Asian Journal of Current Research

Volume 9, Issue 2, Page 73-80, 2024; Article no.AJOCR.11964
ISSN: 2456-804X

Palmyrah (*Borassus flabellifer* L) Tuber in India: Present Status and Scope

P. C. Vengaiah [a*], K R Prasad [a], G N Murthy [a], S. Sumitha [b] and B. A Jerard [b]

[a] ICAR - AICRP Palms, Dr. YSRHU - Horticultural Research Station, Pandirimamidi – 533 288, ASR District, Andhra Pradesh, India.
[b] ICAR-CPCRI, Kasargod, Kerala, India.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.56557/AJOCR/2024/v9i28596

Open Peer Review History:
This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: https://prh.ikprress.org/review-history/11964

Review Article

Received: 13/01/2024
Accepted: 17/03/2024
Published: 21/03/2024

ABSTRACT

Palmyrah palm, is also an important multipurpose tree having great utility of each part of it have economic value right from fruit to root and hence the palm is equated to the "Kalpa Vriksha" in the Indian mythology meaning the tree that gives everything for life. The Palmyra palm can be found in Tamil Nadu, Telangana, Andhra Pradesh, Orissa, and Bihar. The palms in South India are seldom used to the full potential, but the natural regeneration through seeds increases the number of palms in the territory. Very few growers use the young fruits although the delicacy is known to the people. The ripe fruits are not used either for juice or for tuber production, whereas, the tubers are sold in the markets for fresh consumption. Palmyrah tuber flour is used as raw material for various products of starch in food industries and bakery and confectionary items.

Keywords: Palmyrah; tuber; value addition; nutrition; natural food.

**Corresponding author: E-mail: pcvengaiah@gmail.com;*

1. INTRODUCTION

Palmyrah palm (*Borassus flabellifer* L.) belongs to family Arecaceae, cultivated throughout India. Different parts of the palm such as root, leaves, seed and fruit are used for various purposes. In India, the palmyrah palm is established to posses 60 million palms of which the major population is in Tamil Nadu. It is extensively seen in east and west coast. The palm has unlimited scope and the full fledged research for the fullest exploitation to obtain produces and products for National and International markets coupled with developing rural employment potential is yet to be started. Palmyrah provides a wide range of edible and non-edible products which are used for various purposes. Fresh palmyrah tender fruit endosperm (*Nungu*), sap (*Neera*) and tuber flour are perishable and highly prone to post harvest losses due to spoilage [1].

Among the all palmyrah products, tuber is an important edible shoot grown in loose soil about 1-1.5 m high from the seed of ripe fruit and they are mostly cultivated in southern India from January to March. The seeds grow both naturally and planted by local people for commercial sale. Selling sprouts is a good commercial business for local people during peak season like Makara Sankranti in Karnataka, Telangana, and Maharashtra, Pongal in Tamil Nadu. Mature tuber is brittle and breaks off easily which is a rich source of carbohydrates and fiber. Tuber is eaten by many people directly by cooking in open fire after peeling off outer layer. Roasted, dried tubers are ground to make flour which is blended with wheat flour for baking. The flour can be made into a number of food items which are used traditionally. It is used to make *'odiyal'*, which is consumed as khool, a type of porridge, and *'pittu'*, a steamed food. *odiyal* made from palmyrah tuber flour contains 1432 kcal of energy, 10.8 g of moisture, 3.1 g of protein, 77.1 g of carbohydrates and 5.6 g of crude fiber per 100g. Starch is the main carbohydrate present in palmyrah tuber flour [2]. The starch has low viscosity and gelatinization temperature but exhibit good setting property as such food starch. The palmyrah tuber flour starch is devoid of bitterness as it is inherent property of palmayrh tuber and has a grain size of 40 µm similar to potato starch.

