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Preparation and quality characterization of Singhara Gond Pak

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Abstract

Water chestnuts, commonly called as 'Singhara' are fruits grown in ponds, scientifically known as *Trapa natans*. The study was framed to standardized Singhara Gond Pak and to know quality parameters. The nutritional analysis of the selected sample B Singhara Pak where chestnut flour 50% and wheat flour 50% has a Carbohydrate of 89.82 g/100 gms, 1.43g/100 gms of Protein, 366.8 kcal/100 gms of Energy, 0.2 g/100 gms of Total Fats, 8.19 g/100 gms of Moisture, 0.36 g/100 gms of Ash and 5.7 g/100 gms of Crude Fibre. Mineral parameters where 55 mg/100 gms of Calcium and 1.46 g/100 gms of Iron. The results shown significant antioxidant activity, with a DPPH radical scavenging activity is [1278ppm], FRAP value is [9.798 μ mol], and ABTS radical scavenging activity is [76.05GAE/g], making it a promising food product with potential health benefits. Also, the microbial analysis showed the results such as for aerobic plate count below <10 CFU/g, yeast & molds as <10 CFU/g and Enterobacteriaceae was absent in the sample. Shinghara is a gluten-free flour which makes it valuable choice, helps in management of weight and diet for diabetes. It enhances milk supply in lactating mother's, helps in boosting energy, packed with nutrients, aids in digestion and supports postpartum recovery.

Keywords: Singhara Gond Pak, nutritional parameters, sensory evaluation, antioxidant activity

Introduction

The history of Gujarati sweets is rich with cultural and culinary traditions, and one notable delicacy is "wheat pak", also known as "Sukhdi" or "Gond pak". Traditionally made with wheat flour, jaggery and ghee, this sweet treat is a favorite during winters for its warming properties and delightful flavor. Often served at festivals and special occasions, its crispy texture and sweetness make it a beloved dessert for all ages (M. Tarla Dalal, 2024) [12]. An interesting variation, "Singhara Gond Pak", incorporates chestnut flour and edible gums, offering benefits particularly for lactating mothers by boosting energy, enhancing milk supply and supporting postpartum recovery (Dr. Sharada Sphoorthi. Y, 2023) [19].

Indian water chestnut flour, or "Singhare ka Atta", holds significant cultural and culinary importance, especially during religious fasting periods like Navratri. This gluten-free flour is rich in essential nutrients and offers numerous health benefits, including improved cardiovascular and digestive health (Singh, 2015) [19].

Wheat flour, a staple in Indian cuisine, is versatile and essential for making traditionally breads like chapati and roti (Goyal & Choudhary, 2018) [16]. Jaggery, an unrefined sugar, is valued for its distinct flavor and nutritional benefits (Patil & Patil, 2020; Kumar & Reddy, 2019) [17, 18]. Ghee, a clarified butter, is renowned for its rich taste and health properties (Desai & Kapadia, 2020; Kumar & Kumar, 2019) [13, 18]. By the above literature aimed to study the preparation and quality characterization of Singhara Gond Pak.

Materials and Methods

Material Procurement

Chestnut Flour, Wheat Flour, Walnuts, Dry Raisins, Edible Gums, Jaggery and Ghee were collected from D-Mart super market in Hyderabad, India.

Preparation of Singhara Gond Pak

Take Chestnut Flour and Wheat Flour keep aside. Heat ghee in a non-stick pan, add both

flours and cook, stirring continuously, on medium heat, till fragrant. Side by side, heat 2-3 tsp water in another pan, add jaggery and let it melt. Roast walnut and edible gums and grind them into a fine powder. Add the roasted flour in a large bowl and then add walnuts and edible gums powder and mix well. Pour the jaggery syrup and mix till well

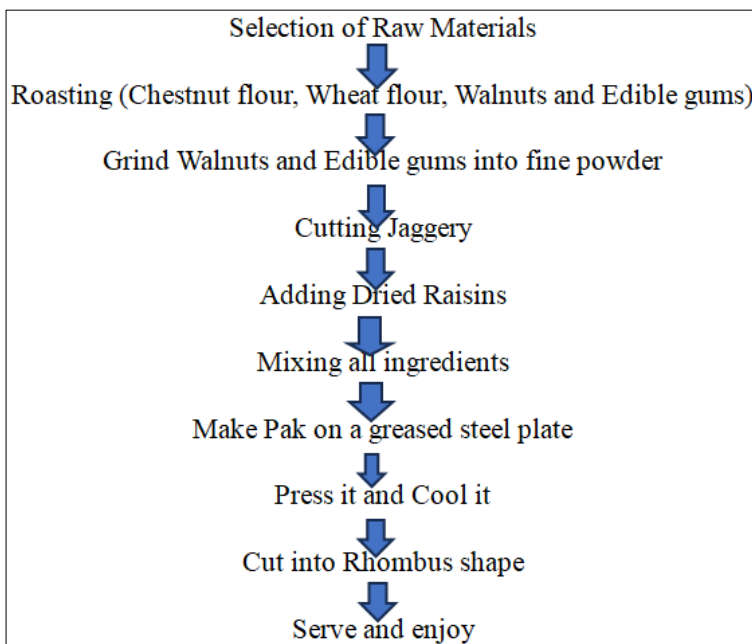
combined. Add dried raisins. Once the temperature of this reduces slightly then grease your steel plate with some ghee. Place the mixture on the greased plate. Press it and cool it at room temperature. Cut it into rhombus shape. Serve and enjoy.

