JETIR.ORG ISSN: 2349-5162 | ESTD Year : 2014 | Monthly Issue
JOURNAL OF EMERGING TECHNOLOGIES AND INNOVATIVE RESEARCH (JETIR)
An International Scholarly Open Access, Peer-reviewed, Refereed Journal

DRAGON FRUIT : A Nutritional Powerhouse for Enhanced Energy Level

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1. Abstract

The climbing cactus Hylocereus undatus, native to tropical regions of Mexico and Central and South America, produces the dragon fruit or red pitaya. This fruit has been traditionally used for centuries to treat various health issues such as arthritis and inflammation, and it has demonstrated promising antibacterial and antimicrobial properties. Dragon fruit is rich in antioxidants that help reduce the risk of chronic diseases by neutralizing harmful free radicals. Its skin contains a higher concentration of bioactive compounds with strong antioxidant effects, making it of interest for both pharmacological and nutritional applications. The fruit is also packed with essential vitamins, minerals, and dietary fiber that support overall health. Recent findings suggest dragon fruit could aid in managing specific health conditions due to its anti-inflammatory and neuroprotective properties. With the growing demand for natural remedies, researching dragon fruit's health benefits is increasingly important. Ultimately, integrating dragon fruit into a balanced diet can help enhance health and well-being while lowering the risk of chronic illnesses.

2. Keyword -: Dragon fruit, Red Pitaya, tropical Fruit, Hylocerus undatus

3. Objective

1) To discover possibility of starting business in country.
2) A brief overview of important elements needed for Dragon fruit business.
3) Know the appearance and potential of Dragon fruit in country.
4) Effective and efficient measures to improve and expand scope of this activity in bangladesh.

4. Introduction

The climbing Cactus Hylocerus, undatus, native to tropical forest in mexico, central America & south america, Produce fruit known drogon fruit or red pitaya which has various alternative name (1-3].t thrives in organic rich soil & can yield four 4-6 cycle annually. the fruit vories in shape, often circular or Pear-shaped with pink or bright yellow skin [4-6]. studies show that it skin & flesh ore high in Polyphenol & antioxidant (7). traditionally leave & Flow of H. undatus used by ancient tribe for their diuretic, hypoglycemic healing Properties (8-9), Fruit come three notable varicher: Hylocereus megowanthus, Hylocereus Polyrhizus, Hylocereus andatus, all valve for

antioxident interest from Farmer globally (10) ripe dragon fruit is notable for its high level of soluble Solid, organic acid, Protein and mineral such as magnesium, calcium, potassium . (11)research indicate that it contain antioxidant, including betaxanthin and betacyanin which have free radicals scavenging properties (12) the fruit is reach fiber, vitamin & antioxidant that aid digestion, Prevent disease like diabet and heart disease and lower cholestrol and blood pressure . (13,67 Dragon fruit with its appealing dark Purple pulp is populair in market & cultivated in several Asian Countries like malasia,Taiwan, and india ,southern china and israel (30) Dragon fruit used in various product like drink, Jams and smoothies making it appealing for its health advantage and vibrant appearance.

5. Morphology

Hylocereus spp. are a type of epiphytic, evergreen cacti that can reach heights of 50 to 8 meters. They feature leafless, fleshy, triangular stems, and their trunks can branch into multiple segments, each capable of growing up to 6 meters tall.(34,35) The text describes a plant species characterized by three wavy wings and the presence of one to three spines, or sometimes none(36). These plants have aerial roots that grow from under the stems, providing support on various surfaces and serving as the main source of water absorption.(34) The flowers of the plant, known as "Queen of the Night," bloom at night and are large, fragrant, and edible, typically measuring 30 cm long and 23 cm wide with a bell shape. The flowers are usually white, with cream-colored lobed stamens and stigmas.(37)

