO CHEMICAL ANALYSIS OF THE DEVELOPED EDIBLE SPOON :

The finalized product is analysed for its physical parameters include weight, length, breath, and chemical constituent includes moisture, ash, p^H .

NUTRIENT ANALYSIS OF THE DEVELOPED EDIBLE SPOON :

The nutrients like Energy, Carbohydrate, Protein, Fat, Fiber, potassium were analysed.

PACKAGING OF DEVELOPED EDIBLE SPOON:

The developed spoon is packed in kraft cutlery pouch.

RESULT AND DISCUSION :

Mean ± standard deviation values of the formulated variations-V1, V2 & V3.

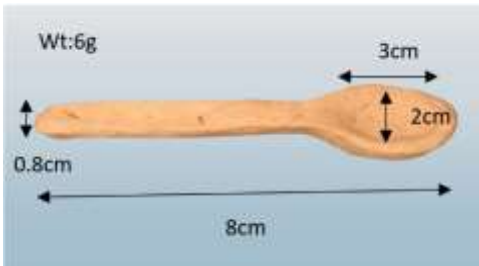
CATEGORY	CONTROL SAMPLE	VARIATION 1	VARIATION 2	VARIATION 3
APPEARENCE	7.7±1.08	7.2±0.66	8.36±0.80	7.13±0.68
COLOR	7.9±0.88	7.2±0.56	7.9±0.78	6.9±0.99
AROMA	7.9±1.12	7.4±1.00	8.2±0.99	7.4±0.85
TEXTURE	7.36±1.21	7.2±1.03	8.2±0.69	7.4±0.68
FLAVOUR	7.76±1.04	7.3±0.95	8.16±0.79	7.13±1.04
TASTE	8.0±1.05	7.16±0.46	8.03±0.76	7.36±0.61
OVERALL ACCEPTABILITY	8.13±0.73	7.5±0.82	8.16±0.79	7.3±0.74

From the above table it is clear that organoleptic score for the variation-II had got highest mean score for all the sensory attributes which includes Appearance (8.36 ±0.80), Flavour (8.16±0.79), Taste (8.03±0.76), Texture (8.2±0.69), Colour (7.9 ±0.78), Aroma (8.2±0.99) and Overall acceptance (8.16±0.79) comparison with other variation-I and variation-II. Compared to all other variations the Variation-II secured highest mean score for overall acceptability. So, it was selected for further study.



Standard Description

PHYSIO-CHEMICAL ANALYSIS OF THE DEVELOPED EDIBLE SPOON:



Physical measurements

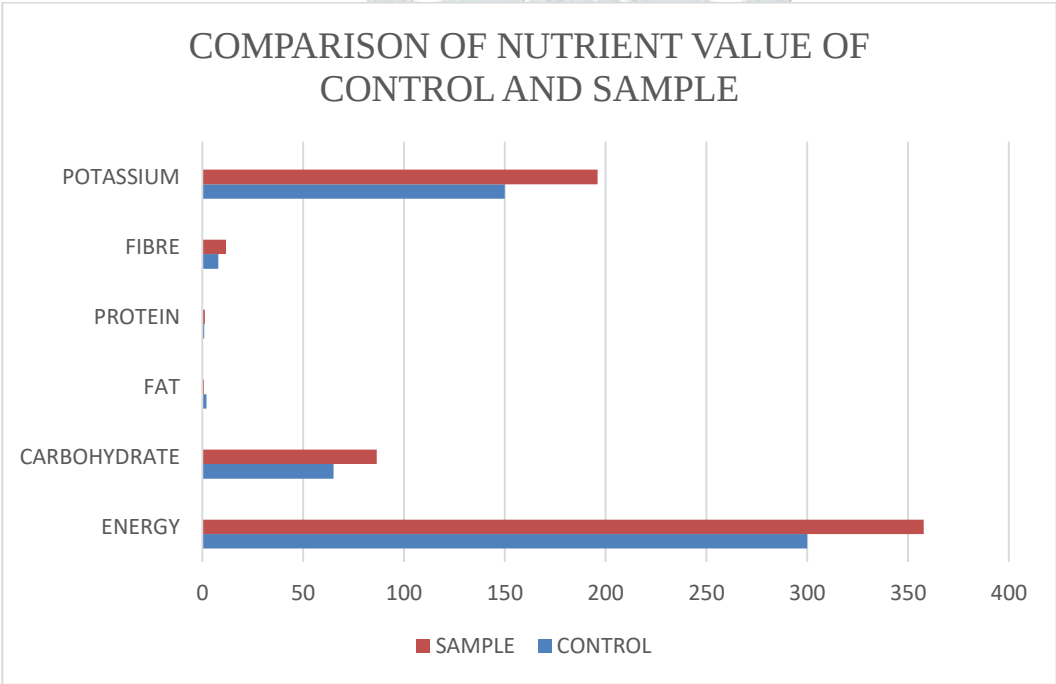
Moisture, Ash and p^H Content of Banana flour edible spoon:

S.NO	PARAMETERS	VALUES/100G
1.	MOISTURE	6.23
2.	ASH	5.31
3.	p ^H	6.48

NUTRIENT ANALYSIS OF THE DEVELOPED EDIBLE SPOON:

S,NO	PARAMETER	VALUES
1.	ENERGY	357.69kcal
2.	PROTEIN	1.21g
3.	CARBOHYDRATE	86.48g
4.	FAT	0.77g
5.	CRUDE FIBRE	11.8g
6.	POTASSIUM	196.0mg
7.	ANTIOXIDANT	63.4mg/dl

COMPARISON OF NUTRIENT ANALYSIS OF DEVELOPED SAMPLE AND CONTROL:



The developed sample shows improved nutrition, with energy rising from 300 to 357.69 kcal to increased carbs

(65 g to 86.48 g) and protein (0.9 g to 1.21 g), while fat drops from 2 g to 0.77 g. Fiber content also increases from 8 g to 11.8 g, supporting better digestion, and potassium rises from 150 mg to 196 mg.

EXPOSURE OF THE DEVELOPED EDIBLE SPOON:

Banana flour edible spoon were exposed to hot water, cold water. Spoon have a holding capacity of up to 2 min hot water, 10 min in cold water.



Figure 12 : Exposure to hot water



Figure 13: Exposure to cold water

BIODEGRADABILITY TEST (SOIL BURIAL TEST):

The edible cutlery, made from natural ingredients without preservatives, began decomposing the next day and fully degraded within 10-12 days in sterile soil. Moisture from rain and microbial activity in the soil accelerated the breakdown, with noticeable disintegration by days 3-4 and significant decay by days 7-8. By days 10-12, complete decomposition was observed, confirming the cutlery's effective biodegradability.

STORAGE AND PACKAGING OF DEVELOPED EDIBLE SPOON:

Each developed edible spoon was individually stored in a kraft cutlery pouch, with approximately 16 spoons collectively packed in a white cardboard box.

CONCLUSION:

This study successfully developed a nutritious edible spoon with potential antioxidant and sensory benefits. The optimized formulation (V2) offered superior sensory characteristics, strong antioxidant capacity, and the presence of beneficial nutrients. Packaged sustainably and priced economically, the edible spoon are eco friendly and biodegradable. Future research should focus on clinical validation, shelf-life studies, and exploration of additional functional ingredients to diversify product offerings.

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