

Review Article

Pharmacological Aspect of *Passiflora Edulis*- A Review

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ABSTRACT

Passion fruit, also known as *Passiflora edulis*, is widely distributed across tropical and subtropical regions of the world and has gained popularity due to its balanced diet and several health advantages. *Passiflora edulis* is basically from Brazil. It has near about 500 species passion fruit has two main types i.e., purple passion fruit and yellow passion fruit. At this time, over 110 phytochemical components have been discovered and recognized, in that teraponids and flavonoids are two main components. In India, the usage of plants as natural treatments is based on local empirical knowledge of their medical characteristics. Many individuals in India and other countries across the world agree that consuming plant items can result in positive therapeutic results. For thousands of years, plants have served as the foundation for many traditional medicines across the world, and they continue to offer humans new treatments. Passion fruit used as an anti-oxidant, anti-inflammatory, anti-diabetics, anti-anxiety, anti-hypertensive, Hepatoprotective and Lung-Protective Activities, Hypolipidemic Activity, Antidepressant Activity, Sedative Activity, anti-fungal antibacterial etc.

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INTRODUCTION

Passion fruit belonging to the dicot family *passifloraceae* which is the largest family and have near about 500 species. There is mainly two types of passion fruit that is yellow passion fruit (*Flavicarpa Degener*) and purple passion fruit (*Passiflora edulis* Sims) also known as granadilla. (Kimbonguila *et al.*, 2019) (He *et al.*, 2020) (Zibadi, Argüelles and Watson, 2008) chemical composition of passion fruit consists of keratinoid, flavonoid, alkaloid and vitamin C, which has medicinal property such as anti-oxidant, anti-anxiety, anti-depressant, etc. and also useful for the research processes. (Rudnicki *et al.*, 2007) In the family *passifloraceae*, *Passiflora edulis* is the economic species and has great medicinal importance. (Dhawan, Dhawan and Sharma, 2004) It is widely cultivated in tropical and subtropical regions in several parts of the world, especially in Asia, South America, south Florida, South Africa and Caribbean. (Zhang *et al.*, 2013) (Yuan *et al.*, 2017) (Hu *et al.*, 2018)

Passiflora edulis is basically from Brazil. This fruit was widely dispersed in to some regions in Indonesia, such as at Gowa highland, West Java, South Sulawesi, North Sumatera, West Sumatera, and malino. In 2003, the cultivation of passion fruit in Indonesia is near about 71,899 tons and it increased to 131,988 tons in year 2010 and in kagoshima 260 tons of passion fruit produce in year 2013. *Passiflora edulis* rind consist of near about 14% of pectin in their extract which is also use for the production of edible coating for the coating of strawberries. For the cultivation of flower buds requires 25/20°C Day/night temperature, but they do not develop above 30°C and for the cultivation of fruit, hand pollination is often performed to get good quality of fruit set. The harvesting should be done within the 2-3 month after pollination. (Matsuda and Higuchi, 2020) (Freitas *et al.*, 2020) (Shimada *et al.*, 2017) *Passiflora edulis* consist of seven different types of varieties between them he yellow-fruited *P. edulis* f. *flavicarpa* O. Deg. and the purple-fruited type, *P. edulis*

Sims these are two main and most common varieties which have considerable economic importance. (Zucolotto *et al.*, 2009) (He *et al.*, 2020). Generally, the yellow passion fruit is 6–12 cm long and 4–7 cm in diameter. Passion fruit consist of bright yellow colored peel which is commonly hard and thick in nature. The purple passion fruit is comparatively small in size that is 4–6 cm long and 3.5 –7cm in diameter. (Narain and Nigam, 2010) *Passiflora edulis* also called as “the king of fruits”, “maracujá”, “love fruit” etc. There is varies type of products present in the market such as cake, ice cream, jam, jelly, yoghurt, compound beverage, tea, wine, vinegar, soup-stock, condiment sauce etc. passion fruit also consist of moisturizing agent because of that these also used in cosmetic products. (Feng Qing et al. 2016)

Description

The *Passiflora edulis* climbing vine is a shallow-rooted, woody, perennial. It is a 3 to 8 inch (7.5-20 cm) long, deep-green and lustrous top, lighter and duller below, and marked with crimson or purple, resembling juvenile stems and tendrils. lossy above, paler and dull beneath, and, like the young stems and tendrils, marked with red or purple, particularly in the yellow form, passion fruit flower has fragrance and it is 2 to 3 inch (5-7.5 cm) wide, is borne at each node on the new growth. The leaf's alternate, sometimes simple, entire, lobed or palmate,