Table 1: Formulation of Singhara Gond Pak

Sample Name	Wheat Flour (g)	Chestnut Flour (g)	Walnuts (g)	Edible Gums (g)	Jaggery (g)	Dried Raisins (g)
Sample A	30 g	20 g	15g	10 g	15g	10 g
Sample B	25 g	25 g	15 g	10 g	15 g	10 g
Sample C	20 g	30 g	15g	10 g	15g	10 g



Fig 1: Singhara Gond Pak



Flow chart-1: Preparation of Singhara Gond Pak

Organoleptic Evaluation

The sensory evaluation was carried out three samples of singhara gond pak prepared Sample A, B and C by using a 7-point hedonic scale with panel of 20 judges considering 6 parameters such as colour, texture, aroma, taste, appearance,

overall acceptability and identified best scores sample, the best score identified sample carried out for further analysis.

Nutritional Evaluation: Proximate analysis is a set of methods used to determine the nutritional composition of a

food sample. It involves the measurement of various components such as energy, moisture, protein, fat, carbohydrates, ash and fiber.

Energy Determination

The energy present in the selected sample was calculated and presented in the table. Energy content of the food product was determined using the FAO method. (Food and Agriculture Organization of the United Nations, 2003).

Protein Determination

The AOAC 2001 by using Kjeldahl method, which is used for the determination of protein in the selected food sample. (AOAC International, 2001).

$$\text{Protein (\%)} = (\text{N} \times 6.25) / \text{Sample weight (g)}$$

Carbohydrates Determination

The AOAC 985.29 by using high-performance liquid chromatography (HPLC) method, which is used for the determination of carbohydrates in the selected food sample. (AOAC International, 2022).

Moisture Determination

The AOAC 925.10 21st Edition is a method for determining the moisture content in the selected food sample by air oven dry method. (AOAC International, 2022).

$$\text{Moisture content (\%)} = [(\text{Initial weight (W1)} - \text{Final weight$$

$$(\text{W2})) / \text{Initial weight (W1)}] \times 100.$$

Ash Determination

The AOAC 942.05 is a method for determination of ash content in the selected food sample by gravimetric method. (AOAC International, 2022).

$$\text{Ash content (\%)} = (\text{Weight of ash} / \text{Weight of the sample}) \times 100.$$

Fat Determination

The AOAC (Association of Official Agricultural Chemists) 20th Edition 2016 method (920.39) by gravimetric determination, which is used for the determination of fat in selected food sample. (AOAC International, 2019).

$$\text{Fat (\%)} = (\text{Weight of extracted fat} / \text{Weight of the sample}) \times 100.$$

Fiber Content

The AOAC 991.43 is a method for determination of total fiber content in the selected food sample by enzymatic-gravimetric method. (AOAC International, 2022).

$$\text{Total Dietary Fiber \% (TDF)} = [(\text{Initial weight of the sample (W1)} - \text{Weight of the protein residue (W2)} - \text{Weight of the ash residue (W3)} + \text{Weight of the filtered fiber residue (W4)}) / \text{Initial weight of the sample (W1)}] \times 100$$

Table 2: The Nutritional Evaluation of the Singhara Gond Pak

Test parameters	Units of measurements	Methods
Energy	Kcal/100 g	FAO
Protein	g/100 gm	AOAC 2001
Carbohydrate	g/100 gm	AOAC:985.29
Moisture	g/100 gm	AOAC:925.10
Ash	g/100 gm	AOAC:942.05
Total fat	g/100 gm	AOAC:920.39
Fiber	g/100 gm	AOAC:991.43

The assessment of calcium and iron concentrations in the samples was conducted (Table 3). Calcium levels were quantified using the AOAC method 984.27, Similarly, iron content was analyzed employing AOAC method 985.35.

