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Development and Organoleptic Evaluation of Value Added Products from Gogu (*Hibiscus cannabinus* L.)

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ABSTRACT

Gogu (*Hibiscus cannabinus* L.*)* belongs to *Malvaceae* family, identified for both its economic, horticultural and industrial importance. Gogu leaves are rich source of vitamins and minerals. It has high antioxidant content related to the presence of anthocyanins with potent antioxidant activity. With this concern, the present research was undertaken to develop and evaluate the value added products from gogu leaves to its organoleptic parameters along with phenolic content and antioxidant activity. The experimental results revealed that phenolic content of the gogu leaves was 16.4 mg GAE / 100 g, The antioxidant activity was 23.7, 19 Eq. µg/g vitamin C per 100 gm. Gogu puliogare paste was prepared by incorporating 70 per cent of leaves was best accepted in terms of appearance 7.40, texture 7.55, colour 7.85, flavour 7.25, taste 7.25 and overall acceptability. The best accepted products were kept for shelf life study by storing in aluminum foil pouch in an ambient temperature. Sensory attributes and microbial load observed for gogu leaf puliogare paste at an interval of initial, 10^{th}, 20^{th} and 30^{th} day revealed that, from initial day to 30^{th}, the overall acceptability scores of gogu puliogare paste decreased from 7.80 to 5.85. The gogu puliogare paste was having the total bacterial count of 10.33 CFU 10^4 /g, The product was able to keep for 30 days and safely used. The study concludes that incorporation of gogu parts like leaves was well accepted. Hence, creation of awareness is needed for commercialization of the product to avail the nutritional benefits from gogu. It need to be encouraged for vulnerable population and also for general public to maintain good health because of rich in protein, energy and fat.

Keywords : Gogu leaves, Value addition, Shelf life, Microbial load, Organoleptic

GOGU (*Hibiscus cannabinus* L.) is an annual herbaceous plant belongs to *Malvaceae* family originated in Africa and is identified for both its economic, horticultural and industrial importance. Intercropping of the Gogu is being practiced in India along with Jowar and Ragi in Karnataka and Andhra Pradesh. Gogu leaves are rich source of carbohydrate (9.9 g), calcium (172 mg), iron (2.28 mg), β-carotene (2,898 µg) and vitamin C (20 mg). The tender leaves are consumed as vegetable salad or for seasoning curries in many parts of India. They are acidic in taste and may be used for the preservation of jelly, flavouring extracts, syrup and wine. It has high antioxidant content due to the presence of anthocyanins for its potent antioxidant activity (Bechoff *et al.,* 2014). Many parts of gogu including seeds, leaves, fruits and roots are used in various food forms. Gogu is used in many folk medicines and valued for its mild laxative effect and for its ability to treat certain diseases. The leaves and flowers are used as a tonic tea for digestive and kidney functions. A lotion made from gogu leaves is used on sores and wounds. Recently reported that, anthocyanin possess some antioxidant activities, which has some beneficial effects in the treatment of diseases such as hypertension, pyrexia, liver disorders and also to prevent cardiovascular and hepatic disease (Karabacak and Bozkurt, 2008). With this concern the present study was undertaken to develop and evaluate the value added products from gogu for its organoleptic parameters along with Phenolic content and antioxidant activity of the gogu (*Hibiscus cannabinus* L.)

Material and Methods

Procurement of the Materials

The fresh Gogu leaves were collected from plants grown at backyard of researcher home for the study purpose. Other ingredients for product development includes ground nut, red chili, fenugreek seeds, mustard seeds, turmeric powder, jaggery, ghee, vegetable oil and salt for research purpose were procured from local market of Bengaluru, Karnataka, India.

Chemical Analysis of Fresh Gogu Leaves

The following nutrients namely Moisture (%), Protein (g), Fat (g), Carbohydrate (g), Energy (K cal), Dietary fibre (g), Ash (g), Iron (mg), β-carotene (µg), Vitamin C (mg) and Calcium (mg) and Phenolic contents were analyzed by following standard procedures described by AOAC, 1995. All samples were worked in triplicates. Antioxidant activity of the gogu leaves was estimated by DPPH method and expressed in terms of ascorbic acid equivalents. (Ranganna, 1996).

Pre-Treatments

Gogu leaves were subjected to Blanching prior to processing by dipping in boiling water for two minutes.

Formulation of the Products

The products were prepared by incorporating the ingredients with different variations to standardize the final product.

Organoleptic Evaluation of the Products

The prepared products were analysed for the sensory characteristics. The sensory characteristics were carried out by a panel of semi-trained members using 9 point hedonic scale for the evaluation of their appearance, texture, colour, aroma / flavour, taste and overall acceptability.

