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NUTRITIONAL COMPOSITION OF DEANNA FIG VARIETY: A COMPARATIVE STUDY WITH SELECTED INTERNATIONAL FIG CULTIVARS

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ABSTRACT

Figs (*Ficus carica* L.) are esteemed for their rich nutritional composition and functional properties. Despite its commercial cultivation, the Deanna fig cultivar remains underexplored in the context of Indian agro-climatic conditions, particularly in Andhra Pradesh. This study evaluates the physico-chemical and biochemical characteristics of the Deanna fig grown in geographical location of Anantapuramu district of Andhra Pradesh and compares its nutritional profile with that of other prominent domestic and international cultivars, including Timla, Sultani, El-Abbody, Brown Turkey, Poona Fig, Black Mission, Afghan, Dinkar and Excel. The physical parameters (fruit weight and size), chemical traits (total soluble solids, pH, titratable acidity, and sugar content) and biochemical properties (total phenolics, flavonoids, ascorbic acid, and antioxidant activity measured via the DPPH assay) were assessed. The Deanna fig demonstrated favourable attributes, including a high fruit weight (60.43 ± 0.35 g), elevated TSS (22.28 ± 0.20°Brix) and strong antioxidant activity (78.75 ± 0.59% DPPH inhibition), along with a notable phenolic content (102.49 ± 0.36mg GAE/100 g FW). Comparative analysis revealed that the Deanna cultivar was superior or on par with many globally recognized varieties, with regional variations emphasizing the influence of agro-climatic conditions on phytochemical profiles. These findings suggest that the Deanna fig grown under the subtropical climate of Andhra Pradesh possesses a robust nutritional and functional profile, making it highly suitable for fresh consumption, processing and potential use in nutraceutical applications.

***Keywords*:** Physical properties**,** vitamins, sugars, phenols, flavonoids, antioxidant activity, tannins, biochemical composition, fig cultivars.

Introduction

The fig (*Ficus carica* L.), a member of the Moraceae family, is one of the earliest domesticated fruit crops and holds a place of prominence in both historical and contemporary agriculture. The Moraceae family comprises over 1,400 species across 40 genera, with nearly 700 species under the Ficus genus alone, underscoring its extensive botanical diversity and it is known by different names across the globe 'Anjir' in Asia, 'Figue' in French, 'Higo' in Spanish and 'Feige' in German the fig carries immense cultural and nutritional relevance (Mardoume *et al.*, 2025). Traditionally believed to have originated in Southern Arabia (Stover *et al.*, 2007), where early parthenocarpic forms thrived in oasis ecosystems, recent archaeo botanical findings point to a polycentric domestication process involving regions like the

Arabian Peninsula, Western Anatolia and the Caspian basin (Langgut, 2024 and Langgut and Garfinkel, 2022). Today, fig cultivation is concentrated in tropical and subtropical regions, particularly within the Mediterranean basin. Turkey remains the leading global producer, accounting for approximately 25% of the world's total production, followed by Egypt, Morocco, Algeria and other countries including the United States, Tunisia, Afghanistan, Brazil, Greece, China, India and Japan. The global fig orchards spread over 2,81,000 ha with an annual production of approximately 1.26 million tonnes (Ramadan, 2023).

In India, according to Food and Agriculture Organization of the United States during the year 2022 the fig cultivation extends over 5,931 ha, producing around 14,874 tonnes, with key production areas in Maharashtra (Pune), Karnataka (Ballari, Chitradurga, Srirangapatnam), Gujarat, Tamil Nadu (Coimbatore) and Uttar Pradesh (Anonymous, 2022). Ballari district leads in terms of cultivation area (1,800 ha) and yield (14,087.83 MT) (Huchchannanavar *et al*., 2023), with emerging potential observed in Northern states like Uttar Pradesh, Uttarakhand, Himachal Pradesh and Punjab (Sharma and Badiyala, 2006). The fig can adapt to varied climatic conditions, from Mediterranean climates with hot, dry summers to tropical and sub-tropical regions up to 1,700m elevation, contributes to its wide cultivation. Cultivar selection is largely determined by resilience to local conditions and end use suitability. The Deanna variety is especially valued for its large, golden yellow fruits with high total soluble solids (21.2 °Brix) and strong adaptability, which makes it well suited for both fresh consumption and drying (Gawade and Waskar, 2005 and Huchchannanavar *et al*., 2023).

Nutritionally, figs are rich in calcium, potassium, iron, magnesium, vitamins (thiamine, riboflavin and vitamin C), polyphenols, amino acids, dietary fiber and antioxidants. Figs stand out with a nutritive value index (11) surpasses that of apples (9) and raisins (6) (Sarkhosh *et al*., 2022). While fresh figs provide around 74 kcal/100 g, dried figs offer 249 kcal/100 g due to moisture loss and exhibit enhanced mineral content (Mahmoudi *et al*., 2018). Fresh figs retain higher vitamin-C and β-carotene levels. Medicinally, figs have been used for treating digestive, dermatological and inflammatory conditions, with cultivars like Deanna and Brown Turkiye gaining recognition for their nutrient density and stress tolerance.

