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Dragon Fruit: A Fruitful Approach for Healthy Skin

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Abstract

The health-enhancing capacity of pitaya fruit (chemical constituents like Vitamin B2, Vitamin C, iron, high dietary fibre, etc.) stems from its abundance of bioactive elements, associated with a multitude of advantages encompassing anti-aging, anti-diabetic, anti-inflammatory, antioxidant, anti-cancer, and antimicrobial properties. This array of favourable effects has led to an upsurge in the consumption of this fruit across various global locales. The pitaya fruit holds remedial significance, contributing to the elimination of heavy metal toxins and the reduction of cholesterol and blood pressure. Additionally, the dragon fruit peel exhibits considerable potential as a natural colouring agent. According to there are two kinds of extraction methods; conventional and modern method. The conventional extraction includes maceration, reflux and Soxhlet extraction and the modern extraction includes MAE (Microwave-Assisted Extraction) and UAE (Ultrasound-Assisted Extraction). The recent introduction of dragon fruit into the country has raised significant concerns regarding its quality assurance, particularly pertaining to the critical aspect of appropriate harvest maturity.

Keywords: Dragon fruit, **anti-oxidant, skin, dragon fruit peel, vitamin C**

INTRODUCTION:

With a population of 267 million, Indonesia boasts a significant market potential for cosmetic goods, driven by the presence of 130 million women. Dragon fruit is a savoury fruit with juicy pulp of creamy and attractive texture having lots of small brittle seeds embedded in it [1]. The substantial consumption of dragon fruit gives rise to substantial quantities of discarded dragon fruit peels, often underutilized. These peels, traditionally employed as fertilizer and a natural food colouring agent, possess additional merits such as antioxidant capabilities, anti-proliferative properties, and the potential for moisturization in cosmetic formulations. Leveraging the antioxidants present in red dragon fruit, these properties serve to combat premature aging resulting from free radical exposure, as well as offer effective acne prevention and treatment. Thus, repurposing dragon fruit peel waste presents a viable avenue for the creation of health-conscious cosmetic alternatives. [2]. Dragon fruit peel holds a notable quantity of the pigment betacyanin, measuring at 150.46 mg per 100 g. This nutrient-rich composition allows for the utilization of dragon fruit peel in the preparation of partially fermented herbal teas. The peel is laden with a spectrum of beneficial components, including vitamins C, E, and A,

alkaloids, terpenoids, flavonoids, thiamine, niacin, pyridoxine, cobalamin, phenolic compounds, carotenes, and Phyto albumin. The significant merit of dragon fruit peel lies in its abundant polyphenol content, positioning it as a valuable source of antioxidants. [3] Furthermore, it boasts a notable presence of Phyto albumins, esteemed for their remarkable antioxidant attributes. Among the pivotal pigments within red dragon fruit, betalains take centre stage, including notable compounds like betacyanin and betaxanthins. These betalains find application as natural food colour agents across diverse sectors within the food industry. [4] The analogy that pitaya seeds may also contain oil like that of most grainy seed oils (flaxseed, rapeseed (canola), sesame seed and grape seed) has surmounted into recovering the seeds and extracting the oil from these seeds.[5] The health-enhancing capacity of pitaya fruit stems from its abundance of bioactive elements, associated with a multitude of advantages encompassing anti-diabetic, anti-inflammatory, antioxidant, anti-cancer, and antimicrobial properties. This array of favourable effects has led to an upsurge in the consumption of this fruit across various global locales. [6] It is ingested for its substantial nutritional content and therapeutic potential in addressing diverse health issues. The primary objective of this investigation is to delve into the research substantiation supporting the assertions of dragon fruit's significant nutritional and healing attributes. The pitaya fruit holds remedial significance, contributing to the elimination of heavy metal toxins and the reduction of cholesterol and blood pressure. Additionally, the dragon fruit peel exhibits considerable potential as a natural colouring agent. [7-8]

Fig 1: Different types of Dragon Fruit.

CHEMICAL CONSTITUENTS:

The composition of this product presents a rich and diverse array of nutritional components, each contributing to a host of valuable uses for the overall well-being of the body. **Vitamin B2**, a vital nutrient, not only serves as an essential dietary element but also plays a pivotal role in facilitating energy production within the body. The presence of **Vitamin C** offers multifaceted benefits, acting as a safeguard against immune system deficiencies, cardiovascular ailments, a spectrum of health issues, degenerative eye conditions, and even the development of skin wrinkles.

