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Nutritional And Therapeutic Uses Of Dragon Fruit

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Abstract

Dragon fruit (Hylocereus spp.), a tropical and subtropical fruit belonging to the Cactaceae family, has gained significant attention due to its rich nutritional profile and various therapeutic properties. This review highlights its taxonomy, morphology, origin, distribution, and chemical composition. Dragon fruit is a valuable source of essential nutrients including vitamins (notably vitamin C, B-complex), minerals (calcium, iron, phosphorus), amino acids, organic acids, and dietary fiber. Its pulp and peel contain beneficial phytochemicals such as flavonoids, polyphenols, betacyanins, and antioxidants, which contribute to its therapeutic effects.

The fruit exhibits several pharmacological activities such as antioxidant, antimicrobial, anti-cancer, anti-Parkinson's, hepatoprotective, anti-inflammatory, laxative, anti-obesity, and wound-healing effects. It has also been reported to aid in cholesterol regulation, digestive health, and immune system enhancement. The seeds and skin are rich in essential fatty acids like linoleic, oleic, and palmitic acids, which further add to its health benefits. Due to these attributes, dragon fruit holds significant promise as a functional food and nutraceutical agent in modern health management. This article aims to provide a comprehensive overview of the nutritional and therapeutic significance of Hylocereus spp. based on recent scientific findings.

Keywords: Dragon Fruit, Nutritional Value, Therapeutic Activity, Vitamins and Minerals, Amino Acids, Antimicrobial Activity, Anti-cancer Properties, Anti-Parkinson's Activity.

Introduction

According to the World Health Organization [WHO]: The world's population, especially in developing countries, depends on traditional plants. Medicines based on primary health care needs. Use of plants for treatment the various afflictions of humans and animals are as old as humans themselves. These plants are widespread in all sectors of society. Therapeutic or indirect as a pharmaceutical of modern medicine. In the Recently, there has been a massive increase in interest in plant research worldwide Collected evidence of the immense potential of medicinal plants used in various traditional systems (Ayurveda, Siddha, Unani) and also a major source of therapeutically valuable biodynamic compounds . Hirokerasundatus is usually the most

cultivated vine cactus belonging to the cactus family. Cactus family known as 'dragon fruit' covered with bright red skin It has green scales and white flesh with tiny black seeds. the flowers are so beautiful. It has been the subject of many researchers, mainly because of its unique taste, shape and flesh color[1-6].

There are three types of commercialized pitaya: her.i.e. Hylocereus polyrhizus, Hylocereus undatus, Hylocereus megalanthus. From its center of origin, the dragon fruit has spread to tropical and subtropical America, Asia, Australia, and the Middle East. At least 22 cultivated. tropical countries such as Australia, Cambodia, China, Israel, Japan, Nicaragua, Peru, Philippines, Spain, Sri Lanka, Taiwan, Thailand, Southwest America, Vietnam, etc. [7-11].

Contains a lot of water (85.30%), Protein (1.10 g), Fat (0.57 g), Dietary Fiber (11.34 g). Plus Vitamin C and Minerals. This species includes calcium, phosphorus, magnesium, and sodium. fructose, and sucrose contained in fruits are about 64.3-104.3, 40.1-64.9 and 5.47.5 mg . Plants in this family can tolerate Extreme heat and cold, dry weather and nutrient- poor soils. or the structures of these plants are used for water storage, reduction, or No leaves, natural waxy surface, nocturnal stomata. An opening for carbon dioxide uptake. This allows plants to Withstands the most difficult conditions. White pitaya is a nutritious fruit, versatile use. The most valuable and commonly used edible parts of the fruit are pulp that makes up 70- 80% of the ripe fruit and may taste similar to kiwi. It is often used in restaurant fruit salads. Young stems of H. undatusis edible and the fresh flower buds are eaten as a vegetable. The dried ones are used in homemade medicines. Shells can be used for crafting colored pigments and slimes used in the food or cosmetics industry. Dragon fruit trees are grown for their large, attractive flowers and for ornamental purposes Bonsai specimen.[12-13].

