

Effects of drying on nutritional characteristics and Phytochemicals in Pulichakeerai (*Hibiscus Sabdariffa*)

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ABSTRACT

Hibiscus sabdariffa (family Malvaceae), commonly known as Roselle or Bissap, is a non-native species to the United States and has shown to exhibit nutraceutical properties, and this plant has been recognized in traditional medicines. The fresh and dried powders are consumed all over the world. Understanding the effect of drying methods on retention of nutrients and antioxidant activity is essential for assessing suitable processing methods for tapping its potential health benefits. In the present study *Hibiscus sabdariffa* leaf was dried using solar and cabinet drying method. The samples were dried till it reaches a moisture content of 4.6 %. The drying time of *Hibiscus sabdariffa* was 48 hours in solar drying and in cabinet drier at 60 ° C it was 8 hours. The fresh, cabinet and solar dried powder samples were analyzed for its nutritional and antioxidant components. The ascorbic acid content of solar dried *Hibiscus sabdariffa* leaf was high (64 mg %) than cabinet dried powder samples (56 mg %). The Beta carotene content was found to be higher in solar dried *Hibiscus sabdariffa* samples (7426 microgram %) than cabinet dried powder sample (5189 micro gram %). The total flavanoid content was found to be higher in solar dried powder samples (958.1 mg) than in cabinet dried samples (923.8 mg). The total phenolic content was found to be higher in solar dried samples (2448 micro g of GAE/g) than cabinet dried *Hibiscus sabdariffa* powder samples (2284 micro g of GAE/g). The antioxidant activity of *Hibiscus Sabdariffa* was found to be higher in solar dried sample (62 mg %) than cabinet dried powder samples (58 mg %). It can be inferred from the findings that the highest antioxidant activity of solar dried powder might be due to the high content of flavanoid. The results of the study showed the potential for retaining quality of *Hibiscus sabdariffa* leaf in solar drying process and value added products using solar drying can be explored for commercialization.

Keywords: *Hibiscus sabdariffa*, flavanoid, ascorbic acid

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INTRODUCTION

Hibiscus sabdariffa commonly known as red sorrel and roselle. Roselle belongs to Malvaceae family. It is an erect, mostly branched, annual shrub. Stems are reddish in color and up to 3.5 m tall. Leaves are dark green to red, alternate, glabrous, long petiolate, palmately divided into 3-7 lobes, with serrate margins.[1]. Many parts of gongura including seeds, leaves, fruits and roots are used in various foods. The young leaves and tender stems of gongura are eaten raw in salads or cooked as greens alone or in combination with other vegetables and/or with meat. They are added to curries as seasoning. They have acid, rhubarb like flavor. The leaves are antiscorbutic, emollient, refrigerant and sedative. The leaves are very mucilaginous and are used as an emollient and as a soothing cough remedy. It is used as folk remedy in treatment of abscesses, cancer, cough, debility, fever, heart ailments [1].

Phytochemicals are also regarded as non-nutritive plant chemicals that have protective or disease preventive properties. They have antioxidant activity and protect our cell against oxidative damage and reduce risk of developing cancers. The most important of these bioactive groups of plants are alkaloids, terpenoids, tannins, saponins, and phenolic compounds [2]. Lack of proper documentation of traditional knowledge regarding the nutritional, phytochemicals and functional properties of region specific underutilized foods is one of the major constraints restricts their inclusion of these foods in the daily diet. Locally available underutilized vegetables are valuable both as food and medicine. The consumption of the underutilized foods has decreased on account of change in dietary practices across generations. Hence, it is essential to exploit the underutilized foods for development of low cost functional foods. This study is hence necessary to reinstate the utilization of our local underutilized foods in our regular dietary.

Gongura is a very rich source of iron, vitamins, folic acid and anti-oxidants essential for human nutrition. Though abundant literature on gongura is available the effect of different drying on phytochemical characteristics was limited and hence the study was carried out to investigate the effect of drying on phytochemical characteristics and to study the effect in product.

MATERIAL AND METHODS

The study was conducted at the Department of Food Science and Nutrition, Community Science College And Research Institute, Tamil Nadu Agricultural University, Madurai, Tamil Nadu, India during the year 2018-2019. The mature *Hibiscus sabdariffa* leaf was cleaned, washed and then dried using solar and cabinet drying method. The samples were dried till it reaches the safe moisture content of 4.6 %.

Chemical analysis:

The moisture content of the samples was estimated by hot air oven method as per the procedure given by AOAC [3]. Crude fiber content was determined as per the method described by Maynard (1970). Ascorbic acid was estimated by [5] method. Calcium by Clark and Collip, [4] phosphorus and iron by [6] were carried out using standard methods.

Phytochemical analysis

The total phenolic content of herbs was determined by FolinCiocalteu's assay [7] by spectrophotometrically. The radical scavenging ability of dried and product sample were tested on the basis of the radical scavenging effect on the DPPH free radical by Goupy *et al.* [9]. In clean and labelled test tubes, 2 ml of DPPH solution (0.002% in methanol) was mixed with 2 ml of different concentrations of sample extracts separately. The tubes were incubated at room temperature in dark for 30 minutes and the optical density was measured at 517 nm using UV-Vis Double beam Spectrophotometer 2201 Model. The absorbance decrease was measured at 517 nm using methanol as a blank in a spectrophotometer. Negative control was prepared by adding 2 ml of DPPH solution to 1 ml of methanol and the absorbance was noted. Ascorbic acid was used as positive control. The calibration curve was plotted using absorbance versus concentrations of ascorbic acid standard and the results were reported as mg ascorbic acid equivalent of antioxidant activity per 100 g of sample on FWB.

