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DRAGON FRUIT: A REVIEW OF HEALTH COVERAGE AND NUTRIENTS

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ABSTRACT

Dragon fruit or pitaya is an exotic tropical plant that brings multiple benefits to human health thanks to its High nutritional value and bioactive compounds, including powerful natural antioxidants. Extracts from stems, flowers, Peels, pulps of dragon fruit own a range of beneficial biological activities against pathogenic microbes including bacteria, fungi and viruses, and diseases like diabetes, obesity, hyperlipidaemia, and cancer. Moreover, dragon fruit extracts Have cardiovascular and hepatoprotective properties, as well as prebiotic potential . Nutritional and biochemical composition of dragon fruit (Hylocereus) species H. undatus (fruits with white pulp And pink skin), and H. polyrhizus (fruits with red pulp and pink skin) were investigated to develop the nutritional Composition data for dragon fruit and compare the difference between H. undatus and H. polyrhizus.It is abundant in vital nutritional ingredients viz. carotene, calcium, fibre, vitamin B, Vitamin C, and phosphorous. Most importantly, being rich in various nutrients, vitamins and minerals and accordingly owing high medicinal values, it is believed To able to lower cholesterol concentration, to balance blood sugar concentration, to prevent colon cancer. Both phenolics and ascorbic acids contributed to the anti-radical power of The two species of Hylocereus fruits but the latter contributed more. By taking into account the Free radical scavenging activity and ferrous ion chelating activity, pulp of H. undatus had the Highest antioxidant properties.

Keywords*: pitaya; Hylocereus polyrhizus; maturity stages; phytochemicals; minerals; semi-arid conditions.*

1. INTRODUCTION

Dragon fruit or pitaya is the fruit of several different Tropical climbing plants of the genus Hylocereus, family Cactaceae. The plant is known by many names, such as dragon Fruit, pitaya, pitahaya, night-blooming cereus, strawberry Pear, Belle of the Night, Cinderella plant Although the pitaya is native to the tropiIcal areas of North, Central and South America, it Is now cultivated worldwide due to its commercial Interest, not demanding cultivation requirements, i.e. high drought tolerance, easy adaptation to light intensity and high temperature, a wide range of tolerance to different soil salinities, and benefits to human health [1]. The Red Dragon Fruit or Red Pitaya, Hylocereus polyrhizus [8, 9], is a perennial climbing vine Cactus species. The ovalshape of the fruit is remarkably decorative, with a bright red-purple Skin, studded with green scales or bracts [11-13]. The fruit does resemble a dragon and causing locals To call it as Buah naga or Buah Mata Naga. The fruit, with its scaly structured peels, has a delicate And sweet red-purple color flesh, embedded with numerous small black seeds . The species Comes in a number of varieties, namely H. undatus (white pulp with bright red skin), H. polyrhizus (red pulp with bright red skin) and Selenicereus megalanthus (white pulp with yellow skin). The species originates from the tropical forest regions of Mexico and Central and South America and recently has been widely grown in Malaysia, Thailand, Vietnam, Australia, Taiwan and some Other parts of the world[3].The fruits of Hylocereus species, which is often called 'the scaly fruit' in Latin America or 'dragon Fruit' in Asia, are medium-large berries bearing large green or red scales . There are several varieties of pitaya fruit; red pitaya with white flesh (Hylocereusundatus), red pitaya With red flesh (Hylocereuspolyrhizus) which has been used in this study and another type is yellow Pitaya with white flesh (Hylocereusmegalanthus). Red pitaya has high moisture content and is rich in fiber, phophorus, vitamin C and calcium. According to Norhayati (2005), the crude dietary fiber in red pitaya is 10.1g per 100g of edible Portion, in addition to the high content of antioxidant vitamins such as vitamin A, C and E which are 102.13 µg, 540.27 mg and 105.67 µg per 100 g dry weight, respectively[2] Since pre-Columbian times, pitayas have been Very common in their native countries, where they are Consumed by the general population.