History

Literature dates dragon fruit to the 13th century. that is the fruit was believed to have been introduced to Vietnam by the French. The average yield per hectare is 20-25 tons. Pre-Columbian era, H. undatus Widespread in many tropical regions of the Americas and the Caribbean Dispersal by Birds and Breeding and Cultivation of Seeds by Humans for it’s edible fruit. introduced to the Philippines by the Spaniards16th century. Hawaii has a locally famous cactus hedge over lava rock Wall of Punahou School, Honolulu, Kapunahou Hedge. 1836, Mrs. Bingham planted her Hylocereus undatus hedge, a famous cactus Known as Paninio Kapunahou in Hawaii. people were out in the evening 'Rent' a cutting now to see it bloom across the island This type is everywhere. In South Africa it was introduced into the country Can be grown in gardens due to its ornamental invasiveness But, only with permission. usually limited and localized, mainly Explosion from homestead garden affects native plant communities and localsecology. . Malaysia is another region where dragons can be reliably found. fruits. It was first introduced in 1999 in Sitiawan, Johor and Kuala Pira regions. Colombia and Nicaragua are other places where the pitahaya fruit is grown. commercial purposes. These regions prove that pitaya is a cactus fruit. A taste loved by many people without forgetting its medicinal properties trust. H. undatus is widely naturalized in eastern Australia. Considered an environmental weed in open forests, dry rainforests and dikes Regions and coastal vegetation in temperate regions[14-16].

It has been recorded from coastal counties in south-east and central Queensland and the northern New South Wales; on local weed list in Byron Shire in northern New South Wales Redland Shire in southeastern Queensland. continue to grow normally.

Taxonomy Classification

Table 1. Taxonomy Classification of Dragon Fruit

Domain	Eukarya
Kingdom	Plantae
Sub Kingdom	Trachebionta
Division	Magnoliopsida
Sub Division	Spermatophyta
Class	Magnoliopsida
Order	Caryophyllales
Family	Cactaceae
Sub Family	Cactoideae
Tribe	Hylocereae
Genus	Hylocereus
Species	Hylocereus Undatus

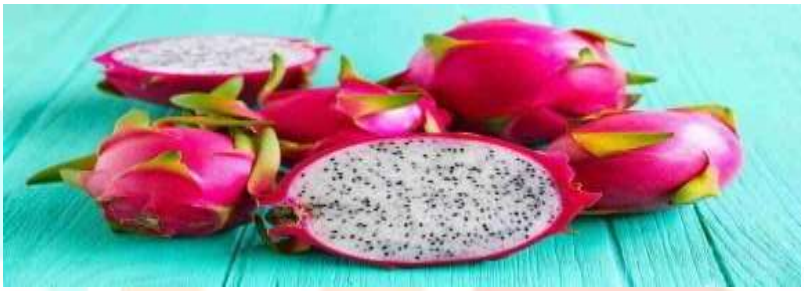

Figure 1. Dragon Fruit

Synonyms

- Cereus guatemalensis (Eichler) A. Berger
- C. tricostatus Rol.- Goss
- C. undatus Pfeiff
- C. undulatus D.Dietr
- Hylocereus tricostatus (Gosselin) Britton & Rose.

Common Names

Pitaya, Night blooming Cereus, Strawberry Pear, Belle of the Night, Cinderella Plant, Jesus in the Cradle, Queen of the night.

Origin and Distribution

H. undatus is found in Brazil, Colombia, Costa Rica, Curacao, Ecuador, El Salvador, Guatemala, Mexico, Panama, Venezuela, Uruguay. Originally It is now commercially and widely cultivated in Central and South Spines: Distributed in many countries with tropical and subtropical climates, including USA [South Florida, California, Hawaii], Australia, Taiwan, Vietnam, Malaysia and Israel. Degener tells how this species reached Hawaii in his 1830 shipment from Hawaii. Plants being loaded onto a ship going from Boston to Canton at a port in Mexico China. He says most of the plants died and were discarded during the stop over In Hawaii, the captain noticed that the white pitaya was still partially alive. Cuttings were planted and thrived, and cacti were widely propagated Houseplants of the island. It blooms splendidly there, but rarely bears fruit. This art is often used as a rootstock to which various ornamental cacti are grafted Examples include Zygocactus, Epiphyllum, and Rhipsalis. Mainly flowers and bears fruit August and September.

Morphology

Dragon fruit is a vast or tangled terrestrial or epiphytic cactus. She Climbs with aerial roots and can reach heights of over 10 meters as it grows on rocks and trees. The morphology of dragon fruit is root, stem, thorn, flowers and fruits.

Roots

Dragon fruit have hairy root that grow in the top soil plant.

Stem

Green 3-winged, from a few cm up to 5 m long in mature plants, 4 to 7.5 cm margin sundulate and horny wide with wings that are 2, 5 to 5 cm wide. Stem is triangular in shape, prickly very short and inconspicuous, so often considered "spineless cactus".