Palmyrah tuber flour is used as raw material for various products of starch and sweeteners in food industries [3]. Starch is used as a taste enhancer, binder, filler, thickening agent, and stabilizer. The raw and [2] cooked Palmyrah tubers have been consumed and used as a raw material for food preparation [4]. During the fruiting season of September to October. Palmyrah palm can bear 200-300 fruits which often contain 2-3 seeds. After the pulping process, seeds are collected and beds are prepared with 3-4 layers of seeds with the maintenance of moisture level. During germination, the germination axis of the seed goes to the ground and the distal part that remains inside the seed grows into the scavenger during and after germination. Palmyrah haustorium is a delicious white spongy edible part, and the seed produces a sprout that gives rise to the palmyrah tuber product. Typically, Palmyrah tubers are harvested at their fully mature stage at end of four months period. Tubers contain a lot of nutrients, phenols, and metal ions that exhibit antioxidant properties. The seed kernel contains a galactomannan.

Upon generation, the seed produces a sprout (fleshy food-preserving flakes) which gives rise to the product palmyrah tuber(*Tegalu)*, boiling and drying or drying alone. This shoot grows up to 12-15 cm in height before being harvested. If the germinated seed is dried in the sun, it is called *Odiyal* (un- boiled tuber). The sprout can be boiled and dried, in which case it is called *pulukodiyal* (boiled tuber). The tuber is eaten directly by many people by cooking it over an open fire after peeling off the outer layer. The boiled and unboiled tuber can be ground and sieved to obtain palmyrah flour (*odiyal* flour or *pulukodiyal* flour).

The Palmyrah tuber is an inexpensive source of starch, carbohydrates, lipids, some minerals, and some health- promoting bioactive compounds [5,6] which is useful in controlling various diseases, especially diabetes. Regular consumption of palmyrah tuber flour increases body strength, and reduces hunger, and mixing palmyrah tuber flour with other foods is said to positively reduce malnutrition. Palmyrah tuber flour is not widely consumed by people, but the excellent nutritional and therapeutic value of this palmyrah tuber flour offers great potential for processing into various quality products. As nearly 5,000 tons per year, of tubers, are used for the production of value-added products [7].

The suitability of any post-harvest food treatment depends on its effect on the nutritious and functional properties of the food [8]. The

application of different processing methods to 'palmyrah' tubers may influence the physical and functional properties of flour. And at present, they are preserved by either sun-dried (raw dried tubers) or boiled. Sun drying is a common food preservation method that leads to nutritional loss and is time-consuming in processing, hence the quality and storage stability of tuber is poor. Therefore, boiling and drying heat treatments have been adopted to preserve nutritional composition and extend the shelf life by maintaining the moisture content of these seasonal products.

The appropriate and successful incorporation of flour into food products depends on the physio-chemical, functional, and nutritional composition [9]. Therefore, the proximate composition, functional properties such as water binding capacity, foaming properties, and swelling power of flours are usually analyzed to predict their suitable incorporations and explorable applications in food systems. Previously, research has been conducted on the effect of precooking and air temperature on the drying kinetics and quality of tuber flour using hot air drying [10]. And different studies have been conducted on the analysis of the physical and chemical properties of tuber and palm flour [11]. And so far, no research has been conducted to compare different types of processing such as boiling, steaming, and hot air oven drying with the quality of palmyrah tuber flour. Considering these shortcomings, the present study was planned to investigate the effect of different heat treatments on the drying behavior and the physio- chemical and functional properties of the resulting flour for effective use as a food ingredient in processed products.

2. TUBER PRODUCTION

Tuber is produced from palmyrah fruit which contain three numbers of nuts or seeds, all the 3 seeds will germinate whether planted the as a whole fruit or planted after separating the 3 seeds. It was found that optimum time for harvesting of tuber is 135 days after sowing and tuber length ranges from 30-55 cm and give 60-70 g weight. The palmyrah tuber is cut into pieces, cleaned, washed, and dried in a tray dryer for four hours. To make palmyrah tuber flour, dried tubers are mashed and sieved. Followed by soaking the palmyrah tuber flour in distilled water for three hours at room temperature to eliminate the bitter taste component flabelliferin. The phytochemical analysis showed the presence of alkaloids and saponins and GC/MS screening of the extracts revealed the presence of fatty acids, alkanes, alkenes, ketones, aldehydes, diterpenes, phytols, and sterols. This also showed that the roots are good source of Vitamin E with rich nutrients, can be used in health promoting benefits. Intensive research should be carried out to process high value added products from them. The optimum age of harvesting tuber for high nutritive values was found in tuber at age 4 months i.e 120 days [11,12].

