



# Phytonutrient analysis and sensory evaluation study on pandan amaryllifolius

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## ABSTRACT

**BACKGROUND OF THE WORK:** Pandan leaves (*Pandan amaryllifolius*) is a leaf that is rich in bioactive components. This aroma is due to the presence of the compound 2-acetyl-1-pyrroline (2AP) and is the only species of Pandanus genus. The sweet and delightful flavour of pandan leaves, which is well-known as a source of natural flavouring is commonly used in culinary arts such as food colouring, flavour enhancing and aromatic flavour into the dishes for its fragrant leaves. Pandan is an excellent source of vitamins and antioxidants known to help boost the immune system and prevent conditions like cancer, heart disease, and diabetes. Some of the vitamins and antioxidants in Pandan include Beta-carotene Vitamin C. Pandan is a rich source of flavonoids and phenolic compounds, nutrient such as carbohydrate, amino acid protein, crude fibre, total values are analyzed using standard procedure.

**MATERIALS AND METHOD:** The Pandan leaves were collected, air dried, powdered and incorporated with beverages and was allowed for sensory evaluation by 20 panel members. Phytochemicals and nutrient analysis was carried to analyze the secondary metabolites and nutrients present in the pandan leaf powder.

## RESULT AND CONCLUSION:

The sensory evaluation conducted in our research lab showed a good score card result. The phytochemical analysis represented the presence of phenol, alkaloid, flavanoid, saponins and tannins. The presence of these phytochemicals revealed the antioxidant property of *Pandan amaryllifolius* which can be further used for the anticancer analysis.

**Key Words:** Pandan leaf powder, nutrient analysis, Phytochemicals, antioxidants activity.

## INTRODUCTION

*Pandanus amaryllifolius* is a true cultigens, and is believed to have been domesticated in ancient times. It is sterile and can only reproduce vegetative through suckers or cuttings. It was first described from specimens from the Maluku Islands, and the rare presence of male flowers in these specimens may indicate that it is the origin of the species. These, as no other wild specimens have been found, this is still conjecture. The plant is grown widely throughout Southeast Asia and South Asia. (Bungihan *et al.*, 2004).

Pandan is an excellent source of vitamins and antioxidants known to help boost the immune system and prevent conditions like cancer, heart disease, and diabetes. Some of the vitamins and antioxidants in Pandan include: Beta-carotene. Vitamin C. Pandan, also known as screw pine, is a tropical plant prized mostly for its long, blade-like leaves. It's a popular ingredient in many Sri Lankan, Thai, and other South Asian dishes. Pandan is suspected to have originated from the Moluccas, where the only known flowering specimen was found. From there it would have been spread by humans through Southeast Asia and Sri Lanka, where it is used as a flavoring. Pandan can be readily recognized by the distinctive scent of its leaves. (Peter KV *et al.*, 2004)

Pandan is a tropical plant mostly known for its blade-like and long leaves, also known as screw pine, screw tree, and umbrella tree. South Asian, Thai, Sri Lankan dishes use pandan leaves as a popular ingredient. The variety of Pandan leaves and fruit have a broad range of culinary uses. The leaves are often boiled, juiced, or used to wrap and flavor meats, while the fruit can be eaten raw or made into marmalade. Pandan fruit is also boiled and ground into an edible, highly nutritious paste that's a staple food in a few parts of the world. Pandan leaves are commonly pulverized to produce an emerald-green extract. The more mature the leaf, the darker the hue and deeper the flavor. Furthermore, Pandan leaf powder is used to flavor both

savory and sweet dishes. Its taste is described as a grassy vanilla with a hint of coconut. (Tafesse TB, *et al.*, 2017). Pandan leaves are widely used in South East Asia for flavouring various food products such as bakery products, sweets and even home cooking because of its distinct and pleasant aroma. The aroma is due to the presence of many volatile compounds in the leaves of *P. amaryllifolius*, particularly 2-acetyl-1-pyrroline. The other alkaloids (such as, pandanamine, pandamerilactones) with pyrroline-derived structures are also found in the leaves (Thirawarapan *et al.*, 2007).