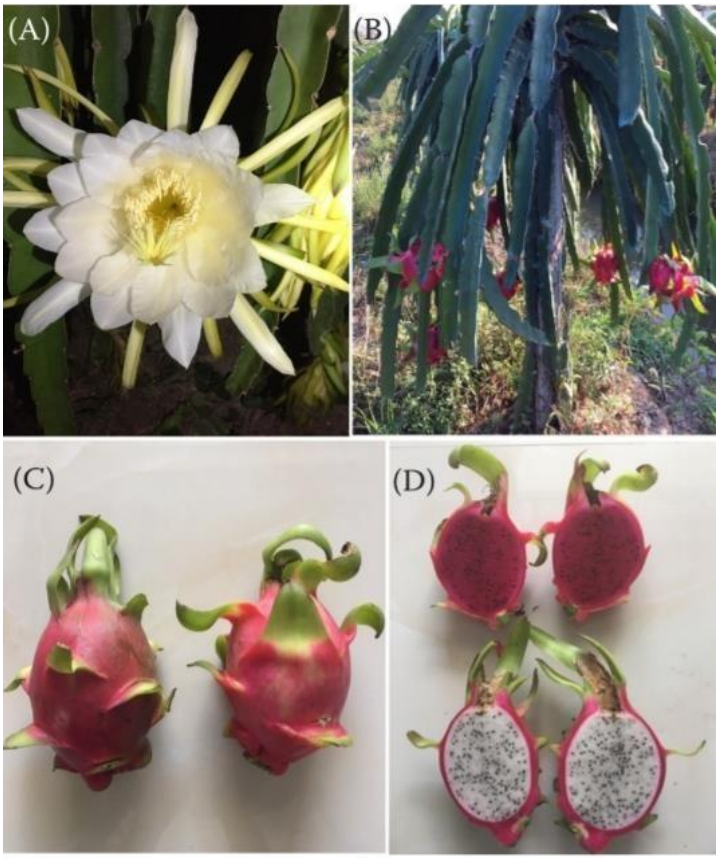

Fig1:Flowers, stems and fruits of the pitaya of the genus Hylocereus: flower blooms at night (A); branched stems (B); Pitaya of H. undatus (left) and H. polyrhizus (right) ©; the oval shape with bright, red skin and green foliaceous Bracts/scales resembling the skin of a dragon; red pulp and white pulp of H. polyrhizus and H. undatus (D) https://doi.org/10.17221/139/2020-CJFS[1]

Recently, pitayas are traded in international markets and have become the most Important export fruit of Vietnam. Demand will increase For many years as this delicious fruit becomes better known In other markets[13]. Salinity reduces water availability to plants (osmotic effect) and can Have a toxic effect from action of the saline complex or the specific action of sodium, chlorate, sulfate, carbonate, or bicarbonate ions. The Physical effects on soils are clay dispersion and soil structure degradation as effect of excessive sodium ions The osmotic and toxic effects of salts on plants are simultaneous. The Toxicity directly affects physiological and metabolic processes of plants, While the osmotic factor has an indirect action reducing the osmotic Pressure and consequently the absorption of water and nutrients as proposed by Cavalcante .[10]

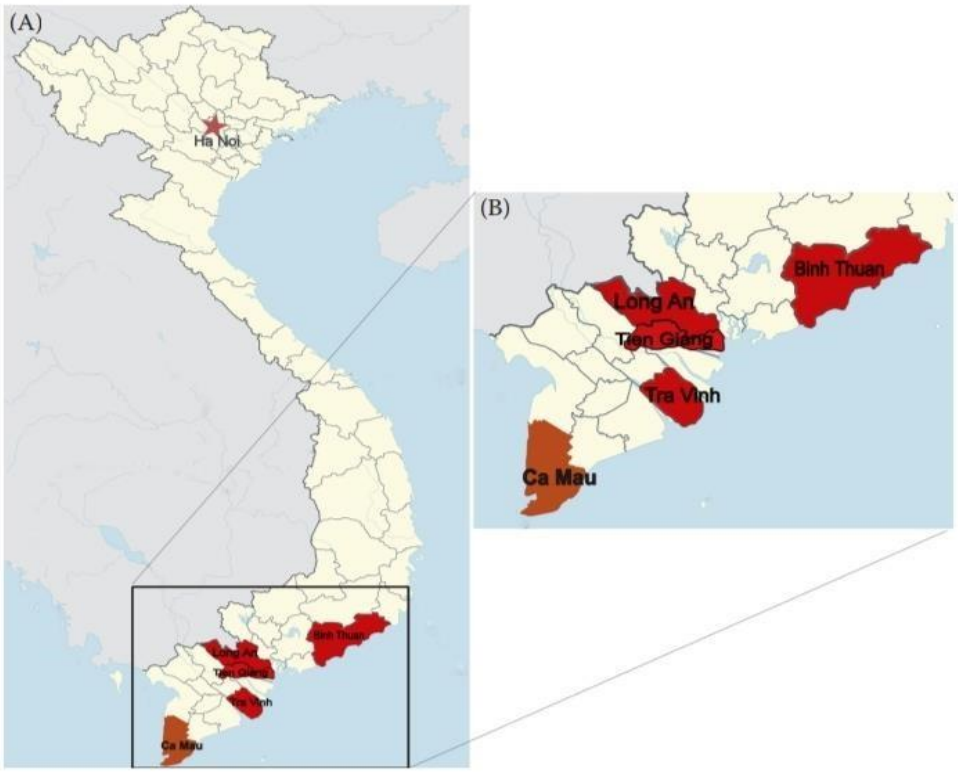

Fig 2: Maps showing the main dragon fruit cultivating areas of Vietnam in black rectangle (A), the star points to Ha Noi, the capital of Vietnam; the magnified map (B) shows the largest growing areas with the highest production of pitaya, i.e. southeast and the Mekong River Delta; Ca Mau province, in the south of the country, has mangrove areas where the dragon fruit has been successfully cultivated [1].

