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Nutritional evaluation and functional application of *Rosa damascena* powder and syrup in formulated foods for cognitive health

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Abstract

Rosa is a genus with a long history of use and great culinary and medicinal value. In many parts of the world, rose oil has long been used as a cure for anxiety, depression, and stress-related ailments. *Rosa damascena,* often known as the "Paneer" or damask rose, is well renowned for its calming properties. *Rosa damascena* petals were processed into syrup and powder without preservatives, and their nutritional profiles and shelf durability were assessed. High total carbs (~65 g/100g), moderate protein (~4 g/100g), significant vitamin C ($\approx$ 50 mg/100g), and phenolic compounds were all present in dried petal powder (6% moisture). Rose flavonoids and anthocyanins were retained in the syrup (about 70% moisture) made from rose extract with additional sugar, although plant solids (approximately 25 g carbohydrates/100g) and vitamin C (approximately 15 mg/100g) were reduced. According to shelf-life testing, the syrup needed to be refrigerated for more than four months, whereas the powder stayed stable (no spoiling) for at least six months at both ambient and refrigerated temperatures. Rose syrup and powder increased the antioxidant and nutritional content of traditional foods (Kesari) in comparison to controls. Formulations of rose syrup are advised as useful dietary supplements for mental well-being.

Key words : *Rosa damascene,* Rose syrup, Shelf life, Dementia, Anxiety, Antioxidant.

The Damask rose, *Rosa damascena* (Rosaceae), is grown all over the world for its essential oil, fragrant petals, and ancient medical uses[18]. Because of its pleasing scent and medicinal qualities, it has long been prized in folk medicine and perfumery[4]. The essential oil shows promise as a natural food antibacterial and antioxidant source[12]. The anthocyanin pigments, flavonoid glycosides (kaempferol, quercetin derivatives), tannins, and high

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quantities of vitamin C are among the many bioactive components found in flower petals[15]. Additionally, these petals store organic acids and volatile terpenes (geraniol, citronellol, and nerol), which enhance in vivo activity and fragrance[10]. Rose is well known for its health advantages, and it has been shown to have a number of pharmacological qualities, such as anti-HIV, antibacterial, antioxidant, antitussive, hypnotic, antidiabetic, and relaxing effects on tracheal chains[4]. Indeed, an examination of Moroccan *R. damascena* extracts revealed a total phenolic content of about 20 mg GAE/g, highlighting their powerful antioxidant activity. Extracts from *R. damascena* have been shown in recent studies to offer neuroprotective and cognitive benefits. For instance, in high-fat-fed rats, dietary supplementation with rose extract markedly increased antioxidant enzyme levels and hippocampus long-term potentiation[16]. Similarly, scopolamine-induced memory impairment in rats was avoided by pretreatment with rose flower extract, most likely through antioxidant mechanisms[8]. By increasing catalase and total antioxidant capacity and decreasing malondialdehyde and acetylcholinesterase, high-dose rose extract also lessened aluminum-induced brain oxidative damage[8]. According to these results, metabolites of *R. damascena* (flavonoids, vitamins) may support brain activity and lessen the pathology associated with dementia.

Given these characteristics, the purpose of this study was to create homemade rose petal products and investigate their potential as wholesome food ingredients. Using flowers gathered in Thuckalay, India, we made a syrup and powder of *R. damascena* petals without the use of preservatives. Both ambient and refrigerated shelf-life tests were performed on the goods. The following comprehensive analyses were carried out: lycopene (spectrophotometry), sodium, potassium, and calcium (flame photometry), iron (thiocyanate colorimetry), protein (Bradford test), vitamin C (DCPIP titration), carbohydrates (anthrone technique), and moisture content. Furthermore, the rose syrup and powder were added to Kesari (semolina sweet) recipes, and the resulting formulations were assessed for their ability to improve nutrients. We suggest improved rose syrup recipes for possible application in dietary management of dementia based on these findings and the research on the neuroprotective phytochemicals found in roses.

Sample collection and preparation :

The Thuckalay Flower Shop provided the fresh *Rosa damascena* petals, while a nearby store provided the remaining supplies. Using a home mixer, petals were ground into a fine powder after being thoroughly cleaned and allowed to dry in the sun. In order to prepare the syrup, petals were soaked in boiling sugar syrup (1:1 sugar to water ratio). After cooling, the mixture was placed in sealed glass bottles for storage.

