

## Development and Popularization of Value added Products from Thavun- An Under Utilized Palmyra Product

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**ABSTRACT:** The current study focuses on the development of food products using thavun, analyzing its nutritional composition, and popularizing the developed thavun products. Thavun is sweet and spongy haustorium that is an early germinate product from dry panampazham that has fallen on the ground after complete ripening. Palmyra Thavun is an unpopular, underutilized and seasonally available perishable product with limited post-harvest shelf life. Palmyra Thavun possess anti-microbial, antioxidant, anti-diabetic and anti-inflammatory properties and also rich in phytochemicals. In this study, food products like jam, syrup, jujube, pachadi and idli powder were developed using thavun and standardized. The sensory evaluation for the developed thavun food products was carried out with the help of 10 trained panel members using 5-point Hedonic scale. The results of organoleptic evaluation concludes that Sample A - Thavun Jam (100% of thavun) and Sample A - Thavun syrup (100 % of thavun syrup), Sample C (80 % of thavun jujube and Sample B (60 % of thavun idli powder) gained high mean score value than the other samples. Analysis of proximate composition and the determination of phytochemicals and antioxidant activity of the selected palmyra thavun food products were carried out. It is evident that palmyra thavun products are rich in micro and macronutrients, phytochemicals and antioxidant. The microbial load of the packed thavun food products at 5 days intervals using the plate count method was analyzed. Zip-lock pack showed minimal microbial count than the developed palmyra thavun food products packed with the aluminium foil cover. The cost of the products was calculated and the popularization among the self-help group was performed. The cost of the developed Thavun Products (per 100g) are Thavun Jam (Rs. 32), Thavun Syrup (Rs. 35), Thavun Jujube (Rs. 38), Thavun Pachadi (Rs. 40) and Thavun Idly Powder (Rs. 55). The study results portray that the development of food products using palmyra thavun, effectively extends the shelf life of an under-utilized thavun.

**Keywords:** Palmyra Thavun, Spongy haustorium, Hedonic scale, Popularization, Self-help group.

### INTRODUCTION

Palmyra palm (*Borassus flabellifer* L.) is a promising species in the trumpet vine family, Arecaceae that is native to Indian sub-continent and also found naturalized in South-East Asian countries (Anuradha Srivastava *et al.*, 2017). The Asian Palmyra palm *Borassus flabellifer*, a multipurpose and a great utility tree occurs in the state of Tamil Nadu (Basava Prasad *et al.*, 2022). The Greek words “Borassus” means fruit’s leathery covering and “Flabellifer” means fan-shaped leaves. The name Palmyra was based on ‘Palmeira’ a Portuguese word that indicates the leaf’s resemblance to the palm of hand. In India, the palmyra trees are cultivated widely in Tamil Nadu, Kerala, Andhra Pradesh, Bengal, Bihar, Orissa, and along the west coast of India. The Palmyra tree is a slow-growing, monocot dioicous perennial tree growing up to 30 m in height and with 150 year of life span, that withstands any adverse climatic conditions and yields

fruits after 15 years of complete maturation (Haynes and Laughlin 2000).

Palmyra palm represents the third most ultimately important plant family that has potential economic usages and is called as “Karpakatharu” which is considered nature’s enduring gift to mankind (Bayton, Ross, 2007; Thirupathi Venkadesh, 2020). The Palmyra tree has its standards in cultural, economic, ecological, medicinal and nutritional values, as the entire part of the palmyra tree shows usefulness in its native or modified forms (Karuppusamy Arunachalam, 2011). The palmyra palm products are palmyra toddy, panampazham, palm jaggery, nungu, panaithavun, panaikizhangu.