Moreover, the inclusion of **iron** is of paramount importance, as it serves as a cornerstone for optimal brain and muscle functionality, enabling these crucial systems to operate at their best. The presence of anti-oxidants further bolsters the product's health-promoting potential by shielding cells from the detrimental impact of free radicals, which are implicated in the onset of heart disease, cancer, and various other ailments.

The infusion of magnesium into this composition adds another layer of significance. **Magnesium** not only acts as an energy enhancer but also plays a key role in regulating essential mineral levels such as sodium, potassium, and calcium, thus promoting balanced physiological functioning. Its capacity to induce relaxation in muscles and nerves, alleviating anxiety and aiding muscle recovery, underscores its multifunctional impact on overall well-being.

Furthermore, the product's **high fibre** content holds immense value, contributing to a spectrum of health benefits. Fiber, renowned for its role in promoting heart health, works to mitigate the risk of heart disease while simultaneously assisting in the regulation of blood sugar levels. Its pivotal role in maintaining bowel health and effectively managing cholesterol levels further solidifies its stature as a vital component within this composition. In summation, the intricate interplay of these diverse nutritional elements amalgamates to form a product that not only enriches the diet but also nurtures a holistic state of health and vitality.[9]

Acknowledged as a tropical superfood, dragon fruit stands out due to its remarkable nutritional density, boasting a wealth of nutrients while maintaining a low-calorie content. Notably, it has been reported that this fruit possesses the potential to contribute to the management of chronic ailments, enhance the well-being of the digestive system, and fortify the body's immune defences. Abundant in a diverse array of vitamins, minerals, and dietary fibres, dragon fruit emerges as a compelling option for addressing weight loss, diabetes control, and the reduction of cholesterol levels [10].

An analysis of the extract from H. polyrhizus revealed a total of 24 constituents, collectively accounting for 90.66% of the overall composition. Among these, triterpenoids comprised 29.77% and steroids constituted 16.46%. The extract showcased notable quantities of specific compounds, including β-amyrin (15.87%), α-amyrin (13.90%), octacosane (12.2%), γ-sitosterol (9.35%), octadecane (6.27%), 1-tetracosanol (5.19%), stigmast-4-en-3-one (4.65%), and campesterol (4.16%) [11].

The red dragon fruit peel extract contained an assortment of phytochemical compounds, encompassing flavonoids, phenols, hydroquinone, steroids, triterpenoids, saponins, and tannins. This intricate composition contributes to the extract's potential health benefits and underlines the multifaceted nature of the phytochemical richness present in dragon fruit peel [11]

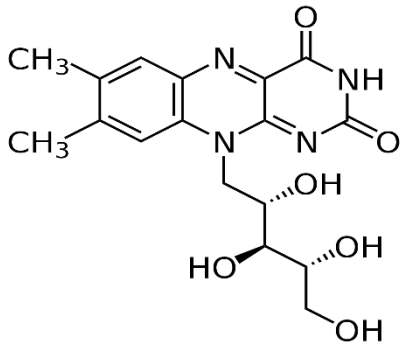


Fig 2: Vitamin B (Riboflavin)

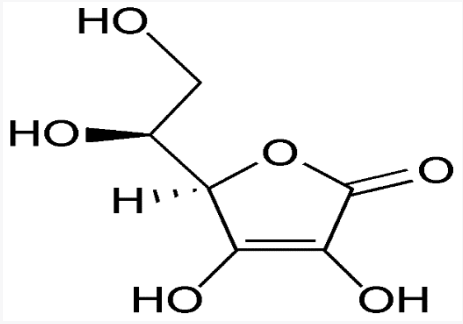


Fig 3: Vitamin C (Ascorbic acid)

CULTIVATION AND PROPAGATION:

Dragon fruit is a semi-epiphytic plant well-suited for dry tropical or subtropical climates, with a preferred temperature range of 21-29 °C, although it can endure temperatures as high as 38-40°C and short periods of freezing temperatures. This crop thrives with ample sunshine and a rainfall range of 600-1300 mm, characterized by alternating wet and dry seasons. It is cultivated year-round in tropical and subtropical regions. Optimal growth conditions involve a photoperiodic climate typical of tropical and sub-tropical areas, along with sufficient rainfall and well-draining sandy soil. Moderate temperatures are beneficial for robust fruit development, while excessive sunlight and complete shade can hinder flower formation and fruit growth, impacting overall fruit development. Dragon fruit is adaptable to various soil types, including those enriched with organic matter, and typically requires 30-40 inches of annual rainfall. Propagation of dragon fruit is achieved through seeds and stem cuttings. Seedlings derived from seeds take around 4-5 years to mature and bear fruit, while plants propagated vegetatively through cuttings flower within three years. The flowering and fruit-setting process of dragon fruit is influenced by environmental factors such as photoperiod, temperature, rainfall, light intensity, and relative humidity. For enhanced fruit production, it is recommended to add 40 kg of cow dung, 50 g of urea, 100 g of TSP, 100 g of MoP, 100 g of gypsum, and 10 g of borax per plant pit. Proper vertical support using pillars is essential for cultivating dragon fruit, with the stem needing attachment to the support using clips. Regular irrigation is crucial to build adequate reserves within the plant for proper fruit development. Sprinklers with a coverage diameter of 1-1.5 meters, placed under trees, are suitable for concentrating water into the root zone. Dragon fruit reaches maturity in approximately 28-30 days after flowering. Flower bud emergence occurs around 15-17 months after planting, with blooming requiring an additional 28 days. Harvesting of ripe fruits takes place within 30-50 days after pollination. During storage at ambient temperatures (27-34 °C) for the first four months, dragon fruit experiences no significant changes in colour, flavour, odour, total soluble solids (TSS), or pH. Subtle alterations in pH are observed after the fourth month. As the fruit matures, its peel changes from green to red, with variations in pulp colour based on the variety. HUP-002 variety exhibits red pulp, while HUP-001 has white pulp. Dragon fruit cultivation is a lucrative venture due to its early and productive nature, and adopting the latest agricultural practices can lead

to increased benefits for growers.. Currently, red-fleshed dragon fruit are in high demand because of the health benefits of betalain, a plant-derived natural pigment. This can be extracted and stabilised easily for use as a natural food colorant[12-14]

ANALYTICAL TECNIQUES:

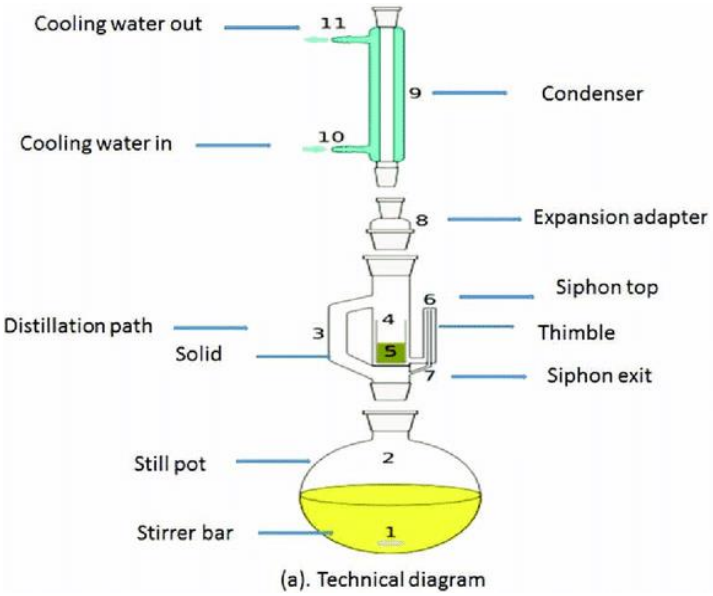
According to there are two kinds of extraction methods; conventional and modern method. The conventional extraction includes maceration, reflux and Soxhlet extraction and the modern extraction includes MAE (Microwave-Assisted Extraction) and UAE (Ultrasound-Assisted Extraction).[15]

CONVENTIONAL EXTRACTION:

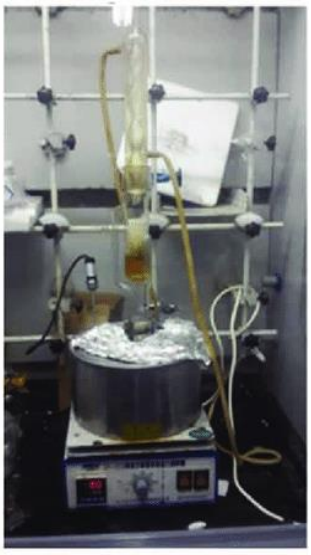
Extraction by maceration: Maceration, a recognized technique, involves a straightforward extraction process conducted within a basic container. Despite its extended duration, this method entails immersing the specimen within a sealed solvent, followed by agitation. Extraction occurs under room temperature conditions. Upon completion, solid samples are segregated from the solvent using techniques like filtration, decantation, or clarification. The maceration method's appeal lies in its versatility, as it doesn't demand specialized facilities and remains the prevalent approach for extracting bioactive compounds. The effectiveness of maceration hinges on factors such as raw material quantity, solvent selection, and process duration.[15]

Extraction with Soxhlet:

The Soxhlet extraction technique involves applying heat during the process, facilitating solvent circulation. In comparison to maceration, Soxhlet extraction yields higher quantities of extracts. This approach employs a specialized Soxhlet apparatus, encompassing components like a heat source, flask, Soxhlet extractor, and condenser which functions as a solvent coolant. Methanol and water are commonly utilized solvents in Soxhlet extraction, although other solvents such as hexane, chloroform, butanol, and propanol can be efficiently employed based on their boiling points. Notably, the advantage of Soxhlet extraction lies in its inherent ability to obviate the need for post-extraction separation steps. This method is particularly suitable for compounds resistant to heat-induced changes. The solvent of choice maintains an organic nature and is employed in a specific proportion. Commonly used solvents for extracting polyphenols encompass water, chloroform, methanol, propanol, n-hexane, ethanol, ethyl acetate, and acetone. To enhance extraction yields, organic solvents can be readily mixed.[11]



(a). Technical diagram

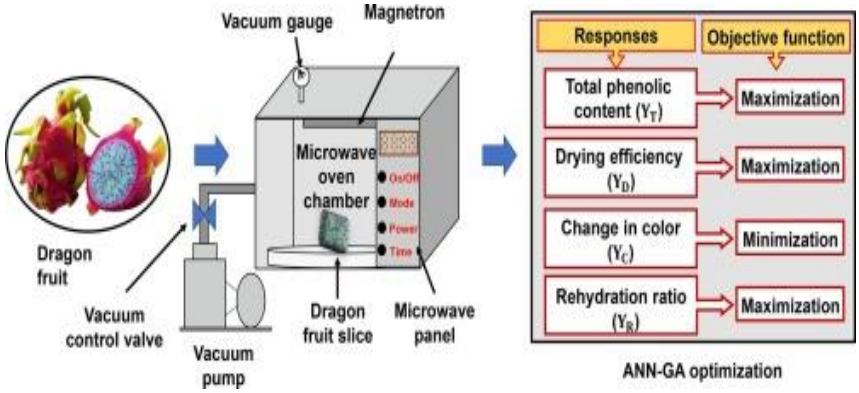


(b). Laboratory equipment

MORDERN EXTRACTION:

Microwave Assisted Extract (MAE): Microwave-Assisted Extraction (MAE) is a method employed for extracting natural compounds utilizing microwave technology. This technique is notably effective in preserving delicate compounds that are susceptible to damage. MAE offers the advantage of shorter extraction

times, reduced solvent usage, and heightened product yields. Despite its accelerated extraction rate, it is important to note that MAE entails higher associated costs. When applying MAE to polyphenol extraction, several factors merit consideration, including the nature of the material being extracted, choice of solvent, purity, power settings, application duration, sample surface area, and operational temperature. The selection of an appropriate solvent is particularly crucial, as it significantly impacts the solubility efficiency of components. Notably, conventional solvents like dichloromethane and hexane are unsuitable for MAE due to their inability to effectively respond to microwave radiation [11] For the extraction of bioactive compounds from pitaya peels, the MAE method was employed alongside the one-factor-at-a-time (OFAT) approach. The process involved liquid-solid extraction, where freeze-dried samples and 50 mL of distilled water were combined in a 1000 mL extraction vessel, which was then placed within the MAE apparatus. Optimal MAE conditions were determined: a power setting of 400W, a temperature of 45°C, an extraction time of 20 minutes, and a sample weight of 1.2 g. Following extraction, the resultant homogenate underwent centrifugation at 9000 rpm for 40 minutes at 25°C. This procedure was repeated twice to maximize bioactive compound extraction. All experimental steps were carried out in triplicate [12].



