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DEVELOPMENT AND CHARACTERIZATION OF A FUNCTIONAL FOOD PRODUCT INCORPORATED WITH *PANDANUS AMARYLLIFOLIUS* LEAF POWDER

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Abstract

The growing demand for functional foods has encouraged the incorporation of plant-based ingredients with health-promoting properties into conventional food products. *Pandanus amaryllifolius*leaf powder is a rich source of bioactive compounds, including phenolics, flavonoids, vitamins, minerals, and natural antioxidants, making it a promising functional ingredient. The present study was aimed to develop and characterize functional food products incorporated with *Pandanus amaryllifolius* leaf powder and to evaluate their nutritional and quality attributes. Five value-added food products, namely rose milk, milkshake, brownie, samosa, and cutlet, were formulated by incorporating different levels of *Pandanus amaryllifolius* leaf powder. The formulations were standardized based on sensory acceptability. The optimized products were evaluated for physicochemical characteristics, proximate composition, mineral content, antioxidant activity, and sensory attributes using standard analytical methods. The results indicated that *Pandanus amaryllifolius* leaf powder can be successfully incorporated into both dairy- and cereal-based food products to develop nutritious and functional foods.

INTRODUCTION

The genus Pandanus from the family Pandanaceae comprises approximately 600 species distributed in tropical and sub-tropical regions (Takayama *et al.,* 2002). Among them only nineteen species of Pandanus are recorded in India (Karthikeyan, 1989).It was first described by Scottish botanist Roxburgh in 1832 and revised by American botanist Benjamin C. Stone in 1978 from the Maluku Islands, Indonesia and the rare presence of male flowers in these specimens may indicate that it was the origin of the species. It was considered as an ancient cultigen, with no confirmed wild populations, suggesting long-term human cultivation possibly originating from the Moluccas in Indonesia. (Stone, 1978; Setyowati*et al.,* 1999). As a shrub in the wet tropical biome, *Pandanus amaryllifolius*thrives in humid lowlands, favouring coastal regions, disturbed sites, and swampy or stream side areas

within primary and secondary tropical rain forests. However, its occurrences are invariably linked to human cultivation rather than natural wild populations (Siemonsma, 1999). The plant was typically propagated vegetative and maintained in small-scale gardens for flavoring Southeast Asian dishes farms and domestic settings across these tropics, with no documented cases of invasiveness it remains largely dependent on human cultivation and has not naturalized in any introduced areas. In subtropical zones, such as parts of Australia and the United States, it was occasionally grown in greenhouses or protected outdoor areas to replicate tropical conditions. The plant is rare in the wild, female flowers are unknown, male flowers are very rare thus the fruits are unknown Pandan leaves possess a floral, herbal, sweet, and grassy aroma without earthy notes. The fragrance is bright and is often described as having a vanilla-like nuance (Krishnan *et al.,* 2007)

MATERIALS AND METHODS

1. Collection and Preparation of Plant Material

Fresh leaves of *Pandanus amaryllifolius* was collected from the fresh home garden, Aumanai and thoroughly washed with distilled water to remove dust and impurities. Fresh *Pandanus amaryllifolius* leaves were washed thoroughly, cut into small pieces, and shade-dried at room temperature (25–30°C) in a well-ventilated area until completely dry. The dried leaves were ground into a fine powder, sieved through a 60-mesh sieve, and stored in airtight containers for further analysis and food product formulation.

FORMULATION OF *PANDANUS AMARYLLIFOLIUS* LEAFPOWDER INCORPORATED FOOD PRODUCTS

The *Pandanus amaryllifolius*leaf powder prepared using different drying methods were selected for the preparation of the product. The products such as *Pandanus amaryllifolius* leaf powder incorporated Cutlet, *Pandanus amaryllifolius* leaf powder incorporated Samosa,and *Pandanus amaryllifolius* eaf powder incorporated Rose milk based product were developed and compared with standard.