The world's main producers are Colombia and Israel, although pitaya has been cultivated in Vietnam, Nicaragua and, most recently in Australia, United States, and Brazil[10]

2. BOTANICAL CLASSIFICATION

The genus Hylocereus (A. Berger) Britton and Rose (1909) comprises 18 species (Anderson 2001) and it is characterised by the following typical features: i) climbing cacti, often epiphytic, with elongated stems normally 3-angled or 3-winged, freely branching, and branches emitting aerial roots, the areoles bearing short wool and several short spines, or rarely spineless; ii) flowers very large, funnel-form, usually bloom at night, limb as broad as long; iii) ovary and hypanthium (pericarp) bearing large leafy bracts but no spines, felt, wool, or hairs; iv) outer perianth-segments similar to the leafy bract on hypanthium, but longer; inner perianth segments narrow, acute or acuminate, mostly white, rarely red; v) stamens very many, as long as the style, or shorter; vi) fruit spherical to oblong, usually red and fleshy, spineless but with several broad leafy bracts, mostly large and edible; and vii) seeds small, black, elongate or kidney shaped The morphology of flower ,Stem, and fruit of Hylocereus spp[1].

Kingdom	*Plantae* – Plantas
Subkingdom	*Tracheobionta* Vascular plants
Superdivision	*Spermatophyta* Seed plants
Division	*Magnoliophyta* or Angiosperms – Flowering plants
Class	*Magnoliopsida* or Dicotyledonous
Subclass	*Caryophyllidae*
Order	*Caryophyllales*
Family	*Cactáceae*
Subfamily	*Cereoideae*
Tribe	*Hylocereae*
Subtribe	*Hylocereinae*
Gender	*Hylocereus*
Species	*H. undatus*

Fig 3: Botanical classification of Dragon fruit [14]

3. NUTRITIONAL VALUES

Fig 4 : nutrition include in dragon fruit [21]

Composition of dragon fruit:

Dragon fruit's nutritional value includes good amounts of vitamin C (ascorbic acid), a water-soluble nutrient, crucial for proper iron absorption and essential for normal body function.

Because it is not stored in the body, it must be obtained daily from one's diet. Vitamin C helps strengthen the immune system by stimulating the defensive action of white blood cells against invading pathogens.While 2,000 – 3,000 daily milligrams of vitamin C can effectively protect the immune system, the intake of just 500 milligrams of vitamin C also increases the body's production and blood levels of glutathione, an antioxidant that detoxifies bacterial waste products and has some beneficial influence on the immune system.Additionally, dragon fruit provides small quantities of minerals, mainly iron, phosphorus and calcium, as wells as vitamins B2 (rivoflavin) and B3 (niacin)[21].The fruit gives us sugar, between 11 and 16%, which are absorbed slowly because of the fiber containing the same fruit. Fiber types are mucilage and pectin, which provides benefits to the intestinal transit. The fat content is very low. The dragon fruit has little protein, about 1%.

Oxalates: Hylocereus presents calcium oxalates fruit, like other cacti plants, such as prickly pear cacti (Opuntia ficus-indica).

Flavonoids: The flowers and fruits Of the plant contain flavonoids: kaempferol, quercetin, isorhamnetin and derived compounds. In case of purple dragon fruit pulp, it also has the benefits of anthocyanins or natural pigments with antioxidant and protective effect for capillary fragility.Purple pigments are especially beneficial for the health of the eyes.[14]The fruit pulp of all dragon species is interspersed with edible black seeds, and is sweet In taste, abundant in nutrients such as soluble sugars, proteins, and Minerals like potassium, magnesium, and calcium along with other Bioactive compounds. The red color of the pulp is Mainly due to the presence of water-soluble nitrogen-containing pigments called betanins such as isobetanin, phyllocactin, phyllocactin, and Hylocerenin, which are antioxidants with radical scavenging ability. Dragon fruit is reported to have numerous health imparting phytochemicals such as polyphenols, flavonoids, and vitamin C which bestow Strong antioxidant potential to dragon fruit. Beta-Cyanins present in the red pulped dragon fruit protect the mice from Diet-induced obesity and its related metabolic disorders reported that the consumption of dragon Fruit by type 2 diabetics substantially reduced the levels of total Cholesterol, triglycerides, and LDL cholesterol while it increased the Levels of HDL cholesterol. [9]In recent years, there has been increasing interest not Only in the identification of the phytochemical com-Pounds present in dragon fruit but also in the exploitation of their potential medicinal properties. Betalains, Flavonoids, polyphenols, terpenoids, steroids, saponins, alkaloids, tannins, and carotenoids are bioactive Compounds which can be extracted from all the parts Of the pitaya [1]

Composition of Dragon fruit per 100g.