The bloom, clasped by 3 large, green, leaf like petal, consists of 5 greenish-white sepals, 5 white petals, 5 stamens with large anthers, the ovary, and triple-branched style forming a prominent central structure. The passion fruit is round shape, 1 1/2 to 3 inch (4-7.5 cm) wide, has a tough rind, smooth, waxlike, ranging in hue from dark-purple with faint, fine white spots, to light-yellow or pumpkin-color. It is 1/8-inch (3 mm) thick, adhering to a 1/4-inch (6 mm) layer of white pith. A hollow within is roughly containing a fragrant lump of double-walled, membranous sacs filled with a pulpy fluid with an orange hue and up to 250 tiny, firm, dark-brown or black pitted seeds. The flavor is delightful, pungent, guava-like, subacid to acid. (Passion fruit - Wikipedia n.d.)

Importance of passion fruit: -

Passion fruit is a fruit that has several advantages and a nutritious nutritional profile. It has significant amounts of vitamin A, which is crucial for skin, eyesight, and the immune system, as well as vitamin C, a crucial antioxidant. A healthy body also need phosphorus, niacin, and vitamin B-6, all of which are found in passion fruit. Antioxidants are substances that aid in the body's defense against dangerous free radicals, and *Passiflora edulis* is a great source of them. The body's systems depend on antioxidants to be healthy. Antioxidants are known to increase blood flow, particularly to the neurological system. Additionally,

they lessen the body's cellular stress and inflammation, both of which have been linked to disorders including heart disease and Alzheimer's disease. The pulp of the passion fruit is quite high in dietary fiber. Every diet should include fiber as a key element. It aids in digestion regulation and gut health maintenance, reducing constipation and bowel issues.

The American Heart Association Trusted Source claims that fiber also improves heart health by lowering cholesterol. The majority of Americans do not consume enough dietary fiber. The most recent dietary recommendations from the U.S. Department of Agriculture (USDA) provide for an intake of 34 g Trusted Source for males ages 19 to 30 and 28 grams for female ages 19 to 30. Regular consumption of passion fruit may aid to enhance digestion, reduce constipation, and general wellness. Vitamin C, an antioxidant that helps shield the body from harm brought on by free radicals, is abundant in passion fruit. (Thokchom and Mandal, 2017)

Traditional Medicine Uses

Extracts of some selected plant parts have been used widely in folk medicine in South America. Leaf extract of *Passiflora edulis* has been widely used for the dealing of symptoms of alcoholism, anxiety, migraine, nervousness, analgesic, hypertension, insomnia etc. a juice which is made from flower is used to treat some respiratory diseases such as bronchitis, whooping cough, asthma, etc. In traditional medicine the plant is used as a heart tonic, mild diuretic, digestive stimulant and a treatment for urinary infections. Fruit seed oil has been used as a stimulating lubricant and massage oil. Passion fruit also has been used for the hair growth treatment and it helps to skin looking younger. (Zibadi, Argüelles and Watson, 2008) passion fruit tea also uses for various types of benefits such as

- Weight loss.
- Lowered anxiety.
- Reduced inflammation.
- Lowered stress hormones.
- Improved digestion.
- Skin care.
- Boosted immunity. (*Passion Fruit Tea: Benefits & How to Make | Organic Facts*, no date)

Clinical Uses

Passion fruit is full of this antioxidant. It is used by our body to create collagen, which maintains youthful-looking skin, blood vessels, cartilage, and muscles. Additionally, it promotes physical healing, reduces inflammation, and shields cells from harm. It reduces the likelihood of contracting some forms of cancer and colds. (*Health Benefits of Passion Fruit*, no date) *Passiflora edulis* also

used for the treatment of some viral infection such as placental infection of zika virus which is spared by the *aedes africanus* and some other species of mosquitos belongs from family *flavivirudae*. The extract of passion fruit seeds is very beneficial for this type of infection. (Tanabe *et al.*, 2021) (D. Bagul, N. Badar and J. Tiwari, 2022)

Etymology

The Latin genus name for the passion fruit, which is translated as "passion fruit," is because it is one of the numerous species of the passion flower. *Passiflora*, and generally called as "passion fruit". Around 1700, the name was given by missionaries in Brazil as an educational aid while trying to convert the indigenous populations to its name was *flor das Cinco chagas* or "flower of the five wounds" to represent the crucifixion of Christ and his ascension, with other plant parts also bearing the names of emblems from Jesus' agony. (*Passion fruit (fruit)* - Wikipedia, no date).