Calcium (Ca): The AOAC 984.27 is a method for determination of calcium content in the selected food sample by Atomic Absorption Spectroscopy (AAS). (AOAC International, 2022).

$$\text{Calcium content (\%)} = [(\text{Absorbance of sample solution (A)} \times \text{Volume of the sample solution (V)} \times \text{Dilution factor (DF)} \times 40.08)] / \text{Weight of the sample (W)} \times 1000.$$

Iron (Fe): The AOAC 985.35 is a method for determination of iron content in the selected food sample by Atomic Absorption Spectroscopy (AAS). (AOAC International, 2022).

$$\text{Iron content (\%)} = [(\text{Absorbance of sample solution (A)} \times \text{Volume of the sample solution (V)} \times \text{Dilution factor (DF)} \times 55.85)] / \text{Weight of the sample (W)} \times 1000.$$

Table 3: Mineral of the Singhara Gond Pak

Test parameters	Units of measurements	Methods
Calcium	mg/100 gm	AOAC 984.27
Iron	mg/100 gm	AOAC 985.35

Antioxidant analysis of Singhara Gond Pak

The antioxidant activity of food samples was evaluated using assays: DPPH (2,2-diphenyl-1-picrylhydrazyl), FRAP (Ferric Reducing Antioxidant Power), and ABTS (2,2'-azinobis(3-ethylbenzothiazoline-6-sulfonic acid)) assays. Each assay was conducted following standardized procedures.

Table 4: Antioxidant activity of the Singhara Gond Pak

Antioxidant activity	Units	Method
DPPH	ppm	Brand-Williams <i>et al.</i> , 1995 ^[11]
FRAP	μmol Fe +2 /g	Benzie & Strain (1996) ^[10]
ABTS	GAE/g	Re <i>et al.</i> , 1999 ^[1]

DPPH Methods: (2,2-Diphenyl-1-picrylhydrazyl) is a method for determination of antioxidant activity in the selected food sample. (Brand-Williams *et al.*, 1995) [11].

Antioxidant activity (%) = [(Absorbance of the DPPH solution without sample – Absorbance of the DPPH solution with sample) / Absorbance of the DPPH solution without sample control] x 100

FRAP Method– (Ferric Reducing Antioxidant Power) is a method for determination of antioxidant activity in the selected food sample. (Benzie and Strain, 1996) [10].

FRAP value ($\mu\text{mol TE/g}$) = (Absorbance of the sample - Absorbance of the blank) / (Absorbance of the Trolox standard – Absorbance of the blank) x Concentration of Trolox standard ($\mu\text{mol/ml}$) x Dilution factor

ABTS Method- (2,2'-Azino-bis (3-ethylbenzothiazoline-6-sulfonic acid)) is a method for determination of antioxidant activity in the selected food sample. (Re *et al.*, 1999) [11].

ABTS value ($\mu\text{mol TE/g}$) = (Absorbance of the sample - Absorbance of the blank) / (Absorbance of the Trolox standard – Absorbance of the blank) x Concentration of Trolox standard ($\mu\text{mol/ml}$) x Dilution factor

Microbiological Analysis

Microbial analysis such as aerobic plate count, yeast & molds and Enterobacteriaceae was carried out for 30 days of study by procedure followed by Indian standard method. (FSSAI Manual, 2nd Edn. 2022).

Statistical Analysis

Data obtained from sensory analysis is subjected to mean and standard deviation and it was statistically calculated by ANOVA using a significance of P value 0.05.

Results and Discussion

Sensory Evaluation

The mean and standard deviation of the sensory scores for different parameters in terms of Colour, sample A has a mean value of 6.55 with a standard deviation of 0.73 while sample B has a mean value of 6.80 with a standard deviation of 0.42 and sample C has a mean value of 6.55 with a standard deviation of 0.73 (Table 5). Regarding Texture, sample A has a mean value 6.60 with a standard deviation of 0.71, while sample B has a mean value 6.70 with a standard deviation of 0.55 and sample C has a mean value 6.35 with a standard deviation of 0.83. Further Taste, sample A has a mean value 6.30 with a standard deviation of 0.71, while sample B has a mean value of 6.80 with a standard deviation of 0.42 and sample C has a mean value of 6.55 with a standard deviation of 0.73. In terms of Aroma, sample A has a mean value 6.55 with a standard deviation of 0.73 while sample B has a mean value 6.75 with a standard deviation of 0.51 and sample C has a mean value 6.40 with a standard deviation of 0.82. For Appearance, sample A has a mean value 6.45 with a standard deviation of 0.76, while sample B has a mean value 6.65 with a standard deviation of 0.58, and sample C has a mean value 6.30 with a standard deviation of 0.86. These measurements provide an assessment of the sensory attributes for three samples A, B and C. Sample B generally tends to have higher mean value across all attributes, indicating a potentially better sensory experience compared to sample A and C.

