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Phytochemical and nutrient analysis of *borassus flabellifer* fruit and formulation of products

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***Abstract*---**Consumer's interest in healthy eating, in the last decades, shifted towards the potential health benefits of fruits. In the present study, the *Borassus flabellifer* fruit was selected for the preparation of *Borassus flabellifer* fruit incorporated payasam in different ratios and a standard was prepared to compare the samples. The product was prepared using standard procedures. Sensory evaluation was done by 20 selected panel members and the best product was selected. The *Borassus flabellifer* fruit was then subjected to phytochemical and nutrient analysis. The phytochemical analysis of *Borassus flabellifer* fruit revealed the presence of several bioactive phyto constituents such as flavanoids, phenol, alkaloid, saponins, tannin, and terpenoids. Nutrients such as total protein, total carbohydrate, calcium and phosphorus were also analyzed.

Keywords*---Borassus flabellifer,* phyto constituents, flavanoids, saponins, terpenoids.

Introduction

Jerry states that plants play a major role in health as medicine since the human era began. Plants and trees have been used partly and as whole for many medicinal purposes. It got its own specificity with gallons of medicinal stuff in it. Palmyra palm tree belong to the 'palm' family. The official tree of Tamil Nadu State in Indiais the Palmyra tree. It is called karpaha, nungu, celestial tree in Dravedian

culture and is highly respected by people. All parts of the tree could be used for medicinal purposes. (A. Jerry, 2018).

Palmyra tree also known as "*Borassus flabellifer"*is tall in stature. 'Borassus' is a Greek word which means the leathery covering of the fruit and *'flabellifer'*, means fan-bearer. (Jana *etal.,* 2017). *Borassus flabellifer*L, belongs to family Arecaceae. In India it is called as the tree of 800 uses (Davis TA and Johnson DV, 1988). The tree grows with a black stem and crown of leaves at the top to a tallness of about 30 m. Leaves would be around 0.9-1.5 m in diameter. It has unisexual flowers, large fruits, fan shaped palmate and hard horny spinescent serratures over the petiole edges. The tree has a life span of up to 100 years (Sahni et al., 2014).

By-products such as palm sugar and gur (molasses) are also prepared from the juice extracted from tree trunk. The immature soft juicy seed nuts and neera are very popular in the tropical parts of India as a soft natural drink to protect against hot summer. The soft orange-yellow meso-carp pulp of the ripe fruit is sugary, dense and edible, rich in vitamin A and C. Borassus also contains steroidal saponins a compound called flabelliferrins, which are bitter in taste. (Sandhya *et al.*, 2010).

Various processed products such as soft beverages, jam, toffee, delicious food items and sweets are prepared from the ripe fruit pulp (Das and Das 2003).
Contemporary science has proved that fruits, leaves, barks and roots have a few substances namely phytochemicals, vitamins, minerals, proteins, etc which on consumption helps in promoting as well as disease preventing benefits (Prasad *et al.,* 2016). The coconut like fruit is12-15 cm wide, three-sided when young, becoming rounded or more or less oval, and capped at the base with overlapping sepals (Morton JF, 1988).

During summer season the palm fruit is used to keep the body hydrated and it helps to prevent malnutrition in children and adults. It prevents painful urination and tiredness in the body and replenishes the lost minerals and nutrients of the body. It is used effectively to treat digestive problems and other stomach ailments. Sugar palm fruit is a good option for those who are on a diet (Rajendran *et al.,* 2008).

Nausea and vomiting as well as worm infestation can be treated with the fruit pulp. It works as an expectorant and also as a liver tonic. Sugar palm fruit jelly alleviates the itchiness associated with prickly heat. Sugar palm fruits are a healthy option for people on diet or suffering from diabetes due to the richness in minerals and vitamins. It is a rich source of vitamins such as B, C and rich in minerals such as iron, zinc, potassium, calcium, phosphorus, thiamine, and riboflavin (Vengaiah *et al.*, 2013).

The fresh pulp is reportedly rich in vitamins A and C (Nadkarni KM, 2002).The fresh sap is a good source of vitamin B-complex (Morton JF, 1988). Palmyra is an excellent substitute for making oral rehydration solution, which is used for the maintenance of the electrolyte balance within the body cells. Oral rehydration solution is very useful for people suffering from vomiting and diarrhoea (Andrews JM. 2001)

The fruit pulp of *B. flabellifer* has been used in traditional dishes and the sap, has been used as a sweetener for diabetic patients (Masayuki Y, *et al*, 2007). Pramod *et al.,* 2017 states that palm fruit has anti-inflammatory and antioxidant properties. Due to the presence of high content of crude flavonoids, saponins and phenolic compounds the antioxidant activity could be attributed. The fruit pulp helps to cure skin inflammations. (Vengaiah et al., 2013).