Shelf Life Stability of the Products

After sensory evaluation, the best accepted puliogare paste was kept for shelf life study. The product was stored at ambient temperature by packing in aluminum foil pouch. The Gogu puliogare paste was evaluated on initial, 10th, 20th and 30th days for sensory attributes and also for microbial load using nutrient agar for total bacterial count.

Statistical Analysis

All the analysis were performed in triplicates and values were subjected for statistical analysis. The data was tabulated by keeping in the view of study objectives. Analysis of variance (F-Test) was done. Difference were declared statistically significant when ≤ 0.05.

Results and Discussion

Nutrient Composition of Gogu Leaves

Gogu leaves were analysed for its nutrient compositions by standardized experimental procedures and the findings are depicted in Table 1. Findings revealed, 100 g of gogu leaves contain 82.4 per cent of moisture, 1.4 g protein, 0.9 g fat, 14.5 g carbohydrate, 71.0 Kcal of energy, 4.5 g dietary fibre, 0.8 g ash, 164 mg calcium, 1.8 mg iron, 2,416 µg of β-carotene and 16 mg of vitamin C, respectively. Similar values were reported by Kubmarawa *et al.* (2009) that the Gogu leaves contained 1.24 g protein, 2.3 g fat and 29.61 per cent crude fibre, respectively.

Table 1

Nutrients composition of gogu leaves per 100g

Nutrients	Composition
Moisture (%)	82.4
Protein (g)	1.4
Fat (g)	0.9
Carbohydrate (g)	14.5
Energy (K cal)	71
Dietary fibre (g)	4.5
Ash (g)	0.8
Calcium (mg)	164
Iron (mg)	1.8
β-carotene (µg)	2,146
Vitamin C (mg)	16

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Total Phenolic Content and Antioxidant Activity of the Gogu

Total polyphenolic content and antioxidant activity of gogu leaves were estimated and the findings are recorded in Table 2. The results revealed that, total polyphenolic content of gogu leaves was found to be is 16.4 mg GAE/100 g of leaves. The antioxidant activity in leaves was 23.7 µg, (vit. C Eq µg / g).

TABLE 2

Phenolic content and Antioxidant activity of gogu leaves per 100g

Phenolic content and Antioxidant activity	Composition
Total Polyphenolics (mg GAE/100 g)	16.4
Antioxidant activity (Vit-C Eq. µg/g)	23.7

TABLE 3

Standardization of gogu puliogare paste (GPP) form Gogu leaves

Ingredients	GPP 1 (g)	GPP 2 (g)	GPP 3 (g)
Gogu leaves	50	60	70
Ground nuts	25	15	10
Red chilly	10	10	10
Fenugreek seeds	1	1	1
Mustard seeds	1	1	1
Turmeric powder	1	1	1
Curry leaves	10	10	5
Oil	2	2	2
Salt	As per taste	As per taste	As per taste

GPP-Gogu puliyogare paste

Formulation of Product

All the ingredients were weighed accurately by using digital weighing balance. The experimental GPP was prepared by incorporating different levels of gogu leaves at different concentrations of 50, 60, 70 per cent for all the variations to standardize in Table 3. The methodology used for preparing the GPP was depicted in Fig. 1 and Plate 1.

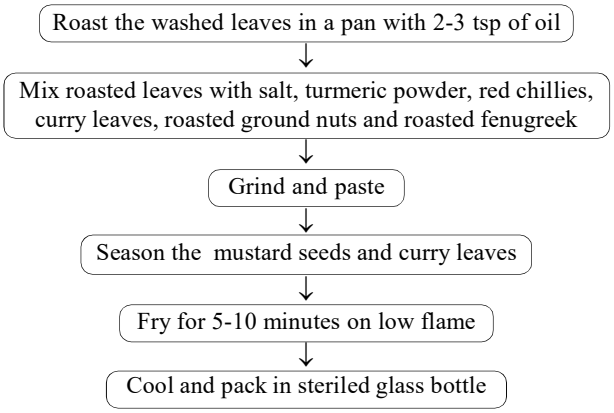

Fig. 1: Preparation of Gogu puliogare paste

Plate 1: Gogu Puliogare Paste (GPP)

Organoleptic Evaluation of the Gogu Puliogare Paste

The gogu puliogare paste was analysed for the sensory characteristics by 21 semi-trained members using 9 point hedonic scale. Sensory scores obtained were presented in the Table 4. GPP-3 scored highest in appearance, texture, colour, aroma / flavour, taste and overall acceptability *i.e.* (7.40, 7.55, 7.85, 7.25, 7.25, and 7.50, respectively). Whereas, GPP-1 had low sensory scores for appearance (6.95), while GPP 2 had lower sensory scores for texture, colour, aroma and taste (7.10, 6.80, 6.85 and 6.85), respectively. F value showed significant difference for colour and

