



A study on the Nutritional and Medicinal Properties in Dragon Fruit: A Review

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Abstract: This review will discuss the cultivation, dietary advantages, and medicinal aspects of dragon fruit. The adaptable dragon fruit plant thrives on soils with a somewhat coarser texture. Stem cuttings are a frequent method of plant propagation. This fruit's high nutritional content, which includes being a strong source of minerals, glucose, fructose, dietary fiber, and vitamins. It has been discovered that a variety of phytochemical antioxidants, such as betalains, polyphenolic compounds, and carotenoids, have chemo-protective properties against oxidative stress in the body and maintain an ideal balance between antioxidants and oxidants for the improvement of human health. The human body's immune system is bolstered by it, and it is also used to treat diabetes, cancer and cardiac problem. Dragon fruit has a lot of promise for use as medicinal herbs. Due to their ability to sell their goods for a profit in the marketplaces, commercial growers are rapidly growing in number across the globe. There isn't a lot of information currently accessible about dragon fruit production. The market for dragon fruit can be expanded as well as the advantages to producers and consumers throughout the world are maximized by conducting research on many elements of its cultivation and health benefits.

Keywords: Dragon Fruit, Nutritional Properties, Health Benefit, Medicinal Property, Cultivation

Introduction:

Dragon Fruit is a superfruit that is a member of the Cactaceae family of climbing cacti and is extremely nutrient-dense and medicinal. It also known as Pitaya, has recently attracted a lot of interest from gardeners due to its strong antioxidant potential, vitamins and mineral content, in addition to its attractive colour and fruit's economic value. There are four different varieties of the fruit are available, each with a leathery, slightly leafy skin: *Hylocereus undatus*, which has white flesh with pink skin, *Hylocereus polyrhizus*, which has red flesh with pink skin, *Hylocereus costaricensis*, which has violet red flesh and pink skin, and *Hylocereus (Selenicereus) megalanthus*, which has white flesh with yellow skin (Fig. 1). The main benefit of this crop is that it may be sown and will continue to grow for roughly 20 years. The main disadvantage is, two years of planting, it begins to bear fruit, and five years later, it is fully productive. Commercial cultivation of Dragon Fruit is practised in the United States, Australia, Nicaragua & Vietnam [1]. The presence of bioactive chemicals linked to several health advantages, including anti-diabetic, anti-inflammatory, antioxidant, anti-cancer, and antibacterial, is what gives pitaya fruit its potential to promote good health. These advantageous effects have led to an increase in this fruit's consumption across the globe [2] [3]. Due to the significant demand for dragon fruit on both the local and international markets, small-scale home growers as well as operators of medium- and large-scale plantations may find it profitable to engage in this activity.



Fig 1: Varieties of Dragon Fruit

Cultivation of Dragon Fruit

A semi-epiphytic plant, dragon fruit likes a dry, tropical or subtropical climate with typical temperatures of 21 to 29 °C, while it can also survive brief periods of cold temperatures and temperatures as high as 38 to 40 °C. This crop requires alternating wet and dry seasons with 600-1300 mm of rainfall and sunlight [4]. The plants will suffer damage at temperatures exceeding 40 °C, which will result in stem yellowing. Areas with a lot of rain are unsuitable for growing crops because too much rain damages flowers and fruits. As long as the soil is well-drained, dragon fruit can be cultivated in a variety of soil types. The best type of soil is, however, one that is high in organic matter and slightly acidic. Since the land is sub-marginal, organic fertiliser will be utilised to make up for the soil's deficiency in organic matter. Dragon fruit plants do well in sandy loam that has a high organic content and do well in well-drained soil.

Seeds and stem cuttings were both used for dragon fruit propagation. The vegetative propagated plants generate blooms in three years, whereas the seedling from a seed needs four to five years to produce flowers and fruit [5]. Because the plant only blooms at night, pollination may be hampered. A paucity of genetic variety and the absence of pollinating organisms in some production sites necessitate manual cross-pollination to assure fruit set and growth [6]. Environmental parameters such as photoperiod, temperature, rainfall, light intensity, and relative humidity have an impact on dragon fruit flowering and fruit setting [7]. For higher fruit production, 40 kg of cow dung, 50 g of urea, 100 g of TSP, 100 g of MoP, 100 g of gypsum, and 10 g of borax per plant pit are advised [8]. Fruit is typically planted with a vertical pillar support, and the stem of the fruit needs to be clipped to the support. With the plant hanging down from the top, the pillar has a frame attached to it (Fig. 2). To guarantee that the plant has enough reserves to support the growth of the fruits, regular irrigation is essential [9].



Fig 2: Dragon Fruit Planting.

Sprinklers for under trees that can focus water into the root zone and have a wetting area of 1 to 1.5 metres in diameter are suitable. After flowering, dragon fruit takes 28–30 days to reach maturity [10]. The physiological characteristics of dragon fruit are significantly influenced by variety and flowering period.

