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A-review: on Nutritional and Medicinal Importance of Dragon Fruit (*Hylocereus* species)

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ABSTRACT

Dragon fruit *Hylocereus species* is a recent table fruit and very much liked for its refreshing juice. The fairly low maintenance, succulent hardy nature high yielding, better keeping quality and survival low irrigation make dragon fruit a paying proposition. It is belongs to family Catacaeae. This is due to its special colour (especially red/purple pigments in red-flesh dragon fruit), high nutritional values and ant-oxidative properties of the fruit. Dragon fruit having heavy nutritional value energy 264 Kcal, water 87 g,protein1.1 g, fat 0.4 g, carbohydrate 11.0 g, fiber 3g, calcium 8.5 mg, iron 1.9 mg, phosphorus 22.5 mg,vitamin B_1 (Thiamine) 0.04 mg, vitamin B_2 (Riboflavin) 0.05 mg and vitamin B_3 (Niacin) 0.16 mg per 100 g fruit pulp. It is very useful for lower blood sugars in type 2 diabetes. Dragon fruit is beneficial for carbohydrate metabolism, heart tissues, and teethes, healthy blood and tissue formation strengthening bones due to high calcium content, strengthening immune system, faster healing of bruises and wounds, respiratory tract infections and even as a mild laxative due to substantial fibre content. Dragon fruit has low cholesterol concentration, to balance blood sugar concentration, to prevent colon cancer, to strengthen kidney function and bone, to strengthen the brain workings, increasing the sharpness of the eyes as well as cosmetic properties. The seeds of dragon fruits are high in polyunsaturated fats that reduce triglycerides and lower the risk of cardiovascular disorders.

Key word: *Nutritional value, Antioxidant, Anticancer, Antibacterial and anti-diabetic*

Introduction

Dragon fruit *Hylocereus species* is a modern table fruits of tropical and sub tropical region and very much liked for its refreshing juice, which has a high medicinal value. The fairly low maintenance, succulent hardy nature high yielding, better keeping quality and survival low irrigation make dragon fruit a paying proposition. It is also known as night-blooming careus, strawberry pears, queen of the night and Honolulu Queen, Latin American names *pitaya* and *pitahaya* (Martin *et al*., 1987). Dragon fruit originated principally from the tropical and subtropical forest regions of Latin Americas, including North, Central and South America (Ramli *et al.,* 2016: Ortiz and Takahashi, 2015). According to Aztec literature, *Pitahaya* fruits date back to the 13th century. At present time, dragon fruit is being commercially cultivated in Brazil, Australia, Colombia, Costa Rica, Egypt, Israel, Japan, Mauritius, Mexico, Nicaragua, Taiwan, the USA and Vietnam (Merten, 1987). The dragon fruit has been fruitfully introduced into a lot of other tropical and sub tropical countries like West Indies California, Florida Algeria and Israel. It is

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extensively distributed in India, Sri Lanka, Thailand, Malaysia, Australia and Philippines. In India it was introduced somewhat in late 90s. And is still the area under Dragon fruit is very limited. Dragon fruit cultivation is very limited area in India. Few farmers of Kerala, Karnataka, Tamil Nadu, Maharashtra, Utter Pradesh, Andhra Pradesh, Gujarat and some parts of Rajasthan have taken up dragon fruit cultivation. The total area under dragon fruit cultivation may be less than 100 to 150 acres.

The fresh fruit of dragon fruits used as dessert fruit in the form of slices. They are widely used in various food products such as sweets, yogurts, ice creams, pastries, jams, jellies and wines. This is due to its special colour (especially red/purple pigments in red-flesh dragon fruit), high nutritional values and ant-oxidative properties of the fruit. Fruit are edible as well as flower buds that are eaten as vegetable and dried buds are use for home made medicine. In Taiwan, dry flowers are used as vegetables besides this it is also taken in the form of juice, jam, or preserves according to the taste needed; besides used as fresh table fruit (Luders and Mc Mahon, 2006).

Botany of Dragon Fruit

Dragon fruit belongs to the family Cactacaeae and genus *Hylocereus*. This plants genus is mostly characterized by climbing vine cactus with aerial roots that bear a glabrous beautiful berry with large scales (Fournet, 2002). *Hylocereus spp*. are diploid in nature with chromosome number 2n = 22 (De Dios, 2004 and Lichtenzveig *et al*., 2000). Dragon fruits many species use as ornamental qualities but they also include nearly 250 cultivated species of fruit-bearing and industrial crops (Fouqué, 1969). But some species are of economic value.

