

Analysis of phytochemicals in bael (*Aegle marmelos* (L.) Corr.) fruit incorporated ice cream premix

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Abstract

The present study was undertaken to develop and evaluate the bael fruit incorporated ice cream premix, and to evaluate the changes in the phytochemicals parameters of these products as influenced by treatments. Results showed that the higher concentration of phenols (20.90mg GAE/100g), flavonoid content (2.82mg/100g) and carotenoids (5.32mg/g) was in treatment T₄. The incorporation of bael fruit powder up to 15 per cent was found to have superior phytochemicals in the developed ice cream premix.

Index terms: Phytochemicals, Carotenoids, Flavonoid content, Phenols and Ice cream Premix

Introduction

Bael (*Aegle marmelos* Correa.) is a lesser known fruit crop indigenous to India. It belongs to the citrus family Rutaceae and it is also known as Bengal quince, bilva, Indian quince, golden apple, holy fruit, bel, belwa, sriphal, stone apple and maredo in India (Singh *et al.*, 2019). Bael tree possesses great mythological importance in the Hindu religion. It is considered as holy tree in India. Leaf of this sacred tree which is vernacularly known as Tripatra is essential in offerings to Lord Shiva. It is one of the most important wonder tree species used in various indigenous systems of medicine in India, China, Burma and Sri Lanka (Singh and Bhatnagar, 2019). Its medicinal properties have been described in the ancient treatise like Charaka Samhita, Upvana Vinod and Yajur Veda and it has also been portrayed in the paintings of Ajanta Caves.

Every part of the tree such as leaves, roots, seed, bark and fruit possess anti-microfilarial, antifungal, immunomodulatory, anti-proliferative, wound healing, antifungal, analgesic, anti-inflammatory, antipyretic, hypoglycaemic, anti dyslipidemic, anti-fertility and insecticidal activity. Bael includes a wide range of cultivars like Kagzi Gonda, Gonda no. 1, Gonda no. 2, Kagzi Etawah, Mirzapuri and Baghel. It is a natural source of antioxidants and nutraceuticals.

The fruit is nearly spherical and 5 to 15 cm in diameter. The rind of fruit is grey or yellow and the pulp is sweet, thick, aromatic, gelatinous and orange in colour. The pulp has numerous seed which are densely covered with fibrous hairs and are oblong and flat. The skin of the fruit is so hard it must be cracked with a hammer. The bael fruit pulp contains many functional and bioactive compounds such as carotenoids, phenolics, alkaloids, coumarins, flavonoids, terpenoid and other antioxidants which may protect us against chronic diseases. The bael fruit is of considerable medicinal value when it just begins to ripen.

Materials and methods

Carotenoids (mg/ 100gm)

Total carotenoid content was determined by Roy (1973) with some modification. Five gram of sample was crushed in acetone till it become colorless. The extracted solution was poured into separating funnel and petroleum ether was added. The separating funnel was kept undisturbed to separate the formed carotenoid from acetone to petroleum ether layer. After that, colored solution was separated in a 50 ml volumetric flask and sample absorbance was measured at 452 nm in spectrophotometer, using petroleum ether as blank. The results were expressed as mg/100 gm.

$$\text{Total carotenoid (mg/100mg)} = \frac{3.857 \times \text{absorbance} \times \text{volume made up} \times \text{dilution} \times 100}{\text{Weight of sample} \times 100}$$

Total phenol content (mg GAE/100 mg)

Total phenol content of the sample was estimated by using Folin Ciocalteu Reagent (FCR) method and expressed as mg Gallic acid equivalent (GAE) per 100ml. A known volume of 0.2- and 1-ml samples were taken and volume was made up to 3 ml with water and 2.5 ml of 10 per cent v/v folin-ciocalteu reagent was added. After 5min, 2 ml of 20 per cent sodium carbonate was added and incubated the tubes at room temperature for 15 min. The absorbance of the color developed was measured at 765 nm and total phenol content was expressed as mg/100g extract (Madaan *et al.*, 2011).

$$\text{Total phenol (mg GAE/100g)} = \frac{\text{Abs} \times \text{Vol.made up} \times \text{dilution} \times 100}{\text{Aliquot taken} \times \text{sample weight} \times 1000}$$

Total flavonoid content (mg/100)

Total flavonoid content of the sample was estimated by aluminium chloride method using quercetin as standard. Sample of one gram was taken 10 ml of 80% methanol and centrifuged for 10 minutes at 4000 rpm. One mL of supernatant was pipetted out and to which 0.3 mL of sodium chloride (10%) was added after 5 minutes and sodium hydroxide at 2 mL was added after 6 minutes. Then the pink-yellow colour appears and the absorbance of the sample solution was measured at 510 nm by using spectrophotometer and expressed in mg quercetin equivalents (Madaan *et al.*, 2011).

Statistical analysis

The average, mean and standard deviation of basic statistical tools were adopted. The level of significance used in 'F' and 't' test was $p=0.01$. Critical difference values were calculated whenever 'F' test found significant.