TABLE 4

Sensory scores of the gogu puliogare paste

n=20

Products	Appearance	Texture	Colour	Aroma	Taste	Overall Acceptability
GPP-1	6.95	7.35	7.20	7.20	7.15	6.80
GPP-2	7.20	7.10	6.80	6.85	6.85	6.90
GPP-3	7.40	7.55	7.85	7.25	7.25	7.50
F Values	NS	NS	*	NS	NS	*
SEm±	0.050	0.0508	0.107	0.047	0.043	0.165
CD @ 5 %	-	-	0.405	-	-	0.313

GPP1-50g gogu leaves incorporation, GPP2-60g gogu leaves incorporation, GPP3- 70g gogu leaves incorporation

* Significant at 5% level, NS- non-significant

overall acceptability. Mean sensory scores for gogu leaf sauerkraut showed that it was best accepted by the panelist with (6.25) over all acceptability Deepa *et al.,* 2016.

Shelf Life Study of the Product

Best accepted product from different level of gogu leaves incoropration was subjected for the shelf life study. Aluminum foil was used as packaging material stored at ambient temperature. Sensory attributes and microbial load were observed for Gogu leaf puliogare paste at an interval of initial (0^{th}), 10^{th}, 20^{th} and 30^{th} day.

Effects of storage on sensory characteristics of Gogu puliogare paste were studied and results were depicted in the Table 5. The findings revealed that, sensory score were decreased with increase in storage days. F value showed significant difference for all the sensory parameters at 5 per cent level. The decreased scores for appearance, texture, colour and taste with the progress in the storage period was because of the loss of moisture due to evaporation and changes in aroma. The decreased score of taste can be related to oxidation of fat. Bisla *et al*. (2014) reported that, food products developed by incorporation of *Catharanthus roseus* fresh leaves rasam and stuffed Idli were moderately acceptable and the scores for their overall acceptability awarded by the panel of judges were 7.0 at 3 g and 7.4 at 4 g, respectively. For palak methi muthia, methi parantha, coriander chutney and cucumber soup the most acceptable level of incorporation of Catharanthus roseus (Sadabahar) fresh leaves was

TABLE 5

Effect of storage on sensory attributes of gogu puliogare paste

n=20

Products	Duration	Appearance	Texture	Colour	Flavour	Taste	Overall Acceptability
Gogu Puliogare Paste	Initial	7.80	7.80	7.80	7.75	7.70	7.80
	10th day	7.55	7.45	7.30	7.30	7.35	7.30
	20th day	6.80	7.05	6.95	6.95	6.90	6.90
	30th day	6.05	6.05	6.05	6.25	6.20	5.85
	F value	*	*	*	*	*	*
	SEm±	0.62	0.57	0.54	0.400	0.41	0.68
	CD at 5%	0.423	0.388	0.42	0.400	0.35	0.38

*Significant at 5% level

TABLE 6
Total microbial count of gogu puliogare paste (GPP)

Products	Duration	Taste
Gogu puliogare paste	Initial	0.00
	10th day	5.00
	20th day	7.00
	30th day	10.33
	F value	*
	SEm±	1.08
	CD @ 5 %	2.40

*Significant at 5% level

3 g per serving and the respective scores for overall acceptability ranged from 6.6 (palak methi muthia) to 7.15 (cucumber soup). Non significant differences were found in scores for all organoleptic characteristics of food products. Hence, Gogu puliogare paste was accepted by sensory panels and is suitable for preparation.

Microbial Study of the Gogu Puliogare Paste

Table 6 depicts the total microbial load *i.e*., total bacterial count of best accepted Gogu puliogare paste at an the interval of 10 days for the period of one month. The readings at initial, 10th, 20th and 30th days was found to be 0.00, 5.00, 7.00 and 10.33 x 10^4/ g, respectively. The increased microbial count was found may be due to characteristics of raw material from its origin. The product can safely stored and consumed because it contains lesser microbial count compared to upper limit *i.e.,* 25 CFU per 100 ml of processed foods. The increase in moisture content during the storage period might be the reason for increased microbial load (Kayitesi Laurence *et al.,* 2012).

From the above findings it could be concluded that, Gogu is a rich source of vitamin C, β-carotene and antioxidant like phenolic compounds. Incorporation of Gogu plant parts like leaves was well accepted. Hence, commercialization of the product and creation of awareness regarding health benefits and usage is needed to avail the nutritional benefit from Gogu. It need to be encouraged for vulnerable population and general public because of richness in protein, energy and fat.

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