Due to their climacteric and highly perishable nature, figs have a shelf life of just 1- 2 days under ambient conditions. Postharvest interventions such as cold storage and modified atmosphere packaging can extend shelf life up to four weeks. Drying remains the most widely adopted preservation method for figs, reducing moisture content to 20% through sulphur fumigation and controlled dehydration (Jokic *et al*., 2014). Cultivars like Deanna, Dinkar and Kadota are particularly suitable for drying due to their high TSS and firm texture. In contrast, Brown Turkey, Poona and Black Mission are preferred for fresh consumption (Pereira *et al*., 2020).

Recent studies indicates that fig-based products derived from Deanna figs retain higher fiber and fat content, while those from Ballari figs show elevated protein and mineral profiles. Dehydration significantly alters moisture content, sugar levels and antioxidant properties (Boukhalfa *et al*., 2025). For value-added processing such as jams, pastes and confections, cultivars like Conadria and Celeste show desirable characteristics (Andreou *et al*., 2021). Varieties including Black Mission, Adriatic and Brown Turkey are rich in phenolics and flavonoids, which makes them valuable for nutraceutical applications. Despite this growing body of research, limited scientific information exists on the nutritional and functional profile of Deanna figs cultivated in semi-arid regions of India, particularly Andhra Pradesh.

Hence, this study aims to investigate the nutritional and functional profile of the Deanna fig cultivar cultivated in the semi-arid regions of Andhra Pradesh. By evaluating its physico-chemical and biochemical attributes and comparing them with national and international cultivars.

Materials and Methods

Sample collection

Matured fresh fig fruits (*Ficus carica* L.) of Deanna variety were collected from well-maintained orchards located in Anantapuram district of Andhra Pradesh during the peak harvest season (April, 2025). Fruits were harvested at commercial maturity stage, determined based on external colour change (green to lemon yellow) and fruit size (60-65g average weight) ensuring uniformity across samples. Fruits were randomly collected from 10 trees (3 fruits per tree), resulting in a total of 30 fruits and each fruit was analyzed in triplicate to ensure accuracy and reproducibility. Randomization was followed during fruit selection to minimize positional bias across trees and orchard blocks. Immediately after harvest, fruits were washed under running tap water to remove surface contaminants, allowed to air dry and the peduncles were removed. The fruits were then stored at 10 ± 2 ºC until further analysis.

Measurement of fruit physical properties

The physical properties of fruits such as individual fruit weight, length and diameter were recorded using digital weighing balance (Citizen CY2202, India) with a readability of 0.01 g and digital Vernier caliper (Mitutoyo CD-6 CS, Japan) with an accuracy of ±0.01 mm, respectively**.**

Moisture content (%)

Fresh fruits were washed under running tap water, surface moisture was removed using clean blotting paper and the samples were cut into small pieces to ensure uniform drying. Approximately 5.00 ± 0.01 g of homogenized sample was accurately weighed using an analytical balance (±0.001 g) and transferred into pre-dried, pre-weighed moisture dishes. The dishes containing the samples were placed in a laboratory hot air oven (Memmert UN110, Memmert GmbH, Germany) and dried at 105 ± 2 °C until a constant weight was obtained (approximately 12–16 h) (AOAC, 2000). After drying, the dishes were removed from the oven and immediately placed in a desiccators containing silica gel and cooled to room temperature, thereby preventing moisture absorption from the ambient environment. The samples were then weighed and the moisture content was calculated on a fresh weight basis using the equation (1)

$$\text{Moisture content (\%)} = \frac{\text{Sample weight before drying (g)} - \text{Sample weight after drying (g)}}{\text{Sample weight before drying (g)}} \times 100 \quad (1)$$

Total Soluble Solids (TSS)

Total Soluble Solids (TSS) of fresh fig samples were determined using a handheld digital refractometer (ATAGO PAL-1, Atago Co. Ltd., Tokyo, Japan). The refractometer was calibrated with distilled water before usage to ensure measurement accuracy. Fresh fruits were cut open and the pulp was carefully scooped out and homogenized using a clean mortar and pestle to obtain a uniform juice. A few drops of the homogenized juice were placed on the prism surface of the refractometer and the reading was recorded once it stabilized and expressed in °Brix.

pH

The pH of fresh fig fruit was measured using digital pH meter (HANNA Instruments, Romania). Approximately 10 g of fresh fig pulp was homogenized with 50 ml of distilled water using a highspeed homogenizer. The homogenate was filtered through Whatman No. 1 filter paper to obtain a clear extract. The pH of the filtrate was recorded directly after calibrating the instrument with standard buffer solutions of pH 4.0 and 7.0 at room temperature (25±2 °C) (Boukhalfa *et al*., 2025).