Figure1: dragon fruit peel

The pitaya fruit typically has 3 to 5 spherical buds that can develop into flower buds within two weeks. These buds are usually green and cylindrical, growing up to 28 cm in about 16 to 17 days(37). The fruit comes in two colors: bright red or yellow with green scaled(38). The pulp color varies by species, with options including red, purple-red, or white, surrounded by numerous tiny black seed A(37,38,39). Among cultivated species, there are distinct varieties based on skin and pulp color, including white (Hylocereus undatus), red (Hylocereus costaricensis and Hylocereus polyrhizus), and a unique type with yellow skin and white pulp (Hylocereus megalanthus). These species are cultivated in various countries, with three common types typically available in the m(40,41,42,43)

6. Cultivation -:

Mexico is origin of Hylocereus genus, which encompasses Pitaya Cactus, likely brought to central america by Europeans. morton defined Pormalization in 1987, Dragon fruit is cultivated in various contries including us, israel Australia, Cyprus x several location in southest Asia like Thailand & vietnam (7) this sami- epiphytic Plant flourish in tropical subtropical area with drug condition & temp beth 21-29°c, Lit can endure brief freezing temp & temp as high. as 40°c Dragron fruit require bright sunlight, alternating wet & dry season & receive -500-1400mm of annual rainfall, thriving in slightly heavy texture Soil (31,32) depsite its preference for humid climate, fruit set issue may arise. [33] economic incentive have populiarized drogon fruit Cultivation, leading to its growth in over 20 contries with Primary Production region [33] Driven by economic incentives, dragon fruit has attracted worldwide attention, leading to its cultivation in more than 20 tropical and subtropical countries. These countries include the Bahamas, Bermuda, Indonesia, Colombia, Israel, the Philippines, Myanmar, Malaysia, and Mexico, [33.34]. The epicenter of dragon fruit production is mainly Southeast Asia, especially involving major players such as Thailand and Vietnam. [33]

Figure 2 -: Dragon Fruit

7. Harvesting -:

After year of planting the initial harvest occur. main Pruning take place after this Period & Frequent watering, necessary, in 24-28 day dragon fruit skin change red to pink (36). reaching As Peak color in. 4-5 day. For optimal sweetness * Size it is best to wait around 2 month after Fruit sets before harvesting. Cutting bear fruit faster than seed grown Plant, wich take about 8 yr. once ripe dragon fruit con be harvested by twisting to avoid stin damage (34) it can stored at ciic for 25-30 days white at room temp it lasts only up to to day (34,44)

8. Characteristics -:

Characteristic of dragon fruit Pulp were studies to assess it quality. Both red & white dragon fruit have low level of dry matter deu to their Juicy nature. the PH value of pulp were Similar through slightly lower than skin [32] density and fat content were consistent across both type. red fleshed dragon fruit Pule is richer in amino acid and fiber & has double vitamin c Of white flesh Pulp while white fresh contain more carbohydrate. red fleshed variety Contain betacyanin give red- violet color. in term of antioxidant Capacity red dragon fruit Pulp singnifaently surpasse white pulp attributed to Presence betacynin which enhance antioxidan Properties . The pigment molecule contains a phenolic structure, betacyanin helps to increase the total number of phenolic compounds. Thus, the pigment can serve as an antioxidant. Due to the significant levels of nutritional and functional elements identified in the dragon fruit, the results are useful for marketing as a fruit rich in nutrients.(32)

