

ANTIOXIDANT ACTIVITY, TOTAL PHENOL, FLAVONOID, AND ANTHOCYANIN CONTENTS OF JAMUN (*SYZYGIUM CUMINI*) PULP POWDERREGINOLD JEBITTA S^{1*}, JEYANTH ALLWIN S²¹Department of Food Processing and Engineering, Karunya University, Coimbatore, Tamil Nadu, India. ²Research Scholar, Suganthi Devadason Marine Research Institute, Tuticorin, Tamil Nadu, India. Email: reginoldjebitta@gmail.com

Received: 27 January 2016, Revised and Accepted: 30 January 2016

ABSTRACT

Objective: The main aim of the study is to find the nutritional properties of Jamun pulp powder even after drying under different drying condition. Total phenol, anthocyanin, and flavonoids present in each dried samples vary with respect to temperature. These results will be a source for the further study in antioxidants and pharmaceutical formulations.

Methods: Quantitative analyzes of significant phytochemicals were performed by standard methods. 1,1-diphenyl-2-picrylhydrazyl assay was done to find out the antioxidant activity.

Results: Among all the different dryers, the maximum amount of total phenolic content measured by Folin-Ciocalteu method was 13.99 mg GA equivalents/g, total flavonoid contents as measured by aluminum chloride method was 104.8 mg quercetin equivalents (QE)/g, and anthocyanin content 7.56 mg/g was found in freeze-dried at -40°. The lowest was found in cross flow dryer with phenol content 7.6 mg GA equivalents/g, flavonoids 34.05104.8 mg QE/g, and anthocyanin 1.43 mg/g. The antioxidant property was high in freeze dried powder.

Conclusion: *Syzygium cumini* is an underutilized fruit which is available plenty in India. It has an abundant amount of antioxidant and nutritional properties which can be a high potent in pharmaceutical.

Keywords: *Syzygium cumini*, Flavonoids, Total phenol, Anthocyanin, Antioxidant activity.

INTRODUCTION

Jamun fruit is an underutilized fruit available in India. Other names are java plum Indian blackberry, etc. In fruit and vegetables, the plant tissues contain many pharmacological capacities chemical and biological properties. The most common phytochemical antioxidants include ascorbic acid (Vitamin C), tocopherols, and tocotrienols (Vitamin E), carotenoids (provitamin A), and phenolic compounds such as phenolic and flavonoid acids (flavones, isoflavones, flavanones, anthocyanins, and catechins) [1,2]. The antioxidant property is to neutralize free radicals and prevent diseases [3]. The effective protection exerted by plants on degenerative diseases has been widely reported [4-6]. The medicinal properties of various plant materials have been recognized since the beginning of the 5th [7]. Jamun trees are found growing throughout the Asian subcontinent, Eastern Africa, South America, and Madagascar and have also naturalized to Florida and Hawaii in the United States of America [8]. The tree fruits once in a year and the berries are sweetish sour to taste. The ripe fruits are used for health drinks, making preserves, squashes, jellies, and wine. Thus, this fruit available in abundant can be utilized to generate novel medicinal compounds to cure emerging diseases. Hence, the present study was aimed at exploring the positive medicinal values of *Syzygium cumini* by evaluating the antioxidant activity, relative content of total phenol, flavonoids, and anthocyanin.

The best method to produce high quality dried product is freeze drying. On comparing freeze drying with other drying system, the energy consumption and cost are comparatively high [9,10]. There were many studies which report that there is the influence of various drying methods on the quality attributes of various fruits and vegetables including the color of a dehydrated apple, banana, carrots, and potatoes [11], b-carotene and ascorbic acid retention in carrots and strawberry [12], antioxidants and color of yam flours asparagus [13], and color and antioxidant of beetroots [14].

METHODS**Sample**

Jambola mature fruits were directly obtained from producers in the region of Pollachi. The fruits were sorted by its maturity, and the fully ripped fruits were washed in normal tap water. The free water in the fruit was removed using a hair dryer and wiped out with tissue papers. Pre-weighed 100 g of the Jamun fruit was packed in each PP zip lock bag and kept in a deep freezer at -30°C for further use.