Palmyra fruit contains ascorbic acid the natural vitamin. The fruits are used as aperients and to improve the digestion and also used as cooling, laxative, anthelmintic and sedative (Rajendran *et al.,* 2008). For people with sensitive skin the pack made from sugar palm fruit helps to prevent prickly heat, boils and redness of-the-face. It is also beneficial in treating inflammatory skin problems such as redness due to intense heat. (Morton, J.F. 1988). According to VijayaKumari *et al.,* 2014 the palmyra fruit pulp has good water and fat absorption properties. So palmyra fruit pulp is used in bakery industry and in various food formulations.

The nutritional values of Palmyra young fruit contains protein, fat, carbohydrate, fiber, calcium, phosphorus, iron, thiamine, riboflavin, niacin and Vitamin C (Vengaiah PC, *et al.,* 2015). The fresh palm juice is a sweet, clear, colourless juice containing sucrose, reducing sugar, protein and fat (Shamala and Sreekantiah, 1988). The fruits of the *Borassus flabellifer*(Palmyra) are used various properties in example it's used against helmintic, diuretic, antioxidant, enhanced antibacterial activity, wound healer, immune modulator, against inflammation, nausea and vomiting. It is also used to keep the body hydration, used to relief the digestive problems and other stomach problem, laxative. It prevents the malnutrition also. (Rajendran K, *et al.,* 2008)

Materials and Methods
Collection of Sample

The sample used for the proposed study is *Borassus flabellifer* fruit. The sample was collected from palm plantation Nagercoil. *Borassus flabellifer* fruit were taken and the top portion of the fruit is cut and pulp is taken separately for further use.

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Phytochemical Analysis

Phytochemical analysis is done to find out the phytochemicals present in *Borassus flabellifer* fruit qualitatively and quantitatively. Qualitative analysis of the major constituents present in *Borassus flabellifer* fruit such astannin, flavonoids, saponins, terpenoids, and alkaloids were determined using standard procedures (Harborne, 1973). The phytochemicals which showed positive in qualitative analysis such as tannin, flavanoid, saponin and alkaloid were subjected to quantitative analysis.

Nutrient Analysis

Nutrient analysis was done to find the nutrients present in *Borassus flabellifer* fruit especially carbohydrate, protein, calcium and phosphorus using different methods such as Anthrone method, Bradford's colorimetric method, Flame photometry and Wet digestion method etc.

Formulation of the Product

Borassus flabellifer fruit was selected for the preparation of the product. *Borassus flabellifer* fruit incorporated payasam in different ratios were prepared using standard procedures. The procedures for the preparation of payasam are given below:

Table 1
Ingredients used for *Borassus flabellifer* fruit incorporated Payasam

Ingredients	Standard	Sample-1	Sample-2	Sample-3
Milk	250 ml	250 ml	250 ml	250 ml
Cardamom	1/4tsp	1/4tsp	1/4tsp	1/4tsp
Sago	50g	50g	50g	50g
Saffron	1/4 tsp	1/4 tsp	1/4 tsp	1/4 tsp
Ghee	2 tbsp	2 tbsp	2 tbsp	2 tbsp
Sugar	150g	150g	150g	150g
Mixed dry fruit	1 tbsp	1 tbsp	1 tbsp	1 tbsp
Palm fruit	-	25g	50g	75g

Preparation of *Borassus flabellifer* fruit incorporated Payasam

Take a pan and place it in a medium flame and heat ghee in it. When the ghee is hot enough add the mixed dry fruit and roast it and kept aside. Take a pan and boil the milk, add the sago and boil until it cook and then add the sugar. Finally add the palm fruit paste, saffron, ghee and the roasted dry fruit and serve it in a bowl.

Sensory Evaluation of the Formulated Product

Sensory assessment were evaluated on the quality description i.e., appearance, texture, taste, color, flavor, and over all acceptability using a score card. The sensory evaluation was carried out for the products in 3 different ratios. The products were evaluated by a panel of 20 semi trained panel members from the

Department of Nutrition and Dietetics, Muslim Arts College, Thiruvithancode, Kanyakumari Districtand the best product was selected.

