NEW ERA AGRICULTURE MAGAZINE

Dragon Fruit: A Nutritional Powerhouse for Modern Health

Gitanjali Kumari[1] Priya Gupta[1], Adrija Chakraborty[2], Saurabh Singh[2]*

1. Introduction:

Dragon fruit, known by others name as pitahaya or pitaya, is the fruit of several different cactus species. Belonging to the genus Hylocereus, which are perennial, herbaceous, climbing cacti predominantly found in tropical and subtropical regions. These species are well adapted to drought-prone environments and display remarkable ecological resilience. The crop is believed to have originated in regions of southern Mexico, Guatemala, and Costa Rica, where it has been traditionally cultivated. Dragon fruit plants typically have a lifespan of up to 20 years, begin fruiting approximately two years post-planting, and generally reach optimal productivity between the third and fifth years of cultivation.

Globally, dragon fruit has gained commercial significance and is cultivated in countries such as Vietnam, China, Mexico, Colombia, Nicaragua, Ecuador, Thailand, Malaysia, Indonesia, Australia, and the United States. Among the Hylocereus genus, five major types are distinguished based on fruit color and skin characteristics:

1. *Hylocereus undatus* produces white pulp with pink skin
2. *Hylocereus polyrhizus* bears red pulp and pink skin
3. *Hylocereus costaricensis* features violet-red pulp with pink skin
4. *Hylocereus megalanthus* produces white pulp enclosed by yellow skin
5. *Hylocereus guatemalensis* contains red pulp and reddish-orange skin

The edible fruit pulp of all dragon fruit types contains numerous black seeds and offers a mildly sweet taste. It is rich in soluble sugars, proteins, and essential minerals such as potassium, magnesium, and calcium. Additionally, the pulp harbors various bioactive compounds with functional and therapeutic potential. The characteristic red hue of the fruit pulp is attributed to a class of water-soluble, nitrogenous pigments known as betacyanin's, which include isobetanin, phyllocactin, and hylocerenin, all known for their potent antioxidant and radical scavenging activities.

Several phytochemical constituents

Gitanjali Kumari[1] Priya Gupta[1], Adrija Chakraborty[2], Saurabh Singh[2]*
[1] Department of Dairy and Food Science Technology, Banaras Hindu University, Varanasi.
[2] Department of Dairy Technology, National Dairy Research Institute, Karnal, Haryana.

such as polyphenols, flavonoids, and ascorbic acid (vitamin C) contribute to the fruit's antioxidant capacity. Red-fleshed dragon fruit, in particular, has demonstrated anti-obesity and anti-metabolic disorder effects in animal studies, largely due to its high betacyanin content. Clinical and preclinical investigations have further indicated its ability to improve lipid profiles by reducing total cholesterol, triglycerides, and low-density lipoprotein (LDL), while elevating high-density lipoprotein (HDL) levels in individuals with type 2 diabetes. Additionally, consumption of dragon fruit has been shown to enhance insulin sensitivity and reduce blood glucose levels, reinforcing its therapeutic potential in metabolic disorders. Administration of white-fleshed dragon fruit juice has also shown promise in ameliorating insulin resistance, liver steatosis, and adipose tissue hypertrophy induced by a high-fat diet in murine models, though without significant influence on overall body weight.

In India, dragon fruit was introduced in the late 1990s, and its cultivation area has been expanding steadily due to growing domestic and international demand. Given its origin from a xerophytic cactus family and requirement for long-day photoperiods for flowering, the crop thrives in dry, frost-free agro-climatic zones, particularly in the southern, western, and north-eastern regions of India. Its adaptability, coupled with high market value and nutritional benefits, presents economic opportunities for smallholder growers and commercial-scale producers alike.

Despite its widespread use and acknowledged nutritional benefits, comprehensive data on the complete nutrient and phytochemical composition of dragon fruit remains limited. Detailed profiling of its biochemical constituents is essential for establishing its value in routine diets and for its inclusion in public health nutrition strategies. Promoting dragon fruit as a functional food could significantly contribute to addressing nutritional deficiencies and lifestyle-related diseases. Accordingly, the present investigation aims to evaluate and

Table 1. Physicochemical composition of dragon fruit

Nutrients	Amount
Protein	1.1 g
Water	87 g
Fat	0.4 g
Fiber	3.0 g
Carbohydrate	11.0 g
Ascorbic acid (vitamin C)	20.5 mg
Thiamine (vitamin B1)	0.04 mg
Riboflavin (vitamin B2)	0.05 mg
Niacin (Vitamin B3)	0.16 mg
Iron (Fe)	1.9 mg
Calcium (Ca)	1.9 mg
Phosphorus (P)	22.5mg

document the nutrient composition of both white and red-fleshed dragon fruit varieties, laying the groundwork for their inclusion in future nutrition interventions and health-promoting food innovations.