Edible Cactacaeae species classified according to stem habit, colour of the fruit skin and colour of the fruit pulp (Table 1). Edible cacti are divided into two groups according to habit of stem namely vine as

Table 1. Classification according to stem habit, colour of the fruit skin and colour of the fruit pulp

Species	Colour of Fruit skin	Fruit pulp
Vine cacti		
Hylocereus undatas	Red	white
Hylocereus undatas	White	Red
Hylocereus triangularis	Yellow	White
Hylocereus costaricensis	Red	red
Hylocereuspolyrizus		
Syn. Hylocereus monacanthus	Red	red
Hylocereus ocampoins	Yellow	red
Selenicereus megalanthus		
Syn. *Hylocereus megalanthus*	Yellow	white
Columnar cacti		
Cerus triangularis	Yellow	white
Acanthocereus pitajaya	Yellow	white
Cereus ocamponis	Red	Red

Sources: Crane and Balerdi (2004); Mizrahi and Nerd (1999); Tel Zur *et al*., 2004a/b)

Botanical description

Kingdom	: Plantae (plants)
Sub kingdom	: Tracheobionta (vascular plants)
Super division	: Spermatophyta (seed plants)
Division	: Magnoliophyta (flowering plants)
Class	: Magnoliopsida (dicotyledanae)
Order	: Caryophyllales
Family	: Cactaceae
Genus	*: Hylocerus* (Berger) Britt and Rose.
Species	*: Hylocerus undatus* (Haw.) Britt and Rose.

Source: Britton and Rose (1963); ISB (2002); NPDC (2000)

Fig:1. Red skin white flesh dragon fruit

Fig.2. Red skin red flesh dragon fruit

(epiphytic or climbing) cacti and columnar cacti. Edible vine (climbing) cacti species belongs to two different genera *Selenicereus* and *Hylocereus* whilst the columnar Cactacaeae species belongs to three genera namely cereus, Pachycereus and Stenocereus (Crane and Balerdi, 2004).

Nutritional Value

The red dragon fruit is a rich source of nutrients and minerals such as vitamin B_1, vitamin B_2, vitamin B_3 and vitamin C, protein, fat, carbohydrate, crude fiber, flavonoid, thiamin, niacin, pyridoxine, kobalamin, phenolic, betacyanins, polyphenol, and carotene (Le Bellec *et al.*, 2006). Red dragon fruit (*Hylocereus polyrizus)* is rich in phytoalbumins which exhibit high antioxidant activities (Mahattanatawee *et al.*, 2006). Thus, the probiotic properties and high antioxidant uses of the red *pitaya* fruit have been reported Fathordoobady *et al.*, 2016; Xu *et al*., 2016).

Table 2: Dragon fruit pulp contains

Nutrients	Amount per 100 g
Water	87 g
Protein	1.1 g
Fat	0.4 g
Carbohydrates	11.0 g
Fibre	3g
Vitamin B1 (Thiamine)	0.04 mg
Vitamin B2 (Riboflavin)	0.05 mg
Vitamin B3 (Niacin)	0.16
Vitamin C (Ascorbic acid)	20.5 mg
Calcium (Ca)	8.5 mg
Iron (Fe)	1.9 mg
Phosphorus (P)	22.5 mg
Zinc	NA

Source://www.healwithfood.org/nutrition-facts/dragon-fruit-nutritional-health benefits.

Importance and uses

Dragon fruit is considered highly nutritious and medicinal fruit. The edible portion in this fruit is 70 to 80 per cent. Dragon fruit is rich source of vitamin C content 6000mg/100 g of fruit pulp (Rahmawati and Mahajoeno 2009). It is also rich source of pectin. Pectin extracted from dried dragon fruit peels about 14.96 to 20.14 per cent (Nur Izalin *et al.* 2012).

It is very useful for lower blood sugars in type 2 diabetes. Dragon fruit is beneficial for carbohydrate metabolism, heart tissues, and teethes, healthy blood and tissue formation strengthening bones due to high calcium content, strengthening immune system, faster healing of bruises and wounds, respiratory tract infections and even as a mild laxative due to substantial fibre content (Sonawane, 2017).