PHARMACOLOGICAL PROPERTIES OF DRAGON FRUIT:

Antioxidant activity: Differences in antioxidant capacities between ethanolic extracts of H. undatus peel and flesh were proposed, attributed to the higher flavonoid content in the peel compared to the flesh [13]. Notably, dragon fruit peel demonstrates heightened flavonoid levels even when compared to the pulp, leading to the preference for ethanol extraction due to its distinct oxidative capabilities [14]. Pertaining to its antioxidant efficacy, research highlights the greater concentration of bioactive compounds with antioxidant properties within pitaya peel, rendering it particularly captivating for pharmacological and nutritional considerations. Findings from this study focusing on pitaya underscore its functional attributes in mitigating the risk of chronic ailments [15]. The evaluation of antioxidant activity employed the DPPH (2,2-diphenyl-1 picrylhydrazyl) assay [16]. Within the dragon fruit peel extract, flavonoids and phenols emerged as the primary contributors to its antioxidant potential [17]. Active oxygen species like hydroxyl (OH•) are recognized as agents causing oxidative harm, underscoring the emphasis on active oxygen scavengers like natural phenolics to counteract cell damage. A significant element within dragon fruit, betacyanin, stands out as a potent antioxidant [17]. The presence of active oxygen species, like hydroxyl radicals (OH•), is believed to contribute to oxidative harm, prompting significant interest in active oxygen scavengers such as natural phenolics to counteract cellular damage. A key component within dragon fruit of notable importance is betacyanin, renowned for its robust antioxidant properties. [18]

Antimicrobial activity: The antimicrobial potential of H. undatus peel extracts obtained through ethanol, chloroform, and hexane was examined. Results from the disc diffusion assay demonstrated inhibitory zones spanning approximately 7 to 9 mm against both Gram-positive and Gram-negative bacteria [13]. An investigation into the antimicrobial properties of red pitaya peels revealed noteworthy in vivo and in vitro effects against various microorganisms, including Escherichia coli and Pseudomonas aeruginosa. The study also unveiled antimicrobial efficacy in the hexane, chloroform, and ethanol extracts derived from H. undatus skin, showcasing the ability to impede the growth of both Gram-negative and Gram-positive bacteria [19].

Anti-inflammatory activity: Flavonoid compounds, identified as instrumental elements in this context, function as potent anti-inflammatory agents by effectively inhibiting the enzymatic actions of cyclooxygenase

and lipoxygenase, as detailed by Hendra et al. in 2020. Similarly, a distinct study conducted by Liana et al. in 2019 shed light on dragon fruit peel extracts demonstrating commendable anti-inflammatory efficacy through the suppression of hyaluronidase activity, attributed to the phenolic and flavonoid constituents within the extract. The comprehensive exploration of dragon fruit's anti-inflammatory potential underscores its remarkable capabilities. This fruit showcases notable prowess in curbing inflammatory processes by concurrently targeting cyclooxygenase, lipoxygenase, and hyaluronidase. The collective impact of these multifaceted compounds solidifies dragon fruit's status as a robust anti-inflammatory agent. It's noteworthy that both cited studies exclusively concentrated their investigations on the peel of the red dragon fruit, revealing that this particular component is pivotal in delivering these anti-inflammatory effects. Notably, a key finding emerged from one study, indicating that the red dragon fruit peel boasts a higher abundance of flavonoids and phenolic content compared to its flesh. This nuanced understanding of dragon fruit's bioactive properties and anti-inflammatory potential holds promise for further exploration and application in the realm of health and wellness.[20]

Anti-aging properties: Utilizing the potent properties of dragon fruit, a remarkable natural remedy has emerged in the form of a specialized facial cream that offers a multi-faceted approach to combat the aging process. By incorporating this dragon fruit-infused cream into your skincare routine, you can proactively shield your skin from premature aging. The cream's abundance of antioxidants acts as a formidable defence, effectively impeding the progression of aging within your skin cells.