- **Method of preparation of *Pandanus amaryllifolius*Leaf powder incorporated Cutlet and Standard Cutlet**

- Boiled and mashed potatoes were cooked and mixed with vegetables until it become soft.
- A small amount of oil was heated in a pan, sauted with onion, green chilli, and ginger-garlic paste until it reaches golden colour.
- Cooked vegetables, mashed potatoes, salt, and spices were added and mixed well In case of Sample *P. amaryllifolius*leaf powder wasincorporated.

- Shaped the mixture into cutlets, dipped in maida slurry, and coated with breadcrumbs.
- Fried the mixture in hot oil until golden brown and served hot.

Table.1. Ingredients of standard and *P. amaryllifolius* incorporated Cutlet

Ingredients	Standard Cutlet	*P. amaryllifolius* Incorporated Cutlet
Potato	3	3
Onion – 1	1	1
Green chilli	2	2
Ginger-garlic paste	1 tsp	1 tsp
carrot, beans, peas	½ cup	½ cup
Red chilli powder	½ tsp	½ tsp
Garam masala	½ tsp	½ tsp
P. amaryllifolius leaf powders	-	1 tsp
Salt	Small Amount	Small Amount
Coriander leaves	2 tbsp	2 tbsp
Oil	Small Amount	Small Amount

- **Method of preparation of *Pandanus amaryllifolius* Leaf powder incorporated Samosa and standard Samosa**
- Kneaded Maida with salt and water was made into stiff dough.
- Sauted with onion, chilli, ginger added boiled peas.
- Added mashed potato, salt, and spices and mixed well. In case of sample samosa *P. amaryllifolius*leaf powder was incorporated and mixed well.
- The dough was shaped into cones, filled and sealed.
- The stuffing was Fried until it reaches golden brown and served hot.

Table.2. Ingredients of standard Samosa and *P. amaryllifolius* Incorporated Samosa

Ingredients	Standard Samosa	*P. amaryllifolius* Incorporated Samosa
Maida	1 cup	1 cup
Potato	3	3
Onion	1	1
Green chilli	2	2

Peas	¼ cup	¼ cup
P. amaryllifolius leaf powders	-	2 tsp
Ginger	1 tsp	1 tsp
Salt & spices	Small amount	Small amount
Oil	For frying	For frying

Method of preparation of *Pandanus amaryllifolius*Leaf powder incorporated Rose Milk and standard Rose Milk

- Fresh milk was boiled and allowed to cool to room temperature.
- Sugar was added, in case of sample rose milk Powdered *P. amaryllifolius*was also added and mixed thoroughly until completely dissolved.
- Rose syrup was added to the milk and stirred uniformly.
- The prepared rose milk was refrigerated at 4°C and served chilled for further analysis.

Table 3. Ingredients of standard Rose milk and *P. amaryllifolius* Incorporated Rose Milk

Ingredients	Standard	*P. amaryllifolius* Incorporated Rose Milk
Milk	1 cup	1 cup
Sugar	2 tsp	2 tsp
Ice Cream	1 scoop	1 scoop
P. amaryllifolius leaf powders	-	1 tsp
Ice cubes	few	few

SENSORY EVALUATION OF THE STANDARD AND *PANDANUS AMARYLLIFOLIUS* INCORPORATED FOOD PRODUCTS.

The recipes were standardized in terms of the ingredients used, the quantity of each ingredient and the time taken for cooking. Sensory properties, among many other factors, influence considerably the quality of food products. Sensory assessment was evaluated on the quality descriptions i.e., appearance, taste, color, flavor, texture and overall acceptability using a score card.A score card is a tool used for evaluation by providing direction and degree of judgment through suitable and defined scores. In the present study, the leaf powder of *Pandanus amaryllifolius* prepared using different drying methods such as shade drying, sun drying, and hot air oven drying was successfully incorporated into various food products including cutlet, samosa, and Rose milk. All

formulated products were compared with their respective standard samples prepared without *Pandanus amaryllifolius* leaf powder. The products were evaluated by a panel of 20 trained members from the PG and Research Department of Nutrition and Dietetics, Muslim Arts College. The mean score for sensory analysis of the formulated products was given in the following

