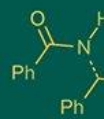


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Ramdai Kumeti
Department of Post Harvest
Management, MGUVV, Durg,
Chhattisgarh, India

Bhagwat Kumar
Assistant Professors,
Department of Agril.
Processing and Engg.,
MUGVV, Durg, Chhattisgarh,
India

Dr. Ganesh Parsad Nag
Department of vegetable
Science, MGUVV, Durg,
Chhattisgarh, India

Rahul Sahu
SMS (KVK) Department of
Agril. Processing and Food
Engg., IGKV, Raipur,
Chhattisgarh, India

Purushottam Sahu
Department of Agricultural
Statistics and Social Science
(L.), IGKV, Raipur,
Chhattisgarh, India

Danendra Kumar Jain
Ph.D. Scholar, Department of
Fruit Science, MGUVV, Durg,
Chhattisgarh, India

Manisha
Department of Post Harvest
Management, MGUVV, Durg,
Chhattisgarh, India

Deepak Kumar
Plantation Species Medicinal
and Aromatic Crops, MGUVV,
Durg, Chhattisgarh, India

Corresponding Author:
Ramdai Kumeti
Department of Post Harvest
Management, MGUVV, Durg,
Chhattisgarh, India

Development and standardization of wild date palm (*Phoenix sylvestris* Roxb) liquid jaggery blend with dry ginger powder

Ramdai Kumeti, Bhagwat Kumar, Ganesh Parsad Nag, Rahul Sahu, Purushottam Sahu, Danendra Kumar Jain, Manisha and Deepak Kumar

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Abstract

The present experiment “Development and Standardization of wild date palm (*Phoenix sylvestris* Roxb) liquid jaggery blend with dry ginger powder” The lab experiment was carried out in 2024-2025 at the Horticulture Processing Laboratory, Krantikari Debridhur College of Horticulture and Research Station, MGUVV, Jagdalpur, Bastar (C.G.) The objectives of the To study the biochemical parameter of sap, Biochemical study of developed liquid jaggery blend with different level of dry ginger powder, Sensory evaluation of developed liquid jaggery. The trial completely randomized design (CRD) with 7 Treatment and 3 replication and twelve observation. Treatment T₄ with 12 g of dried ginger powder include with highest value and statistically at per T₃ with 10 g In contrast, T₀ received the lowest value the lack of ginger led to subpar sensory qualities. Due to Climacterics nature, wild date palm must be transformed into liquid Jaggery blend with dry ginger powder or another value added product in order to be supplied throughout the year. The sap jaggery was observed ellipsoid. Liquid jaggery sample 2000 (ml) ginger powder (g) and the record TSS (° Brix), pH, titratable acidity (%), total sugar (%), reducing sugar (%) and non reducing sugar (%). Result of proximate composition of sample showed that values of ash content and all sample were evaluated for mineral content. Iron 3.691%, magnesium 2.291%, Phosphorus 3.426%, Calcium 2.756% Potassium 3.74% (10mg per 100 gm).

Keywords: Wild date palm, liquid jaggery, dry ginger powder, parameter of sap and mineral content

Introduction

The wild date palm (*Phoenix sylvestris* Roxb.) is a chromosome number of 2n = 36. With a lesser-known fruit plant commonly found in desert and dry regions. Locally called “Khajoor” or “Khejur,” it belongs to the palm family (Palmae) and is believed to have originated around the Persian Gulf. Over time, it has been cultivated in India, Africa and Spain since ancient times. In India, wild date palms grow naturally along roadsides, in household gardens, forests, and even on barren lands. It is often considered a staple for poorer communities, especially among tribal and forest-dwelling populations. Due to its low pulp content, larger seeds and lower sugar levels, the fruit has limited commercial value. Instead, it is primarily used for making “Neera,” a traditional drink. However, when fully ripe, the fruit is highly valued by villagers and tribal communities, serving as an essential source of nutrition and local produce.

