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Vidyavathi C Kamble
 M.Sc. Scholar, Department of
 Food Science and Nutrition,
 University of Agricultural
 Sciences, GKVK, Bangalore,
 Karnataka, India

Revanna ML
 Assistant Professor,
 Department of Food Science
 and Nutrition University of
 Agricultural Sciences, GKVK,
 Bangalore, Karnataka, India

Corresponding Author:
Vidyavathi C Kamble
 M.Sc. Scholar, Department of
 Food Science and Nutrition,
 University of Agricultural
 Sciences, Bangalore, GKVK,
 Bangalore, Karnataka, India

Development and organoleptic evaluation of value added products from gogu seeds (*Hibiscus cannabinus* L.)

Vidyavathi C Kamble and Revanna ML

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Abstract

Gogu (*Hibiscus cannabinus* L.) belongs to *Malvaceae* family identified for both its economic, horticultural and industrial importance. Gogu Seeds are rich source of protein and crude fibre. The seeds are bitter in taste, resembles cotton seed oil may use as a source of edible oil. It has high antioxidant content related to the presence of anthocyanins with potent antioxidant activity. With this concern the present research study was undertaken to develop and evaluate the value added products from gogu seeds for its organoleptic parameters along with Phenolic content and Antioxidant activity. The experimental results revealed that phenolic content of the Gogu seed was 16.4 mg GAE/100 g. The antioxidant activity was 23.7, 19 vitamin C Eq. $\mu\text{g/g}$ per 100 gm. Gogu seed chikki was prepared by incorporating 20 percent of seed 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 product was kept for shelf life study by storing in aluminum foil pouch in an ambient temperature. Sensory attributes and microbial load were observed for gogu seeds chikki at the interval of initial, 10th, 20th and 30th day, revealed that from initial day to 30th, the overall acceptability scores of gogu seeds chikki decreased from 8.05 to 5.80, having the total bacterial count of 10.33 CFU 10⁴/g. The products can be kept for 30 days and can be safely used. The study concludes that incorporation of Gogu parts like seeds was well accepted. Hence commercialization of the products and creation of awareness is needed to avail the nutritional benefit from Gogu. It need to be encouraged for vulnerable population because of rich in protein, energy and fat.

Keywords: Gogu seeds, organoleptic, shelf life, microbial study

1. Introduction

Gogu (*Hibiscus cannabinus* L.) is an annual or biennial 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. It has high antioxidant content related to the presence of anthocyanins with potent antioxidant activity (Bechoff *et al.*, 2014) [3]. Many parts of gogu including seeds, leaves, fruits and roots, are used in various foods. Gogu is used in many folk medicines. It is valued for its mild laxative effect and for its ability to treat certain diseases. Gogu Seeds are rich in protein (20.9 g), fat (21.3 g), crude fibre (15.5 g) and calcium (300 mg) per 100 g. The protein yield of a gogu crop is in estimated as 400 to 500 kg ha⁻¹. The seeds are bitter in taste but are eaten in some parts of Africa. They contain oil, which resembles cotton seed oil suggest that the seed oil may be used as a source of edible oil. Seeds have been used an aphrodisiac coffee substitute (Watt and Breyer, 1962) [14]. Gogu seeds yield an edible vegetable oil. The gogu seed oil is also used for cosmetics, industrial lubricants and biofuel production. Gogu oil is high in omega polyunsaturated fatty acids (PUFAs) which are now known to help in keeping humans healthy. Gogu seed contains percent of 9.6 moisture, 6.4 ash, 20.4 oil, 21.4 nitrogenous matters and 12.9 crude fiber. Palmitic, oleic, and linoleic acids were reported as major fatty acid (Zawawi *et al.*, 2014) [16]. With this concern the present research study was undertaken to develop and evaluate the value added products from gogu seeds for its organoleptic parameters, shelf life along with Phenolic content and Antioxidant activity of the gogu seeds (*Hibiscus cannabinus* L.).