After 15–17 months of planting, flower buds should appear, and 28 days are needed for blossoming. After pollination, ripened fruits could be picked 30 to 50 days later [11]. For up to 25–30 years, a dragon fruit plant can produce fruit.

Nutritional value of Dragon Fruit:

The influence of the growing environmental circumstances has a major impact on the nutritional composition and phytochemical characteristics of Dragon fruit [12]. The proximate values in gram or mg per 100g edible portion of white-flesh dragon fruit are moisture (85.3% average), protein (1.1), fat (0.57), crude fiber (1.34), energy (67.7) (Kcal), ash (0.56), carbohydrates (11.2), glucose (5.7), fructose (3.2), sucrose, sorbitol (0.33), vitamin C (3.0), Mg, K, Na, Zn and P [13]. Vitamin C, vitamin B1, vitamin B2, vitamin B3, vitamin E, and vitamin A are all present in the pulp of dragon fruit. The vitamin C concentration of dragon fruit of three species, including *Hylocereus costaricensis* (super red pulp), *Hylocereus polyrhizus* (red pulp), and *Hylocereus undatus* (white pulp), collected from various regions, varied from 3.3 to 6.0 mg 100 g⁻¹. Many authors have studied this issue and concluded that the vitamin C concentration varies depending on the origin, species, crop, extracting method, and fruit maturity level [14]. While the moisture content, fat content, and other characteristics of red-flesh dragon fruit differ from those of white-flesh dragon fruit. The nutritious value of the dragon fruit is present in every component. The young or tender stem has high levels of nutrients, including raw protein, raw fiber, and a few minerals like calcium, magnesium, zinc, potassium, and iron. While certain fatty acids can be found in the pulp and seeds. When the pulp of the *Hylocereus undatus* was examined, the most prevalent fatty acids were found to be linoleic acid (50.8%), oleic acid (21.5%), and palmitic acid (12.6%) [15]. Additionally, quinic acid and cinnamic acid were examined, as well as a number of other minerals, including carbohydrates, proteins, and organic acids.

The most essential fatty acids found in the dragon fruit seed include linoleic acid, linolenic acid, and other fatty acids such palmitic acid (17.5%), oleic acid (22.7%), and cis-vaccenic acid (3%) that have laxative effects on gastroenteritis. When compared to the pulp of the dragon fruit, the premature stem contains larger concentrations of ascorbic acid, which serves primarily as a risk-reduction measure for illnesses including anaemia, scurvy, and weakness.

Dragon fruit has a lot of carbs, primarily glucose, fructose, and some oligosaccharides [16]. The dragon fruit's peel, in particular, is rich in pectin and dietary fibers and contains the most macronutrients. Numerous studies have been conducted on the Physico-chemical properties of pectin derived from the peel of the dragon fruit. The peel is also utilised for the extraction of pectin. The pectin included in the peel has strong cholesterol-absorption abilities, which aids in reducing the consequences of high blood cholesterol.

The amino acids and organic acids, for instance, are found in greater concentrations in dragon fruit peel than in dragon fruit pulp, according to some scientists [17]. The organic acids are tartaric acid, malic acid, citramalic acid, fumaric acid, propanedioic acid, talonic acid, and mannonic acid. It also contains vital amino acids including tyrosine, glutamic acid, leucine, lysine, tryptophan, valine, alanine, serine, and aspartic acid [18].

Because of its high antioxidant content, the dragon fruit is used in the food processing industry as both a prebiotic supplement and a natural colourant [19]. As an example, betalains, betacyanin, flavonoids, hydroxycinnamates, and polyphenols [20]. Dragon fruit seeds, peel, and pulp all contain polyphenols, with seeds and peel containing more than pulp does. These are a collection of plant-based antioxidants that also include lignin, flavonoids, and phenolic acids. These have a great capacity for scavenging free radicals, which lowers the risk of chronic diseases. Flavonoids play an important role in acting as brain cells and blood arteries, which helps to lower the risk of heart disorders, while hydroxycinnamates aid in the prevention of cancer [21].

The red dragon fruit peel includes important lipids such stearic acid pentenoic acid, docosanoic acid, propanoic acid, and butanoic acid, according to numerous analyses [17]. The natural pigment betacyanin has a number of bioactivities, including anti-cancer, antioxidant, antibacterial, and mamore effects. These also aid in reducing oxidative liver damage and coronary artery disease. Additionally, ice cream, biscuits, and yoghurt all use betacyanins as a natural colouring agent. More betacyanins were

recovered from the dragon fruit peel than the pulp, and these betacyanins are now used in culinary items as either a functional component or a natural colourant [17].