9. Nutritional Value

Nutritional content of dragon fruit is influence by its Species country of origin and harvest time, with growing nutritional environmen significantly impacting its Phytochemical characterstic (32) it contain potassium , Phosphorous ,sodium and Magnesium Compaired to mangosteen and Pineapple [, 45, 46] it valuable source of minerel, glucose, fructose, dietry Fiber and vitamin , especially vitamin c, Phosphorus, and calcium alongside variety of antioxidant [46] Fresh dragon fruit contain about 82.5-83%. moisture mineral ,Protein and fat. Per 100 gm of fresh Pulp it offer nutritional content of dragon fruit is influence by its Species country of origin & harvest time, with growing nutritional environment significantly impacting its Phytochemical characterstic (32).red outer layer notable. for its high antioxidant activity potassium Provide essential nutritient like vitamin , B1, B3 and c while being low in carbohydrat & fat (48) Also, unlike other subtropical fruits, this fruit shows a relatively high level of antioxidant activity.(44) Dragon fruit is low in carbohydrates and fat-free, but it is rich in nutrients, including vitamins B1, B2, B3, C, fiber and minerals such as Ca, Fe and P. While essential fatty acids, l 'linoleic and linolenic acid, found in 50% of the seeds(49). Compared to the flesh of the dragon fruit, the initial stem has a higher content of ascorbic acid, which can help reduce the risk of developing certain diseases such as scurvy, anemia and weakness (7). Dragon fruit has the potential to serve as an important source of pectin in fruit production.c Due to its abundant amount of polyphenolic compounds and antioxidant qualities, dragon fruit is highly valued around the world(50)

Table 1: Botanical Classification Nomenclature of Hylocereusund atus.

Rank	Specific Name
Kingdom	Plantar (plant)
Sub Kingdom	Trachebionata (vascular plant)
Super division	Spermatophyta (seed plant)
Division	Magnoliophyta (flowering plant)
Class	Magnoliopsida (Dicotyledons)
Order	Carryophyllales
Family	Cactaceae (cactus family)
Subfamily	Cactoideae
Tribe	Hylocereae
Genus	Hylocereus (A.Berger) Britton and rosee
Species	Hylocerus undatus (Haw) Britton and rose

10. COMPOSITION OF FATTY ACID

Fatty acid composition of oil is crucial quality factor. study Conducted on fatty acid composition of red & white Pitaya seed fat, revealing that while both oil contain same fatty acid element Their level vary significantly (32) according to table Predominant fatty acid in red & white pitaya seed oil linolic acid make these oil suitable for cooking. white pitaya seed oil has higher percentage of oleic acid compared to red Pitaya seed oil which does not contain oleic acid, overall White Pitaya seed oil has slightly higher concentration of Polyunsaturated fatty acid (PUFA'S) than Pitaya seed oil while amount of saturated and monosaturated fatty acid (32) Dragon fruit seed are noted for their health benet (3)having comparable amount of essential fatty acid to corn oil's'(5)but more than sesame(51)or olive (52) . However linseal(13) be dry(56)and grapes oil bost even higher level essential fatty acid (54,55,32)

Table 2 : 100gm Dragon Fruit contain nutrient

Component	Amount
• Water	• 87 gm
• Protein	• 1.1 gm
. fat	• 0.4 gm
• Carbohydrates	• 11.0gm
• Iron	• 1.9 mg
• Fat	• 0.4 gm

• Vitamin B1	• 0.04 mg
• Vitamin B3	• 0.05mg
• Vitamin c	• 20.5 mg
• Calcium	• 8.5 mg

11. MEDICINAL AND NUTRITIONAL IMPORTANCE OF FRUIT

Dragon fruit is popular for its health benefits due to its rich content of essential nutrients like vitamins, minerals, complex carbohydrates, dietary fiber, and antioxidants. Its seeds contain powerful antioxidants such as catechin, epicatechin, and gallic acid. Additionally, the pulp and skin of dragon fruit are rich in bioactive phytochemicals like betacyanins and phenolic compounds, which provide antioxidant and anti-inflammatory p(56)

11.1 Wound healing Properties

The extract from dragon fruit leaves and flowers was found to enhance wound healing in an injured diabetic rat by increasing tensile strength and promoting healing activity. Bioactive substances from dragon fruit pulp, such as hydroxyproline, collagen DNA, and total protein, have traditionally been used to treat wounds.(57) Young stems and fresh flowers of the dragon fruit plant can be eaten as vegetables, while dried flowers are used in home remedies. Dragon fruit is commonly used in fruit salads and juices at restaurants. Its high vitamin C content may help prevent coughs and asthma and speed up the healing of cuts and wounds.(58)

11.2 Anti-cancer Properties

The natural anticancer properties of certain components are valuable in cancer treatment. Studies on various human cancer cell lines, including prostate (PC3), breast (Bcap-37), and gastric (MGC- 803) cancers, revealed that dragon fruit extract exhibits significant cytotoxic activity, particularly in MGC-803 cell A(59). The skin of the dragon fruit contains bioactive compounds that may inhibit cancer cell growth(63). Additionally, extracts from H. undatus demonstrate potential anticancer and antiapoptotic effects when tested on human liver cancer cells (HepG-2), indicating their therapeutic promise(60).