Drying conditions

The stored Jamun fruits were taken from the deep freezer and kept at room temperature to reach its normal state. Jamun pulp was extracted manually by separating the pulp from the seed. The extracted pulp was dried in the sun drying (T1), cross-flow drying 50°C, 60°C, and 70°C (T2, T3, and T4), vacuum shelf drying 40°C, 50°C, and 60°C, (T5, T6, and T7) freeze dryer at -20°C, -30°C, and -40°C (T8, T9, and T10). The dried material was ground to fine powder using a mechanical blender and passed through 24 mesh sieves. The powdered sample was further used to make the different extraction.

Preparation of the extract

An amount of 10 g of Jamun pulp powder was extracted with 20 ml ethanol (75%), (Merck, extra pure) for 1 minute using an ultra turax mixer (13,000 rpm) and soaked overnight at room temperature. The sample was then filtered through Whatman No.1 filter paper in a Buchner funnel. The filtered solution was evaporated under vacuum in a rotator at 40°C then dissolved in respective solvents. The dissolving rate of the crude extracts was approximately 100%. The solution was stored at 18°C until use.

Total phenols

Total phenols were estimated by the standard analysis of [15]. A sample of 0.5 g was taken and dissolved in an equal amount of water and ethanol. From the dissolved solution 0.2 ml was taken and made to

3.0 ml with distilled water. FCR of 0.5 ml was added and kept for 3 min. Sodium carbonate (20%) of 2.0 ml was added with the sample solution and kept in boiling water bath for 1 min and the reading was obtained at 650 nm.

Total flavonoids

Flavonoids of the samples were determined by the standard method given in Chi Chang [16]. Dissolved samples of 0.5 ml were taken, and 1.5 ml of 95% ethanol was added. 0.1 ml of $AlCl_3$ and 0.1 ml of potassium acetate was added. The sample solution was made to 3.0 ml with water and incubated for 30 min. The absorbance was read at 415 nm.

Antioxidant activity 1,1-diphenyl-2-picrylhydrazyl (DPPH)

The DPPH assay was carried out according to the procedure described by Brand-Williams, Cuvelier, and Berset [17,18] with some modifications. The assay procedure was similar to the ABTS method described above. The solution of DPPH (600 μ M) was diluted with ethanol to obtain an absorbance of 0.7 ± 0.02 units at 517 nm. Powder extract (30 μ L) or controls (Trolox, Vitamin C) were allowed to react with 3 mL of DPPH radical solution for 30 min in dark and the decrease in absorbance from the resulting solution was monitored.

Total anthocyanin

About 10 mg of powder were extracted two times with 10 ml of an HCl/water/ethanol solution (1/29/70). The extract was centrifuged for 10 minutes at 10,000 g and recorded in a Beckman DU-640 spectrophotometer (Beckman Coulter, Fullerton, USA) [19]. Total anthocyanin content was expressed as cyanidin-3-rutinoside, which was previously identified as the major anthocyanin present in açá. The molar absorptivity (Emolar) of cyanidin-3-rutinoside used was 32,800 at λ_{max} absorbance (about 534 nm), in HCl/water/ethanol solution (1/29/70) at 20°C [19]. Analyzes were performed in duplicate and the results were expressed as mg/100 g of dried juice matter (excluding the mass of carrier agents).