Palmyrah haustorium, young fruit kernel and boiled tuber are known as the important sources of nutrition and anti-oxidants to humans, these are seasonable products. Spongy haustorium or Thavun formed during germination of seed nut is spongy, sweet and is a delicacy (Glanista Tharmaratnam, 2018). Palmyrah Seeds are sprouted with in a period of 2-3 weeks; at this

stage spongy endosperm is available inside the nut. On germination, the basal part of the embryo enlarges to form the cotyledon structure, and this is called haustorium. The haustorium transfers the nutrients to the embryo. Hence haustorium will be more nutritious containing sugars, essential amino acids and other micro nutrients and bio active compounds which are highly beneficial for our health. People in rural areas consume it raw and fresh. It has been proved through scientific investigations that an increased consumption of this haustorium has several health's promoting as well as disease preventing benefits. Haustorium actually transfers the nutrients to tubers which ultimately produce valuable plants (Vengaiyah *et al.*, 2019). Fresh toddy is best to treat ulcers. Palmyra tuber gives a good cure for heat and venerable diseases by



**Image 1:** Palmyra Thavun.

A delicate, spongy haustorium or Thavun is developed during the germination of seed nuts. At two to three weeks, palmyrah seeds begin to sprout; at this point, the nut's spongy endosperm is accessible. The embryo of a palmyrah seed divides into two components, the haustorium and cotyledon. Although the haustorium takes the nutrients from the endosperm and transmits them to the cotyledon, the cotyledon transforms into a radicle and subsequently develops a new plant. After entering the endosperm, the haustorium absorbs the nutrients and breaks down the complex nutrition molecules into their simpler forms, such as simple sugars, amino acids, and so on, in order to fuel its growth, which takes a few weeks. At this point, the haustorium will have a greater abundance of sugar and other necessary nutrients, phytochemicals, etc. Yet, after six weeks, when it begins to get nutrients from the haustorium, the cotyledon begins to grow.

Palmyra Thavun possesses anti-microbial, antioxidant, anti-diabetic and anti-inflammatory properties and rich phytochemicals (Haynes and Laughlin 2000). It is evident that palmyra plant seed embryo is rich in micro, macro nutrients and antioxidant properties and has nutraceutical potential for the treatment of malnutrition (Vedapriya, 2017). This spongy haustorium has high moisture and fibre content. Palmyra thavun is the best cooling agent and helps in cure of stomach scars (ulcer) and kidney stones.

Palmyra thavun is an under-utilized, unpopular, seasonally-available and perishable palm product with a limited post-harvest shelf-life. There is a mandatory

cooling the body and helping in improving beauty. It aids in treating anxiety, mental confusion, fungal infection, urinary diseases and dysentery. Nungu is the best cooling agent that aids in better digestion, and cures small pox, stomach-related problems and heat-related problems.

Germinated seed's hard shell is cut open to take out the crunchy kernel which tastes like a sweeter water chestnut known as "thavanai" in Tamil and "buragunju" in Telugu. Thavun or thavanai is sweet and spongy haustorium when eaten raw, is an early germinate product from dry panampazham that has fallen on the ground after complete ripening. Palmyra thavun is an under-utilized, unpopular, seasonally-available and perishable palm product with a limited post-harvest shelf-life.



**Image 2:** Palmyra seed with thavun and sprout.

need for analyzing Palmyra thavun's physio-chemical properties, development of value-added products and popularization of developed thavun products (Merugu *et al.*, 2021). Development of products from palmyra thavun can extend the availability of thavun for a maximized period without spoilage. The edible palm products such as neera, palm jaggery, palm sugar, palm candy, palm chocolate, tuber flour and palmyra thavun are rich sources of vitamins and minerals, but products are not widely commercialized to date, due to the lack of value addition (Lim, 2012).

To ensure the availability of these products in the international market throughout the year, they must be preserved with lengthen shelf life (Glanista Tharmaratnam, 2018). The popularization holds essentiality in gaining maximum reach of developed thavun products and in introducing an Agro- based a commercially profitable product that helps in uplifting the economic status of the native rural people living in the palm cultivation areas (Vengaiyah *et al.*, 2017).

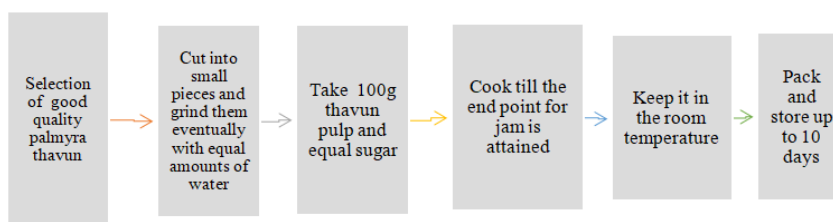
## MATERIALS AND METHODS

### A. Development and standardization of palmyra thavun value added products

**1. Preparation of palmyra thavun jam:** The recipe formulation and use of ingredients for the preparation of palmyra thavun jam and control jam are depicted in the below Table 1 and Fig. 1.