3. TRADITIONAL KNOWLEDGE

During the fruiting season of August to October, After the pulping process, seeds are collected and beds are prepared with 3-4 layers of seeds with the maintenance of moisture level. During germination, the germination axis of the seed goes to the ground and the distal part that remains inside the seed grows into the scavenger during and after germination. Palmyrah the seed produces a sprout that gives rise to the palmyrah tuber product. Typically, Palmyrah tubers are harvested at their fully mature stage at end of four months period. This shoot grows up to 12-15 cm in height before being harvested. If the germinated seed is dried in the sun, The sprout can be boiled and dried. The tuber is eaten directly by many people by cooking it over an open fire after peeling off the outer layer. Boiled or cooked in open fire tubers sold in roadside and open markets @Rs.20/- for five numbers, and each farmer or trader earns more than one lakh rupees during the season from October to January of every year [4].

4. PALMYRAH TUBER COMPOSITION

The mature tuber is brittle and it breaks off easily and is less fibrous compared to immature ones which are flexible. The tuber is a rich source of starch. The optimum stage for harvesting tuber is 135 days after sowing and the weight of the tuber range from 90-110g. The moisture content of the palmyrah tuber flour was 5.19 %. The ash and fat contents (dry matter basis) were 2.60 % and 0.57 % respectively. The protein content, fibre content and carbohydrate content were 3.20 %, 10.17 % and 69.38 % respectively. The caloric value obtained was 282.19 kcal/100g. The pH and titratable acidity values were 5.78 and 1.12 % respectively. Water absorption capacity (18 %), fat absorption capacity (14.0 %) and bulk density (0.70 g/cm3) were recorded for the palmyrah

tuber flour. The values for swelling power, foam capacity and foam stability were 4.55, 21.32 % and 29 % respectively. The values moderately higher than of similar flours and the flour may be used direct or combined with other flours for preparation of foods. Tuber cooked with autoclave followed by dried in hot air gives good quality of flour and suji(Rava). Tuber flour can store 30 days in LDPE and 50 days in HDPE packing material under room temperature.

Mature palmyrah tubers were collected and stored at low temperature (4°C). The tubers (apocolon) remaining the outer layer were sliced and dried at 60 °C for 24 hrs. The dried tubers were finally milled using pulveriser to pass through a 250µm sieve. The samples were then packaged in polyethylene bag and stored in a refrigerator (4°C) until use. Tables 1 and 2 show the analysis of the physiochemical composition and functional characteristics of palmyrah tuber flour (10).

Fig. 1. Tuber production from palmyrah nuts

Fig. 2. Tuber cleaning and selling

Table 1. Biochemical analysis of palmyrah tuber (apicolon) flour

	Fresh flour	Soaked and dried flour
MC(w.b %)	5.19	5.32
Fat(%)	0.57	0.43
Ash(%)	2.60	1.80
Protien(%)	3.20	3.40
Fibre(%)	10.17	8.80
Copper(ppm)	0.11	0.05
Zinc(ppm)	0.29	0.41
Iron(ppm)	1.16	2.40
Manganese(ppm)	0.26	0.05

Table 2. Functional properties of palmyrah tuber flour

Water absorption capacity (%)	18
Fat absorption capacity (%)	14.0
Bulk density (g cm $^{-3}$)	0.70
Swelling power(g g^{-1})	4.55
Foam capacity (%)	21.32
Foam stability (%)	29

5. BENEFITS OF PALMYRA TUBER FLOUR FOR HEALTH

Because palmyra tuber flour has a low glycemic index, it is beneficial for diabetics. The presence of phytochemical substances helps to prevent chronic diseases, age-related disorders, and cardio vascular illnesses, as well as to improve overall health. Flabelliferin, a bitter substance present, has antibacterial effects.