Choline, dopamine hydrochloride, amaranthin, amine, and Nbenzylmethylene isomethylamine are all found in the dragon fruit peel, which was extracted in order to identify the alkaloids that were present in the fruit. With choline and Nbenzylmethylene isomethylamine being the two most prevalent alkaloids discovered in dragon fruit peel [17]. As opposed to the green dragon fruit, which accumulates less alkaloids, red dragon fruit does. Studies and research are being conducted, although there is still a lack of much information about the alkaloids.

Medicinal Properties and Health Benefits of Dragon Fruit:

Due to its abundance in vital nutrients like vitamins, minerals, complex carbs, dietary fibre, and antioxidants, dragon fruit has grown in popularity as a result of its health advantages. The presence of catechin, epicatechin, epicatechin gallate, epigallocatechin, caffeine, and gallic acid, which have strong antioxidant effects in people, have been found in the seeds of dragon fruit [22]. Betacyanins, phenolic compounds, polysaccharides, and terpenoids, which function naturally as antioxidants and anti-inflammatory agents, are among the phytochemicals with bioactive qualities found in the pulp and peel of dragon fruit.

Wound Healing Property

The injured-diabetic rat was given an extract of dragon fruit leaves and blossoms, and as a result, the wound healing activity of the rat increased dramatically [23]. While increasing tensile strength by promoting healing activity, bioactive substances like hydroxyproline, DNA collagen content, and total proteins found in dragon fruit pulp were once utilised as a traditional medicine to cure wounds [23]. Young stems of the *H. undatus* plant, dragon fruit, and fresh flower buds can all be consumed as vegetables. Dried flower buds are used to make homemade medicines. In restaurants, it is frequently used in fruit salads and as juice. Due to the high vitamin C content of dragon fruit, regular consumption can help prevent cough and asthma. It can also speed up the healing of cuts and wounds [24].

Anticancer Property:

Components with natural anticancer activity are incredibly useful in the treatment of cancer. The human prostate cancer cell line PC3, the human breast cancer cell line Bcap-37, and the human gastric cancer cell line MGC-803 were examined for the extraction of cytotoxic activity from dragon fruit. On MGC-803 cells, a type of gastric cancer cell, *H. polyrhizus* shown greater cytotoxic activity than *H. undatus* [25]. The bioactive chemicals found in the dragon fruit peel, including B16F10, AGS, and MCF-7, have the potential to suppress the proliferation of cancer cells. The use of MGC- 803, PC3, and Bcap-37 reduces the morbidity of cancer [17]. Human liver cancer (HepG-2) cells were exposed to the methanol fruit pulp extracts of *H. undatus*, which showed promising anticancer and anti-apoptotic characteristics which suggested that it having anti-cancerous property [26].

Anti-ageing Property:

Vitamin E and beta carotene, which function as an inhibitor for the formation of cancerous cells, are abundant in dragon fruit. Particularly the red dragon fruit aids in delaying the onset of ageing. Consuming dragon fruit can lower the body's fat cells because it is a dependable supply of fibers [27].

Anti-obesity Property:

The methanol flesh extract of the *H. Costaricensis* that was administered to the test rats had an anti-obesity effect. the juice extract of *H. Undatus's* anti-inflammatory, antilipase, and anti-diabetic properties [28]. The presence of bioactive substances including saponin and triterpenoid with great application potential was observed in the dragon fruit results. Crude fibers, lipid profiles, and flavonoids present in the dragon fruit extract can prevent intestinal cholesterol from being absorbed [14].

Anti-diabetics Property:

Diabetes is also one of the main causes of death globally. Diabetes mellitus is a metabolic illness with natural and herbal therapies for therapy [29]. According to reports, dragon fruit exhibits phosphodiesterase inhibitory activity, which lowers blood glucose levels. Due to the antioxidant effects of flavonoids and their ability to inhibit phosphodiesterase, which in turn promotes insulin retention, they aid in reducing oxidative stress [29]. Studies indicate that the glucose found in dragon fruit aids in controlling blood sugar levels for diabetic patients, which makes it effective in lowering blood sugar levels in those with type 2 diabetes. In type 2 diabetics, eating red dragon fruit has been shown to lower levels of total cholesterol (TC), triglycerides (TG), and low-density lipoprotein cholesterol (LDL-C), while raising HDL-C levels [30]. Few researches have examined the positive effects of white dragon fruit on diabetes and NAFLD (Non-alcoholic Fatty Liver Disease), despite the fact that both red and white dragon fruits are said to be a rich, natural, and affordable source of bioactive nutrients [31].