Spines

1 to 3 conical spines up to 1 cm long but usually about 2-3 mm long.

Flowers

Flowers are ornate, fragrant and beautiful 25-35 cm long by 30 cm across, white with green outer tepals and bracts. Flowers bloom in the evening when the buds grow About 30 cm. The outer petals are cream colored and bloom around 9 o'clock, then followed by a crown of white areas containing yellow lines stamens. The funnel-like flowers were finally in full bloom at midnight. Dragon fruit is known as the night-blooming Cereus. let's go when it blooms. The berries give off fragrance. The scent is said to attract pollinating bats and dragon fruit flower.

Fruit

Flowers grow into fruits and do not fall off. Dragon fruit is round and slightly oval shape into the size of an avocado. bright red fruit leather for white varieties and red dragon fruit, red dragon fruit is dark to black, yellow to yellow Pitaya. His skin was stuffed with tassels that rivaled dragons scale.

Nutritional Constituents

The typical nutritional values per 100 g of raw pitaya [of which 55 g are edible areas follows:

Table 2. *Nutritional Constitute*

NUTRIENTS	AMOUNT
Water	80-90 gm
Ascorbic acid (vitamin C)	04-25 mg
Ash	0.4-0.7 gm
Calcium	06-10 mg
Calories	35-50 gm
Carbohydrates	09-14 gm
Phosphorous	16-36 mg
Fat	0.1-0.6 gm
Fiber	0.3-0.9 gm
Protein	0.15-0.5 gm
Iron	0.3-0.7 mg
Niacin	0.2-0.45 mg

Nutritional value

- The proximate values in gram or mg per 100g edible portion of white-fresh 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 (3.0p)
- Vitamins and Minerals: Rich in Vitamin C (up to 6 mg/100g), magnesium (Mg), potassium (K), sodium (Na), zinc (Zn), phosphorus (P), calcium (Ca), and iron (Fe).
- Vitamin C Variation: Varies by species and cultivation method; red-flesh varieties show higher levels.
- Fatty Acid Profile (especially in pulp/seeds of H. undatus): Linoleic acid (50.8%), Oleic acid (21.5%), Palmitic acid (12.6%)
- Bioactive Compounds: Contains antioxidants like ascorbic acid, phenolic compounds (quinic acid, cinnamic acid), and other organic acids.
- Health Significance: All parts of the fruit (pulp, seeds, stem) have nutritional benefits, including raw fiber, protein, essential minerals, and fatty acids.

Table 3. Nutritional Value of Dragon Fruit

Nutrient	Amount Per 100 g	% Daily Value	Comment
Water	87 g	NA	Very high water content
Protein	1.1 g	2.1 %	
Fat	0.4 g	NA	Contains practically no fat
Carbohydrates	11.0 g	3.4 %	
Fiber	3 g	12 %	Very good source of dietary fiber
Vitamin B1 (Thiamine)	0.04 mg	2.7 %	
Vitamin B2 (Riboflavin)	0.05 mg	2.9 %	
Vitamin B3 (Niacin)	0.16 mg	0.8 %	
Vitamin C (Ascorbic Acid)	20.5 mg	34.2 %	Contains more than 3 times the amount of vitamin C found in carrots
Calcium (Ca)	8.5 mg	0.9 %	
Iron (Fe)	1.9 mg	10.6 %	A good source of iron
Phosphorus (P)	22.5 mg	2.3 %	
Zinc (Zn)	NA	NA	

Proteins-Amino acids and organic acids

By one of the scientists, part of its content was more nutrients such as amino acids and organic acids. Dragon fruit peel and dragon fruit pulp. Contains essential amino acids such as tyrosine, glutamic acid and leucineysine, tryptophan, valine, alanine, serine, aspartic acid, organic acids Tartaric acid, malic acid, citramalic acid, fumaric acid, propanedioic acid, talonic acid and mannonic acid.

Carbohydrates

Dragon fruit is high in carbohydrates, mainly glucose, fructose, and some Study of oligosaccharides . especially dragon shells Fruits have the most macronutrients, found in pectin and fibers. The peel is also used for pectin extraction. A survey of the physicochemical properties of pectin has been carried out dragon fruit skin. The pectin contained in the pericarp has high absorbability, cholesterol, which helps reduce the effects of blood cholesterol.