6. VALUE ADDED PRODUCTS FROM PALMYRAH TUBER

Osmotic dehydration of tuber pieces osmosis, the osmotic time of 5 to 6 hours was required to attain maximum weight loss and solid gain by tuber pieces. The optimum combination of tuber pieces for weight loss (water removed) and solid gain were found to be: 60% sugar syrup solution + 4 mm tuber thickness + 1: 6 sample to sugar syrup solution ratio. Bakery products i.e cake, cookies and noodles were prepared with tuber flour 75% to avoid the bitterness by cold extraction of flour. Process optimized for cookies and bread from tuber flour. The bakery items enriched with fiber and good for health [2].

Flour and Rava was prepared was found superior quality in the method of steam cooked(in auto clave) followed by drying as compared to other traditional methods i.e open fired, fired in iron tin and directly dried. Biscuits and bread was prepared with tuber flours of 5, 10 and 15%, results shows that bitterness is increasing with increase of tuber flour. It was observed that bitterness was avoided by using removal of outer skin of tuber followed by hot water blanching. Removal of bitterness in Plamyrah Tuber(apicolon) was removed using cold extraction method i.e flour is subjected to soak at normal water at room temperature for 6 hour and water is drained and flour dried at low temperature and observed that nutritional losses due to soaking in water is very low.

Fig. 3. Flour making from palmyrha tuber

Fig. 4. Value added products from tuber flour

Fig. 5. Palmyrah tuber flour and group of people with ASHA NGO

Optimization of process for cake, cookies and noodles with palmyrah tuber flour was studied and it was observed that up to 50 % of tuber flour can substitute with in place of refined wheat flour and bitterness was removed with cold extraction process [13].

6.1 Scope

However, there is a need to improve the low cost mechanisation system for tuber processing. Further, the product needs improved market promotion for it to become not only cost effective but also economically lucrative to those who are involved in its promotion and marketing. Food products bakery and confectionary from palmyrah tuber are not commercialised as the process for the preparation of those foods are traditional practice, and not hygienic. Even though the Palmyrah is an economically important palm it has not received proper attention from the agricultural research workers, probably on account of the fact that it is very slow growing palm found mostly in the wild state. In this context mechanization as well as product development with high standards very much a need and need to develop value addition techniques and popularizing the same [14].

7. PALMYRAH TUBER FLOUR MAKING - A SUCCESS STORY

Tribal farmers can earn more by selling natural available produce in forest and their fields. After the successful training from ICAR-AICRP Palms, HRS Pandirimami on Palmyrha tuber making process, Triabl farmers through NGO called ASHA made Palmyrah tuber flour and sold at the rate of Rs. 120/- per kg in which there no economical activity before. Now during the season October to January, on an average of Rs.25000/- to 35000/- per each tribal farmer ny selling tube rand tuber based flour [15].

Tribal area of chinturu area plenty of palmyrah palms. But no earnings from palmyrah, only seasonal products for their own consumption, by using ICAR –AICRP Palms technology, tribal farmers benefited to through palmyrah tuber flour, even sent one consignment to UK and benifitted…Sri S Subhani, Head ASHA NGO.