Titratable acidity (%)

The pulp was extracted from fruit and homogenized using a mortar and pestle to obtain a uniform paste. An aliquot of 10 g of the homogenized pulp was diluted with 90 mL of distilled water in a 250 ml beaker and mixed thoroughly to prepare the extract. A 10 ml portion of this extract was transferred into a clean conical flask, and 2–3 drops of phenolphthalein indicator (0.5% in ethanol) were added. The sample was titrated against standardized 0.1 N sodium hydroxide (NaOH) solution until a faint pink end point persisted (AOAC, 1995). The titration volume was recorded and titratable acidity (TA) was calculated and expressed as % citric acid equivalents using the following equation.

$$\text{Titratable acidity (\%)} = \frac{\text{Titer value} \times \text{Normality of NaOH} \times \text{Eq. wt.of citric acid} \times 100}{\text{Sample weight (g F.W.)} \times 1000} \quad (2)$$

Total sugars (g/100 g F.W)

One gram of homogenized fig pulp was placed in a 100 ml conical flask and hydrolyzed with 10 ml of 2.5 N HCl in a boiling water bath (95 ± 2 °C) for 2–3 h. After cooling, the mixture was neutralized by gradual addition of solid Na_2CO_3 until effervescence ceased and the pH approached neutrality. The volume was adjusted to 100 ml with distilled water. From this solution, 0.5 ml of the extract was mixed with 4 ml of freshly prepared Anthrone reagent (0.2% in concentrated H_2SO_4) in a test tube. The mixture was vortexed, heated at 60 °C for 10 minutes and then cooled to room temperature. Absorbance was measured at 630 nm against a reagent blank using a UV-VIS spectrophotometer (Hedge *et al*., 1962). Sugar concentration was calculated from a glucose standard curve and expressed as percentage on a fresh weight basis.

Reducing sugars (g/100g F.W)

One gram of fresh fig pulp was accurately weighed and homogenized in 10 ml of distilled water to ensure complete extraction of soluble sugars. The homogenate was centrifuged at 2,700 rpm for 10 minutes and the clear supernatant was collected. An aliquot of 1 ml of the supernatant was mixed with 2 ml of freshly prepared 3,5-dinitrosalicylic acid (DNS) reagent in a test tube and heated in a water bath at 85 °C for 5 minutes to develop the characteristic reddish-brown colour. After cooling to room temperature, the absorbance was measured at 510 nm using a UV-VIS spectrophotometer (Teixeira *et al*., 201). The

concentration of reducing sugars was determined from standard calibration curve prepared using analytical grade glucose and expressed as a percentage of fresh weight.

Non-reducing sugars (g/100g F.W)

Non-reducing sugar content was determined by subtracting the reducing sugar value from the total sugar value and the result was expressed as a percentage of fresh weight (Ranganna, 1986).

Ascorbic acid (mg/100g F.W.)

Ascorbic acid content in fresh fig pulp was quantified using the titrimetric method described in the AOAC Official Method 967.21 (AOAC, 1995), which employs 2,6-dichlorophenolindophenol (DCPIP) dye as the titrant. For standardization, 5 ml of a known ascorbic acid solution was mixed with 5 ml of 3% metaphosphoric acid and titrated with DCPIP dye until a light pink colour persisted for 15 seconds.

$$\text{Dye factor} = \frac{0.5}{\text{Titer value (ml)}} \qquad (3)$$

Where, 0.5 mg represents the mass of ascorbic acid in the standard aliquot used.

The dye factor was calculated based on the volume consumed. For sample analysis, 10 g of fig pulp was homogenized with 3% (w/v) metaphosphoric acid and diluted to 100 ml. The filtrate obtained was titrated against the standardized dye and the ascorbic acid content was calculated using the Equation (4) (Nielsen, 2017).

$$\text{Ascorbic acid}\left(\frac{\text{mg}}{100\text{ g}}\right) = \frac{\text{Titer value x Dye factor Volume made up}\times 100}{\text{Sample weight (g)}\times\text{Aliquot taken (ml)}} \qquad (4)$$

Antioxidant properties (% of DPPH activity)

Fresh fig pulp (10 g) was homogenized with 40 ml of 80% methanol using a chilled pestle and mortar. The homogenate was transferred into a conical flask, sealed, and agitated on a rotary shaker at 150 rpm for 30 minutes at room temperature. The extract was centrifuged at 4,000 rpm for 10 minutes, and the supernatant was collected. The residue was re-extracted twice under identical conditions to ensure maximum recovery of antioxidants. All supernatants were pooled and made up to a final volume of 50 ml with 80% methanol, yielding an extract concentration equivalent to 0.2 g fresh weight per ml. An aliquot of 1 ml of each dilution was mixed with 3 ml of 0.1 mM DPPH solution prepared in methanol. The reaction mixtures were incubated in the dark at room temperature for 30 minutes to prevent light-induced degradation. Absorbance was measured at 517 nm using a UV–VIS spectrophotometer with a 1 cm pathlength cuvette, and 80% methanol was used as the blank (Brand-Williams *et al*., 1995; Tikent *et al*., 2023). This assay provides a reliable estimate of the hydrogen-donating capacity of phenolic compounds.

$$\%\text{DPPH Inhibition} = \frac{(A_0 - A_3)\times 100}{A_0} \qquad (5)$$

Where, A_o is Absorbance of control sample and A_s is absorbance of fruit sample.

Total phenolic content (mg GAE/100 g F.W.)