RESULT

Formulation and Sensory Evaluation of Standard and *Pandanus amaryllifolius* incorporated Cutlet

The results of the sensory evaluation showed that the mean score and standard deviation scores of food products for sensory parameters such as Appearance, Texture, Taste, Colour and overall acceptability of products incorporated with *Pandanus amaryllifolius* leaf powder, In the present analysis the overall acceptability reported that *Pandanus amaryllifolius* leaf powder incorporated samosa represented higher acceptability by the trained panel members compared to cutlet and rose milk. The incorporation of *Pandanus amaryllifolius* leaf powder did not negatively affect the sensory quality of the products and, in some cases, improved their organoleptic characteristics. The result of sensory evaluation of the Standard and *Pandanus amaryllifolius* incorporated samosa was displayed in Table.2. and Plate.1.

Plate **1. Standard and *Pandanus amaryllifolius* incorporated Products**

1. Cutlet

2. Samosa

3. Rose milk

Table.2. Sensory Evaluation of Standard and *Pandanus amaryllifolius* incorporated Products

Sl.N0	Sensory Parameters	*P. amaryllifolius* incorporated Cutlet		*P. amaryllifolius* incorporated Samosa		*P. amaryllifolius* incorporated Rose milk		
		M±S.D	S.M.E	M±S.D	S.M.E	M ± S.D	S.M.E	
1	Appearance	4.8±0.24	0.10	4.63±0.4	0.34	4.7±0.21	0.21	

2	Texture	4.3±0.49	0.10	4.67±0.89	0.78	4.2±0.32	0.11	
3	Taste	4.5±0.5	0.11	4.87±0.9	0.34	4.6±0.6	0.13	
4	Flavor	4.77±0.24	0.10	4.32±0.43	0.67	4.7±0.14	0.16	
5	Colour	4.3±0.49	0.10	4.09±0.48	0.90	4.2±0.19	0.15	
6	Overall Acceptability	4.3±0.49	0.10	**4.56±0.98**	0.39	4.2±0.19	0.14	

DISCUSSION

Pandanus amaryllifolius is indigeneous and widely available in Indonesia. Using indigeneous plants for extraction of essentials for betterment of lives is the sustainable approach to achieve sustainable development goals. (SDGs) (Tari *et al.,* 2017). *P.amaryllifolius* has found extensive applications across multiple sectors, spanning food, the chemical industry, environmental restoration, and energy (FatihanimMohd*et al.,* 2008).The Geneva-based International Standards Organization (ISO) has included *P.amaryllifolius* in the document 676 that lists 109 herb and spice plant species useful as ingredients in food. (Peter, 2001). Because of their distinctive and pleasant scent, *Pandan* leaves are frequently used in Southeast Asia to flavour a variety of foods, including baked goods, desserts, and even home cooking. The only *P. amaryllifolius* species with fragrant leaves is remaining to the chemical 2-acetyl-1-pyrroline (2AP), which is responsible for the perfume. (Bhuyan and Sonowal, 2021).In the present research, the sensory evaluation showed that the mean score and standard deviation scores of food products for sensory parameters such as Appearance, Texture, Taste, Colour and overall acceptability of products incorporated with P*andanus amaryllifolius* leaf powder prepared using different drying methods. In the present study, *P. amaryllifolius* incorporated samosa should higher acceptability in the sensory evaluation compared to cutlet and rose milk.

CONCLUSION

The food conceptualization component of this investigation successfully demonstrated the practical applicability of *Pandanus amaryllifolius* leaf powder as a natural functional food ingredient. The incorporation of Pandan leaf powder into rose milk, samosa, and cutlet resulted in products with desirable colour, flavour, aroma, texture, taste, and overall acceptability. Sensory evaluation revealed high consumer acceptance for all developed products, with formulations prepared using *Pandan* leaf

powder receiving the highest overall acceptability scores.

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