Current Scenario in India

In India, the production of passion fruit is limited to the north-eastern states. In some parts of the Nilgiri hill region, Karnataka, as well as in the north-eastern states of Manipur, Nagaland, Mizoram, Arunachal Pradesh, and Meghalaya, passion fruit is grown. Nagaland and Manipur these are the two Indian states with the greatest passion fruit production rates.

Passion fruit industry

Manipur has two processing facilities (Exotic Juices and one new), Nagaland has three (Lungnak, closed down; Dimapur, privatized; and new; Mokochung); and Mizoram has one (new) facility for the processing of passion fruit. Eco Verse sells "Pasip," a 1.5-million-liter juice beverage made in Manipur from fruit that was gathered and processed by Exotic Juices Ltd. Marketed in all of India's main cities, pasip will soon be exported. The establishment of a modern processing complex with the most up-to-date process knowledge and large-scale passion fruit production were facilitated with the support of SFAC, SBI, NEDFI, MOFPI, APEDA and Exim Bank. (Thokchom and Mandal, 2017)



A

B



C

D

Figure: A- yellow and purple passion fruit. B- growing stage of passion fruit and flower. C-juice of passion fruit. D- moisturizer of passion fruit.

Nutritional and Chemical Composition

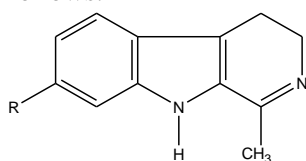
Table: Nutritional composition of passion fruit per 100g.

Nutrients	Nutrient content per 100g	Nutrients	Nutrient content per 100g
Dietary fiber	10.4 g	Crypto xanthene	41 μ
Energy	97 kcal	Carotene	743 μg
Carbohydrates	23.38g	Iron	1.60 mg
Protein	2.20 g	Magnesium	29 mg
Riboflavin g	0.130 mg	Potassium	348 mg
Folates	14 μg	Calcium	12 mg
Niacin	1.5 mg	Phosphorus	68 mg
Total fat	0.7 g	Vitamin A	1274 IU
Pyridoxine	0.1 mg	Vitamin C	30 mg
Zinc	0.10 mg	Vitamin E	0.02 μg
Selenium	0.6 μg	Vitamin K	0.7 mg

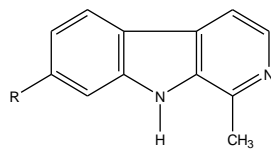
Above table shows the nutritional and chemical composition of purple and yellow passion fruit juice described from the USDA Food Composition Database. The Evidence suggests that the juice of purple and yellow passion fruits contains significant amounts of carbohydrates, vitamins A and C, minerals, and fiber. The nutritional content of purple passion fruit was, in general, largely the same as that of yellow passion fruit. Generally speaking, the passion fruit has a good chance of becoming a useful meal. This fruit is very effective for human health. passion fruit consist of various type of important chemical constituent such as esters (59.24%), terpenes, flavonoids (158.0mg/ml), aldehydes (15.27%), ketones (11.70%), lipids, alkaloids Sulforaphanes, Carotenoids and other The presence of several chemicals in passion fruit has been established. (Thokchom and Mandal, 2017) (He *et al.*, 2020)

Bioactive compounds

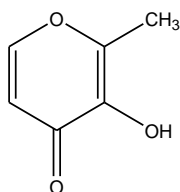
The bioactive compound present in *Passiflora edulis* as follows:



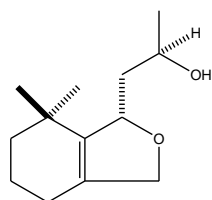
R= OH = Harmalol
R= OCH₃ = Harmalin



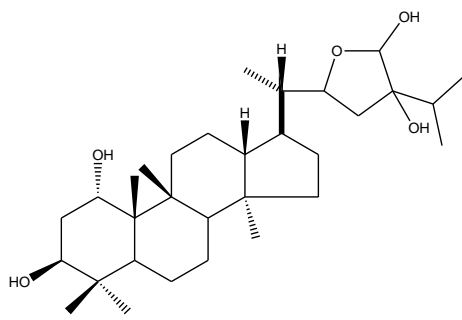
R=H = Harman
R=OH= Harmol
R=OCH₃= Harmin