Approximately 1 g of freshly homogenized fig pulp was extracted with 10 ml of 80% ethanol (solid-to-solvent ratio 1:10, w/v) to efficiently dissolve phenolic compounds. The extraction was carried out at room temperature (25 ± 2 °C) for 30 minutes, followed by centrifugation at 4,000 rpm for 10 minutes to clarify the extract. The resulting clear supernatant was used as the working solution. A 1 ml aliquot of the extract was mixed with 5 ml of Folin–Ciocalteu reagent (previously diluted tenfold with distilled water) and 4 ml of 7.5% sodium carbonate solution. The mixture was incubated in the dark at room temperature for 30 minutes to allow complete colour development. Absorbance was measured at 760 nm using a UV–VIS spectrophotometer (Ignat *et al*., 2011 and Rani *et al*., 2024). Gallic acid was used as the calibration standard (R^2 > 0.99), and the total phenolic content was expressed as milligrams of gallic acid equivalents (GAE) per 100 g fresh weight (FW).

$$\text{TPC}\left(\text{mg}\frac{\text{GAE}}{100\text{g}}\right) = \frac{\text{Absorbance of sample x Dilution factor}}{\text{Slope of the standard curve}} \qquad (6)$$

Total flavonoids (mg QE /100 g F.W.)

Approximately 1 g of freshly homogenized fig pulp was extracted with 10 mL of 80% ethanol (solid-to-solvent ratio of 1:10, w/v) to efficiently solubilize flavonoid compounds. The mixture was vortexed and kept at room temperature (25 ± 2°C) for 30 minutes to ensure adequate extraction, followed by centrifugation at 4,000 rpm for 10 minutes. The clear supernatant obtained was used as the working extract. For the assay, 0.5 ml of the extract was mixed with 0.3 ml of 5% sodium nitrite solution and allowed to react for 3 minutes. Subsequently, 0.3 ml of 10% aluminium chloride solution was added, and the mixture was incubated for 5 minutes to promote complex formation. Thereafter, 2 ml of 1 M sodium hydroxide was added and the final volume was adjusted to 10 mL with distilled water. The absorbance was recorded at 415 nm using a UV-VIS spectrophotometer (Shimadzu, Japan). Flavonoid content was quantified from a

quercetin standard calibration curve (R^2 = 0.998) and expressed as milligrams of quercetin equivalents (QE) per 100 g fresh weight (FW) of fig pulp (Shraim *et al*., 2021).

Total tannins (mg CE/g F.W.)

The extract was prepared by weighing 5 g of fresh fig pulp was homogenised with 25 ml of 80% aqueous methanol using a chilled pestle and mortar. The homogenate was transferred to a conical flask, sealed and kept on a shaker at room temperature (25 ± 2 °C) for 2 h to ensure complete release of phenolic compounds. The mixture was then centrifuged at 5000 rpm for 10 min and the supernatant was collected as the working extract. From this extract, 0.5 ml was taken into a test tube and mixed with 0.5 ml of Folin-Denis reagent followed by 1 ml of sodium carbonate solution (35%). The reaction mixture was allowed to stand at room temperature for 30 min for colour development. Absorbance was measured at 700 nm using a UV-VIS spectrophotometer. Results were expressed as mg tannic acid equivalents (TAE) per g fresh weight based on a calibration curve prepared with standard tannic acid solutions (Sadasivam, 1996)

Results and Discussions

Fruit weight and morphology

The Deanna fig cultivar grown under the tropical region of Andhra Pradesh exhibited an average fruit weight of 60.43 ± 0.35g (Table 1), aligning closely with values reported by previous studies on fig variety from Turkyei and California which varied between 43.50-70 g (Calıskan and Polat, 2011 and Hiwale *et al*., 2015) (Table 2). This weight also compared with the Indian national average (46.60 g) (Rani *et al*., 2024), indicating that the local environmental conditions of Andhra Pradesh may enhance the phenotypic expression of fruit size in the Deanna cultivar. On the other hand, the fruit weight recorded in this study was significantly greater than that of several established Indian varieties, such as Poona (24.60 g), Dinkar (25.76 g) and Excel (24.72 g), as well as international cultivars including Afghan (41.35 g) and Conadria (38.76 g) (Gawade and Waskar, 2005 and Solomon *et al*., 2006). On the other hand, the weight was lower when it is compared with certain varieties such as Sultani (71.31 g) and El-Abbody (74.14 g) from Egypt (Abou-Farrag *et al*., 2013) and Timla (69.00 g) from India (Pandidurai *et al*., 2021) (Table 3). The substantial fruit weight of the Deanna cultivar from Andhra Pradesh not only places it in a competitive bracket among global fig varieties but also enhances its suitability for fresh consumption and high-end retail markets, where parameters such as fruit size, visual appeal and pulp yield are paramount quality indicators. These findings suggest a positive genotype and environment interaction favourable for producing export grade fig fruit under Andhra Pradesh subtropical conditions.

Skin and pulp colour

The Deanna fig cultivar is distinguished by its visually skin colour appears like golden-yellow to lemon-yellow and creamy white pulp, features that mostly contrast with the darker pigmentation observed in several domestic and international cultivars. Such as, Black Mission exhibits a deep purple to black epidermis with creamy pink pulp, while Brown Turkey presents a dark purple-brown skin enveloping pinkish-red flesh (Rani *et al*., 2024). El-Abbody is noted for its nearly black exterior and dark red pulp, whereas Sultani displays a deep purple-brown skin with bright red pulp (Abou-Farrag *et al*., 2013). Among Indian varieties, Timla features a pinkish-red pulp, Dinkar possesses a creamy flesh tinged with dark red and Poona fig offers a rosy pink interior (Gawade and Waskar, 2005). In contrast, cultivars such as Conadria and Excel exhibit greenish to greenish-yellow skins, with Conadria displaying dark pink pulp and Excel showing comparatively lighter tones.