2. Materials and Methods

2.1 Procurement of the Materials

The fresh Gogu seeds were collected from plants grown at Home for study purpose. Other ingredients for product development includes jaggery, ground nut and ghee for product development were procured from local market, of Bengaluru, Karnataka, India.

2.2 Chemical and nutrient analysis of fresh Gogu seeds and developed product

The following nutrients namely Moisture (%), Protein (g), Fat (g), Carbohydrate (g), Energy (K cal), Dietary fibre (g), Ash (g), Iron (mg), β -carotene (μ g), Vitamin C (mg), and Calcium (mg) and Phenolic content was analyzed by standard procedures described by AOAC, 1995. All samples were worked in triplicate. Antioxidant activity of the gogu leaf was estimated by DPPH method, expressed in terms of ascorbic acid equivalents. (RANGANNA, S., 1996)^[12].

2.3 Pre-treatments

Gogu seeds were cleaned, dried in hot air oven at 60 °C and stored at ambient temperature used for further analysis.

2.4 Formulation of the products

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

2.5 Organoleptic evaluation of the products

The prepared products were analysed for the sensory characteristics. The sensory characteristics were carried out by a panel of 20 semi-trained members using a 9 point hedonic scale, for the evaluation of their appearance, texture, colour, aroma/flavour, taste and overall acceptability.

2.6 Shelf life stability of the products

After sensory evaluation, the best accepted gogu seeds chikki was kept for shelf life studies. The products were stored at ambient temperature and were packed in aluminum foil pouch. The Gogu seed chikki was evaluated on initial 10th, 20th and 30th days for sensory attributes and microbial load using nutrient agar for total bacterial count.

2.7 Statistical analysis

All the analysis was performed in triplicates and values were used for statistical analysis. The data was tabulated

keeping in the view the objectives of the study. Analysis of variance (F-Test) was done with three replications. Difference were declared statistically significant when $p \leq 0.05$.

3. Results and Discussion

3.1 Nutrient composition of Gogu seeds

Gogu seeds were analysed for its nutrient compositions by standardized experimental procedures and findings are depicted in Table 1. Gogu seeds contain 9.9 percent moisture, protein (28.9 g), fat (18.8 g), carbohydrate (38.2 g), energy (437 Kcal), dietary fibre (16.2 g), ash (4.2 g), calcium (558 mg), iron (2.2 mg) and vitamin C (3.8 mg) per 100 g of seeds. Lower values are reported by Olawepo *et al.*, (2014)^[11] reported that, Gogu seeds had 4.65 g of moisture, 25.12 g crude protein, 18.89 g of crude fat 4.40 g of ash content, 251 mg of calcium and 2.99 mg of iron respectively. Which might be due to difference in variety and climatic conditions.

Table 1: Nutrient composition of gogu seeds per 100 g

Nutrients	Content
Moisture (%)	9.9
Protein (g)	28.9
Fat (g)	18.8
Carbohydrate (g)	38.2
Energy (K cal)	437
Crude fibre (g)	16.2
Ash (g)	4.2
Calcium (mg)	558
Iron (mg)	2.2
Vitamin C (mg)	3.8

Phenolic content and Antioxidant activity of the gogu

Table 2 reveals the total polyphenolic and antioxidant content of gogu seeds. Findings showed it has phenolic content 4.6 mg GAE/100 g seeds, The antioxidant activity in seeds was 0.52 μ g (vitC Eq μ g/g) respectively. The values reported by Yusri *et al.*, (2012)^[15] was higher than the present values that is Gogu seeds had 5.36 mg GAE/100 g of phenolic content and 0.62 μ g ATE/g of antioxidant activity. Bors *et al.*, (2014)^[5] reported that, the various types of radish and mustard seeds were evaluated on the basis of the total phenolic content (TPC) ranged between 260 and 516 mg GAE/ 100 g of fresh weight. This may be due to varietal differences.