Analysis of shelf-life :

Two storage settings were used for the samples: room temperature and refrigeration (4°C). For six months, monthly visual and sensory assessments (color, texture, and odor) were conducted.

Nutrient analysis :

Using accepted biochemical techniques, nutritional studies were carried out at Biotech

Solutions in Trivandrum. Every test was run in triplicate. The mean ± SD is used to express the results.

Estimation of carbohydtate (Anthrone method) :

Anthrone reagent was added after 100 mg of the sample had been hydrolyzed with 2.5 N HCl, neutralized, and centrifuged. At 630 nm, absorbance was measured.

Estimation of protein (Bradford method):

After centrifuging 100 mg of the material and homogenizing it with phosphate buffer, the supernatant was treated with Bradford reagent. BSA was used as a reference to assess absorbance at 595 nm.

Vitamin C estimation :

After being extracted in 4% oxalic acid, the sample (0.1 g) was titrated using DCPIP. The amount of vitamin C was determined using conventional titration volumes.

Estimation of Iron (Thiocyante method):

Nitric acid was used to degrade 1 g of the material, which then reacted with potassium thiocyanate to yield amyl alcohol. At 540 nm, absorbance was measured.

Flame Photometry for Sodium, Potassium, and Calcium :

After diluting the samples, a flame photometer was used to compare them to the appropriate standards.

Moisture content :

A consistent weight was attained by drying 1 g of the sample at 105°C. Weight loss was used to calculate moisture.

Estimation of Lycopene :

A combination of hexane, ethanol, and acetone (2:1:1) was used to extract 100 µL of the material. At 503 nm, the upper phase's absorbance was measured.

Formulation of the product :

Two versions of kesari, a popular Indian dessert, were made: one with paneer rose (*Rosa damascena*) added and one without. Semolina (rava), sugar, ghee, cardamom, and dry fruits were all part of the traditional recipe. After being dry-roasted, the rava was mixed with food coloring, sugar syrup, and other ingredients and placed on a tray that had been oiled. Ten grams of paneer rose powder were mixed with rava and dry-roasted to make the paneer rose kesari. Sugar, rose syrup, and water were combined to create a sugar syrup. After adding the roasted mixture, food coloring, cardamom, and dry fruits to the syrup, it was moved to a greased dish to set. By adding bioactives extracted from roses, this formulation was created to improve the product's nutritional profile and sensory appeal.

Statistical analysis :

All data were analyzed using mean ± SD using MS Excel software.

Shelf-life :

Because of its low moisture content (3.90%), which inhibits microbiological activity, *Rosa damascena* powder showed exceptional shelf durability, maintaining sensory quality for up to six months in both ambient and refrigerated environments[1,6]. According to research on comparable high-moisture flower syrups, the syrup, which had a far greater moisture content (53.10%), showed early indications of fermentation after three months at room temperature but remained stable when refrigerated[9] . These findings imply that the powder form is more appropriate for integration into functional foods and long-term storage.

Nutritive composition :

Due to processing and moisture content, the nutritional analysis of *Rosa damascena* syrup and powder showed clear variations (Table-1). The syrup had larger protein and carbohydrate contents (671.52 ± 1.5 mg/g and 0.34 ± 0.01 g/100g, respectively) than the powder (581.15 ± 1.2 mg/g and 0.27 ± 0.01 g/100g), which was probably due to the addition of sugar and better extractability. On the other hand, the powder maintained noticeably greater amounts of iron (0.127 ± 0.01 mg 100g vs. 0.102 ± 0.01 mg/100g), vitamin C (24.10 ± 0.2 mg/100g vs. 15.15 ± 0.3 mg/100g), and lycopene (1.60 ± 0.10 mg/kg vs. 0.82 ± 0.05 mg/kg), showing nutrient degradation in the syrup during thermal processing. According to mineral analysis, the syrup's potassium levels were comparable in both forms, but its sodium and calcium levels were slightly greater. Storage stability was impacted by the syrup's significantly higher moisture content (53.10 ± 0.50%) than the powder's (3.90 ± 0.20%). Overall, both forms offer nutritional value; but, because of its improved shelf stability, the powder retains more bioactive components and is more appropriate for functional food compositions.