Results and discussion

Total phenol content (mg GAE/100g)

The Total phenol content in bael fruit incorporated ice cream premix is represented in Table 1. The observations concerning the phenol content were found significant among the treatments. The mean phenol content is 13.97mg GAE/100g. The significantly highest phenol content was observed in T₄ (15% bael powder+ 44% sugar + 34 % SMP + 0.2% CMC + 0.2% GMS + 0.2% gelatin: 20.90mg GAE/100g). The significantly minimum phenol content was in T₁ (4.87mg GAE/100g). Maximum phenolic content was observed in T₄ (20.90mg GAE/100g), followed by T₃ (16.68mg GAE/100g) and minimum phenolic content was in T₁ (4.87mg QAE/100g). Phenolic content was more in T₄ is due to the increased concentration of bael fruit powder. As bael fruit itself is a good source of phenols. It contains phenolic acids like ellagic acid, gallic acid, chlorogenic acid and ferulic acid (Venthodika *et al.*, 2021). Similar finding was observed in bael pulp residue incorporated goat meat nuggets, as the bael pulp residue increased phenolic content increased from 1171.18 ± 9.96^b to 1437.06 ± 10.48^a $\mu\text{g/g}$ (Das *et al.*, 2015). Teradal *et al.*, 2017 studied the better biochemical outcomes predict a health promoting role of the combination of ingredients that were used in the wholesome grain based functional foods. Harish *et al.*, 2022 study in confirm with results that the total phenol content and per cent antioxidant activity of the cookies was increased with the increasing level of incorporation of pomegranate seed powder.

Total flavonoid content (mg/100mg)

The data in the Table 1 reproduces the flavonoid content in bael fruit powder incorporated ice cream premix. The observations concerning the flavonoid content were found significant among the treatments. A significantly maximum flavonoid is noticed in T₄ (15% bael powder+ 44% sugar + 34 % SMP + 0.2% CMC + 0.2% GMS + 0.2% gelatin: 2.82mg/100mg). The significantly minimum flavonoid content was observed in T₁ (0.14mg/100mg). Flavonoid content of bael fruit incorporated into ice cream premix ranged from 0.14 to 2.82mg/100g. Among the various treatment combinations, T₄ (2.82mg/100g) recorded the highest total flavonoid content. This may be due to the presence of higher concentration of bael powder in ice cream premix. As bael contains flavonoids like kaempferol, protocatechuic acid and quercetin and also contains flavone glycosides, rutin, flavan-3-ols and flavone. The presence of these compounds has increased the total flavonoid content. The outcomes are in harmonious with the Chandrashekar *et al.* (2020) study on bael fruit herbal tea, which had total flavonoid content of 73.0 ± 2.4 $\mu\text{mol CE/g}$ in bael fruit incorporated herbal tea powder.

Table 1: Effect of bael powder fruit incorporation on total phenol, flavonoid content of ice cream premix

Treatments	Total phenol content (mg GAE/ 100g)	Total flavonoid content (mg/100g)
T ₁ : 59% sugar + 34 % SMP (Control)	4.87 ^c	0.14 ^d
T ₂ : 5% Bael fruit powder + 54% sugar + 34% SMP	13.45 ^b	2.34 ^c
T ₃ : 10% Bael fruit powder + 49% sugar + 34% SMP	16.68 ^b	2.54 ^b
T ₄ : 15% Bael fruit powder + 44% sugar + 34% SMP	20.90 ^a	2.82 ^a
Mean	13.97	1.96
S.Em±	0.97	0.05
CD at 1%	4.03	0.20

Carotenoids (mg/100gm)

Table 2 depicts the carotenoids of bael fruit incorporated ice cream premix. The mean value for carotenoids was 3.51mg/g. The significantly maximum carotenoid in premix were observed in T₄ (15% bael powder+ 44% sugar + 34 % SMP + 0.2% CMC + 0.2% GMS + 0.2% gelatin: 5.32mg/g) which was at par with T₃ (4.55mg/g). Statistically, the significant minimum carotenoids in ice cream premix were seen in T₁ (1.23mg/g).

Table 2: Effect of bael powder fruit incorporation on Carotenoids of ice cream premix

Treatments	Carotenoids (mg/g)
T ₁ : 59% sugar + 34 % SMP (Control)	1.23 ^c
T ₂ : 5% Bael fruit powder + 54% sugar + 34% SMP	2.93 ^b
T ₃ : 10% Bael fruit powder + 49% sugar + 34% SMP	4.55 ^a
T ₄ : 15% Bael fruit powder + 44% sugar + 34% SMP	5.32 ^a
Mean	3.51
S.Em±	0.26
CD at 1%	1.06

Carotenoid present in ice cream premix is ranged from 1.23 to 5.32mg/g. The maximum carotenoid content is present in T₄ (5.32mg/g) which is on par with T₃ (4.55mg/g) and minimum content of carotenoids is present in T₁ (1.23mg/g). The increasing trend in the carotenoids content in ice cream premix was observed. This might due the presence of carotenoid pigment present in bael fruit. These results are in parallel with the findings of Kaur and Kochhar, (2017), they found significant increase in carotenoids content in bael powder incorporated bakery products. Teradal., 2017 quoted that the green leafy vegetables are store house of vitamins such as beta-carotene, ascorbic acid, folic acid and riboflavin as well as minerals such as iron calcium and phosphorus. They also contain immense variety of bioactive non-nutritive.

Conclusion

The higher concentration of phenols (20.90mg GAE/100g), flavonoid content (2.82mg/100g) and carotenoids (5.32mg/g) was in treatment T₄. The incorporation of bael fruit powder up to 15 per cent was found to have superior phytochemicals in the developed ice cream premix.

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