The stems of *P. amaryllifolius* were slender, about 2-5 cm thick, decumbent, and ascending reaching 1.0-1.6 m tall. The leaves are middle to pale green, somewhat flaccid, more or less glaucous beneath and the apex with a very few prickles less than 1 mm long. The blades are commonly 25-75 cm in length and 2-5 cm in width, rarely with 1–3 small stout prickles on midrib near the base. The flowers are unknown and probably never produced. In its large growth phase, *P. amaryllifolius* eventually produce erect stem reaching 2.0-4.5 m tall and 15 cm diameter, usually sparsely branched. (Thirawarapan SS, 1998).

#### Classification of Pandan leaves is below

- Kingdom: *Plantae*
- Subkingdom: *Tracheobionta*
- Super Division: *Spermathophyta*
- Division: *Magnoliophyta*
- Class: *Liliopsida*
- Subclass: *Arecidae*
- Order: *Pandanales*

Pandan leaves are used in the perfume industry and also medicinally as a diuretic, cardio-tonic and anti-diabetic (Wakte KV *et al.*, 2010). The diuretic effect of the leaves has been reported by Ysrael *et al.* (1995). The leaves are used to refresh the body, reduce fever, and relieve indigestion. Pandanus contains phytochemicals like steroids, carbohydrates, phenols, isoflavones, coumestrol, lignans, alkaloids, glycosides, amino acids and vitamins, terpenoids, flavonoids, saponins. Chief characters of transverse section of leaves

include sclerenchymatous patches, parenchymatous mesophyll cells, bundle sheath cells (Bindu Gopalkrishnan *et al.*, 2015). Significant pharmacological activities reported by scientists are anti-microbial, anti-diabetic, anti-viral, anti neoplastic, anti-oxidant, anti-diuretic, analgesic and neuroprotective (Singh Gurmeet, Parle Amrita, 2015) Pandanus leaves is rich in terpenes and sesquiterpene hydrocarbons (Yoshihashi, 2002). Beside the aromatic compound, the leaves also have been reported to contain maltodextrin (Chaiser and Cheetangdee, 2006). Mahmoud A. M. Al-Alwani *et al.* (2017) examined natural dye extracted from *Pandanus amaryllifolius* leaves as sensitizer in fabrication of dye-sensitized solar cells.

Besides its culinary value, pandan leaves are used in the perfume industry and also medicinally as a diuretic, cardio-tonic, anti-diabetic and for skin disease. Tender shoots are directly eaten in the case of severe jaundice. Furthermore, the leaves are used to refresh the body, reduce fever, and relieve indigestion, and are reported to contain various alkaloids and unglycosylated pandanin protein which exhibits antiviral activity. Infusion of leaves is taken internally as a sedative (Arumugam *et al.*, 2014).

In the present Research, *P. amaryllifolius* was selected and its phytochemical and nutritive values were analyzed. The antioxidant activity was demonstrated to examine the anticancer property of *P. amaryllifolius*. As *Pandan* is an edible leaf it can be further used as an aromatic medicine, from which natural medicines for various diseases can be isolated, in spite of using chemical medicines.

## METHODOLOGY

### MATERIALS AND METHOD

#### a. Collection of sample

The sample used in the study was *Pandanus amaryllifolius* leaves. The leaves were collected from Arumanai. The other ingredients were purchased from the nearby supermarket. The collected leaves were cleaned thoroughly and dried under the shade. Once the drying process is complete, the dried leaves were ground to powder using blender for use. The dried leaf were powdered and kept in an airtight container for further studies.



**Fig.1** *Pandanus amaryllifolius*

#### **b. Processing of the sample**

The sample was thoroughly washed in running water 2-3 times. The samples were cleaned to remove the foreign particles. Then it was dried by shade with careful attention. The dried *Pandanus amaryllifolius* was powdered using a standard mixer, till it becomes a fine powder. Then the sample powder were packed in polyethylene bags and stored in the refrigerator for further analysis.

#### **c. Preliminary phytochemical analysis**

Petroleum ether, chloroform, acetone, ethyl acetate, ethanolic and aqueous extracts of selected *Pandanus amaryllifolius* were tested for the presence or absence of steroids, phenolic compounds, alkaloids, saponins, tannins, flavonoids, terpenoids according to the standard method (Trease G, Evans SM, 2002; C. M. Ejikeme *et al.*, 2014).