Vitamins and Minerals

The pulp of dragon fruit contains essential vitamins such as vitamin C, vitamin c.B1, vitamin B2, vitamin B3, vitamin E, vitamin A .Also phosphorus, calcium, iron, magnesium, and zinc. The amount of dragon fruit skin is limited.

Antioxidants

Dragon fruit is very rich in antioxidants and has been used to fortify prebiotics and as a natural coloring agent in the food industry. betalains, betacyanins, flavonoids, hydroxycinnamates, polyphenols, etc. Polyphenols are found in dragon fruit seeds, skin and pulp of , but seeds and skin contain more polyphenols compared to the pulp. This is a group of plant-derived antioxidants that include flavonoids, phenolic acids, lignin, and more. They have a high free radical scavenging capacity that reduces the risk of chronic diseases.

Fatty acids

Dragon fruit seeds are composed of important essential fatty acids close to about 50D44, such as linoleic acid, which has a laxative effect against gastroenteritis (Yanyi Huang et al.al., 2021) and other fatty acids. B. Palmitic Acid (17.5%), Oleic Acid(22.7%), cis- vaccinic acid (3.0%). is ascorbic acid Especially in early stems of dragon fruit,Its main function is to reduce disease risk factors such as:B. Anaemia, scurvy and wasting.

Lipids and Betacyanins

Many analyzes have been done showing red dragon fruit peeling contains essential lipids such as stearic acid, pentenoic acid, docosanoic acid,propanoic acid and butanoic acid[9]. Betacyanin Anti-obesity, natural pigment with as many bioactivities as anti-obesity Cancer, Antioxidants, Antimicrobials. These help prevent reduction of coronary artery disease and oxidative liver injury. Betacyanin is used in food as a natural colouring agent Also yogurt, ice cream and biscuits. Betacyanin was extracted from dragons. Dragon fruit has more skin than pulp, Food as Functional Ingredient or Natural Colorant in Food.[18-19]

Alkaloids

The dragon fruit peel has extracted to detect the alkaloids present in the dragon fruit, it is composed of choline, dopamine hydrochloride, amaranthin, amine and N- benzylmethylene isomethylamine[29]. In which N-benzylmethylene isomethylamine and choline are most common alkaloids found in dragon fruit peel.

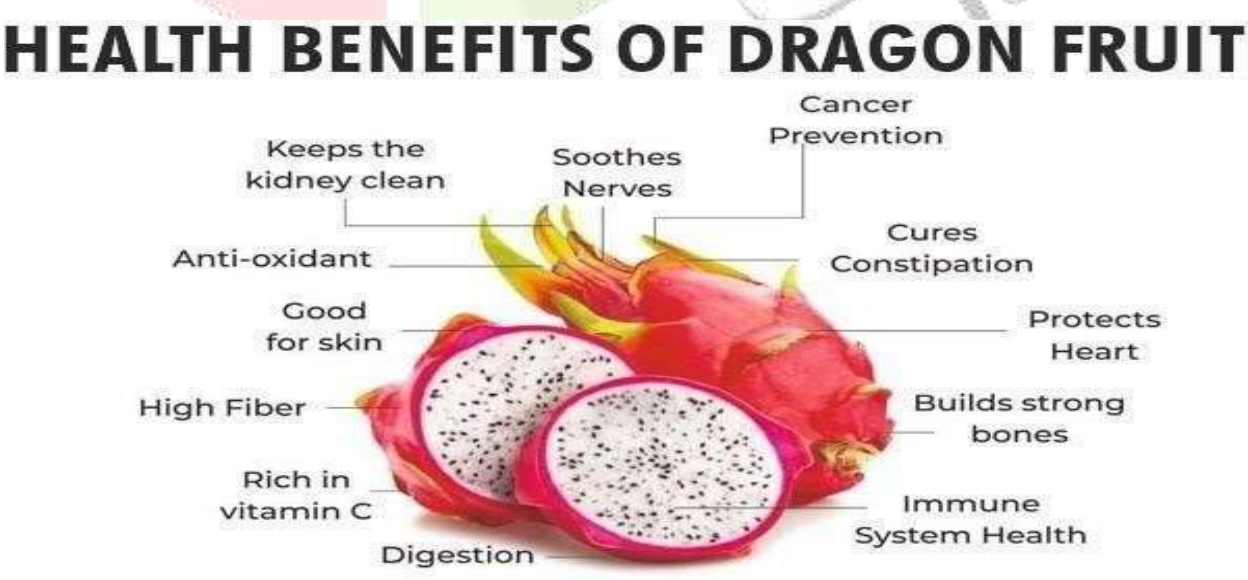

Figure 2. Health Benefits of Dragon Fruit

Therapeutical activities of Dragon fruit

Dragon fruit is rich in minerals and vitamin C. Vitamin A, Vitamin B, Fats, Carbohydrates, Antioxidants, Flavonoids, Beta cyanins, Polyphenols with high antioxidant properties, carotene iron, phyto albumin properties.