**Table 1: Ingredients used for thavun jam.**

Sr. No.	Name of the ingredients	Control	Sample A	Sample B	Sample C	Sample D
1.	Palmyra thavun pulp(g)	-	100	70	50	30
2.	Papaya pulp (g)	100	-	30	50	70
3.	Sugar (g)	100	100	100	100	100

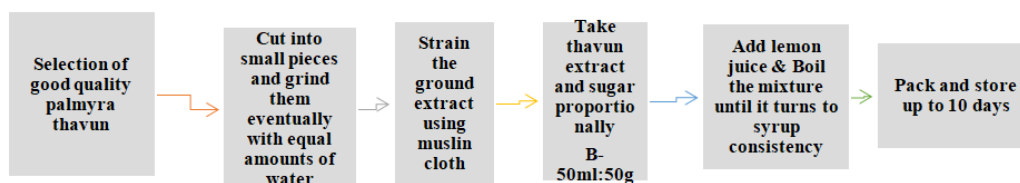


**Fig. 1.** Preparation of Thavun Jam.

**2. Preparation of palmyra thavun syrup:** The recipe formulation and use of ingredients for the preparation of palmyra thavun syrup and control syrup are depicted in the below Table 2 and Fig. 2.

**Table 2: Ingredients used for thavun syrup.**

Sr. No.	Name of the ingredients	Control	Sample A	Sample B
1.	Palmyra thavun extract(ml)	-	100	75
2.	Sugar(g)	100	100	50
3.	Lemon juice(ml)	5	5	5
4.	Water (ml)	100	-	-

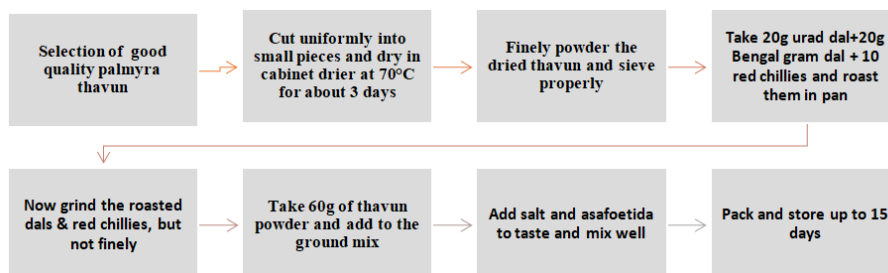


**Fig. 2.** Preparation of Thavun syrup.

**3. Preparation of palmyra thavun idly powder:** The recipe formulation and use of ingredients for the preparation of palmyra thavun idly powder and control idly powder are depicted in the below Table 3 and Fig. 3.

**Table 3: Ingredients used for thavun idly powder.**

Sr. No.	Name of the ingredients	Control	Sample A	Sample B	Sample C
1.	Palmyra thavun powder (g)	-	70	60	50
2.	Urad dal (g)	50	15	20	25
3.	Bengal gram dal (g)	50	15	20	25
4.	Red chillies(g)	20	20	20	20
5.	Salt(g)	7	7	7	7
6.	Asafoetida (g)	2	2	2	2

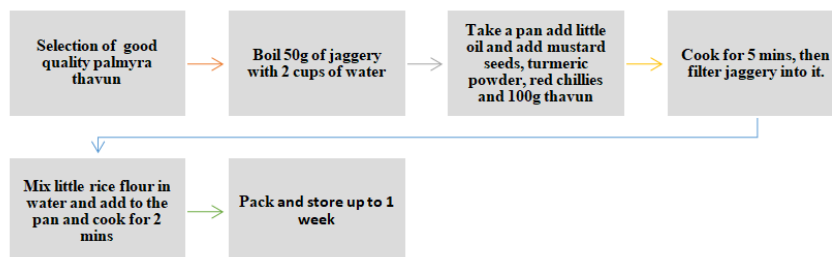


**Fig. 3.** Preparation of Thavun idly powder.

**4. Preparation of palmyra thavunpachadi:** The recipe formulation and use of ingredients for the preparation of palmyra thavunpachadi and control pachadi are depicted in the below Table 4 and Fig. 4.