Liquid jaggery may be considered as an intermediate product obtained during the preparation of solid jaggery. This form of jaggery is although viscous in nature, but highly rich in nutritive value and can be considered as nutraceutical product due to its medicinal properties. Liquid jaggery can be used in almost all the products in which jaggery is used. It provides a huge possibility of innovation and value addition of different products in the race of natural sweeteners. With the help of research work and technical support from institute like NSI Kanpur, IISR Lucknow, RSJRS Kolhapur, RARS Anakapalle and CFTRI Mysore. Liquid jaggery can play a key role in growth of cottage industry as well as it will be economically beneficial for the country. This paper aim to provide a comprehensive review of the qualitative and nutritive value of liquid jaggery along with its market potential during its upcoming years.

According to the Food Safety and Standards Authority of India (FSSAI), cane jaggery is a by-product of boiling or processing sugarcane juice. Jaggery is generally referred to as "medicinal sugar" due to its use in Ayurveda and its similarity to honey. It is extremely high in minerals, protein and vitamins. "Jaggery" is used as a functional food and is high in protein, minerals, vitamins, carbohydrates, phenolic acid and other nutrients, as well as antioxidant and medicinal properties. Jaggery is a type of nutritious food which contains enough carbohydrates (sucrose, fructose and glucose), minerals (calcium, potassium, sodium, iron, zinc, magnesium) and vitamins (B, C, D and E) for normal human growth and function.

Materials and Methods

Experiment site

The sap of wild date palm tree (*Phoenix sylvestris* Roxb) is the typically harvested during winter season in Chhattisgarh (Bastar) production, while the fruits reach full ripeness in the summer. For this study 14 to 15 years old tree were sap collected in may from Laboratory trial was carried out at Horticulture Processing Laboratory, Krantikari Debridhur college of Horticulture and Research Station (MGUVV) Jagdalpur Bastar (C.G.)-494001

Preparations of date juice

The harvested date fruits were thoroughly washed with water to remove any adhering dust and foreign particles. The seeds were manually separated from the pulp, which was then chopped into small pieces. The prepared pulp was stored in sterile containers at 8 °C until the experiment commenced. For the liquid-state fermentation, the fruit pulp was mixed with distilled water in a ratio of 1:3 by weight. The mixture was heated to 80 °C for 30 min with continuous stirring to eliminate pathogenic and spoilage organisms and to maximize the extraction of reducing sugars. After cooling to room temperature, the mixture was filtered using cheesecloth to remove insoluble materials. The filtrate was then centrifuged (Thermo Scientific Sorvall LYNX 4000) at 18.9 x g for 20 min to concentrate the TSS in the juice. Date juice samples with four experimental TSS concentrations (10%, 15%, 20%, and 25%) were prepared by dilution and subsequent heating using a rotary evaporator set at 65 °C. The TSS concentrations were selected based on their relevance to commercial vinegar production, where different sugar levels influence the fermentation process and the final product's acidity, flavor, and antioxidant profile. By exploring these specific levels, this study aims to provide practical insights into the relationship between TSS concentration and vinegar quality.

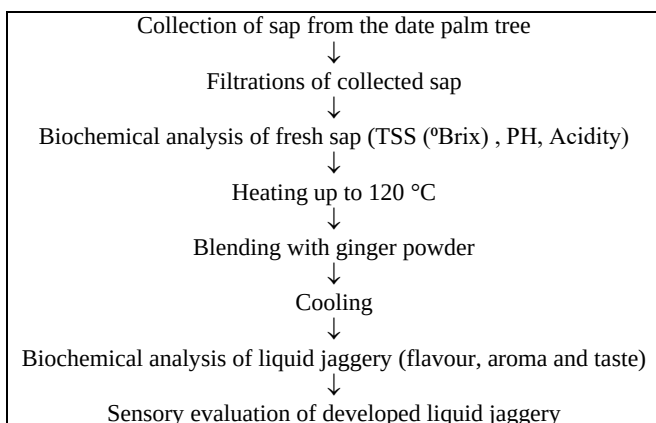


Fig 1: Flow chart of preparation of wild date palm liquid jaggery

Determination of Total Soluble Solids (TSS)

A hand held refractometer with 0 to 90° Brix scale was used for TSS measurement (Patil S. and Anekar S., 2014) ^[12].