Antimicrobial activity

Every plant has physiological and biochemical resistance to counteract for different pathogens when infection occurs. Recent studies tested the anti- bacterial activity of dragon fruit peel extract, betacyanin's, phenolics, fatty acids, terpens and tannins can be responsible for the dragon fruit antimicrobial activity. Dragon fruit was undergone study which found that the antibacterial activity of chloroform, ethanol and hexane extract were obtained from the exhibited inhibition zone is about 7 to 9 mm against the gram-negative and gram-positive bacteria. Betalain also plays wide role in mechanism of microbial inhibition, but only specific cellular and molecular mechanism of antimicrobial activity of betalains further should be investigated .The stem of H. polyrhizus MeOH extract has strong antimicrobial against S. aureus, P. aeruginosa, C. albican.[20-24]

Prebiotic activity

Prebiotics are indigestible oligosaccharides that have beneficial effects on nutrition Attacks the host by stimulating the growth of normal intestinal flora. Various studies prebiotics have been shown to provide and mitigate protective effects against colon cancer Trends in inflammation-associated bowel disease. Microbiota growth for example, the colon prevents the invasion of lactobacilli and bifidobacterial Allows pathogens to enter the digestive tract and promotes good health digestive system[25-27].

Mixed oligosaccharide content of H. undatus About 85% of the ethanolic meat extract was detected. These oligosaccharides It was more resistant to human salivary α- amylase than inulin. Maximum hydrolysis of samples in α-amylase with increasing pH (4, 5, 6, 7and 8) were 2.90, 3.08, 3.28, 6.8%, and 11.18%, respectively. Maximum. In hydrolysis was 5.72, 8.03, 7.39, 12.32, and 16.22%, respectively. or Oligosaccharides also showed high resistance to artificial hydrolysis. human gastric juice. About 50% of the pitaya consumed is mixed .Oligosaccharides enter the colon despite hydrolysis by salivary α-Miniature versions of amylase (16%), stomach acid (2.5%) and other brush border enzymes Intestinal (30%) Mixed oligosaccharides in pitaya also promoted It Proliferation of beneficial bacteria such as Lactobacillus Delbruck and Bifidobacterium bifidus. Bacterial counts of L. delbrueckii and B. bifidium increased from 9.02 x 107 to 6.17 x 109 and from 1.70 x 108 to 2.22 x 109 cells/ml, or when extracts from H. undatus are used as the carbon source [28-31].

Anticancer

The anticancer properties of Hylocereus species have recently been studied. There is some evidence that the polyphenols, flavonoids and betanins contained in Hylocereus species are responsible for the anticancer effects. H. undatus shells extracted with the solvent system ethanol-water. 50 v/v exhibited a dose-dependent and proliferative activity against a human hepatocellular carcinoma cell line (HepG2)21, an IC50 value of 81±0.01 mg/ml was recorded after 48 hours of incubation. Nitric oxide (NO) free radicals are neutralized by polyphenols. Promotes tumor growth and metastasis. The disallowed compound NO is a potential anticancer drug. On the other hand, flavonoids are highly valued for their anticancer properties due to the presence of three hydroxyl groups next to the C2C3 double bond. Betacyanin, its molecular structure resembles that of flavonoids, and probably does. Anticancer activity. In addition, H. undatus extracts have anticancer effects on other cells. A significant reduction in cell viability was observed in human breast tissue. Different amounts (0-600 g/mL) were pre-treated with cancer cells (MCF- 7). Undatus meat extract from ethanol. Notably, an extract from H. undatus at 600 g/mL reduced proliferation of MCF-7 cells bynearly 85%. Another in vitro anti-proliferative study on melanoma cell (B16F10) suggested that the peel and flesh of H. polyrhizus that extracted with 80% acetone inhibited the cancer cell growth in a dose dependent manner[32-33] .

Anti - Parkinson's activity

Anti-Parkinson's disease activity was present in ethanol extracts of Holocene's undatus pulp with high levels of flavonoids and amino acids Alkaloids have been studied recently. This activity is done with a mouse, Results showed that they have this activity[34].