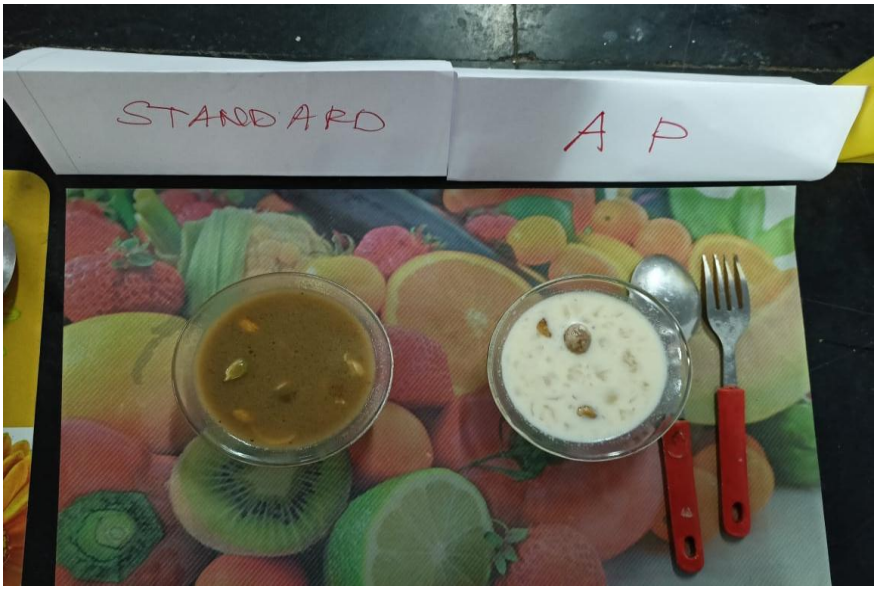

Plate: 1 Standard Payasam and *Borassus flabellifer* fruit incorporated Payasam

Statistical Analysis

All the above said observation was statistically analysed. The collected data were interpreted through statistical analysis namely mean, standard deviation and standard error mean.

Result and Discussion

Characterization of Phytochemicals from *Borassus flabellifer* fruit

The phytochemical constituents of *Borassus flabellifer* fruit were analyzed for the presence of secondary metabolites such as terpenoids, flavanoids, alkaloids, saponins and tannin and the result are represented based on the presence and absence of phytochemicals.

Table 2
Qualitative Analysis of Phytochemicals

SL. NO:	Name of test	Sample
1	Tannins	+
2	Flavanoids	+
3	Saponins	+
4	Terpenoids	-
5	Alkaloids	-

+Presence - Absence

From the above table it is found that the *Borassus flabellifer* fruit showed the presence of tannins flavanoids and saponins and the absence of alkaloids and terpenoids. The phytochemicals which showed positive in qualitative analysis were subjected to quantitative analysis. The amount of phytochemicals was determined through standard procedures. The values were analysed and tabulated.

Table 3
Quantitative Analysis of Phytochemicals

SL. NO	Name of test	Sample code [F]
1	Flavanoids	9.8
2	Saponins	27.3
3	Tannins	15.6

From the above table and figure it is found that, the *Borassus flabellifer* fruit has 9.8 µg/ mg of flavanoids27.3µg/ mg of saponin and 15.6 µg/ mg tannins.

Nutrient Analysis of *Borassus flabellifer* Fruit

The nutrients present in *Borassus flabellifer* fruit such as carbohydrate, protein, calcium and phosphorus were analysed and the results were tabulated.

Table 4
Nutrient Analysis of *Borassus flabellifer* Fruit

NUTRIENTS	AMOUNT
Carbohydrate	8.96 g
Proteins	0.3 g
Calcium	125 ppm/mg
Phosphorus	2.1 µg/ml

The nutrient analysis for *Borassus flabellifer* fruit was carried out using standard procedures. The carbohydrate content of *Borassus flabellifer* fruit was 8.96 µg/1ml. The protein content of *Borassus flabellifer* fruit was 0.3 g. The calcium content of *Borassus flabellifer* fruit was 125 ppm/mg. The phosphorus content of *Borassus flabellifer* fruit was 2.1 µg/ml.

Sensory Evaluation

The sensory analysis of the formulated products is given in the following tables and figures

Table 5
Sensory Parameters of *Borassus Flabellifer* Fruit Incorporated Payasam

SI.NO	Sensory parameter	Standard		Sample	
		M±S.D	M.S.E	M±S.D	M.S.E
1	Appearance	4.85±0.85	0.190	4.85±0.85	0.190
2	Texture	4.95±0.217	0.048	4.95±0.217	0.048
3	Taste	4.75±0.43	0.096	4.95±0.217	0.048

4	Flavour	4.72±0.72	0.144	4.75±0.43	0.096
5	Colour	4.65±0.48	0.096	4.95±0.217	0.048
6	Overall acceptability	4.75±0.43	0.096	4.92±0.27	0.054