Prebiotic Property:

Fruit has titratable acidity and is just mildly acidic. The main components that contribute to acidity in fruits are organic acids; therefore, the acidity is a measure of the overall amount of organic acids in the fruit. The human body uses organic acids for a variety of processes, including maturation and growth. Dragon fruit contain lactic acid, which is associated to improved intestinal health and improved nutritional absorption, among other health benefits. Lactic acid may potentially work as an antioxidant to protect cells against ageing and chronic disease. The *H. undatus* pulp was ethanologically extracted, and it was discovered to contain around 85% mixed oligosaccharides, which are prebiotics and have stronger resistance to human salivary α -amylase than inulin, which cannot be digested in the stomach [32]. It promotes the growth of beneficial bacteria like lactobacilli and bifidobacteria, which aid in digestion and bolster the immune system [32]. It functions as a dietary supplement as well [33].

Antioxidant and Antimicrobial Property:

The phytochemicals in dragon fruit, including polyphenols, flavonoids, and vitamin C, are crucial for the fruit's antioxidant function [34] [35]. Utilising medicinal plants' natural antioxidant substrates has a significant impact on the growth of cellular damage caused by free radicals, which is a crucial factor in serious disorders like cancer. The dragon fruit and its peel are extracted using ethanol because of the fruit's unique capabilities for various oxidants, despite the meat of the dragon fruit being higher in flavonoids [32]. The high concentration of vitamin C in dragon fruit is crucial for boosting the immune system and promoting the body's other antioxidants to work more effectively.

Each plant possesses physiological and biochemical defences against various pathogens that can be activated in response to infection [14]. Betacyanins, phenolics, fatty acids, terpenes, and tannins may all have a role in the antibacterial action of dragon fruit peel extract, according to recent studies [36]. In a study on dragon fruit, it was discovered that extracts of the *H. undatus* peel have antibacterial properties when combined with chloroform, ethanol, and hexane. As a result, both gram-negative and gram-positive bacteria are inhibited by a zone that measures between 7 and 9 mm [32]. A unique cellular and molecular mechanism of betalains' antimicrobial activity needs be further explored, despite the fact that betalains play a significant role in the mechanism of microbial suppression [37]. Using cup agar and disc diffusion methods, it was discovered that the stem of *H. polyrhizus* has potent antimicrobial properties against *S. aureus*, *P. aeruginosa*, *C. albicans*, *Aspergillus niger*, and *F. oxysporum*, with inhibition zones of 29, 29, 29.5, 17.5, and 29.5 mm and 9.5, 11, 10, 8, and 16.5 mm, respectively [32].

Other Health Benefits:

The health advantages of dragon fruit include flavonoids, which have anti-cardiovascular effects. Dragon fruit also helps to alleviate vaginal discharge and bleeding issues. Although dragon fruits are high in fiber, they help in meal digestion. The B vitamin family (B1, B2, and B3), which plays a significant role in health benefits, is also abundant in dragon fruit. Vitamin B2 in dragon fruit functions as a multivitamin but also helps to improve and restore appetite loss. Vitamin B1 aids in enhancing energy generation and glucose metabolism. Additionally, the vitamin B3 found in dragon fruit helps to moisturise and smoothen skin while also helping to lower levels of harmful cholesterol. Additionally, it enhances vision and lowers blood pressure. Due to its high-water content relative to other nutrients, dragon fruit can also be consumed as fresh fruit to quench thirst in addition to being used as food colouring. It has significant levels of calcium

and phosphorus. It plays a significant part in tissue creation, aids in bone strengthening, and creates strong teeth.

The Mayas have utilised dragon fruit as a medicine from ancient times, utilising both the fruit and the blossoms as a hypoglycemic, wound cleanser and diuretic, for diarrhoea, tumour disintegration, and as a healing agent. The seeds and blossoms can also be used to enhance renal function, as laxatives, and as beverages for those with gastritis. The numerous bioactive substances present in this plant, particularly in the fruit, are the source of these traits. A study using dragon fruit extract at doses ranging from 1250 to 5000 mg/kg did not result in interferences or abnormalities in the organs of animal models, further demonstrating its safety [38] [39] [40] [41].

There are studies that demonstrate the impacts of dragon fruit as well, but more thorough research is required to demonstrate the advantages that this plant may offer customers. Dragon fruit can also be utilized for a variety of technological applications in the food and pharmaceutical industries, opening up new opportunities for the development of multi-targeting medications to prevent and treat a number of diseases.

In several nations, dragon fruit is gaining popularity. It can be eaten raw or used to beverages, jellies, and chocolates. The pharmaceutical and culinary sectors can also employ the pigments as a colouring agent.

Conclusion:

The conclusion of this review is that dragon fruit is one of the most popular and nutrient-dense fruits in the world. A wide variety of minerals and nutrients are present, so it offers phytochemicals with antioxidant, anti-microbial, anti-cancer, anti-diabetic, anti-cardiac and anti-aging properties. As a result, the use of dragon fruit has recently grown in importance both economically and nutritionally. It is a repository for phytochemicals that promote both health and economic growth.

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