Nutrient	Amount
Calories (kcal.)	36
Carbohydrates (g.)	13,2
Proteins (g.)	0,4
Fats (g.)	0,1
Fiber (g.)	0,5
Vitamin C (mg.)	25
Phosphorus (mg.)	19

Fig 5: Composition of dragon fruits [14]

4. PHYTOCHEMISTRY AND MEDICINAL PROPERTIES OF DRAGON

FRUIT:

Phytochemical compositions:

Phytochemicals are Defined as the bioactive, non-nutrient plant compounds These compounds are secondary plant metabolites, and they are Associated with health benefits . In recent years, there has been increasing interest not Only in the identification of the phytochemical compounds present in dragon fruit but also in the exploitation of their potential medicinal properties. Betalains, Flavonoids, polyphenols, terpenoids, steroids, saponins, alkaloids, tannins, and carotenoids are bioactive Compounds which can be extracted from all the parts Of the pitaya [1].Determination of moisture and ash content was conducted using AOAC standard method. The determination of the degree of esterification of pectin was performed using Fourier Transform Infrared Spectroscopy (FTIR). DPPH assay was used to determine the antioxidant activity of the pectin extract. Based on the result, the yield of pectin decreases (20.34 to 16.20%) with the increase of extraction time, moisture contents were between 4 to 6% while ash contents were between 7 to 10%. Pectin from dragon fruit peels was determined as low methoxyl pectin and has a high percentage of antioxidant activity with a low value of inhibition concentration (IC50) (0.0063 to 0.0080 mg/mL). 60 mins extraction sample exhibits the highest antioxidant activity (81.91% at 40 µg/mL), followed by 80 mins extraction (81.68% at 40 µg/mL), 40 mins extraction (81.38% at 40 µg/mL) and 20 min extraction (81.31% at 40 µg/mL). These fruits may vary in functionality and nutritional properties, depending on their variety. This study builds on the existing knowledge fruit pomaces' nutritional properties. This stresses the need to consider both the nutritional and functional characteristics of a fruit product before being integrated into

a food product[16]. Red dragon fruit (Hylocereus polyrhizus) is an Exotic, sweet and nutritionally wise fruit that is widely Cultivated around Southeast Asia. In Malaysia, the Annual production of dragon fruit is about 10, 961 tons. Red dragon fruit is highly sought after Because of their high nutritional content. Dragon fruit Contains up to 9 g per 100 g of vitamin C which is the Highest in the fruit among other vitamins. Protein, carbohydrate, fat, B1, B2, and B3 Vitamins, thiamine, niacin, flavonoids, betacyanin are Among any other nutrients that can be found in dragon Fruit . The dragon fruit is Phytochemicals are Defined as the bioactive, non-nutrient plant compounds These compounds are secondary plant metabolites, and they are Associated with health benefits . In recent years, there has been increasing interest not Only in the identification of the phytochemical compounds present in dragon fruit but also in the exploitation of their potential medicinal properties. Betalains, Flavonoids, polyphenols, terpenoids, steroids, saponins, alkaloids, tannins, and carotenoids are bioactive Compounds which can be extracted from all the parts Of the pitaya [1].Determination of moisture and ash content was conducted using AOAC standard method. The determination of the degree of esterification of pectin was performed using Fourier Transform Infrared Spectroscopy (FTIR). DPPH assay was used to determine the antioxidant activity of the pectin extract. Based on the result, the yield of pectin decreases (20.34 to 16.20%) with the increase of extraction time, moisture contents were between 4 to 6% while ash contents were between 7 to 10%. Pectin from dragon fruit peels was determined as low methoxyl pectin and has a high percentage of antioxidant activity with a low value of inhibition concentration (IC50) (0.0063 to 0.0080 mg/mL). 60 mins extraction sample exhibits the highest antioxidant activity (81.91% at 40 µg/mL), followed by 80 mins extraction (81.68% at 40 µg/mL), 40 mins extraction (81.38% at 40 µg/mL) and 20 min extraction (81.31% at 40 µg/mL). These fruits may vary in functionality and nutritional properties, depending on their variety. This study builds on the existing knowledge fruit pomaces' nutritional properties. This stresses the need to consider both the nutritional and functional characteristics of a fruit product before being integrated into a food product[16]. Red dragon fruit (Hylocereus polyrhizus) is an Exotic, sweet and nutritionally wise fruit that is widely Cultivated around Southeast Asia. In Malaysia, the Annual production of dragon fruit is about 10, 961 tons. Red dragon fruit is highly sought after Because of their high nutritional content. Dragon fruit Contains up to 9 g per 100 g of vitamin C which is the Highest in the fruit among other vitamins. Protein, carbohydrate, fat, B1, B2, and B3 Vitamins, thiamine, niacin, flavonoids, betacyanin are Among any other nutrients that can be found in dragon Fruit . The dragon fruit is eaten as fresh Fruit, peeling the skin away. They are also refined into Juice, beverages and syrups. The peel, considered waste From the processing of dragon fruit, is about 22% of the Whole fruit . Such waste is also abundant, according to Literatures, with beneficial compounds like flavonoids And pectin. Dragon fruit peel consists Mainly of pectin (10.79%), betacyanin pigments (150.46/ 100g db) and a total dietary fibre of up to 69.3% Commercial pectin has been most Prevalently derived from apple pomace and citrus peel And the use of dragon fruit waste to produce valueadded Ingredients such as pectin has a huge potential[15].