Determination of pH

pH was measured according to Rangana S. (1986) using a digital pH meter.

Determination of Total titrable acidity

It was determined by titrating a known weight of liquid jaggery with 0.1N NaOH solution using phenolphthalein as an indicator. The results were expressed as percent anhydrous citric acid (w/w).

Determination of Total sugar

To measure the total sugar, fill a 250 ml flask with a 50 ml solution of clarified sugar. Five millilitres of HCl are added and the mixture is permitted to rest at room temperature (20 °C or above) for a full 24 hours. 0.1 N NaOH is used in combination with a phenolphthalein indicator to reverse this and replenish the volume. It was titrated and the value was noted. The sugar content was all shown as a percentage.

Determination of reducing sugar

Ranganna (1977) ^[10] explained how reducing sugars were estimated using Lane and Eynon's titrimetric methods.

Determination of Non reducing sugar

The reducing sugar value was subtracted from the total sugar sample to determine the non-reducing sugar value.

Non-reducing sugar (%) = Total sugar (%) - Reducing sugar (%)

Determination of ash

The ash content of burfi was estimated by following the protocol of AOAC (2000). Three g of accurately homogenized sample was taken in clean dry, moisture free silica crucible. The weight of the crucible was noted. The initial ashing was carried out over a low flame to char the sample. The crucible was then placed in muffle furnace at 550 °C to get ash for 6 h. The crucible was then cooled until a constant weight (W2) was achieved.

$$\% \text{ Ash} = \frac{W_1 - W_2}{\text{Weight of sample}} \times 100$$

Where,

W1 = Weight of sample + crucible before ashing

W2 = Weight of sample + crucible after ashing

Statistical analysis

The experiments were carried out using Completely Randomized Design (CRD) with three replications. The statistical analysis was done by Panse and Sukhatme, (1995) with slight modification.

Analysis of biochemical parameters of fresh sap

Fresh sap of the wild date palm (*Phoenix sylvestris* Roxb) is a highly nutritious, translucent, nutrient-dense and sweet liquid. The quality of the finished product was assessed by analysing the biochemical characteristics of fresh sap of wild date palm. The biochemical properties of fresh sap of

wild date palm are listed in Table 1. Fresh sap of wild date palm was found to have light milky colour. The average TSS (°Brix), pH, Titratable acidity (%), Total sugar (%), Reducing sugar (%) and Non-reducing sugar (%) were 12.33°Brix, 5.65 mg/100 g, 0.24%, 13.07%, 2.35%, 10.72%, respectively.

Table 1: Biochemical parameters of fresh sap of wild date palm

S. No.	Parameters	Average $\pm$ SD
1	TSS (°Brix)	12.33 $\pm$ 1.52
2	Colour	Light milky
3	pH	5.65 $\pm$ 0.02
4	Titrateable acidity(%)	0.24 $\pm$ 0.009
5	Total sugar (%)	13.07 $\pm$ 0.15
6	Reducing sugar (%)	2.35 $\pm$ 0.02
7	Non-reducing sugar (%)	10.72 $\pm$ 0.14

Moisture (%)

Table 2 presents the data, which is visually shown in Figure 1. Treatment T₀, which included 0 g of dried ginger powder, had the greatest moisture content (6.48%), statistically comparable to treatment T₁, which contained 2 g of dried ginger powder (6.28%). The moisture content of Treatment T₇, which contained 18 g of dried ginger powder, was significantly lower at 7.71%.

Iron (mg/100 g)

Table 2 presents the data, which is visually shown in Figure 1. Treatment T₇, which included 18 g of dried ginger

powder, had the highest iron content (2.75 mg/100 g), statistically at par to treatment T₆, which contained 14 g of dried ginger powder (2.59 mg/100 g). Treatment T₀, which included 0 g of dried ginger powder, had the lowest iron content (2.32 mg/100 g).