Table 2: Phenolic content and Antioxidant activity of gogu leaves, flowers and seeds

Components	Seed
Total Polyphenolics (mg GAE/100 g)	4.6
Antioxidant activity (Vit-C Eq. μ g/g)	0.52

Table 3: Formulation used for making gogu seeds chikki (GSC) for 100 g

Ingredients	GSC 1 (g)	GSC 2 (g)	GSC 3 (g)
Gogu seeds	5	10	15
Ground nut	45	40	35
Jaggery	48	48	48
Ghee	2	2	2

GSC-Gogu Seed Chikki

All the ingredients were weighed accurately by using digital weighing balance. The experimental GSC was prepared by incorporating different levels of gogu seeds at different

concentrations of 5, 10, 15% for all the variations to standardize (table -3). The methodology used for preparing the GSC was depicted in fig (1).

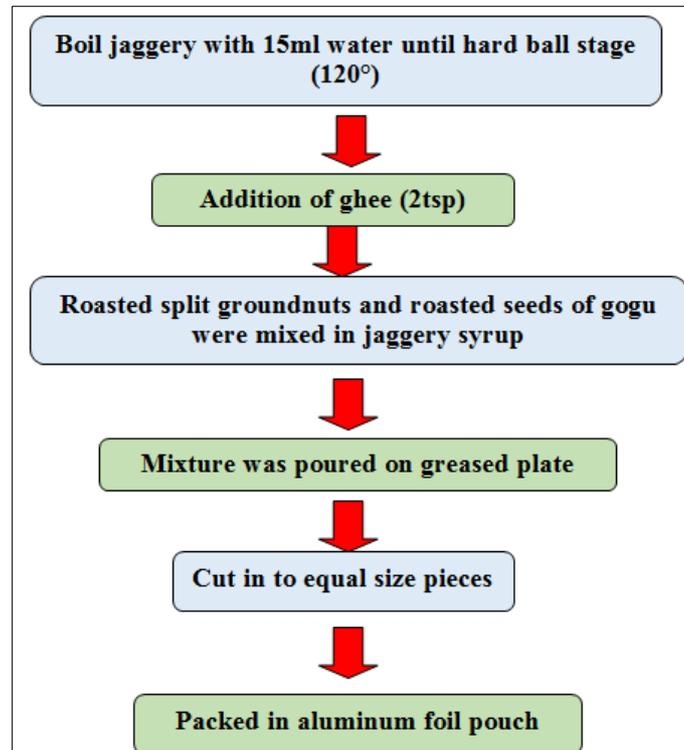


Fig 1: Preparation of Gogu Seeds Chikki

Nutrient composition of gogu seeds chikki (GSC)

Nutrient composition of gogu seeds chikki was depicted in the Table 4. The moisture content of GSC 1, 2 and 3 was 3.4, 3.7 and 3.9 percent respectively. Protein was high in GSC 1 i.e, 13 and low in GSC 3(12.4 g). GSC1 has high fat (21) compared to other two variations. High Carbohydrate, Energy, crude fibre, calcium and iron was recorded in GSC3 (59.5 g), GSC 1(478 Kcal) and GSC 3(3.4 g), GSC 3(110.3 mg) and 2.6mg in GSC1 respectively. Hiridyani and Charak., (2015)^[7] reported that, peanuts with flax seed chikki at 50% and 100% revealed that moisture (%) 3.4, ash (%) 1.3, fat (%) 24.5, fiber (%) 2.3, protein (%) 12.92, carbohydrate(%) 58.78 and calorific value (kcal) 479..80 per 100 g respectively.