#### **d. Nutrient Analysis**

- The amount of carbohydrate present in the given plant sample was analysed using Anthrone method (Hedge, J.E and Hofreiter, B.T.1962)
- The amount of protein was analysed using Lowry' s method (Lowry *et al.*, 1951)
- The total fat content in *Pandanus amaryllifolius* was estimated by Batch Solvent Extraction method (Min .D.B and Steenson, D.F, 1998)
- The amount of Vitamin C in *Pandanus amaryllifolius* was estimated by standard method (Rao, B and Deshpande, V, 2006)
- The determination of crude fiber in *Pandanus amaryllifolius* fruit powder was estimated by standard method (Rahul *et al.*, 2010)

## Antioxidant Analysis of *Pandanus amaryllifolius* leaves extract

The total antioxidant capacity of the *Pandanus amaryllifolius* leaves extract was evaluated by the phospho-molybdenum method, according to the procedure described by Prieto et al., 1999, 1mg/mL of extract was combined with 3 mL of reagent solution (0.6 M sulfuric acid, 28 mM sodium phosphate and 4 mM ammonium molybdate). Ascorbic acid was used the standard and 1ml of varying concentration of standard combined with 3ml of reagent solution. The tubes containing the reaction solution were incubated at 95°C for 90 min. Then, the absorbance of the solution was measured at 695 nm using a UV-VIS spectrophotometer against blank after cooling to room temperature. The total antioxidant activity is expressed as the number of gram equivalent of ascorbic acid. The calibration curve was prepared by mixing ascorbic with methanol.

### Formulation of the product

The powdered *Pandanus amaryllifolius* leaves were used for the preparation of tea, laddu and jam.

### Ingredients used for Tea

S.NO	Ingredients	Standard Tea	<i>Pandanus amaryllifolius</i> leaves Tea
1	<i>Pandanus amaryllifolius</i> leaves Powder		1g
2	Green tea leaves	1g	
3	Cardamon	2 pieces	2 pieces
4	Sugar	5g	5g

**Ingredients used for Laddu**

S.NO	Ingredients	Standard Laddu	<i>Pandanus amaryllifolius</i> leaves Laddu
1	<i>Pandanus amaryllifolius</i> leaves extract		100ml
2	Gram Flour	30g	
3	Sugar	15g	15g
4	Oil	13ml	13ml
5	Cashew nuts	5 pieces	5pieces

**Ingredients used for Jam**

S.NO	Ingredients	Standard jam	<i>Pandan amaryllifolius</i> leaves Jam
1	<i>Pandanus amaryllifolius</i> leaves extract		100ml
2	Pineapple extract	100ml	
3	Corn flour	5g	5g
4	Sugar	15 g	15g
5	Lemon	1 tsp	1tsp

**METHOD**

A large-sized bowl was taken. The Pandan leaf powder was added to the cup of water and it was allowed to boil finally sugar was added. Then corn flour was added for the gelatinization of starch. Stirring was done till it reaches desired Consistency. The whole process was carried out in medium flame. After reaching required consistency the stove was turned off and cooled down and finally the jam was ready to eat.



## Sensory evaluation

The quality of the prepared products was assessed by the means of human sense of Organs are called as “ Sensory Evaluation or Organoleptic Evaluation” . This evaluation was a valuable tool in solving problems involving food acceptability. It was useful in product improvement and market research. It depends upon the resources given by different sense organs such as eyes, taste buds of tongue and olfactory of lobes of the mouth feel. (Manoranjankalia, 2002).

### Conduct of Sensory Analysis

Sensory analyses were conducted in a clean undistributed environment. The prepared products were coded and presented to the panel members with a score card were the quality parameters were qualified by panelist. Sensory evaluation of the prepared product was given.

### Preparation of Score Card

Score card is an essential tool in organoleptic evaluation. Score card should be simple. Clearly typed and should comprise of unambiguous terms. Score card was formulated with the aspects of appearance, colour, flavor, taste and overall acceptability. Sensory attributes range from excellent very good, good and fair.

### Selection of Panel Members

Prepared products were subjected to analysis to find out acceptability. The formulated Products organoleptically evaluated by using numerical score card to estimate the acceptance of 20 semi trained panel members from department of the Nutrition and Dietetics, Muslim Arts College Thiruvithancode. The panel members were asked to evaluate the product for appearance. Colour, flavor, taste and overall acceptability by using score card.