**Table 4: Ingredients used for thavunpachadi.**

Sr. No.	Name of the ingredients	Control	Sample
1.	Palmyra thavun (g)	-	100
2.	Ladies finger (g)	100	-
3.	Oil (ml)	8	8
4.	Turmeric powder(g)	5	5
5.	Mustard seeds(g)	2	2
6.	Jaggery (g)	50	50
7.	Red chillies(g)	10	10
8.	Salt	5	5
9.	Water (ml)	10	10
10.	Asafoetida (g)	2	2

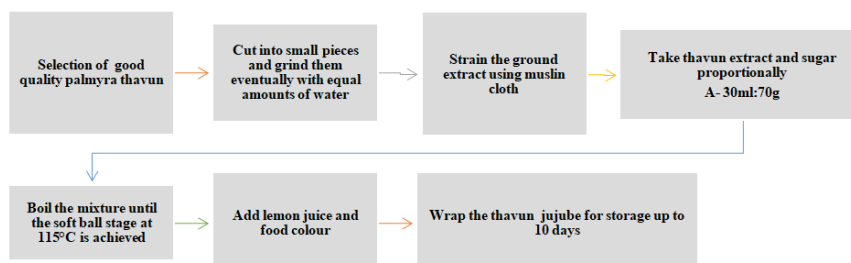


**Fig. 4.** Preparation of Thavunpachadi.

**5. Preparation of palmyra thavun jujube:** The recipe of palmyra thavun jujube and control jujube are depicted in the below Table 5 and Fig. 5.

**Table 5: Ingredients used for thavun jujube.**

Sr. No.	Name of the ingredients	Control	Sample A	Sample B	Sample C
1	Palmyra thavun extract(ml)	-	50	40	30
2	Sugar(g)	50	50	60	70
3	Lemon juice(ml)	5	5	5	5
4	Food colour(g)	0.5	0.5	0.5	0.5
5	Water (ml)	50	-	-	-



**Fig. 5.** Preparation of Thavun jujube.

**B. Organoleptic evaluation of developed palmyra thavun products:**

**1. Sensory Evaluation of developed palmyra thavun products:**

Sensory evaluation is defined as “A scientific discipline used to evoke, measure, analyze and interpret those responses to products that are perceived by the senses of sight, smell, touch, taste and hearing” (Stone and Sidel 1993). The sensory characteristics of the developed palmyra thavun based products like jam, syrup, jujube, idli powder and cookies were assessed with the help of 10-15 semi-trained panel members using 5-point Hedonic scale. The mean score of all the attributes (appearance, color, taste, texture and overall acceptability) helped in picking up the best out of samples and control.

**2. Statistical analysis:** The mean value and standard deviation of the developed Palmyra Thavun products were analyzed statistically by using Mean Deviation.

**C. Proximate composition, antioxidant and phytochemical analysis in the selected palmyra thavun products:**

**Nutritional Analysis:** The protein, fat and calcium content in the selected palmyra thavun products were analyzed using the AOAC method (20<sup>th</sup> & 19<sup>th</sup> edition). Soxhlet apparatus is used to estimate the fat content using hexane as a solvent. The amount of energy in the selected palmyra thavun products were estimated using PCAF method (9<sup>th</sup> edition). The estimation of sugar in the selected palmyra thavun products were based on FSSAI, Manual 4. The analysis of Vitamin-C and



Carbohydrates in the selected palmyra thavun products were based on IS 5838 and IS 1656.

#### Qualitative screening of phytochemicals:

The qualitative phytochemical screening of the Palmyra thavun based food products using 3g of extracts from thavun, thavun pulp, thavun extract, thavun powder respectively were dissolved in 30 ml ethanol and centrifuged.