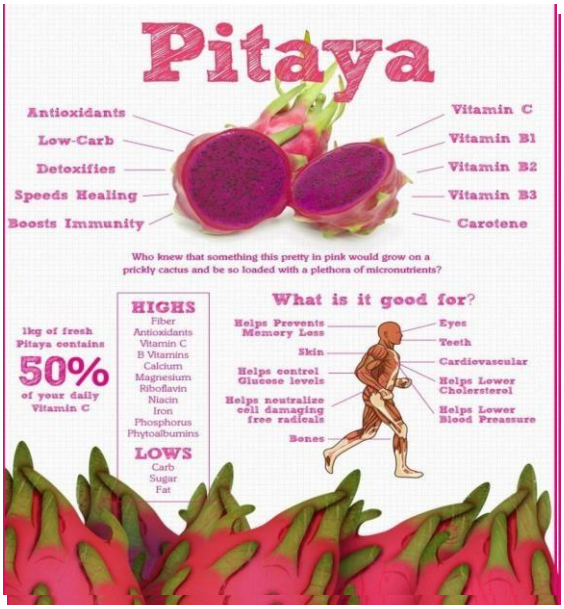

Fig 6: beneficious pitaya [27].

Antioxidant activities:

Exploitation of natural antioxidant substrates in medicinal plants with preventive influences on cellular damage caused by free radicals, which are involved in many diseases like cancer, has been increasing Thus, the popularity of many plants in disease prevention could be attributed to the antioxidant (radical-scavenging) properties of their constituent phenolic compounds (such as flavonoids, phenolic acids, stilbenes, lignans and tannins), alkaloids, and vitamin C [1].Dragon fruit peel extract contains betacyanins and anthocyanins and has a high enough activity against free radicals[22]. Therefore, a temperature of 100oC with an extraction time of 25 minutes produced the highest antioxidant activity[17].The antioxidant properties of the dragon fruit are Widely acknowledged and the antioxidant activity of different species, as well as the antioxidant content of different parts of the plant (e.g. pulp, peel, stem, Foliage), have been subjected of many detailed studies Most studies have been focused on two species Of the genus Hylocereus, which stand out in cultivation and distribution: H. polyrhizus and H. undatus. Two of the most widely used methods to evaluate antioxidant activities are 2, 2'-diphenyl-βpicrylhydrazyl (DPPH) and 2, 2'-azino-Bis (3-ethylbenzothiazoline-6-sulphonic acid) (ABTS±) . Both are spectrophotometric techniques Based on quenching of stable coloured radicals (DPPH Or ABTS+) which determine the radical scavenging ability of antioxidants even when present in complex biological mixtures (e.g. plant or food extracts)In a further study with red pitaya obtained similar

results like regarding the higher antioxidant Activity of the peel compared to the pulp. Thus, the antioxidant activity of the pitaya peel (445.2 mg mL–1) Was greater than in the pitaya pulp (1 266.3 mg mL–1). The highest concentration of compounds with antioxidant activity in the fruit peels, usually discarded, supports its value as leftovers rich in fibre, nutrients, and Bioactive compounds[1].fruit is being particularly requested In the market (1) because of its health benefits and colour. Dragon fruit is gaining much attention recently because of its Micronutrient enrichment regulated by the phenolics that Possess antioxidant and antiproliferative activities (2) in addition To its attractive colour. The pulp is popularly consumed in fresh Fruit, and the juice is an additive to ice-cream colouring Application (3). It exhibits anti-inflammatory and antidiabetic Properties with a suppression effect on cardiovascular disease Including cancer prevention potential (4). Dragon fruit juice is Therefore industrially manufactured as a functional drink (5) to Serve the consumers' requirement of a natural supplement Promoting good health condition. The fruit is considered as a Functional food and therefore accounted as a food product With high economic value (6).[22]

Antidiabetic properties:

Diabetes mellitus is one Of the most common systemic diseases in the world, Linked to hyperglucemia as the result of a malfunction Of the pancreas in the production of insulin and/or To the inadequate sensitivity of cells to the action of in-Sulin (American Diabetes Association 2009).In the folk medicine of many countries, diabetic treatment have traditionally included plants such as neem (Azadirachta indica), ivy gourd (Coccinia indica), bitter gourd (Momordica charantia), jamblon (Syzygium cumini), aloe vera (Aloe barbadensis Miller), and chicory (Cichorium intybus). In general, medicinal plants show antidiabetic effects through biochemical mechanisms such as recovery of pancreatic β-cell function, improvement of insulin sensitivity by receptors, stimulation of insulin secretion, inhibition of liver gluconeogenesis, enhanced glucose absorption, and inhibition of glucose-6-phosphatase, β-amylase, and β-glucosidase activities The beneficial effects of red and white dragon fruit In diabetes prevention were also investigated by Pool Sup et al. (2017) through a systematic review and meta Analysis of more than 401 studies, including publications in medical journals but also unpublished academic Research, which compared the effect of dragon fruit With placebo or no treatment in prediabetes or type 2 Diabetes subjects. There is a general trend to observe A greater reduction of blood glucose with higher doses Of pitaya, but Poolsup et al. (2017) concluded that due To restricted available data and poor quality of clinical Evidence, further well-controlled clinical trials are yet Required to further evaluate the clinical benefits of this Fruit in prediabetes and type 2 diabetes patients.[1]Management of this chronic disease involves the use Of pharmacotherapy, exercise, and dietary therapy. Different classes of antidiabetic pharmacotherapeutic agents have Been discovered and their selection for use in management Depends on the type of diabetes mellitus, age of individual, Response of the person, and other factors. Generally, pharmacotherapy used includes (i) drugs that stimulate or facilitate The release of insulin from the pancreatic -islet cells, (ii) Those that increase the sensitivity of receptors to insulin or Reduce insulin resistance, (iii) those that reduce the rate at Which glucose is absorbed, and (iv) those that inhibit protein Glycation [4].