The pale skin and pulp coloration of the Deanna fig are largely attributed to its comparatively lower accumulation of anthocyanins and flavonoid pigments synthesized via the phenylpropanoid pathway (Veberic *et al*., 2008). This gives the fruit a light golden colour, mild taste and lower astringency, which differentiates it from the darker tones of many common fig cultivars. Its lighter pigmentation also helps reduce darkening during drying, improving visual quality and facilitating accurate grading (Gawade and Waskar, 2005 and Solomon *et al*., 2006). Deanna also preserves favourable post-drying traits, including firm texture, a balanced sugar-acid ratio, high TSS and adequate moisture content (Bharat and Dhumal Nilesh, 2016), allowing it to dry efficiently while maintaining quality. While darker cultivars are often preferred in conventional markets for their robust hue and intense flavour, Deanna is better suited for premium and health driven markets, where consumers favour its bright appearance and refined flavour. The colour characteristics of fruit and pulp of different verities of fig fruits are depicted in Figure 1.

Fig. 1 : The fruit and pulp colour of various cultivars of fig fruit

Total Soluble Solids (°Brix)

The total soluble solids (TSS) of Deanna fig cultivar grown in subtropical region of Andhra Pradesh was 22.28 ± 0.20 °Brix, indicating a high level of sugar accumulation (Table 1). When it is compared with Deanna variety grown under other climatic zones of India was slightly higher i.e. 21.20 °Brix (Hiwale, 2015) (Table 2), while Deanna fruits cultivated under different agro-climatic conditions of other countries have shown a wider range of TSS i.e. 18.20 to 25.00 °Brix (Calışkan and Polat, 2011). When compared with other fig cultivars, the TSS of Deanna in this study was higher than the El-Abbody (16.7 ± 0.3 °Brix), Timla (19.0 °Brix), Poona Fig (19.34 °Brix) and the widely cultivated Black Mission, which typically ranges between 18-21 °Brix (Solomon *et al.*, 2006). Other varieties such as Afghan (16.3 °Brix) and Excel (16.48 °Brix) also demonstrated lower TSS levels, while Conadria exhibited a slightly closer value (20.15 °Brix) (Table 3). The high TSS content in Deanna reflects favourable sugar metabolism, enhancing its sweetness and overall organoleptic profile. Elevated TSS levels also contributes significantly to dried fig quality by improving taste, reducing water activity and facilitate the extending of shelf-life (Gawade and Waskar, 2005).

pH

pH of the Deanna fig cultivar cultivated under the sub-tropical region of Andhra Pradesh was 5.58 ± 0.05 (Table 1), indicating a moderately low acidity. Deanna figs cultivated in other parts of India have reported an average pH of 5.40 (Table 2), while studies from other geographical locations of other countries reported mean values of 5.25. When compared with other fig cultivars, the pH was higher than that of Timla (5.10), Sultani (5.28) and El-Abbody (5.42) (Pandidurai *et al.*, 2021 and Abou-Farrag *et al.*, 2013) (Table 3), suggesting a less acidic and potentially more palatable sensory profile for fresh consumption. The high pH value of Deanna fig cultivated in Andhra Pradesh may be attributed to local environmental variables such as soil composition, irrigation practices and microclimatic conditions. As previously emphasized by Pereira *et al.* (2020), fig pH is highly responsive to external agronomic and ecological factors, underscoring the cultivars physiological adaptability across diverse growing regions. From a postharvest perspective, a near-neutral pH exceeding 5.0 confers advantages in microbial stability and shelf-life extension, especially for drying and processing applications. Fruits with higher pH values tend to exhibit reduced sourness, decreasing the need for acid correction during processing such pH conditions make Deanna particularly suitable for incorporation into acid sensitive matrices, such as dairy based products, confectionery and bakery formulations, in which pH stability plays a critical role in maintaining product integrity (Gawade and Waskar, 2005 and Solomon *et al.*, 2006).

Titratable acidity (%)

The titratable acidity of the Deanna fig cultivated in Andhra Pradesh was 0.279 ± 0.003% (Table 1),

which is higher than values reported for the same cultivar grown in other regions of India, averaging 0.16% (Swetha *et al*., 2022). In comparison, Deanna figs from geographical locations of other countries exhibited a moderate acidity level of 0.21% (Pereira *et al*., 2020) (Table 2). When compared with other cultivars, the Deanna cultivated in Andhra Pradesh showed notably higher acidity than Sultani (0.21%), El-Abbody (0.14%) and Brown Turkey (0.24%) (Abou-Farrag *et al*., 2013 and Rani *et al*., 2024). This variation was might be due to the influence of environmental factors such as soil composition, irrigation and ripening stage on organic acid accumulation in figs (Chessa *et al*., 2021).

At the same time, the pH of the Deanna fig from Andhra Pradesh was slightly higher than values reported for Timla (5.10), Sultani (5.28), and El-Abbody (5.42), indicating a comparatively lower buffering capacity and reduced sournes (Pandidurai *et al*., 2021 and Abou-Farrag *et al*., 2013). This relatively higher pH, in tandem with elevated total soluble solids (22.30 °Brix) (Table 3), suggests an optimal sugar to acid ratio that enhances the sweetness perception while retaining desirable acidity to balance flavour complexity and freshness (Chessa *et al*., 2021). In addition, the slightly acidic profile may contribute to microbial stability and shelf life during postharvest storage and transportation. From a processing perspective, such sugar-acid harmony is particularly advantageous in confectionery, bakery and dairy based formulations, where controlled acidity enhances product compatibility and sensory stability (Gawade and Waskar, 2005; Pereira *et al*., 2020).