11.3 Antiaging Property:

Dragon fruit is rich in Vitamin E and beta-carotene, which help inhibit cancer cell formation. The red variety of dragon fruit is known to delay aging, and its high fiber content can aid in reducing fat cells in the body.(61)

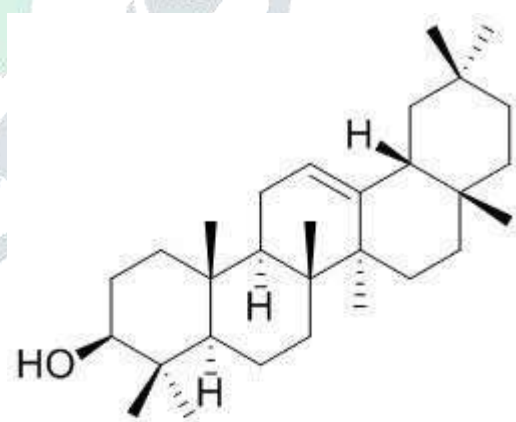
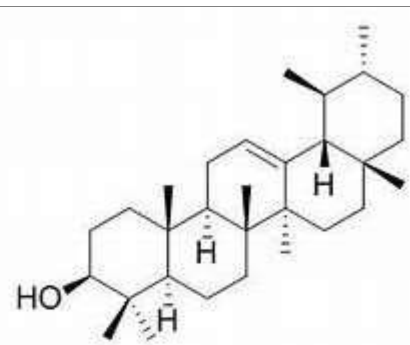
11.4 Anti obesity properties

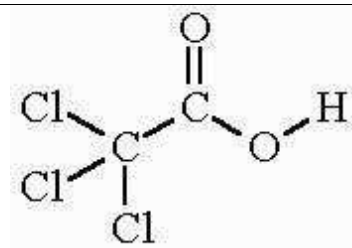
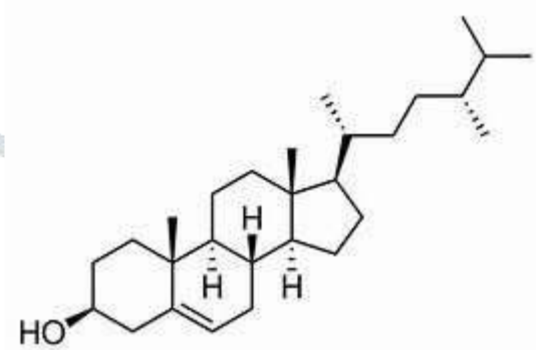
The methanolic extract from H. Costaricensis showed an anti-obesity effect in rats, while the sugar extract from H. Unda demonstrated anti-inflammatory, anti-lipase, and anti-diabetic Properties(62) Dragon fruit was found to contain bioactive substances like saponin and triterpenoid, which have significant application potential. Additionally, the crude fiber, lipid profiles, and flavonoids in dragon fruit extract may help prevent cholesterol absorption in the intestines.(64)