Furthermore, this innovative cream hails as an effective solution for those grappling with persistent acne concerns. The dragon fruit's substantial reservoir of vitamin C lends itself to an exceptional remedy for treating acne-related issues. Regular application, ideally twice a day, harnesses the acne-fighting potential of this cream to deliver optimal results, aiding in the restoration of clear and blemish-free skin.

Beyond its prowess in addressing acne, the dragon fruit face cream extends its benefits to another vital realm of skincare—soothing sunburned skin. Infused with vitamin B3, the cream serves as a soothing balm for parched and sunburnt skin, offering both moisturization and relief. Notably, the inclusion of dragon fruit juice in the cream unveils an additional layer of protection, akin to a natural sun shield. A prudent application before venturing into the sun forms a barrier against the potentially harmful UV rays, safeguarding your skin's health. Upon allowing the cream to absorb into your skin, a simple rinse with cold water completes the process, leaving you shielded from the adverse effects of sun exposure.

Unveiling yet another facet of its versatility, the dragon fruit face cream contributes to achieving a complexion that exudes radiance and luminosity. The application ritual extends from the face to the neck and other body areas, permitting the cream to seamlessly integrate into your skin. Allowing the cream to be absorbed fully before taking a shower enhances its effectiveness. By embracing this practice twice a week, you can unveil the potential for a bright and revitalized complexion that emanates an enviable glow.

In essence, the dragon fruit face cream encapsulates the essence of nature's bounty, offering an all-encompassing solution that targets aging, acne, sunburn, and overall skin vitality. Through consistent and mindful incorporation into your skincare regimen, this cream stands as a testament to the remarkable benefits derived from harnessing the inherent properties of the dragon fruit—a holistic approach to nurturing your skin's health and radiance. [21]

APPLICATION OF DRAGON FRUIT ON SKIN:

Dragon fruit, known for its vibrant appearance, offers an array of compelling health benefits that make it a valuable addition to one's diet. Notably, it is devoid of cholesterol, saturated fat, and trans-fat, making it a prudent choice for individuals aiming to manage their blood pressure and cholesterol levels. Moreover, its rich fibre content contributes to promoting healthy digestion by aiding in toxin elimination and maintaining optimal bowel function. This fibre also plays a pivotal role in stabilizing blood sugar levels, which is especially beneficial for individuals seeking to regulate their glucose levels. Emphasizing its nutritional prowess, dragon fruit boasts a substantial Vitamin C content, providing about 10% of the recommended daily intake in a single serving. Its mineral profile is equally impressive, featuring calcium for bolstering bone and dental health, phosphorous for supporting tissue development, and iron for enhancing blood vitality. These nutrients are present in notable amounts – for instance, a single dragon fruit contains approximately 8.8 grams of calcium, 36.1 milligrams of phosphorus, and 0.65 milligrams of iron. Beyond these nutritional attributes, dragon fruit wields powerful antioxidants in the form of Phyto albumins and lycopene, which have been linked to potential cancer prevention. An intriguing facet of dragon fruit is its ability to foster a healthy gut environment through its high content of polysaccharides and mixed oligosaccharides. These compounds have been demonstrated to

stimulate the growth of beneficial gut bacteria, specifically Lactobacilli and Bifidobacterial, contributing to improved digestive health. Furthermore, emerging studies suggest that dragon fruit could hold promise in the realm of diabetes management. Animal research indicates its potential as an anti-diabetic agent, as it is believed to facilitate the regeneration of pancreatic cells and mitigate resistance to fibroblast growth factor-21 (FGF-21). On another beneficial front, dragon fruit exhibits antifungal and antibacterial properties that augment the body's white blood cell count, bolstering defences against toxins and preventing the infiltration of harmful fungal or bacterial agents into organs. The culmination of these multifaceted health advantages has spurred innovative culinary explorations, as exemplified by the development of fruit spreads incorporating dragon fruit. By harnessing its myriad beneficial components, this venture seeks to provide a delectable and health-promoting product that encapsulates the remarkable qualities of dragon fruit.[22]

PHYSIO-CHEMICAL COMPOSITION:

The consumable portion of the fruit comprises the mesocarp, which possesses a gel-like consistency and contains numerous small, tender seeds uniformly distributed throughout the flesh. In most species of Hylocereus, the fruit pulp constitutes a substantial portion, ranging from 60% to 80% of the fruit's mature weight. However, the juice yield, excluding seeds, is notably lower, accounting for only 55% in certain pitahaya varieties.