Antiviral and antimicrobial activity:

Physiological and biochemical foundation of plant resistance to assaults with the aid of unique pathogens (i.e. virus, fungi, or bacteria) is associated to secondary metabolites that plant life synthesised after a microbial contamination (García-Mateos and Pérez-Leal 2003; MontesBelmont 2009; Hernández-Alvarado et al. 2018; Mickymaray 2019). Different standards can be used for the classification of secondary metabolites worried in plant immunity, i.e. core structure, frequent precursors, and mechanisms of action. According to the mode of biosynthesis and accumulation of defence-related phytochemicals, one of the most regularly used criteria, shielding metabolites produced and saved constitutively in plant tissue are named phytoanticipins (e.g. saponins, glucosinolates, cyanogenic glucosides, and benzoxazinone glucosides) whereas these synthesized de novo in response to contamination are termed phytoalexins (e.g. camalexin, phenylalanine-derived phytoalexins like resveratrol, isoflavonoids like glyceollins, or terpenoids) (Müller and Börger 1940; Van Etten and Bateman 1971; Paxton 1981; Piasecka et al. 2015). The advantages of the consumption of vegetation towards a huge vary of pathogenic microorganisms are related with exclusive bioactive compounds, together with secondary metabolites with higher antimicrobial homes like flavonoids (flavones, flavonols, flavanols, isoflavones, anthocyanidins), terpenoids (sesquiterpene lactones, diterpenes, triterpenes, polyterpenes), steroids, phenolic acids (hydroxybenzoic, hydroxycinnamic acids), stilbenes, lignans, quinones, tannins, coumarins (simple coumarins, furanocoumarins, pyranocoumarins), alkaloids, glycosides, saponins, lectins, and polypeptides, which showcase a top notch antimicrobial doable The antimicrobial pastime of the methanolic extracts towards every pathogenic bacterium used to be evaluated by using the agar diffusion assay. In short, the technique consisted in inoculating and spreading one hundred μL of a suspension containing 108 CFU mL–1 of micro organism on nutrient agar plates and distributing sterile disks (6 mm diameter) impregnated with 30 μL of extract options (100 mg mL–1), and of the high quality controls penicillin G (10 μg per disc) and gentamicin (10 μg per disc) used as requirements to decide the sensitivity of every bacterial species tested. The inoculated plates have been incubated at 37 °C for 24 h, and the antibacterial recreation of every compound was once evaluated via measuring in millimetres (mm) the diameter of the inhibition sector related with every impregnated disk. High antibacterial things to do have been related with inhibition zones of at least 14 mm (including the diameter of the disc). While white pitaya and papaya flesh and peel extracts did now not inhibit the boom of numerous of the examined bacteria, they confirmed some pastime (inhibition zones much less than eleven mm) typically towards Gram-positive bacteria. On the different hand, the methanolic crimson pitaya flesh extract produced inhibition zones with diameters large than 14 mm, i.e. excessive antimicrobial activity, in opposition to all the Grampositive micro organism examined and all the Gram-negative micro organism without S. flexneri (12.50 ± 0.90 mm). These inhibition zones created via the methanolic fruit extracts had been large in some instances than these generated by way of the trendy antibiotics. The effects of Khalili et al. (2012) confirmed the possible of fruit extracts as a supply for the manufacturing of drugs, on account that they established antimicrobial exercise in opposition to a wide spectrum of bacteria, such as those lines which developed resistance to frontline antimicrobial tablets (e.g. E. coli). [1]. Anticancer activity. The antiproliferative achievable of dragon fruit is associated to its content material of sturdy antioxidants such as polyphenol, anthocyanin, betalains, steroids and triterpenoids. Among these compounds, apart from antimicrobial and antiviral properties, betalains can additionally inhibit the lipid peroxidation, cyclooxygenase (COX-1 and COX-2) enzymes and proliferation of hu man tumour cells Supercritical carbon dioxide extracts of pitaya peels from H. polyrhizus and H. undatus possess antioxidant and cytotoxic activities, as confirmed by using Luo et al. (2014). The extracts of each pitaya species confirmed cytotoxic exercise in opposition to three sorts of cells, i.e. PC3 (human prostate most cancers phone line), Bcap-37 (human breast most cancers telephone line), and MGC-803 (human gastric most cancers mobile line) with IC50 values ranging from 0.61 to 0.73 mg mL–1. Luo et al. (2014) additionally recognized β-amyrin, β-sitosterol, and stigmast-4-en-3-one as the compounds accountable for the cytotoxic activities.[1]. Scientists at the National Polytechnic Institute (IPN) had been capable to kill most cancers