11.5 Anti-diabetic Properties

Diabetes is a leading cause of death globally, and diabetes mellitus is a metabolic disease often treated with natural and herbal The grapes(65). Research indicates that dragon fruit may lower blood glucose levels due to its inhibitory effects on phosphodiesterase and its flavonoid content, which reduces oxidative stress and promotes insulin retention(65). Studies show that the glucose in dragon fruit can help control blood sugar in diabetic patients, particularly those with type 2 Diabetes(66). In type 2 diabetics, red dragon fruit consumption has been linked to lower total cholesterol, triglycerides, and low-density lipoprotein cholesterol, while increasing high-density lipoprotein cholesterol levels. However, there has been limited research on the benefits of white dragon fruit for diabetes and non-alcoholic fatty liver disease, despite both types being rich in bioactive nutrients.(67)The pulp of dragon fruit is abundant in vitamin C, antioxidants, unsaturated fatty acids, B vitamins, carotenoids, proteins, and essential minerals like calcium and iron. Research indicates that the vitamin C content can be as high as 6000 mg per 100 H(7,60). The seeds of the fruit contain unsaturated fats, including omega-3 and omega-6 fatty acids, which help lower triglycerides and reduce cardiovascular disease risk. Consuming dragon fruit supports various bodily functions, such as detoxifying heavy metals and enhancing vision. Additionally, lycopene, which gives the fruit its red color, is linked to a lower risk of prostate cancer.(68)

Table 3: Chemical Component in dragon fruit

Sr.No	Chemical composition	Structure
1.	B-amyrin - 15.87% (C30H50O)	
2.	α-amyrin - 13.90% (C30 H50)	

3.	Trichoroacetic acid (C2HCl3O2)	
4.	octadecane - 6.27% (C18H38)	
5.	Campesterol – 4.16% (C28H48O)	

12. PULP

100 g of dragon fruit Pulp contain various nutrient including tran-solube Phenolic compounds , tras ascorbic acid, trans-dietary Fiber & Pectin. Presence of these nutrient affected by dragon fruit nutritional composition & antioxiden activities & as well as by destired characteristic of drugdragon fruit rich loron, which help boost hemoglobin * erythrocyte level. Red dragon fruit jure con significantly support management of gremis in Pregnent women (6,7,69,70)

13. SEED

Dragon fruit contains small black seeds encased in white or pink flesh. The seeds are high in fatty acids, including linolenic, linoleic, palmitoleic, and oleic acids, with the oil extracted from them being particularly rich in the essential fatty acids linoleic and linolenic, which are vital for human metabolism. Additionally, the flesh is abundant in mixed polysaccharides and oligosaccharides that promote the growth of beneficial gut bacteria, including lactobacilli and bifidobacteria. These probiotics play a crucial role in maintaining a healthy gastrointestinal microflora and preventing infections.(71,72)

14. Leaves

The leaves of the dragon fruit are rich and can be used with antibacterial properties in the treatment of infectious diseases, including meningitis. Analyzes have shown that red dragon fruit leaf extracts and white dragon fruit leaf extracts have the ability to prevent the spread of bacteria associated with bacterial meningitis, including Neisseria meningitidis, Streptococcio pneumoniae and Listeria monocytogenes .(73)

15. Stem

The stem of a dragon fruit plant is believed to offer therapeutic benefits. Eating the unripe stem of the dragon fruit, which contains more ascorbic acid than the flesh of the fruit, can help people to avoid certain risk factors for the disease, according to some Studies(14). Due to its relatively low nitrogen requirements compared to many other fruit crops, the possibility of organic cultivation with organic fertilizers and local compost becomes feasible for this crop. Therefore, given its current underutilization, dragon fruit has the potential to become an essential fruit crop in the future.(42)

16. CONCLUSION -:The rising popularity of dragon fruit in India is attributed to its nutritional value and health benefits. Research indicates that dragon fruit is rich in essential nutrients, including vitamins C, B1, B2, and B3, along with high fiber and important minerals like calcium, iron, and phosphorus. It is low in carbohydrates and fat-free, with its seeds providing essential fatty acids necessary for metabolism. These factors enhance its effectiveness in treating various health issues. Additionally, the stem of the dragon fruit has therapeutic properties due to its high ascorbic acid content, which may help reduce disease risk factors. The presence of pectins and betalains in both fresh and dried forms further contributes to its health-boosting qualities.

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