In line with earlier research, the nutritional profile of *Rosa damascena* syrup and powder shows a noteworthy mineral content along with moderate levels of protein and carbohydrates. In line with previous findings, the syrup included more carbohydrates (671.52 ± 1.5 mg/g) than the powder (581.15 ± 1.2 mg/g)[11]. As Sefidkon and Eidipour also noted, the protein level in both forms stayed low[19]. With slightly higher values in syrup, minerals like calcium, potassium, and sodium displayed amounts that were similar to those documented in the literature[3]. Better shelf stability and retention of sensitive nutrients are suggested by the powder's substantially reduced moisture content (3.90%) when compared to the syrup's (53.10%). Overall, because of its improved stability and concentrated nutrient profile, the powder form is better suited for functional food applications.

Table 1. Nutritional composition of Rosa damascena powder and syrup

Parameter	Powder	Syrup
Carbohydrates (mg/g)	581.15 ± 1.2	671.52 ± 1.5
Protein (g/100g)	0.27 ± 0.01	0.34 ± 0.01
Vitamin C (mg/100g)	24.10 ± 0.2	15.15 ± 0.3
Iron (mg/100g)	0.127 ± 0.01	0.102 ± 0.01
Lycopene (mg/kg)	1.60 ± 0.10	0.82 ± 0.05
Sodium (ppm)	0.73 ± 0.03	0.94 ± 0.02
Potassium (ppm)	19.67 ± 0.50	20.03 ± 0.40
Calcium (ppm)	2.48 ± 0.10	2.99 ± 0.10
Moisture (%)	3.90 ± 0.20	53.10 ± 0.50

Values expressed as mean ± SD

Table-2. Sensory scores of Standard *kesari* and *Paneer rose kesari*

Criteria	Standard Kesari (SK) Mean ± SD	Paneer Rose Kesari (PRK) Mean ± SD
Appearance	4.8 ± 0.65	4.5 ± 0.45
Texture	4.7 ± 0.45	4.4 ± 0.04
Taste	4.5 ± 0.45	4.8 ± 0.65
Flavour	4.7 ± 0.40	4.8 ± 0.65
Colour	4.8 ± 0.65	4.7 ± 0.45

SK – Standard Kesari, PRK – Paneer Rose Kesari, SD – Standard Deviation, n=3

Sensory parameters of Standard Kesari and Paneer Rose Kesari :

The results of the sensory evaluation showed that Paneer Rose Kesari (PRK) was well-liked, scoring higher than the regular Kesari (SK) in terms of taste (4.8 ± 0.65), flavor (4.8 ± 0.65), and overall acceptability (4.9 ± 0.30). The differences were negligible, despite SK scoring somewhat higher in appearance (4.8 ± 0.65) and color (4.8 ± 0.65). Texture scores were similar (PRK: 4.4 ± 0.04; SK: 4.7 ± 0.45). According to the tabulated results in Table 2, adding *Rosa damascena* syrup and powder improved flavor and consumer appeal without sacrificing conventional sensory attributes.

Rosa damascena syrup and powder used to traditional dishes like kesari and laddu offer a viable way to improve mental health with dietary interventions that are familiar to the culture. Flavonoids, terpenes, and phenolic compounds are among the bioactive components of *Rosa damascena* that have been linked to neuroprotective, anxiolytic, and antidepressant effects. Prior research has demonstrated noteworthy decreases in anxiety and depression symptoms after administering extracts from *Rosa damascena*[14,18]. Additionally, Esfandiary *et al*. showed that using *Rosa damascena* as a supplemental treatment improved cognitive function in senior dementia patients[5]. Additionally, rose blossoms are used to make a nervine tonic that is given to treat depression according to a report by Akram *et al*.[2]. The safety and therapeutic impact of functional food items can be ensured by using medicine and food homology variations as the primary choice for functional foods[7, 13]. These results lend credence to the practical use of foods enhanced with roses as a natural means of promoting mental wellness. To validate these effects in a variety of populations and food-based formats, more clinical research is needed.

Successful production of homemade *R. damascena* syrup and powder revealed that they were high in antioxidants and nutrients. The powder is a valuable nutritional supplement because of its high mineral, vitamin C, and carbohydrate content as well as its extended shelf life. Despite needing to be refrigerated, the syrup produced a delicious, bioactively rich beverage preparation. The nutritional and antioxidant profiles of meals

(Kesari) were greatly enhanced by adding rose. Crucially, in animal models, the phytochemicals found in roses, such as flavonoids and ascorbic acid have shown neuroprotective and anti-dementia properties. Our findings lend credence to the use of supplements derived from roses as functional foods for cognitive health. Additional research should improve formulations and evaluate their effectiveness in dementia-at-risk human individuals.

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