Table 5: Sensory evaluation of Singhara Gond Pak

Sample	Colour	Texture	Taste	Aroma	Appearance	Overall acceptability
Sample - A	6.55±0.73	6.60±0.71	6.30±0.71	6.55±0.73	6.45±0.76	6.58±0.72
Sample - B	6.80±0.42	6.70±0.55	6.80±0.42	6.75±0.51	6.65±0.58	6.75±0.51
Sample - C	6.55±0.73	6.35±0.83	6.55±0.73	6.40±0.82	6.30±0.86	6.40±0.83

Table 6: ANOVA test for sensory evaluation of Different samples of Singhara Gond Pak

Source of variation	Sum of Squares	Degrees of Freedom	Mean Square	F-Statistic	P-Value	F Crit
Between groups	0.562	2	0.263	0.575	0.575	3.885
Within groups	7.639	15	0.510			
Total	8.165	17				

Nutritive Value of Singhara Gond Pak

The nutritional analysis of selected sample B had a Carbohydrate of 89.82 g/100 gms, 1.43g/100 gms of

Protein, 366.8 kcal/100 gms of Energy, 0.2 g/100 gms of Total Fats, 8.19 g/100 gms of Moisture, 0.36 g/100 gms of Ash and 5.7 g/100 gms of Crude Fibre (Table 7).

Table 7: Nutritive Value of Singhara Gond Pak (sample B)

Test parameter	Results	Units
Energy	366.8	K.Cal
Protein	1.43	g/100 g
Carbohydrate	89.82	g/100 g
Moisture	8.19	g/100 g
Ash content	0.36	g/100 g
Total fat	0.2	g/100 g
Fiber	5.7	g/100 g

As comparing nutritional values with wheat pak (sukhdi/golpadi) one piece golpadi gives 59 calories, out of which carbohydrates comprises 8.1 g, proteins 0.7 g, fiber

0.6 g and fat 2.8 g. The above values of wheat pak is higher than Singhara Gond Pak. (M. Tarla Dalal, 2024) [12].

Mineral Analysis of Singhara Gond Pak (sample B)

Calcium Content results showed significant calcium content in the selected food sample is 55 mg/100 gms. Iron Content results showed significant iron content in the selected food sample is 1.46 mg/100 gms. Compared to wheat Pak calcium is 6.1 mg is lower than Singhara Gond Pak and iron is 0.4 mg is higher in Singhara Gond Pak. (M. Tarla Dalal, 2024) [12].

Table 8: Mineral analysis of Singhara Gond Pak (sample B)

Test parameter	Results	Units
Calcium	55	mg/100 gm
Iron	1.46	mg/100 gm

Antioxidant Analysis for Singhara gond pak

The results showed significant antioxidant activity (Table 9), with a DPPH radical scavenging activity of [1278 ppm], FRAP value of [9.798 μ mol] and ABTS radical scavenging activity of [76.05 GAE/g]. These findings suggest that Singhara God Pak retains its antioxidant properties even after 30 days, making it a promising food product with potential health benefits.

Table 9: Antioxidant parameters of Singhara Gond Pak

S. No.	Test parameters	Units	Results
1.	DPPH	Ppm	1278
2.	FRAP	μ mol	9.798
3.	ABTS	GAE/g	76.05

Microbiological Analysis of Singhara Gond Pak

The microbial analysis was performed such as aerobic plate count as <10 CFU/g, yeast & molds as <10 CFU/g and Enterobacteriaceae showing the results as absent respectively (Table 10). (FSSAI Manual, 2nd Edn. 2022).

Table 10: Microbial Parameters of Singhara Gond Pak

Test parameters	Results	Units
Aerobic plate count	<10	CFU/g
Yeast & Molds	<10	CFU/g
Enterobacteriaceae	Absent	CFU/g

Conclusion

This study successfully created Singhara Gond Pak with improved nutritional benefits and longer shelf life by combining Wheat flour with Chestnut flour in various ratios. Among the three samples tested organoleptically, the sample B i.e 50:50 (Wheat flour: Chestnut flour) ratio was determined to be the most preferred. The nutritious blend, showcasing superior antioxidant and microbial properties. This blend demonstrated an impressive 30-day shelf life with minimal activity, indicating its potential as a viable commercial food product. The results of this study emphasize the potential of Wheat and Chestnut flour blends in developing nutritious and long-lasting food items, offering a valuable contribution to both food industry and consumers.

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