Palmyrah palms gives an average of 300 nuts which will give about 300 tubers in which one can produce about 30 kg of natural flour to use all bakery and confectionary items. Hence there huge scope for getting income from lakhs of palmyrah palms in agency area.., Dr. P C Vengaiah, Sr.Scientist, ICAR-AICRP Palms, HRS Pandirimamidi

8. CONCLUSION

At Present, their utilization for food is carried on at the village level. Production is not on a commercial scale, although they are sold in local markets. However, farmers selling palmyrah tuber have set up their roadside shops, each bundle having 25 palmyrah tubers is being sold for ₹60 during Pongal. The palmyra tree is a unique species that has a wide range of uses in agriculture, food, technology, engineering, and other industries. Along with many positive prospects, it also has many challenges that must be addressed through numerous studies and research. However, if properly tuned, value addition in palmyrah will undoubtedly be a boon to both humans and the economy for our future generations.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Vengaiah PC, Ravindrababu D, Murthy GN, Prasad KR. Jaggery from Palmyrah palm (*Borassus flabellifer*-L). Indian Journal of Traditional Knowledge. 2013;12:714-717.
2. Jansz ER, Wickremasekara NT, Sumuduni KAV. A review of the chemistry and biochemistry of seed shoot flour and fruit pulp of the palmyrah palm (*Borassus flabellifer* L.). Journal of National Science Foundation of Sri Lanka. 2002;30(1,2):61-87
3. Anonymous. AICRP (Palms). Annual Report 2014–15, ICAR - All India Co-ordinated Research Project on Palms. ICAR - CPCRI, Kasaragod. 2015;108
4. Anonymous. AICRP (Palms). Annual Report 2013–14, ICAR - All India Co-ordinated Research Project on Palms. ICAR - CPCRI, Kasaragod. 2014;108
5. Bolade MK, Bello SB. Selected physicochemical properties of flour from the root of African Fan Palm (Borassus aethiopum). International Journal of Food Properties. 2006;9(4):701-713.
6. Jansz EN. Wickremasekara K. Sumuduni. A Review of the Chemistry and biochemistry of seed shoot flour and fruit pulp of the palmyrah Palm (Borassus Flabellifer), Journal of National Sicence Foundation Sri Lanka. 2002;30:61–87.
7. Krishanthy P, Mahendran T. Development of Palmyrah Odial based Breakfast Cereal mixtures," Journal of Agricultural Sciences. 2008;7:29-36.
8. Duvivier PP, Hsieh P, Lai and Charles. Retention pf phenoloics, caratenoides and antioxidant activity in the Taiwanese sweet potato (Ipomea batatas Lam.) CV tainong 66 subjected to different drying conditions, African journal of. 2010;4(2):753-758.
9. Akoja S, Coker O. Physicochemical, functional, pasting and sensory properties of wheat flour biscuit incorporated with Okra powder, International Journal of Food Science and Nutrition. 2018;3(5):64-70.
10. Korese JK, MA. Achaglinkame and S. Chikpah, Effect of hot air temperature on drying kinetics of palmyra (Borassus aethiopum Mart.) seed-sprout fleshy scale slices and quality attributes of its flour," Journal of Agriculture and Food Resesearch; 2021.

11. Vengaiah PC, Murthy GN, Maheswarappa HP. Physico-chemical and functional characteristics of palmyrah (*Borassus flabellifer* L) tuber flour., Indian Society of Plantation Crops; 2013.
12. Sankaralingam A, Hemalatha G, Ali A M, A Treatise On Palmyrahh, ICAR, All India Co-ordinated Research Project (Palms), Killikulam, Tamil Nadu and Central Plantation Crop Research Institute, Kasaragod, Kerala, India; 1999.
13. Vengaiah PC, Murthy GN, Sattiraju M, Maheswarappa HP. Value added food products from Palmyrah Palm (*Borassus flabellifer* L.). Journal of Nutrition and Health Science. 2017;4(1):105. Available:http://dx.doi.org/10.15744/2393-9060.4.105
14. Mohanadas K. Introduction of palmyrah. 2002;10:141.
15. Bikila AM. Effect of predrying treatment and drying temperature on proximate composition, mineral contents, and thermophysical properties of anchote (*Coccinia abyssinica* (Lam.) Cogn.) flour. Food science & nutrition,") Cogn.) flour. Food, science and Nutrition. 2020;8:5532-5544.

© Copyright (2024): Author(s). The licensee is the journal publisher. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
https://prh.ikprress.org/review-history/11964