**Test for Flavonoids:** To 1 ml of the extract, a few drops of dilute sodium hydroxide were added. An intense yellow color was produced, which becomes color-less on addition of a few drops of dilute acid indicates the presence of flavonoids.

**Test for Saponins:** The sample was diluted with 20ml of distilled water and it was agitated in test tube continuously for 15 minutes. The formation of 1cm later of foam showed the presence of saponins.

**Test for Phenolic Compounds:** To the extract few drops of 1% lead acetate were added, the formation of a white precipitate indicates the presence of phenolic compounds

**Test for Glycosides:** To the 1 ml of extract add glacial acetic acid, a few drops of ferric chloride and concentrated sulphuric acid is added and observed for the reddish-brown coloration at the junction of two layers and the bluish-green color in the upper layer

**Test for Tannins:** To 0.5ml of extract solution, 1ml of water and 1-2 drops of ferric chloride solution were added. The blue color was observed for gallic tannins and green-black for catecholic tannins.

**Test for Alkaloids:** To the extract solution Mayer's reagent (potassium mercuric iodide) was added. Formation of a yellow color precipitate indicates the presence of alkaloids.

**Determination of anti-oxidant activity:** The antioxidant activity of the developed palmyra thavun products using the prepared extracts from thavun, thavun pulp, thavun extract, thavun powder respectively were determined by 2,2-diphenyl picryl-1-picryl-hydrazyl (DPPH) method.

**D. Determination of microbial load in the selected palmyra thavun products:** The analysis of microbial load was carried out to determine the shelf-life of the selected Palmyra Thavun based food products. The microbial load was determined at 5 days interval using standard plate count method.

**Cost Analysis of developed value added products:** The cost analysis of the developed palmyra thavun based food products on the basis of raw material, labor cost, instrumentation and equipment used for production and electricity used for research work. The cost calculated for 100gm of the developed palmyra thavun-based food products.

**Popularization of developed value added thavun products:** The popularization among the self-help group using power-point presentation and pamphlet have gained acceptability and maximum reach of the developed thavun based value-added food products.

## RESULTS AND DISCUSSION

**Organoleptic evaluation of developed palmyra thavun value added products:** Organoleptic evaluation was done for each palmyra thavun-based food product to find out the best products with the highest acceptability. The judges were asked to determine the best palmyra thavun products using a five-point scorecard. The mean score of all the quality attributes of products was taken as the overall acceptability score of that product. The products with the highest overall acceptability were selected for further analysis (Fig. 6-11).

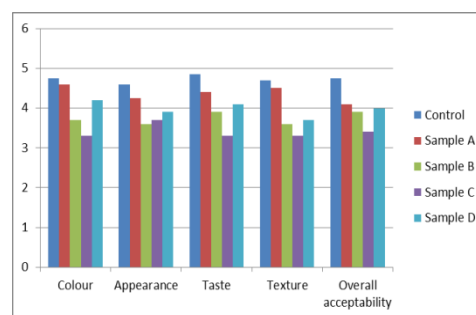


Fig. 6. Palmyra Thavun jam.

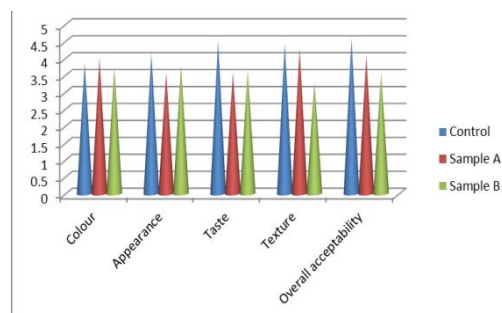


Fig. 7. Palmyra Thavun syrup.

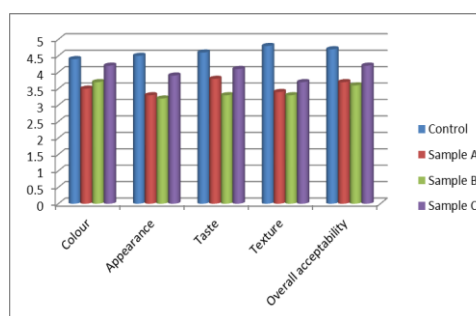


Fig. 8. Palmyra Thavun jujube.