Ascorbic acid (mg)

The ascorbic acid content of Deanna fig grown under sub-tropical region of Andhra Pradesh was 15.97±0.02 mg/100 g F.W (Table 1). In comparison, Deanna figs grown in other regions of India and other geographical locations reported significantly lower ascorbic acid levels with an average value of 1.85 mg/100 g F.W (Hiwale *et al*., 2015; Pereira *et al*., 2020) (Table 2). This implies the local environment including temperature, sunlight intensity and soil composition to favours the biosynthesis and retention of this vital antioxidant.

Similarly, the ascorbic acid content of Deanna variety grown in Andhra Pradesh was higher when compared with other cultivars such as El-Abbody (2.44 mg/100 g F.W), Sultani (6.71 mg/100 g F.W) and Black Mission (3.25 mg/100 g F.W), while exhibiting comparable values to Brown Turkey (13.71 mg/100 g F.W) and exceeding the Afghan variety (11.53-12.95 mg/100 g F.W) (Abou-Farrag *et al*., 2013; Alzahrani *et al*., 2024). Despite being lower than Timla (39.00 mg/100 g F.W) it is one of the highest ascorbic acid concentrations among Indian fig cultivars (Pandidurai *et al*., 2021) (Table 3). The Andhra Pradesh Deanna demonstrates a balanced combination of high vitamin-C content and favourable sensory properties. This enhanced ascorbic acid profile not only enriches the fruits nutritional value as a potent antioxidant and enzymatic cofactor but also contributes to postharvest stability by delaying oxidative degradation and enzymatic browning (Solomon *et al*., 2006; Veberic *et al*., 2008). These traits make the Deanna fig particularly suitable for fresh consumption and value-added processing and there by benefitting both consumer health and industrial applications (Wang *et al*., 2023 and Bhatt *et al*., 2024).

Reducing, non-reducing and total sugars (%)

The Deanna fig cultivated sub-tropical region of Andhra Pradesh exhibited a total sugar, reducing sugars and non-reducing sugars of 19.18 ± 0.11 g/100 g F.W, 17.19 ± 0.07 g/100 g F.W and 1.98 ± 0.01 g/100 g F.W, respectively (Table 1), emphasizing its rich sweetness and predominance of readily metabolizable sugars. The Deanna figs grown in other parts of India have shown similar sugar profiles, with total sugars at 19.04 g/100 g F.W, reducing sugars 17.43 g/100 g F.W and non-reducing sugars 1.79 g/100 g F.W, indicating consistent biochemical traits across domestic cultivation sites (Table 2) (Swetha *et al*., 2022). In contrast, Deanna figs cultivated under other geographical conditions exhibited slightly variable sugar levels, with total sugars ranging from 17.85 g to 25.00 g/100 g F.W, reducing sugars at 16.33 g/100 g F.W and non-reducing sugars around 1.52 g/100 g F.W (Naikwadi *et al*., 2010) reflecting the influence of diverse climatic and soil conditions on carbohydrate metabolism (Table 2). When compared with other fig cultivars, the Deanna variety grown under subtropical region of Andhra Pradesh exhibited higher total sugars than Indian varieties such as Timla (18.04 g/100 g F.W) and Poona Fig (16.01 g/100 g F.W), while being comparable to international cultivars like Black Mission (20.10 g/100 g F.W) and Conadria (17.74 g/100 g F.W) (Pandidurai *et al*., 2021; Gawade and Waskar, 2005; Pereira *et al*., 2020) (Table 3). The predominance of reducing sugars in Deanna suggests a highly active sucrolytic enzyme system, which is advantageous for fresh consumption due to enhanced sweetness and palatability, as well as for drying applications. In dried figs, these sugars contribute to Maillard browning reactions, which intensify flavour, aroma and colour development, while enhancing the

desirable texture and visual appeal of processed products (Del Caro and Piga, 2008; Veberic *et al*., 2008).

Antioxidant activity property (% of DPPH activity)

The Deanna fig cultivar cultivated in Andhra Pradesh demonstrates exceptional antioxidant potential, with a DPPH radical scavenging activity of 78.75 ± 0.59% inhibition (Table 1), indicating a robust ability to neutralize free radicals. This elevated activity suggests that the local agro climatic conditions promote enhanced biosynthesis and retention of bioactive secondary metabolites such as phenolics and flavonoids. In comparison with Indian grown Deanna figs from other regions showed slightly lower DPPH scavenging activity (68% inhibition) (Rani *et al*., 2024) (Table 2). This variation is due to the variation in environmental factors, such as temperature, sunlight and soil composition. Although specific Ferric Reducing Antioxidant Power (FRAP) data for Deanna are unavailable, figs from the Eastern Black Sea region have shown FRAP values ranging from 151.98 to 372.97 µmol Fe^{2+} /100 g fresh weight. When compared with other fig cultivars, the Andhra Pradesh Deanna exhibits higher antioxidant potential relative to Sultani (20-22% inhibition), El-Abbody (12-14%) and Brown Turkey (50.4%) (Abou-Farrag *et al*., 2013). Although Black Mission figs show higher antioxidant capacity (716.30 ± 52.60µmol TE/100 g) using the FRAP assay (Pereira *et al*., 2020) (Table 3), differences in assay methodology prevent direct comparison. Taken together, the DPPH based results confirm Deanna's strong radical scavenging efficiency, emphasizing its value for functional food applications and health-based product development aimed at mitigating oxidative stress.