The mesocarp is comprised of 82% to 88% water content, with a typical concentration of total soluble solids ranging from 7 to 11 g·L–1 in fully ripened fruit. Notably, Hylocereus species featuring white flesh tend to exhibit higher levels of soluble solids compared to those with red flesh. It's worth mentioning that the distribution of soluble solids within the fruit flesh is not uniform; the central portion contains more sugars than the outer regions. These soluble solids primarily consist of reducing sugars, particularly glucose and fructose, with quantities varying from 30 to 55 g·L–1 and 4 to 20 g·L–1, respectively. This variation depends on the specific variety and cultivar. While some researchers employing high-performance liquid chromatography (HPLC) methods did not identify sucrose, others using enzymatic techniques found that sucrose contributes to 2.8% to 7.5% of total sugars.

The acidity of the mesocarp remains generally low, measuring between 2.4 and 3.4 g·L–1. Consequently, there is a high ratio of sugar to acid, which can result in an unsatisfactory sensory experience when consuming the juice in isolation. To enhance the sensory quality, it is customary to blend pure pitahaya juice with juices from more acidic fruits, such as lemon. The primary organic acids found in pitahaya juice are citric acid and L-lactic acid.

Regarding protein content, there are variations in reported values (ranging from 0.3% to 1.5%), potentially due to different methodologies or the possible influence of betalain, the nitrogen-containing pigment responsible for the fruit's red color. The dominant amino acid detected in pitahaya juice is proline, with a notably elevated content of 1.1 to 1.6 g·L–1 of juice. In terms of mineral content, potassium prevails as the most abundant ion, trailed by magnesium and calcium.

Interestingly, Hylocereus species exhibit a relatively low concentration of vitamin C, containing less than 11 mg·L–1. This is notably lower compared to other cactus species like prickly pear, which boast a vitamin C content akin to that found in citrus fruits. Although additional vitamins could be present, they have not been documented. The polysaccharides within the pitahaya mesocarp, responsible for its gel-like texture and juice viscosity, have yet to be fully characterized. Preliminary findings indicate that these polysaccharides might constitute around 1% of the mesocarp's weight (without seeds), primarily consisting of hemicelluloses and to a lesser extent, cellulose and pectin. However, detailed information regarding the hemicelluloses and neutral sugars in the pitahaya mesocarp is still forthcoming.[23]

Flavonoids were previously identified as the major group of phenolic compounds in dragon fruit. The largest number of compounds detected in the dragon fruit samples were from this phenolic class. Eight sub-groups of flavonoids were identified, including anthocyanins, dihydrochalcones, dihydroflavonols, flavanols, flavanones, flavones, flavonols and isoflavonoids. Most of the flavonoids detected were in the glycoside forms[9] Top of Form

CHALLENGES AND FUTURE PERSPECTIVES:

The recent introduction of dragon fruit into the country has raised significant concerns regarding its quality assurance, particularly pertaining to the critical aspect of appropriate harvest maturity. Notably, due to its non-climacteric nature, dragon fruit lacks the capacity to continue ripening post-harvest and could result in subpar quality if picked prematurely. Consequently, an imperative exists to establish the fruit's shelf life across different stages of maturity and to define specific temperature conditions for distinct maturity phases. This initiative holds substantial benefits for farmers and producers, granting them the flexibility to harvest fruits destined for either local or distant markets. Furthermore, the development of quality assurance and safety protocols is essential to enhance fruit quality and guarantee consumer safety [24].

CONCLUSION:

Dragon fruit has various kinds of properties like anti-oxidant properties which helps in the prevention of the anti-aging of the skin then it has anti-inflammatory, anti-microbial properties which are very helpful in the skin protection like protects our skin from premature aging, wrinkles in early age, pimples etc. Not only from the fruit but also the peel protects our skin and gives various benefits.

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