Laxative activity

Several recent studies have shown that ethanol extracts of fruit The pulp of Hylocereusundatus has a laxative effect. This research Mice by number and weight of faeces.

Other Therapeutic activities of Dragon fruit

Dragon fruit has many health-promoting in addition to the bioactivities as well as anxiolytic effect, anti-inflammation activity, antiaging, photo protective property etc. as follows;

- Hepatoprotective activity
- Anti-Obesity activity
- Wound healing activity
- Ageing activity and Weight loss activity

Application Of Dragon Fruit

- Dragon fruit strengthens the immune system. Dragon fruit is rich in vitamin C,Fiber that contributes to an overall healthy body.
- Dragon fruit promotes healing of wounds and cuts.
- Dragon fruit improves eyesight.
- Dragon fruit aids digestion. Due to its fibre content, dragon Fruit Helps Digest Food, Studies Also Suggest Dragon Fruit Promotes growth of probiotics.
- Dragon fruit helps lower blood sugar levels in type 2 diabetes. the study it also suggests that the glucose in dragon fruit may help control blood sugar levels. Blood sugar level indiabetic patients.
- Dragon fruit helps control cholesterol levels. Plenty of dragon fruit Flavonoids known to have beneficial effects on cardiovascular disease illness.
- Dragon fruit is also rich in flavonoids that have anti-cardiopathy properties. Dragon fruit can help treat bleeding problems associated with vaginal discharge.

Toxicity of dragon fruit

Toxicology research is particularly relevant to demonstrate and support food safety. Ingredients as it helps identify possible side effects. Definition of the exposure conditions necessary to produce these effects; evaluation of Dose- response relationships for adverse reactions, including dose definitions The risk of not producing such an effect, and the interpretation of experimental data about risk Evaluation of information on mechanism of action and relevance to humans Metabolic and toxicity data to extend results from animals person. A study on the safe exposure of pitaya fruit. In this context, the potential. The toxicity of the methanol

extract from this fruit is acute and Subchronic administration in rats. In acute toxicity studies, a single dose Oral administration of fruit extract (1250, 2500, 5000mg/kg) to rats He then monitored the animals for 14 days by oral gavage. In sub chronic studies Toxicity, pitaya extract was also orally administered to rats at doses of 1250, 2500and 5000 mg/kg/day he for 28 days. The authors did not observe mortality or signs no significant differences in the presence or absence of acute or sub chronic toxicity, body weight, and organs body weight or hematologic parameters in sub chronic studies. No abnormality viscera were observed between the treatment and control groups, Lethal oral pitaya extract has been determined to exceed 5000 mg/kg, Dose at which no side effects of the extract are observed for male and female rats 5000 mg/kg per day for 28 days was considered. Luo's research and others. We used the MTT assay 3-(4,5-dimethylthiazol-2-yl)-2,5 to determine the cytotoxic activity of diphenyl tetrazolium bromide] Supercritical carbon dioxide extract by gas chromatography-mass spectrometry of H. Bark of polyrhizus and H. undatus in human tumor cell lines prostate cancer cell line (PC3), human breast cancer cell line (Bcap-37) and human Gastric cancer cell line (MGC-803) [35-36].

CONCLUSION

This review is a compilation of exotic fruits, dragon fruit being one of the expensive ones. It is a nutritious fruit and one of the most commonly consumed around the world. I have dragon fruit 18 kinds of fruits with different nutritional value Hylocereus genus therefore has a wide range of minerals and nutrients available, Phytochemicals such as B.Antioxidant, antibacterial, and anticancer effects Properties with the use of dragons, anti- aging properties and many more. In recent years, fruits have become important both economically and nutritionally. Its diet has dietary supplement parameters and helps prevent Strengthens nutrition-related diseases and the human immune system. there is Various dietary supplement properties such as antioxidant activity, anti-diabetes activity, antibacterial activity, anticancer activity, anti-obesity activity, prebiotics Such as activity and wound healing properties may be known as home. Phytochemicals that promote health and economic development. but, further research on identification, purification and quantification of bioactive substances Connection from Pitayais required. and determination of its mechanism Steps should be taken to better understand the medicinal properties of fruits feature. Widely used in various traditional medical systems. medicine.It has been used as an ingredient in food and medicine for centuries. Further study of this fruit will give you various benefits. even a dragon The peel of the fruit is used for the extraction of pectin and betalain and used as a natural product. Dyes in the food industry.

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