Total phenols (mg GAE/100 g)

The total phenolics content of Deanna fig variety cultivated under agro climatic conditions of Andhra Pradesh (102.49 ± 0.36 mg GAE/100 g F.W) (Table 1) was lower than the cultivated in other parts of India (108.75 mg GAE/100 g F.W) and other countries (128.75 mg GAE/100 g F.W) (Table 2), it is due to the change in environmental conditions such as soil composition, sunlight exposure and temperature influence phenolic accumulation even within the same cultivar. When compared with other fig cultivars, the Andhra Pradesh Deanna exhibited higher TPC than El-Abbody (59 mg GAE/100 g F.W) and Sultani (82 mg GAE/100 g F.W) (Abou-Farrag *et al*., 2013), indicating its high antioxidant potential relative to these genotypes and however, darker pigmented varieties such as Brown Turkey (172.00 mg GAE/100 g F.W), Black Mission (281.10 mg GAE/100 g F.W) and Afghan (130.75 mg GAE/100 g F.W) (Table 3) demonstrated higher TPC, likely due to increased anthocyanin and polyphenol accumulation associated with deeper pigmentation (Pereira *et al*., 2020). Despite this, the phenolic profile of the Deanna fig from Andhra Pradesh remains favourable, supporting its classification as a functional fruit with significant health promoting potential. Combined with its high Total Soluble Solids (TSS) and balanced acidity, this cultivar is well suited for fresh consumption as well as value added processing, particularly in products targeting antioxidant enrichment and chronic disease mitigation (Kelliyara and Dhanya, 2003 and Maurya *et al*., 2021)

Total flavonoids (mg QE/100 g)

The Deanna fig cultivated in sub-tropical region of Andhra Pradesh exhibited a total flavonoid content (TFC) of 24.29 ± 0.21 mg QE/100 g F.W (Table 1), indicating a relatively high concentration when compared with Deanna figs grown in other regions geographical locations of India (11.25 mg QE/100 g F.W) (Pereira *et al*., 2020; Chessa *et al*., 2021) (Table 2). This high concentration of TFC suggests that the specific agro-climatic conditions of Andhra Pradesh, including high solar radiation, wide diurnal temperature variations and unique soil characteristics, may enhance flavonoid biosynthesis through upregulation of the phenylpropanoid pathway. Similarly, when compared with other fig cultivars, the Andhra Pradesh "Deanna" exhibited higher flavonoid levels than Brown Turkey (16.25 mg QE/100 g F.W), Black Mission (21.50 mg QE/100 g F.W) and Afghan (12.33 mg QE/100 g F.W) (Rani *et al*., 2024; Solomon *et al*., 2006; Abou-Farrag *et al*., 2013) (Table 3). Flavonoids are well recognized for their antioxidant, metal chelating and anti-inflammatory properties, contributing both to plant defence mechanisms and human health benefits (Basu *et al*., 2010 and Solomon *et al*., 2006).

Tannins (mg CE/g)

The tannins content of Deanna fig from Andhra Pradesh exhibited (1.94 ± 0.001 mg CE/g F.W) (Table 1) was lower than the Deanna figs grown in other regions of India (3.29 mg CE/g F.W) (Table 2) due to the variation in soil properties, environmental properties and agronomical practices. This lower tannin concentration contributed to a more favourable taste profile, characterized by reduced astringency and bitterness, which enhanced the sensory appeal for fresh consumption. When comparing with other fig cultivars, the Andhra Pradesh Deanna recorded lower tannin

content than Dinkar (6.55 mg CE/g F.W), Afghan (4.80 mg CE/g F.W) and Brown Turkey (4.61 mg CE/g F.W) (Rani *et al*., 2024; Gawade and Waskar, 2005) (Table 3), this implies its milder astringency relative to these varieties.

The relatively low tannin content observed in the locally cultivated Deanna suggests a more favourable taste profile, marked by reduced astringency and bitterness key traits enhancing its sensory appeal for fresh consumption. While tannins contribute valuable antioxidant and antimicrobial properties, their excessive presence may negatively affect palatability by imparting a harsh, puckering sensation. As a result, the moderate to low levels identified in Deanna achieve a desirable balance between nutritional functionality and consumer acceptability, particularly relevant for table fig varieties.

Table 1: Physiochemical and biochemical properties of Deanna fig cultivar grown in subtropical region of Andhra Pradesh (Anantapuram District).