cells in vitro the usage of a metabolite extracted from a fruit named scientifically Stenocereus griseus H, and oftentimes recognised as pitaya or dragon fruit.The researchers, from the IPN National School of Biological Sciences (ENCB), stated in a assertion that the finding opens the door for in addition lookup for the improvement of a new drug to assist combat cancer. Dr. Rafael Silva Torres, task leader, stated that the quantity of lung most cancers instances has improved in a number of international locations as China, Korea, Cuba and Mexico. He defined that the lung's physiology makes tough to diagnose lung most cancers in early stages, and the range of pills to deal with the sickness are limited. For this reasons, he stated that it is vital the dedication to enhance new treatments. Researcher Ana Laura Luna Torres, of the IPN National School of Medicine and Homeopathy, led the anti-tumor assessments of extraordinary herbal compounds. After reading every one, she stated that pitaya was once the meals with larger antitumor activity. She defined that it is tough to discover herbal or artificial supplies with exact impact towards most cancers cells, when you consider that these organic gadgets have a very complicated biochemical shape that makes them resistant to many tablets [23].

Anticancer activity:

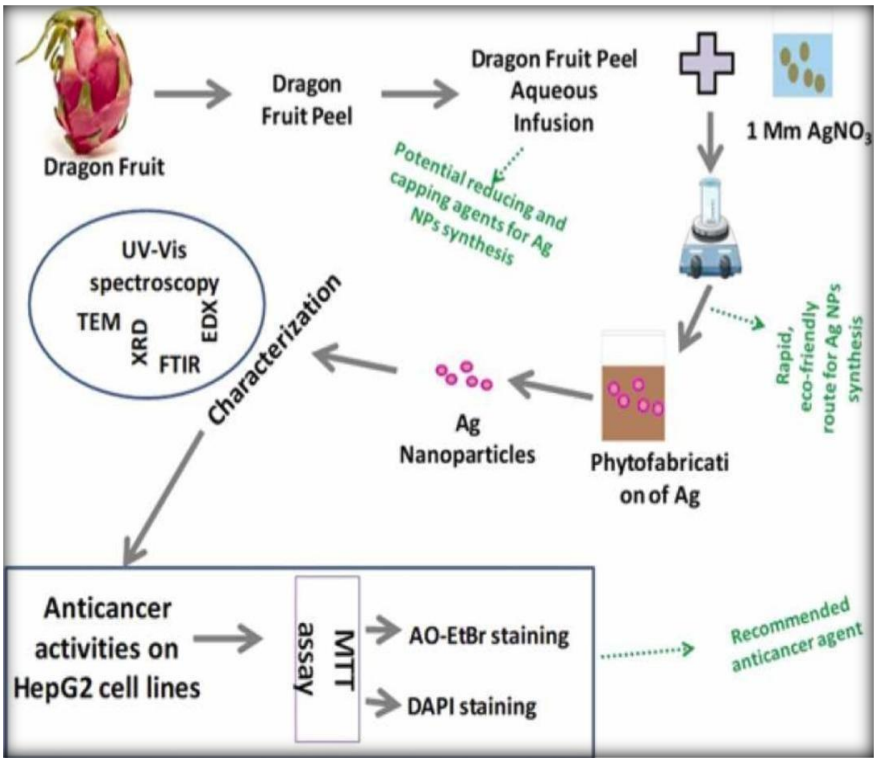

Fig 7: graphical representative of anticancer activity on HepG2 cell lines [25].

The antiproliferative potential Of dragon fruit is related to its content of strong antioxidants such as polyphenol, anthocyanin, betalains, steroids and triterpenoids. Among these compounds, aside From antimicrobial and antiviral properties, betalains Can also inhibit the lipid peroxidation, cyclooxygenase (COX-1 and COX-2) enzymes and proliferation of human tumour cells [1]. Scientists at the National Polytechnic Institute (IPN) were able to kill cancer cells in vitro using a metabolite extracted from a fruit named scientifically ***Stenocereus griseus H***, and commonly known as pitaya or dragon fruit. Researcher Ana Laura Luna Torres, of the IPN National School of Medicine and Homeopathy, led the anti-tumor tests of different natural compounds. After studying each one, she reported that pitaya was the food with greater antitumor activity. She explained that it is difficult to find natural or synthetic substances with good effect against cancer cells, since these biological units have a very complex biochemical structure that makes them resistant to many drugs. The researchers obtained a crude extract from the pulp and peel of the fruit, which was left to macerate for a week in ethanol, so it could release its secondary metabolites. Then the compound was filtered and the alcohol evaporated to obtain an extract. [23]. Herbal Drugs include plants, herbal complexes and hherbal Products or plant or even a combination of plants Which were used thousand years before inventing Modern drugs 13. Herbal treasure options or Complementary alternative medicine (CAM) offers A host of new phytochemicals that could be helpful As a preventive and clinical in managing the liver Associated imbalance involving HCC. Several food Items, as well as herbs that we use in our every-day Life, could be protective agents against liver cancer. Studies have shown that traditional medicines Could delay tumour progression, increase survival, And improve the quality of life due to synergistically efficient chemotherapy / radiotherapy 14. Dragon fruit is an important source of phytochemicals such as polyphenols, flavonoids, and Vitamin C, which are related to its antioxidant Activity 15, 16. The red and white dragon fruits Especially have recently drawn growing attention Worldwide not only because of their economic Values, but also for their health benefits 17. Red Dragon fruit consumption was reported to decrease Total cholesterol (TC), triglyceride (TG), and low-Density lipoprotein cholesterol (LDL-C) levels While increasing the high-density lipoprotein Cholesterol (HDL-C) level in type 2 diabetic 18. Though both red and white dragon fruits are Reported to be a rich, natural and cost-effective Source of bioactive nutrients, few studies focused On the beneficial effects of white dragon fruit on Diabetes and NAFLD (Non-alchoholic Fatty Liver Disease) 19. Therefore, the present investigation Was aimed to explore the phytoconstituents present In various pulp extracts of dragon fruit, H. undatus, And its anti-proliferative effect against human Hepatocellular carcinoma (HepG-2) cell [24].