### Keeping quality of the developed product

Keeping quality of the sample was done for the *Pandanus amaryllifolius* leaves powder. The selected sample was taken in two separate containers and they were started in different temperature like the normal temperature and in the refrigerator. To find out their storage behavior they were kept as such for two



months. These containers were checked for examined once 5-10, 10-15 days for the growth of any microorganism development of any off flavor and production of gases.

## Result and Discussion

The data collected from the study” Evaluation of phytonutrients, microbial density and formulation of *P. Linn, Pandanus amaryllifolius* leaves” were analyzed under the following methods

- Phytochemical Analysis of the *Pandanus amaryllifolius* leaf powder extract
- Nutrient content of the *Pandanus amaryllifolius* leaf powder extract
- Antioxidant Analysis of the *Pandanus amaryllifolius* leaf powder extract
- Organoleptic Estimation of *Pandanus amaryllifolius* Formulated product

### Phytochemical Analysis of the *Pandanus amaryllifolius* leaf powder

In the present study preliminary phytochemical analysis of methanolic extract of *Pandanus amaryllifolius* leaf extract was illustrated in Table: 5, which showed higher concentration of flavanoid and alkaloid (+++) followed by phenol and tannin (++) and saponins in least amount (+). Comparatively in the previous investigation, Sajna Keeyari Purayil *et al.*, (2019), analysed the phytochemical studies in aqueous extract of *Pandanus amaryllifolius* and represented the presence of tannin, terpenoids, glycosides and absence of Phlobatannins and flavanoids. Shameenii A.P *et al.* (2021), reported the presence of alkaloid, saponin, flavonoids, terpenoids, tannins and absence of phlobatannins and cardiac glycosides in ethanolic extract of *Pandanus amaryllifolius*.

**Table: 5. Phytochemical analysis of *Pandanus amaryllifolius* extract**

Sample	Phyto nutrients				
	Phenol	Tannin	Flavanoid	Saponin	Alkaloid
<i>Pandanus amaryllifolius</i> extract	++	++	+++	+	+++

### Nutrient content of the *Pandanus amaryllifolius* leaf powder

The nutrient content (Carbohydrate, protein, fat, vitamin, crude fiber) of the *Pandanus amaryllifolius* leaf powder was analysed using various standard methods and the results were represented in Table:5 and result revealed higher amount of fiber (44.3%) followed by carbohydrate (21.89%), vitamin C (12.04%), protein (1.45%) and least amount of fat (0.7%). Comparatively, Vaewta Cheetangdee and Siree Chaiseri, Kasetsart, 2016 investigated the composition of free amino acids and reducing sugars that could be precursors of ACPY in pandan leaves. Fresh pandan leaves contained 2.38 mg/g fructose and 1.77 mg/g glucose. Major free amino acid in pandan was glutamic acid (0.41 mg/g). Proline, a precursor of ACPY in fragrant rice, was at 0.12 mg/g.

**Table: 5. Nutrient analysis of *Pandanus amaryllifolius* leaf powder**

Sample	Nutrients				
	Carbohydrate (g) (%)	Protein (g) (%)	Fat (g) (%)	Vitamin C (mg) (%)	Fiber (g)(%)
<i>Pandanus amaryllifolius</i> leaf powder	21.89	1.45	0.7	12.04	44.3

### Antioxidant activity of *Pandanus amaryllifolius* leaf powder

In the present research antioxidant property of *Pandanus amaryllifolius* leaf powder extract was analysed using phospho-molybdenum method, revealing the IC 50 value of *P. amaryllifolius* methanolic extract was 36.36 µg/ml GAE/g. In the previous research, Suwannakul *et al.* 2018 illustrated the Antioxidant activity of Pandan prop root by half maximal inhibitory concentration method. The IC50 value of DPPH scavenging activity from pandan prop root crude extract was 230.24 ± 10.69. TPC was 24.75 ± 0.74 mg GAE/g, the IC50 and TPC of pandan leaf extract at 110.57 ± 36.42 µg/ml and 57.25 ± 0.02 mg GAE/g, respectively. Sajna Keeyari Purayil *et al.*, (2019), reported the antioxidant activity of *P. amaryllifolius* leaf

extract as 50µg/mL. The comparative results revealed that *P. amaryllifolius* leaves extract contained bioactive compounds and showed antioxidative activities for it can be used in the treatment of various diseases.