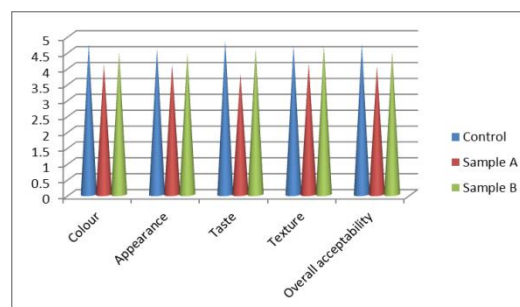


Fig. 9. Palmyra Thavunidli powder



Fig. 10. Palmyra Thavunpachadi



Fig. 11. Value added food products using Thavun.

**Nutrient composition of palmyra thavun value added food products.** The nutritive value of 100g of each selected palmyra thavun based product with the best acceptability scores was calculated to find out its

calories, carbohydrates, proteins, fat, calcium, sugars and vitamin-C content. The results are tabulated in Table 6.

Table 6: Nutrient composition of palmyra thavun based food products.

Samples	Energy (Kcal)	Carbohydrates (g)	Fat (g)	Protein (g)	Vitamin-C (mg)	Calcium (mg)	Sugars (g)
Control jam	165	41	0.4	3	9.03	36	44
<b>Thavun jam</b>	<b>261</b>	<b>64.3</b>	<b>0.3</b>	<b>0.3</b>	<b>0.3</b>	<b>9.3</b>	<b>60</b>
Control syrup	126	32.53	0	0	<0.1	2	32.5
<b>Thavun syrup</b>	<b>313</b>	<b>76.9</b>	<b>0.2</b>	<b>0.7</b>	<b>0.7</b>	<b>19.9</b>	<b>73</b>
Control jujube	316	79.1	<0.1	<0.1	2.5	120.9	80
<b>Thavun jujube</b>	<b>381</b>	<b>94.7</b>	<b>&lt;0.1</b>	<b>0.5</b>	<b>2.8</b>	<b>127.8</b>	<b>78</b>
Control pachadi	190	26.3	7.5	4.2	1.6	19.2	8
<b>Thavunpachadi</b>	<b>305</b>	<b>53.3</b>	<b>7.9</b>	<b>5.1</b>	<b>1.5</b>	<b>19</b>	<b>10</b>
Control idli powder	372	79.3	3.2	6.5	15.8	80.2	7
<b>Thavunidli powder</b>	<b>363</b>	<b>76.7</b>	<b>3.1</b>	<b>7</b>	<b>16.2</b>	<b>90.2</b>	<b>5</b>

According to the study done by Vengaiah *et al.* (2019) the major component of the Palmyrah spongy endosperm powder is carbohydrate. The total carbohydrate is 70% which are the compounds providing the energy needed to operate and maintain muscle cells, brain, red blood cells, etc. The fat content is 2.1g. The fat provides more than half of the body's energy needs. The present study results of the developed palmyra thavun food products Thavun Jujube and ThavunIdli powder exhibits increased content of energy, carbohydrates, sugars and calcium. Thavunpachadi has the highest fat content among all other developed palmyra thavun based food products. The high amount of protein and Vitamin C was estimated in thavunidli powder when compared to other thavun food products developed. In conclusion, it is evident that the value addition resulted in preserving the nutrients in an under-utilized thavun.

**Qualitative screening of phytochemicals:** The qualitative phytochemical screening of the Palmyra thavun food products using extracts from thavun,

thavun pulp, thavun extract and thavun powder shows the presence of Glycosides, Flavonoids, Phenols, Saponins, and absence of Tannins, Alkaloids (Table 7) which coincides with the result of Vengaiah *et al.* (2019). Glycosides have been known to lower blood pressure. Flavonoids are a group of polyphenolic compounds. They also act as antiallergic, anticancer anti-neoplastic activity, and for the treatment of intestinal disorders. Phenolic compounds acts as a cellular support material. Bioactive polyphenols have attracted special attention because they can protect the human body from the oxidative stress which may cause many diseases, including cancer, cardiovascular problems and ageing. Saponins are generally regarded as antinutrients but are also thought to be useful in human diet for controlling cholesterol. Its presence, therefore might suggest that the Palmyrah spongy endosperm powder has medicinal value. Saponins act as bioactive antibacterial agents in plants are also used to treat hypercholesterolemia, hyperglycemia and obesity.