Table 3. Fatty acid composition of two dragon fruit species oil seeds

Fatty acidas	*Hylocereuscostaricensis*	*Hylocereusundatus*
Myristic acid	0.2%	0.3%
Palmitic acid	17.9%	17.1%
Stearic acid	5.49%	4.37%
Palmitoleic acid	0.91%	0.61%
Oleic acid	21.6%	23.8%
Cis-vaccenic acid	3.14%	2.81%
Linoleic acid	49.6%	50.1%
Linolenic acid	1.21%	0.98%

Source: Sonawane, (2017)

Dragon fruit has low cholesterol concentration, to balance blood sugar concentration, to prevent colon cancer, to strengthen kidney function and bone, to strengthen the brain workings, increasing the sharpness of the eyes as well as cosmetic properties (Suryono, 2006).

The seeds of dragon fruits are high in polyunsaturated fats (omega-3 and omega-6 fatty acids) that reduce triglycerides and lower the risk of cardiovascular disorders (Sonawane, 2017). Dragon fruit has many black colour small seeds in fruit pulp. Oil extracted from these seeds of dragon fruit (Ariffin *et al.*, 2009). The oil extract from seeds was found rich with 50 per cent of essential fatty acids namely, linoleic acid and linolenic acid – a necessity in human metabolism and cannot be synthesized from other food components by human body. Certain studies reported that dragon fruit flesh is rich in polysachharides (Xu *et al.* 2016).

The *Hylocereus undatus* flowers is useful for treating many disease like hyperactivity, cough, tuberculosis, diabetes, mumps, bronchitis, and cervical

lymph node tuberculosis for a long time in the southern China folk medicine (Gutierrez *et al.*, 2007; Wu *et al.*, 2011). In Taiwan, the fruit has been used as a food and as a dietary fiber source for diabetic persons (ElfiSusanti *et al.*, 2012). Dragon fruit play important role in digestion system due to fiber, which prevents cancer of the colon and diabetes, neutralizes toxic materials as heavy metals, and reduces high blood pressure and levels of cholesterol in our body (Jaafar *et al.*, 2009). *Hylocereus polyrizus* pulp has been useful for the manufacturing of red colored ice cream, juices, and lipstick (Choo and Yong, 2011).

Biological Activities

Many researchers reported the health benefits of flesh, peel and edible seed of dragon fruit. Hence, this review summarized some medicinal properties of dragon fruit like antioxidant, anticancer, antibacterial and anti-diabetic.

Antioxidant property

Antioxidants are a group of chemical substances naturally found in so many fruits which can prevent or reduce the oxidative stress of the physiological system in our body. The body is regularly producing free radicals due to regular use of oxygen. Oxidative stress free radicals are responsible for the cell damage in our body and contribute to different kinds of health problems, such as cellular necrosis, cardiovascular disease, cancer, neurological disorder, Parkinson's dementia, Alzheimer's disease, inflammatory disease, muscular dystrophy, liver disorder, and even aging (Kumar and Priyadarsini, 2011). We can use of some antioxidant fruits like pomegranate, Blueberries, strawberries, grapes, plums, prunes and dragon fruit in our diet to minimize so many disease. Dragon fruit containing polyphenol, antioxidant, and high fiber content (Omidizadeh *et al*., 2011). The antioxidants such as tocopherols, polyphenols and flavonoids play a very important role in inhibiting or delaying the oxidation of the cellular constituents (Nurliyana *et al.*, 2010 and Khurana *et al*., 2013). The fruit pulp of dragon fruit is rich in antioxidents and vitamin C, polyunsaturated fatty acids, B vitamins, carotene, protein and minerals like calcium, iron, potashiun, sodium, etc (Rahmawati and Mahajoeno, 2009). Commonly the peel of dragon fruit was found to have better antioxidative capacity as compared to theflesh. This might be due to the presence of different bioactive compounds in the peel and flesh. Wojdylo *et al.* (2007) observed that the polyphenolic compounds were found in both the peel and flesh but flavonoids were present generally in the peel. *Hylocereus* species possess promising antioxidant properties which provide health benefits to human (Kumar *et al.*, 2018). High phenolic content were usually correlated with high radical scavenging activity (Li *et al* 2005). The *Hylocereus polyrhizus* have great antioxidant activity due to its high phenolic content 15.92 mg gallic acid/g (Choo and Yong, 2011).