RESULTS AND DISCUSSION

All the dryers have a significant difference with respect to drying temperature shown in Table 1. Anthocyanins phenol and total flavonoids are all highly unstable and are very susceptible to degradation. Their stability can be affected by several factors such as pH, storage temperature, chemical structure, concentration, light, oxygen exposure, solvent exposure, the presence of enzymes, other flavonoids, proteins, and metallic ions [20]. Among the dryers freeze dried samples gave good results with 105.7 mg/g of total flavonoids, 13.99 mg/g of total phenols and 7.25 mg/g of Anthocyanin. Whereas, the very low content of nutrition was found in sundried and cross flow dried samples 36.01 and 35.05 mg/g of total flavonoids, 7.6 and 8.43 mg/g of total phenol and 1.67-1.43 mg/g of anthocyanin. Antioxidant capacity of evaluated species was significantly correlated with TP (0.70) but was not significant with TA content (0.01) [21]. *S. molesta* exhibited total phenolics content of 9.84 mg GAE/g. Total flavonoid contents measured by aluminum chloride method was 10.89 mg QE/g [22]. Phenolic compounds of plants are also very important because their hydroxyl groups confer scavenging ability. Plant materials rich in phenolics are increasingly being used in the food industry because they retard oxidative degradation of lipids and improve the quality and nutritional value of food [20]. Flavonoids are naturally occurring secondary metabolite in plants and are thought to have positive effects on human health. Studies on flavonoid derivatives have shown a wide range of antibacterial, antiviral, anti-inflammatory, anticancer, and anti-allergic activities [23]. Flavonoids have been shown to be highly effective scavengers of the most oxidizing molecules, including singlet oxygen, and various free radicals implicated in several diseases.

In the case of total antioxidant capacity of Jamun pulp powder under various drying temperature, there is the high significant difference between drying temperatures shown in Fig. 1. In cross flow dryer, temperature ranges from 50°C, 60°C, and 70°C where used for drying Jamun pulp and the antioxidant capacity shows very less activity

Table 1: Quantification of major phytochemicals of Jamun pulp powder under various drying temperature

Sample	Total flavonoids mg/g	Total phenol mg/g	Anthocyanin mg/g
T1	36.10	8.43	1.67
T2	30.67	9.49	2.14
T3	35.87	8.43	2.07
T4	34.05	7.6	1.43
T5	76.87	10.89	5.10
T6	77.90	11.45	6.98
T7	79.53	12.57	6.09
T8	104.6	13.08	7.11
T9	105.77	13.72	7.25
T10	104.8	13.99	7.56

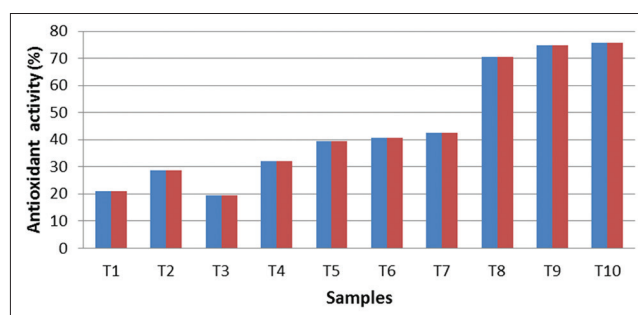


Fig. 1: Antioxidant activity of Jamun pulp powder under various drying temperature

as 20.9-19.4%, whereas in vacuum shelf dryer the activity was increased from 39.4% to 42.5%. When DPPH encounter proton radical scavengers, its purple color fades rapidly. This assay determines the scavenging of stable radical species of DPPH by antioxidants [24]. On comparing the other entire driers freeze dried samples gave a high percentage of activity as 70.4-75.8%. The antioxidant capacity of the fresh fruit and the level of Vitamin C and phenols were not affected by freezing.

CONCLUSION

According to the research study, the percentage of antioxidant activity of 10 different temperatures from sun drying, cross flow drying, Vacuum shelf drying and freeze drying have a significant difference. The freeze dried samples were found to have high antioxidant activity. Based on the EC50 value, the ethanol extract of *Syzygium cumini* showed the best activity.

The present study suggests that Jamun pulp powder has a potential source of natural antioxidants, phenols, flavonoids, and anthocyanin in the freeze-dried sample. On comparing the driers cross flow dryer gave the least result with high degradation on nutrient, vacuum shelf driers had a very moderated level of nutrient and freeze dried sample have high nutritive property.

ACKNOWLEDGMENT

We thank the department of Food Processing and Engineering of Karunya University for providing the laboratory facilities.

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