**Table 7: Phytochemical screening in palmyra thavun food products.**

Samples	Flavonoids	Saponin	Tannin	Alkaloids	Phenolics	Glycosides
Thavun	+	+	-	-	+	+
Extract	+	+	-	-	+	+
Pulp	+	+	-	-	+	+
Thavun powder	+	+	-	-	+	+

**Table 8: Anti-oxidant activity in palmyra thavun food products.**

Samples	Antioxidant activity (Inhibition %)
Thavun	81.8
Extract	18.1
Pulp	54.5
Thavun powder	36.3

**Determination of anti-oxidant activity:** The antioxidant activity of the developed palmyra thavun products using the prepared extracts from thavun, thavun pulp, thavun extract, thavun powder respectively were determined by 2,2-diphenyl picryl-1-picryl-hydrazyl (DPPH) method and the results are tabulated in Table 8.

**Determination of shelf-life of the developed palmyra thavun food products:** The shelf-life of developed palmyra thavun food products packed using aluminium foil cover and zip lock cover were assessed at 5 days interval. The findings are presented in Table 9.

**Table 9: Shelf-life of the developed palmyra thavun value added food products.**

Products	Microbial count (*10 <sup>9</sup> CFU/g)							
	Aluminium foil cover				Ziplock cover			
	Initial	Day5	Day10	Day15	Initial	Day5	Day10	Day15
Thavun jam	-	74 TFTC	103 TFTC	TNTC	-	68 TFTC	96 TFTC	TNTC
Thavun syrup	-	59 TFTC	124 TFTC	TNTC	-	43 TFTC	98 TFTC	TNTC
Thavun jujube	-	124 TFTC	TNTC	TNTC	-	114 TFTC	TNTC	TNTC
Thavunpachadi	-	149 TFTC	TNTC	TNTC	-	134 TFTC	TNTC	TNTC
Thavunidli powder	-	34 TFTC	87 TFTC	149 TFTC	-	28 TFTC	65 TFTC	134 TFTC

(TFTC\* - Too Few To Count; TNTC\* - Too Numerous To Count).

The shelf-life of the thavun jam and syrup was found to be up to 10 days; while for thavun jujube and pachadi it was found to be about 5 days and thavun idly powder had longer shelf life to an extent of about 15 days. There is not much considerable difference in the shelf-life of the developed palmyra thavun food products packed with two different packaging materials like aluminium foil pack and zip lock pack. Zip-lock pack showed minimal microbial count than the developed

palmyra thavun food products packed with the aluminium foil cover.

**Cost Analysis of the developed palmyra thavun products:** The cost analysis of the developed palmyra thavun products based on raw material, labor cost, instrumentation and equipment used for production, and electricity used for research work. The cost calculated for 100gm of the developed palmyra thavun products (Table 10).

**Table 10: Cost of the thavun based food products.**

Sr. No.	Products	Cost per 100g
1.	Thavun Jam	32
2.	Thavun Syrup	35
3.	Thavun Jujube	38
4.	ThavunPachadi	40
5.	ThavunIdli Powder	55

**Popularization of the developed palmyra thavun products:** The developed Palmyra thavun products were popularized among the self-help groups in 3 different areas of Virudhunagar district using power-point presentations and pamphlet have gained acceptability and maximum reach of the developed thavun value-added food products like thavun jam, thavun syrup, thavun jujube, thavunpachadi and thavun idly powder.

The popularization among the woman self-help groups ultimately shows effect in introducing an agro-based commercially profitable business using the under-utilized palmyra thavun with limited post-harvest shelf life, for the rural women in and around Virudhunagar district to uplift their economic status.