Magnesium (mg/100 g)

Table 2 presents the data, which is visually shown in Figure 1. Treatment T₇, which included 16 g of dried ginger powder, had the highest magnesium content (93.12 mg/100 g), statistically at par to treatment T₂ contained 5 g of dried ginger powder (89.42 mg/100 g), T₃ contained 10 g of dried ginger powder (91.33 mg/100 g), T₄ contained 12 g of dried ginger powder (91.77 mg/100 g), T₅ contained 14 g of dried ginger powder (92.33 mg/100 g) and T₆, which contained 16 g of dried ginger powder (92.52 mg/100 g). Treatment T₀, which included 0 g of dried ginger powder, had the lowest magnesium content (76.90 mg/100 g).

Phosphorus (mg/100 g)

Table 2 presents the data, which is visually shown in Figure 1. Treatment T₇, which included 16 g of dried ginger powder, had the highest phosphorus content (144.34 mg/100 g), statistically at par to the treatment, T₅ contained 14 g of dried ginger powder (143.89 mg/100 g) and T₆, which contained 16 g of dried ginger powder (140.16 mg/100 g). Treatment T₀, which included 0 g of dried ginger powder, had the lowest phosphorus content (121.37 mg/100 g).

Table 2: Biochemical properties of liquid jaggery

Notations	Moisture (%)	Iron (mg/100 g)	Magnesium (mg/100 g)	Phosphorus C (mg/100 g)	alcium (mg/100 g)	Potassium (mg/100 g)
T ₀	6.49	2.32	76.90	121.37	134.26	415.72
T ₁	6.28	2.34	88.77	130.08	136.51	436.63
T ₂	5.51	2.35	89.42	132.59	137.31	443.44
T ₃	5.35	2.37	91.33	135.82	140.19	450.12
T ₄	5.23	2.39	91.77	137.75	142.23	454.86
T ₅	5.15	2.41	92.33	140.16	143.12	457.06
T ₆	5.10	2.59	92.52	143.89	144.75	459.59
T ₇	5.07	2.75	93.12	144.34	147.32	465.69
C.D. at 5%	0.418	0.157	3.578	6.35	6.77	18.244
S.E. (m) $\pm$	0.151	0.052	1.183	2.13	2.239	6.671
S.E. (d) $\pm$	0.214	0.074	1.674	3.797	3.166	13.677
C.V. (%)	4.743	3.691	2.291	3.426	2.756	3.74

Sensory attributes of the developed liquid jaggery formulations

Sensory evaluation of wild date palm-based liquid jaggery was carried out using a nine-point hedonic scale. The panellists determined that jaggery containing 12 g dried ginger powder and 2000 ml wild date palm sap was good after using a nine-point hedonic scale to assess sensory qualities. The findings of a statistical analysis of the sensory scores for appearance, colour, taste, flavour and overall acceptability.

Conclusion

- Fresh sap of wild date palm (*Phoenix sylvestris* Roxb.) is a nutritionally rich and suitable raw material for liquid jaggery production.
- Incorporation of dried ginger powder significantly improved the mineral composition of liquid jaggery, particularly iron, magnesium, phosphorus, calcium and potassium contents. Increasing levels of dried ginger

powder resulted in a gradual reduction in moisture content, thereby enhancing the concentration of nutrients in the product.

- Sensory attributes of liquid jaggery were significantly influenced by the level of ginger powder added. Treatment T₄ (12 g dried ginger powder per 2000 ml sap) was found to be the most acceptable formulation based on overall sensory quality, offering a desirable balance of appearance, colour, taste and flavour.
- Excessive addition of ginger powder adversely affected sensory acceptability due to strong pungency and colour darkening.
- The standardized ginger-blended wild date palm liquid jaggery developed in this study has good potential as a nutrient-dense, value-added traditional sweetener and may contribute to diversification of palm-based products and livelihood enhancement in tribal and rural regions.

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