Wound healing activity:

Wound healing is a complex process consisting of several stages aimed at restoring the integrity of damaged tissues, and involving different cell populations, the extracellular matrix, and the action of soluble mediators such as growth factors and cytokines. Wound management constitutes a daily challenge in clinical pathology and it often fails without an appropriate physiological, endocrine, and nutritional support Tsai et al. (2019) used ethanol-water extracts from Different parts of Hylocereus polyrhizus, such as peel, Stem, and flower to perform an in vitro test of their Wound healing properties. NIH-3T3 fibroblast cell line Was used to test cell migration ability in the scratch as Say. The result showed that the stem and flower of drag On fruit extracts in 95% aqueous ethanol at the concentration of 1 000 μg mL–1 promoted the migration Of fibroblasts after 24 h which play a crucial role In the wound healing process. In this study, the extracts from the stem, peel, and flower in 95% aqueous Ethanol of the dragon fruit had high activity in DNA Damage protection. The powerful antioxidants present In the dragon fruit extracts include phenolic and flavonoid contents involved, inter alia, in DNA protection And wound healing activities, properties with potential applications in the pharmaceutical, cosmetic, and Food industries.[1]. The oral soft tissue Is often suffered trauma which Can create wound in every care measure in dentistry. The tooth extraction is one of the action that is often Conducted in dentistry, which causes wounds, both in The soft and hard tissues, therefore, the body responds Physiologically with wound healing (1,2). The wound Healing process, from the start of the trauma up to The healing, consists of complex stages, they are Inflammation phase, proliferation phase and maturation Phase (3,4,5). The platelet is stimulated by collagen to start blood Coagulation process, when the blood vessel breaks. The platelet forms clot by closing the exposed vascular And exerts substance that causes the vasoconstriction Of capillary blood vessel, then it is continued by Endothelial attachment that closes the blood vessel. Those hemostatic components release and activate Pro-inflammation cytokine, such as, Epidermal Growth Factor (EGF), Insulin-like Growth Factor (IGF), Platelet-Derived Growth Factor (PDGF), and Transforming Growth Factor-beta (TGF-β) which have roles in neutrophil Chemotaxis, macrophage, mast cell, endothelia cell and Fibroblast (6,7). The acceleration of wound healing process is influenced By some factors, such as nutrition. Red dragon fruit (Hylocereuspolyrhizus) has peel that contain active Compounds, such as cyanidinsianidin 3-ramnosil Glucocyd 5-glucocyd, flavonoids, tiamine, niasine, Piridoxyne, cobalamine, phenolic, poliphenol, Terpenoid, carotene, phytoalbumin, betalaine. Tanine, Saponinand vitamin C (8,9,10). The result of previous research shows that red dragon Fruit peel has higher antioxidant activity if compares to Its flesh, therefore, it has the potential to be developed As the source of natural antioxidant (9,11,12). Some active substance with antioxidant characteristic As contained in the peel of dragon fruit may accelerate The wound healing process. Saponin and tannin Contents have the role in tissue regeneration in wound Healing process. Flavonoid accelerates wound healing By inhibiting lipid peroxidation, so that may increase [26].

5. CONCLUSION

Due to its nutritional and medical properties, the dragon fruit brings numerous benefits to human health, mostly for the control and management of the oxidative stress. All the different parts of the pitaya (i.e. stems, flowers, peels, and pulps) contain bioactive compounds involved in a wide range of beneficial biological activities, including, antioxidant, antimicrobial, and anticancer capacities. These include betalains, flavonoids, polyphenols, terpenoids and steroids, saponins, alkaloids, tannins, and carotenoids, which have been proven as effective, healthier, safer and sustainable alternatives to synthetic drugs for the treatment and prevention of many diseases such as diabetes, cancer, obesity, hyperlipidaemia and pathogenic agents such as viruses, bacteria, and fungi. Besides the pharmaceutical value of its compounds, the pitaya is also a natural source of colourants with potential uses in the food and cosmetic industries.

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