Development of value added product

Standardisation of Gongura chutney

Freshly harvested *gongura* leaves were purchased from the local market, Madurai, Tamil Nadu, India. The product developed from the gongura leaves was gongura chutney and the ingredients list was given in Table 1.

Table 1 Ingredients for development of Gongura leaf chutney

Sl.No	Ingredients	Quantity(g)
1.	Gongura leaves	55 g
2.	Chopped onion	10g
3.	Garlic	7 g
	Dry chilli	10
4.	Mustard seeds	5
5.	Urudu dhal	3 g
6.	Oil	10 ml

The fresh leaves were cleaned and washed. Heat the pan add oil season with mustard, red chillies, urdhu dhal sauté a while. Add chopped onions and garlic pods sauté it in a medium flame for five minutes and remove from the flame and cool it. Grind the sautéed ingredients adding salt and water as coursed chutney.

RESULT

Table 2: Studies on drying characteristics of *Hibiscus Sabdariffa*

Drying parameters	Solar drying	Cabinet Drying
Drying time (hrs)	48	8
Dehydration ratio	6.8	7.6
Yield (%)	15.8	14.4

The drying time of *Hibiscus sabdariffa* was 48 hours in solar drying process and 8 hours in cabinet drying at 60 °C was 8 hours. The yield of *Hibiscus sabdariffa* powder was high in Solar drier (15.8 %) whereas in solar (14.4 %).

Table 3: Nutritional Characteristics of *Hibiscus Sabdariffa*

Parameters	Fresh sample	Cabinet dried sample	Solar dried Sample
Moisture (%)	85	4.8	4.6
Ash (g)	3.5	9.2	9.85
Crude fibre (g)	17	23	29.1
Vitamin C (mg)	48	56	64 .0
Beta-carotene (mcg %)	5584	5189	7426
Calcium mg	138.3	154.2	162.1
Iron mg	131.3	150.2	158
phosphorous mg	68	74.2	82

In the present study two different drying methods viz ., cabinet and solar drying was tried out. The powder obtained from the cabinet and solar drying method was analysed for its nutritional and antioxidant components.

The ascorbic acid content of solar dried *Hibiscus sabdariffa* leaf was high (64 mg %) than cabinet dried powder samples (56 mg %). The results of the present study is in agreement with Sandopu Sravan Kumar *et al.* [10] reported room- and freeze-dried samples were found to have best quality in terms of ascorbic acid content (11.11 ± 1.04 and 8.92 ± 0.94 g kg^{-1}) compared with those subjected to infrared, crossflow, microwave, oven or sun drying.

The beta carotene content was found to be high in solar dried *Hibiscus sabdariffa* samples (7426 microgram %) than cabinet dried powder sample (5189 micro gram %). The mineral content was found to be higher in cabinet dried powder samples than in solar dried powder samples. The results of the table showed the potential for retaining nutritional quality of *hibiscus sabdariffa* leaf in solar drying process.

Table 4: Quantitative phytochemical analysis of *Hibiscus sabdariffa* leaves and product

Parameters	Fresh sample	Cabinet dried	Solar dried sample	<i>Hibiscus sabdariffa</i> chutney
Total flavanoids (mg GAE / 100 g)	563.7	923.8	958.1	490
Total Phenols (mg GAE / 100 g)	1996	2284	2448	1450
Anti oxidant activity by DPPH method (mg AAE / 100g)	56	58	62	40

The total flavanoid content was found to be higher in solar dried powder samples (958.1 mg) than in cabinet dried samples (923.8 mg).

The total phenolic content was found to be higher in solar dried samples (2448 micro g of GAE/g) than Cabinet dried *Hibiscus sabdariffa* powder samples (2284 micro g of GAE/g) . The results of the present study was in similar with that of Jing Zhen *et al.* [11] who reported atotal phenolic content of different accession of *Hibiscus sabdariffa* by Folin–Ciocalteu assay, which ranges from 18.98 ± 2.7 to 29.9 ± 0.5 mg GAE/g..

The antioxidant activity of *Hibiscus sabdariffa* was analysed by DPPH method. The antioxidant activity of *Hibiscus Sabdariffa* was found to be high in Solar dried sample (62 mg %) followed by cabinet dried powder samples(58 mg %). It can be inferred from the findings that the highest antioxidant activity of solar dried powder might be due to the high content of flavanoid. Manish Kumar *et al.* [12] mentioned DPPH radial scavenging activity of *Hibiscus Sabdariffa* with IC50 values ranging from 46.13 ± 0.37 to 94.16 ± 0.56 $\mu\text{g/ml}$.

The total phenol, total flavonoid and antioxidant activity of *Hibiscus sabdariffa* chutney was 1450 mcg GAE /g, 490 mg of RU/g and 40 % respectively. The reduction in total flavanoid , total phenol and antioxidant in chutney was 13 %, 27 % and 28 %respectivelywhen compared to fresh.

CONCLUSION

The data obtained show the potential for retaining quality parameters of *Hibiscus sabdariffa* leaf under suitable drying methods.Hence to gain the maximum benefit, consumption of solar dried powder by incorporating in foods is advisable.The plant may be used clinically better to explore other activities like antihyperlipidmic, antihypercholesterolemic& antiviral activities for human society in future.

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