2. Nutritional Composition

Dragon fruit contains a diverse range of nutrients essential for human health, including:

a. **Macronutrients:** Low in calories (about 50 kcal/100g), rich in dietary fiber (1.8–3.0g/100g), and contains small amounts of protein and fat.

b. **Micronutrients:** High levels of vitamin C (3.4–11.3 mg/100 g), calcium (11–46 mg/100 g), magnesium (33–46 mg/100 g), Potassium (158–193 mg/100 g), and low level of phosphorus, and iron.

c. **Phytochemicals:** Rich in betalains (especially in red-fleshed varieties), polyphenols, and flavonoids with strong antioxidant properties.

Dietary fiber: Dietary fiber in dragon fruit ranges from 0.8–1.3 g/100 g, aiding digestion and satiety.

3. Bioactive Compounds and Antioxidant Potential

a. **Betalains**: Natural pigments with anti-inflammatory and anti-cancer potential with radical-scavenging properties. Red-fleshed dragon fruit contains abundant betalains 42.7 mg/100 g.

b. **Phenolic Acids and Flavonoids**: Total phenolic content ranges between 25–55 mg GAE/100 g, flavonoids between 15–35 mg CE/100 g. Offer protection against oxidative stress-related diseases such as cardiovascular disease and cancer.

4. Health Benefits of dragon fruits

Health Benefit	Description
Cardiovascular Health	Reduces total cholesterol, triglycerides, and LDL cholesterol levels - Increases HDL cholesterol - Fiber and antioxidants support vascular health
Diabetes and Glycaemic Control	Demonstrates hypoglycemic effects - Improves insulin sensitivity - Fiber slows glucose absorption
Anti-inflammatory & Antimicrobial Effects	Pulp and peel extracts inhibit bacteria like *E. coli* and *S. aureus* Reduces inflammatory markers (e.g., TNF-α)
Digestive Health	Rich in prebiotic fiber, especially oligosaccharides - Promotes growth of beneficial gut bacteria (*Lactobacillus*, *Bifidobacterium*)
Anti-Cancer Potential	Peel and pulp extracts show anti-proliferative effects in vitro - Effective against colon, breast, and liver cancer cells

5. Applications of dragon fruit in Functional Foods	
Application Area	**Examples / Description**
Functional Beverages	Used in juices, smoothies, and wellness drinks
Bakery and Dairy Products	Incorporated into yogurt, ice cream, cakes, and pastries
Nutraceuticals and Supplements	Processed into capsules, powders, and fortified health products
Edible Colorants	Betalain pigments used as natural food dyes for coloring various food and beverage products
Sustainability and By-Product Utilization	Dragon fruit peel, often discarded, is rich in dietary fiber, pigments, and antioxidants. It has potential applications in: Biodegradable films, Animal feed, Natural dyes, Cosmetic formulations

6. Safety and Allergenicity

Dragon fruit is generally safe, non-toxic, and well tolerated, even by those with metabolic disorders. It contains no significant anti-nutritional compounds and supports digestive health due to its high water and fiber content. However, rare allergic reactions such as hives, swelling, or anaphylaxis have been reported, especially in individuals sensitive to tropical fruits or latex. Caution is advised for first-time consumers. Further research on allergenic proteins and clear labelling may help ensure broader consumer safety.

7. Future Prospects and Research Gaps

Despite its rising popularity, dragon fruit's full potential remains underexploited due to gaps in clinical validation, crop improvement, processing, and policy support.

a. Clinical trials are limited more human studies are needed to confirm the long-term benefits.

b. Genetic improvement and post-harvest technology require advancement for yield stability.

c. Integration in public nutrition programs can address micronutrient deficiencies.

8. Conclusion

Dragon fruit stands out as a nutrient-rich superfood with wide-ranging health benefits, including antioxidant, anti-inflammatory, and metabolic regulation properties. Its impressive content of vitamins, minerals, fiber, and bioactive compounds makes it valuable in preventing lifestyle-related disorders such as diabetes, cardiovascular disease, and obesity. With growing interest in functional foods, dragon fruit offers promising applications across the food, pharmaceutical, and cosmetic industries. Despite its potential, further clinical research, genetic advancements, and post-harvest improvements are essential. Promoting dragon fruit through public nutrition initiatives could

support efforts to combat malnutrition and promote holistic health in both rural and urban populations.