### Organoleptic Estimation of Formulated product

In the organoleptic evaluation study, different products were prepared along with the *P. amaryllifolius* fruit powder, the sensory evaluation results were demonstrated in Table: 7, 8 and 9 and reported the mean score values of sensory evaluation and shows different acceptability values for different products. Among these *Pandanus amaryllifolius* leaves powder Tea showed 4.83±0.13 Mean±SD value followed by *Pandanus amaryllifolius* leaves powder Laddu illustrated 4.85±0.10 Mean±SD value then *Pandanus amaryllifolius* leaves powder Jam demonstrated 4.95±0.21 Mean±SD value compared to the standard value. The highest score value was noted in *P. amaryllifolius* leaves powder jam. Yulianto, W.A *et al.*, 2021, showed that the lowest GI (20.03) and the highest RS content (23.99) were found in the fortified parboiled rice that was produced by *Pandan* leaf extract and fortificants soaked at 65°C for 2.5 hrs and cooled at 2°C for 12 hrs that in addition to high levels of retrograded starch, the GI was lowered due to the polyphenol content in the pandan extract. The results obtained indicated that the panelists level of preference for the parboiled rice was between ‘ like’ and ‘ like slightly.

**Table:7. Mean Score for *Pandanus amaryllifolius* leaves powder Tea**

S.No	Sensory Parameters	PAST		PAPT	
		Mean ± SD	SME	Mean ± SD	SME
1	Appearance	4.72 ± 0.01	0.02	4.8 ± 0.13	0.04
2	Texture	4.8 ± 0.16	0.03	4.72 ± 0.13	0.02

3	Taste	4.68 ± 0.37	0.07	4.8 ± 0.19	0.03
4	Flavor	4.72 ± 0.28	0.05	4.8 ± 0.25	0.05
5	Colour	4.8 ± 0.16	0.03	4.6 ± 0.13	0.02
6	Over all acceptability	4.8 ± 0.24	0.04	4.8 ± 0.13	0.02

**Table:8. Mean Score for *Pandanus amaryllifolius* leaves powder Laddu**

S.No	Sensory Parameters	PASL		PAPL	
		Mean ± SD	SME	Mean ± SD	SME
1	Appearance	4.8 ± 0.10	0.02	4.8 ± 0.10	0.10
2	Texture	4.85 ± 0.10	0.02	4.7 ± 0.16	0.03
3	Taste	4.7 ± 0.16	0.03	4.8 ± 0.10	0.02
4	Flavor	4.8 ± 0.16	0.03	4.85 ± 0.16	0.05

5	Colour	4.8± 0.16	0.03	4.6 ±0.13	0.03
6	Over all acceptability	4.85 ± 0.10	0.02	4.85 ± 0.10	0.02

**Table:9. Mean Score for *Pandanus amaryllifolius* leaves powder Jam**

S.No	Sensory Parameters	PASJ		PAPJ	
		Mean ± SD	SME	Mean ± SD	SME
1	Appearance	4.9 ± 0.3	0.14	4.95 ± 0.2	0.04
2	Texture	4.8 ± 0.3	0.06	4.9 ± 0.3	0.06
3	Taste	4.8 ± 0.4	0.08	4.95 ± 0.21	0.04
4	Flavor	4.8 5 ± 0.31	0.07	4.9 ± 0.3	0.06
5	Colour	4.95± 0.4	0.06	4.85 ±0.96	0.21
6	Over all acceptability	4.95 ± 0.3	0.06	4.95 ± 0.21	0.04

## Sensory Evaluation of the products:

The sensory parameters such as appearance, taste, texture, flavor, colour and over all acceptability of the Tea, Laddu, Jam were analyzed by 20 panel members. The products were compared to the standards products and were highly accepted by the panel members.



**Fig.2. Formulated food products for sensory evaluation**

## Conclusions

The present study focused on the phytochemical, nutrient and antioxidant property of *Pandanus amaryllifolius* and the product formulation to recommend the usage of *Pandanus amaryllifolius* in day to day life along with the various food products. Due to the presence of high amount of nutrients and phytochemicals *Pandanas* can be used for the preparation of herbal medicine against various diseases and these can be formulated and consumed along with some foods. This study will help to people to generate awareness for locally available in markets and supplementation of nutrients and antioxidants rich in *Pandanus amaryllifolius* leaves powder is added to the food flavor.

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