Quality attribute	
Weight (g)	60.43 ± 0.35
Diameter (cm)	4.35 ± 0.05
Moisture content (% w.b.)	81.70 ± 0.49
Total phenol content (mg GAE/100 g F.W)	102.49 ± 0.36
Antioxidant activity (DPPH)% inhibition	78.75 ± 0.59
Total flavonoids (mg QE /100 g F.W)	24.29 ± 0.21
Total tannins (mg CE/g F.W)	1.94 ± 0.001
pH	5.58 ± 0.05
TSS (°Brix)	22.28 ± 0.20
Titratable acidity (% Critic acid)	0.279 ± 0.003
Ascorbic acid (mg/100g F.W)	15.97 ± 0.02
Total sugars (g/100 g F.W)	19.18 ± 0.11
Non reducing sugars (g/100 g F.W)	1.98 ± 0.01
Reducing sugars (g/100 g F.W)	17.19 ± 0.07

Table 2: Physiochemical and biochemical composition of Deanna fig cultivar grown at different geographical locations.

Quality attributes	**Geographical location**			
	Turkyei and California	**Maharashtra (India)**	**Tamil Nadu (India)**	**Telangana (India)**
Fruit Weight (g)	43.51-70	46.60	43.53	78.55
Fruit Diameter (cm)	-	-	4.89	5.292
Moisture (%w.b.)	-	75.3-78.0	-	-
Total phenol content (mg GAE/100 g F.W)	128.75	-	108.75	-
Antioxidant (DPPH) activity (%)	-	-	68.00	-
Total flavonoids (mg QE /100 g F.W)	11.25	-	11.25	-
Total tannins (mg CE/g F.W)	-	-	3.29	-
pH	5.25	5.40	-	-
TSS (°Brix)	18.2 -25	21.20 -22	14.20	19.67
Titratable acidity (%)	0.21	0.23	0.16	-
Ascorbic acid (mg/100g F.W)	1.85	12.95	10.40	-
Total sugars (g/100 g F.W)	17.85 - 25	19.04 -19.60	-	-
Non reducing sugars (g/100 g F.W)	1.52	1.79 -2.17	-	-
Reducing sugars (g/100 g F.W)	16.33	17.25-17.43	-	15.14
Reference	Hiwale *et al*. (2015) Caliskan and Polat, (2012) Ahmed *et al*. (2025)	Gawade and Waskar, (2005) Khapre *et al*. (2015)	Rani *et al*. (2024) Swetha *et al*. (2022)	Ali *et al*. (2025)

Table 3: The physiochemical and biochemical properties of various fig cultivars

Parameters	**Timla** (Pandidurai *et al.,* 2021)	**Sultani** (Abou-Farrag *et al*., 2013)	**El-Abbody** (Abou Farrag *et al.,* 2013)	**Brown** Turkey (Rani *et al*., 2024) Pereira *et al*. (2020)	**Poona Fig** Gawade, and Waskar, (2005)	**Black Mission** Solomon *et al*. (2006)	**Afghan** (Rani *et al*., 2024)	**Conadria** Gawade, and Waskar, (2005)	**Dinkar** Gawade and Waskar, (2005)	**Excel** Gawade and Waskar, (2005)
Fruit Weight (g)	69.00	71.31	74.14	49.97	24.60	-	41.35	38.76	25.76	24.72
Fruit Diameter (cm)	2.50-3.50	-	-	4.89	3-4	2 -5	4.28	3.50-5.00	3.20-4.50	3.80-4.50
Length (cm)	-	-	-	5.32	6.58	4 to 8	4.73	7.07	6.80	6.52
Moisture content	79.80	77.81	82.91		-	79.50		-	-	-
Total Phenol Content (mg GAE/100 g)	-	82.00	59.00	172.00	-	281.10	130.75	-	-	-
Antioxidant (DPPH) activity (%)	-	207	128	50.4	-	-	-	-	-	-
Antioxidant capacity (FRAP value)	-	-	-	-	-	716.30 ± 52.60 µmol TE/100g	-	-	-	-
Total flavonoids (mg QE /100 g)	-	-	-	16.25	-	21.50	12.33	-	-	-
Total tannins (mg CE/g)	-	-	-	4.61	-	4.80	6.55	-	-	-
pH	5.10	5.28	5.42	-	-	5.30	-	-	-	-
TSS (°Brix)	19.00		16.7	18.2	19.34	18–22	16.3	20.15	18.36	19.36
Titratable acidity (%)		0.21	0.14	0.24	-	0.21	0.22	-	-	-
Ascorbic acid (mg/100g)	39.0	6.71	2.44	13.71	-	3.25	11.53	-	-	-
Total sugars g/100 g	18.04	-	-	-	16.01	20.10	-	17.74	15.29	16.48
Non reducing sugars g/100 g	9.69	-	-	-	2.25	3.40	-	2.08	2.25	1.62
Reducing sugars g/100 g	8.35	-	-	-	13.76	16.70	-	15.66	13.40	14.86

Conclusion

The present study provides a comprehensive assessment of the physico-chemical and biochemical characteristics of the *Ficus carica L.* cultivar Deanna, cultivated in Andhra Pradesh, India. The results revealed that Deanna fig possesses desirable traits, including high fruit weight, elevated total soluble solids, balanced sugar composition and high levels of ascorbic acid, phenolics, flavonoids, tannins and antioxidant activity. These attributes not only align with but in some cases surpass those reported for established Indian and international fig cultivars, mainly focus on its nutritional and functional value. The cultivar's favourable quality parameters and antioxidant potential support its suitability for both fresh consumption and processing applications. Its promising performance under regional agro-climatic conditions suggests potential for commercial cultivation and further research into its postharvest behaviour, storage stability and adaptability could strengthen its role in sustainable fig production and export systems.

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