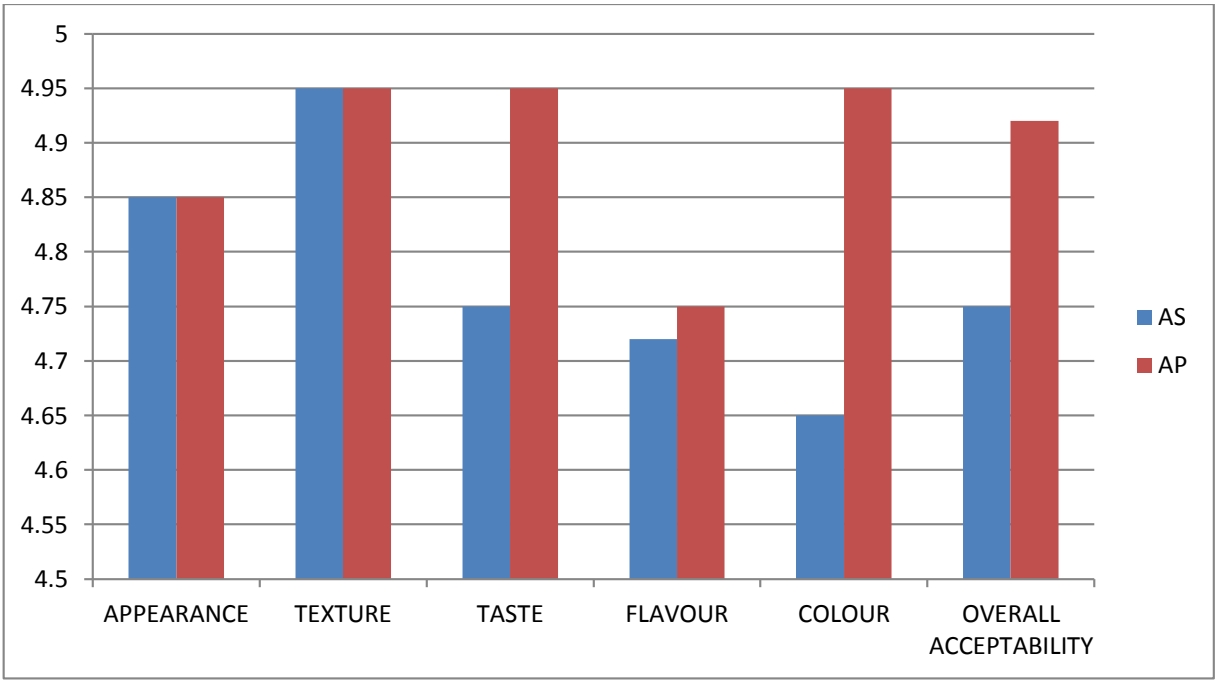

Figure 1. Sensory Parameters of *Borassus Flabellifer* Fruit Incorporated Payasam

The above table and figure shows that the mean sensory parameters for Standard payasam and *Borassus flabellifer* fruit incorporated payasam such as appearance, texture, taste, flavour, colour and overall acceptability is 4.85**,** 4.95**,** 4.75**,** 4.72**,** 4.65,4.75 and 4.85**,** 4.95**,** 4.95**,** 4.75**,** 4.95,4.92 respectively**.**

Discussion

In the present study the phytochemical content of *Borassus flabellifer* fruit were analysed and the result showed that alkaloid, flavanoids and saponins were present in higher amount, while tannin and terpenoid were not detected. This is in agreement with the report of E.I. Okoye (2011), who showed that carbohydrate, protein, alkaloid, flavanoids, starch and saponins are widely distributed in the *Borassus flabellifer* fruit and Lata *et al.,* (2010) who showed the presence of bioactive constituents such as alkaloid, saponins and flavanoids in *Borassus flabellifer* fruit.

Pugalenthi *et al.,* 2004 states that, proteins are essential component of the diet needed for the survival of animals and humans, which function basically in nutrition by supplying adequate amounts of required amino acids. The present study showed the presence of carbohydrate, protein, calcium and phosphorus.

Owori *et al.,* (2007) states that sensory evaluation is an essential component of a food research project or product development. It is a scientific discipline used to evoke, measure, analyze and interpret reactive to those characteristics of food and materials as they are perceived by the senses of sight, smell, taste and touch. In the present study the *Borassus flabellifer* fruit incorporated Payasam was prepared in different ratios and sensory evaluation was done by 20 panel members.

Conclusion

It is concluded that *Borassus flabellifer* fruit (Palmyra Fruit) is rich in various phytochemicals and has several nutritional importance. Palmyra Fruits are very beneficial for health and has various health benefits. The palm fruit also prevents and treats various diseases. This could be attributed to the fact that it has high amount of phytochemicals such as flavanoids, saponins, tannins, and macronutrients such as carbohydrate, protein, fat, and micronutrients such as calcium and phosphorus. Different types of food products can be prepared using *Borassus flabellifer* fruit and it is socio-economic friendly. The *Borassus flabellifer* fruit can be consumed by all the age groups and all types of diseased patients, especially cancer patients and pregnant ladies.

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