Table 4: Nutrient composition of gogu seeds chikki per 100 g

Nutrients	GSC 1	GSC2	GSC3
Moisture (%)	3.4	3.7	3.9
Protein (g)	13	12.7	12.4
Fat (g)	21	20	19.1
Carbohydrate (g)	58.8	59.3	59.5
Energy (K cal)	478	469	460
Crude fibre (g)	1.2	2.3	3.4
Ash (g)	1.9	2.1	2.4
Calcium (mg)	88	99.2	110.3
Iron (mg)	2.6	2.5	2.3
Vitamin-C (mg)	0.3	0.6	0.8

GSC 1- 10% of seeds, GSC 2-20% of seeds, GSC 3-30% of seeds

Sensory score of the gogu seeds chikki

Table 5 presents the sensory scores of gogu seeds chikki. GSC 2 scored highest in the all the sensory attributes with appearance 7.75, texture 7.90, colour 7.85, aroma 7.85, taste 8.10, and overall acceptability 7.95 and lowest was in GSC 3 appearance 6.8, texture 7.25, colour 7.80, aroma 7.55,

taste 7.30 and overall acceptability 6.70. The significant differences were found in appearance, texture, colour, taste, overall acceptability and non-significant difference in aroma. Mala *et al.*, (2015)^[10] reported that, the initial sensory scores of pumpkin seeds chikki and pumpkin chocolate chikki were appearance 8.1±0.73, colour 8.3±0.67, texture 8.0±0.66, flavour 7.2±0.42, taste 8.1±0.73, overall acceptability 8.1±0.73 respectively. Gaggat *et al.*, (2014)^[6] reported that standardization and organoleptic evaluation of recipes using oats and flax seed namely daliya, poha, toast and pancake. The general acceptability of most of the recipes was very good. Most of them scored between good and very good in all parameter.

Table 5: Sensory score of the gogu seeds chikki (GSC) n=20

Products	Appearance	Texture	Color	Aroma	Taste	Overall Acceptability
Control	8.00	7.75	7.95	7.90	7.80	7.85
GSC 1	7.40	7.15	7.20	7.30	7.30	7.40
GSC 2	7.75	7.90	7.85	7.85	8.10	7.95
GSC 3	6.8	7.25	7.80	7.55	7.30	6.70
F values	*	*	*	NS	*	*
S.Em+	0.270	0.135	0.115	0.078	0.115	0.324
CD at 5%	0.478	0.520	0.521	0.467	0.557	0.471

GSC1- 10% of seeds, GSC2-20% of seeds, GSC3-30% of seeds

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

Shelf life of Gogu seeds chikki

Results of storage on sensory characteristics of Gogu seeds chikki was depicted in table 6. Results revealed that there was no significant difference in appearance. Significant difference was found in texture, colour and taste. The overall acceptability decreased by 8.05 to 5.80 from initial to 30th day respectively.

Table 6: Shelf life of gogu seeds chikki n=20

Product	Duration	Appearance	Texture	Color	Flavor	Taste	Overall acceptability
Gogu Seeds Chikki	Initial	8.00	7.90	8.15	7.75	7.90	8.05
	10 th day	7.30	7.15	7.15	7.50	7.10	7.15
	20 th day	7.75	6.75	6.95	6.90	6.90	6.80
	30 th day	6.00	5.85	5.70	5.80	5.70	5.80
	F value	*	*	*	*	*	*
	S.Em±	0.71	0.76	1.01	0.75	0.82	0.86
	CD at 5%	0.35	0.38	0.35	0.33	0.28	0.28

*significant at 5% level

Microbial study of the Gogu seeds chikki

Total bacterial population in Gogu seeds chikki was presented in in Table 7. The total bacterial count at initial 10th, 20th, 30th days of storage was 0.00, 4.33, 7.00 and 10.33 CFU 10⁴/g respectively.

Table 7: Total microbial count of gogu seeds chikki (GSC)

Product	Duration	TBC
Gogu seeds chikki	Initial	0.00
	10 th day	4.33
	20 th day	7.00
	30 th day	10.33
	F value	*
	S.Em±	1.35
	CD at 5%	4.10

*Significant at 5% level

4. Conclusion

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 parts like seeds was well accepted. Hence commercialization of the products and creation of awareness is needed to avail the nutritional benefit from Gogu. It need to be encouraged for vulnerable population because of rich in protein, energy and fat.

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