## CONCLUSIONS

Palmyra thavun is an under-utilized, unpopular, seasonally-available and perishable palm product with a limited post-harvest shelf-life. Apparently "Thavun" was not exposed to the millennial population to taste. The development of thavun based food products mainly focuses on extending the shelf-life of the palmyra thavun. Modern procedures must be used to increase the shelf life of value-added palmyra thavun goods for improved distribution, as well as processing methods to preserve them for use in the off-season. Adding value to thavun entails altering their physical appearance, which improves their acceptance, availability, market viability, and cost-benefit analysis for the producer. The development and popularization of thavun food products gained maximum acceptability.

## FUTURE SCOPE

— In the future, different food products can be developed by applying preservation techniques and different packaging materials to extend their shelf, all year round.

— In the current study, major nutrients were analyzed. Further, analysis of minor nutrients can be focused on in the future.

— In the future, Pre and post-questionnaires can be framed to evidentially assess the awareness and acceptability rate of palmyra thavun products among shelf-help groups in other districts.

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**Conflict of Interest.** None.

## REFERENCES

- Anuradha Srivastava, Bishnoi, S. K. and Sarkar, P. K. (2017). Value addition in palmyra palm (*Borassus flabellifer* L.): A potential strategy for livelihood security and poverty alleviation. *ICAR Research Complex for Eastern Region, Research Centre, RASHTRIYA KRISHI*, 12(1), 110-112.
- Basava, Prasad, A. R., Anandharaj Arun Kumar, Vignesh, S., Chidanand, D. V. and Baskaran N. (2022). Exploring

- the nutritional profiling and health benefits of palmyra *haustorium* (palmyra palm). *South African Journal of Botany*(IF 3.111)
- Bayton, Ross P. (2007). A review of *Borassus* (*Arecaceae*). *Kew Bulletin*, 62(4), 561-585.
- Glanista Tharmaratnam, Ponnuchamy Navaratnam, Sri Thayalan Sri Vijeindran (2018). Preservation of Palmyrah *Haustorium*, Young Fruit Kernel and Boiled Tuber with Lengthen Shelf-Life Consisting their Native Characters. *Annals of Biological Research*, 9(2).
- Jody Haynes and John McLaughlin (2000). Edible palms and their uses. *University of Florida, Institute for Food and Agricultural Sciences*. Fact Sheet MDCE-00-50-1.
- Karuppusamy Arunachalam, Shanmugam Saravanan and Thangaraj Parimelazhagan (2011). Nutritional Analysis and Antioxidant activity of Palmyrah (*Borassus flabellifer* L.) Seed Embryo for potential use as Food Source. *Food Sci. Biotechnol.*, 20(1), 143-149.
- Lim, T. K. (2012). Edible Medicinal and Non-Medicinal Plants. *Springer*, the Netherlands, 371-380.
- Merugu Chandra Surya Rao, Dokka Venkata Swami, Ashok, P., Satya Prakash Nanda and Banavath (2021). Scope, Nutritional Importance and Value addition in Palmyra (*Borassus flabellifer* L.): An under-exploited crop. Bio-active compounds: Biosynthesis, characterization and application, 207.
- Sridevi Krishnaveni, T. R., Arunachalam, R., Chandra Kumar, M., Parthasarathi, G. and Nisha, R. (2020). Potential review on Palmyra (*Borassus flabellifer*). *Advances in Research*, 21(9), 29-40.
- Thirupathi Venkadesh, M. (2020). Palmyrah Palm and Tamilnadu. *Compliance Engineering Journal*.
- Veda Priya Gummadi, Ganga Rao Battu, Keerthana Diyya M. S., and Kiran Manda. (2016). A Review on Palmyra Palm (*Borassus flabellifer*). *International Journal of Current Pharmaceutical Research*, 8(2).
- Vengaiah, P. C., Kumari, V. B., Murthy, G. N. and Prasad, K. R. (2019). Physico-Chemical and Functional Characteristics of Palmyrah (*Borassus flabellifer* L) Spongy *Haustorium* Flour. *Journal of nutrition and health science*, 6(1), 103.
- Vengaiah, P. C., Murthy, G. N., Sattiraju, M. and Maheswarappa, H. P. (2017). Value added food products from palmyra palm (*Borassus flabellifer* L.) *Journal of nutrition and health science*, 4(1), 1-3.

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