Anticancer Property

In dragon fruits found unsaturated fats, vitamins B_1, B_2 and B_3, minerals such as phosphorus, calcium, potassium and iron (Jaafar *et al.*, 2009), Polyphenolics, betalains, and tocopherols. The *Hylocereus* species has anticancer properties were recently studied. Several evidences showed that flavonoids, polyphenols and betanins that present in the *Hylocereus* species are responsible for the anticancer effects (Li*et al.* 2014: Kumar *et al.*, 2011). Dragon fruit give chemo-protective potentials to oppose the oxidative stress and keep balance among antioxidants and oxidants to make human health effects. An imbalance caused by excess oxidants leads oxidative stress, ensuing in damage of DNA and protein and increasing the hazard of degenerative diseases like cancer (Luo *et al.* 2014; Wu *et al.* 2006). These activities of the dragon fruit peel extracts were tremendously perhaps due to the presence of pentacyclic triterpenoids and steroids, which have been known to possess anticancer activity (Luo *et al.*, 2014).

Antimicrobial Property

Many researchers investigated that the chemistry of betalains, the major bioactive compounds in *H. polyrhizus* (Wybraniec *et al*. 2001). The red dragon fruit peel extracts were obtained by maceration using solvent at pH 5 phytochemical characteristics, total phenols, antioxidant, and antimicrobial activity of the peel extracts were observe (Temak *et al.* 2018). The ethanol and methanol extracts of local dragon fruit showed an overall better anti-bacterial activity against *Bacillus* species, *Vibrio* species, *Escherichiacoli* and *Staphylococc*us species (Tahera *et al.* 2014). Nurmahani *et al.* (2012) reported that the chloroform extracts of both *Hylocereus* species peel showed greatest antibacterial activity with *H. polyrhizus* peel being greater than *H. undatus* peel. The chloroform

extract of red flesh pitaya peel can be classified as a good source of potent natural antibacterial agent for both, Gram-positive and Gram-negative bacteria. These studies mentioned that betacyanins, flavonoids, phenolic acids, tannins, and terpenoids might be responsible compounds for the antimicrobial activity (Nurmahani *et al*., 2012; Tenore *et al.,* 2012). The stem extract of *H. polyrhizus* madpowerful antimicrobial activity against *Staphylococcus aureus*, *Pseudomonas aeruginosa Candida albicans, Aspergillus niger*, and *F. oxysporum* with inhibition zones 29, 29, 29.5, 17.5, and 29.5 mm and 9.5, 11, 10, 8, and 16.5 mm, respectively, by cup agar and disk diffusion methods, respectively (Ismail *et al.* 2017).

Anti-diabetic activities

Use of fruits and vegetables in our diet lower the incidence of cancer and cardiovascular diseases (Stintzing *et al.,* 2002). It was observed that the pulp of *H. polyrhizus* exerted a positive influence on cholesterol metabolism (Stintzing *et al.,* 2002). Sudha *et al.* (2017) observed that the white dragon fruit extract had α-amylase inhibitory activity ranging from 1.033 to 32.436% at concentration. They suggested that red pitaya appreciably enhanced insulin resistance and 600 g amount of red pitaya fruit eating every day decreased the blood glucose level in type II diabetics (Omidizadeh *et al.,* 2014 and AbdHadi *et al.* 2012). Dragon fruit is useful in reducing blood sugar levels in people suffering from Type-2 diabetes (Wee *et al.,* 2011). It is supposed that these properties could be produced through the useful combination of micronutrients, antioxidants, phytochemical, and fiber contents in food (Wybraniec *et al.* 2001).

Conclusion

Dragon fruit is one of the most known fruits that is commercially grown in many countries likeBrazil, Australia, Colombia, Costa Rica, Egypt, Israel, Japan, Mauritius, Mexico, Nicaragua, Taiwan, USA, Vietnamand some parts of India for its nutritional advantages.It is considered as a wonderful fruit for human health with high nutritive and medicinal values. It is a promising source of alternative medicine that might serve as anantioxidant, anticancer, antibacterial and anti-diabetic agents. Dragon fruit is beneficial for strengthening bones, teethes, carbohydrate metabolism, heart tissues, healthy blood circulationand tissue formation. In this review paper focused on the pharmacological activities and nutritional benefits of dragon fruit for human health.

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