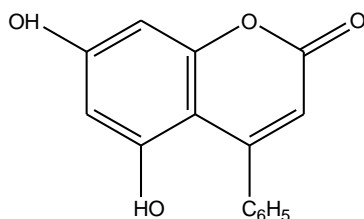
3-Hydroxy-2-methyl-pyran-4-one



1-(7,7-Dimethyl-1,3,4,5,6,7-hexahydroisobenzofuran-1-yl)-propan-2-ol



5-[1-(1,3-Dihydroxy-4,4,9,10,14-pentamethyl-hexadecahydro-cyclopenta[alpha]phenanthren-17-yl)-ethyl]-3-isopropyl-tetrahydro-furan-2,3-diol



5,7-Dihydroxy-4-phenyl-chromen-2-one

Pharmacological aspects

• Anti-oxidant activity

Folk medicine has long utilized *Passiflora edulis* leaves to alleviate anxiety and tension because they are high in polyphenols, which have been identified as natural antioxidants. The antioxidant ingredients in *Passiflora edulis* have raised interest in the plant. The number of polyphenols in the *P. edulis* leaves extract was substantially linked with its antioxidant activity. (Patel, 2009) (da Silva *et al.*, 2013) By preventing oxidative damage, the anti-oxidant action may also delay the onset of inflammatory diseases. (Zeraik *et al.*, 2016) A combination of several antioxidants with various modes of action, including synergistic interactions, determines the antioxidant power of food. Indirectly, solvent polarity was crucial to the extraction procedure because it made antioxidant chemicals more soluble. revealed that, when assessed

using the DPPH and FRAP tests, the antioxidant activity of *P. edulis* fiber concentrate was 5.12 and 6.93 M TE/g, respectively. There are Numerous studies which have shown that flavonoids, isoflavones, flavones, anthocyanins, catechins, and other phenolics are responsible for the majority of antioxidant activity. (López-Vargas *et al.*, 2013) Due to their role in preventing several chronic illnesses, natural antioxidants have attracted a lot of interest.

A balanced consumption of fruits, vegetables and leafy greens can provide these compounds, or they can be taken as supplements. According to ORAC tests, the ingestion of aqueous *P. edulis* extract enhanced serum protein, albumin, and antioxidant status in healthy animals. Tea is a popular beverage used around the globe and may provide the body with more natural antioxidants. Vitexin, isovitexin, and isoorientin are present in large proportions in the tea made from *P. edulis* leaves. It has been demonstrated that consuming them improves the hepatic antioxidant level. (Cazarin *et al.*, 2015)

Additionally, research showing potential negative consequences from consuming synthetic antioxidants have sparked a lot of interest in the usage of natural antioxidants in food items. Higher levels of total phenolic compounds, vitamin C, total carotenoids, and antioxidant activity have all been linked to *P. edulis*. As a result, it has been claimed that the Passion fruit pulp is an excellent source of secondary metabolites such phenols, carotenoids, flavonoids, and tannins as well as other bioactive substances like saponins. (Lourenço, Moldão-Martins and Alves, 2019) (Viera *et al.*, 2022)

• Anti- bacterial activity

For thousands of years, people have used plants as a source for medicinal remedies. Tropical fruits have a long history of usage as traditional herbal remedies because of their wide-spread knowledge of their antibacterial, anti-inflammatory, and antioxidant qualities. The passion fruit cultivar *Passiflora edulis* Sims is mostly utilized commercially for eating, the creation of syrup, and refreshing beverages. Numerous research on the purple variety of *P. edulis* Sims var. *edulis* in recent years have found that it contains a significant amount of piceatannol. Most of this polyphenol may be found in the seeds, and it exhibits strong antioxidant and possible antibacterial properties. (Jusuf, Putra and Dewi, 2020)

• Anti-inflammatory activity

Their leaves are also made to create a tea that is commonly used in traditional medicine to treat skin irritation and intermittent fever. There have been studies on the sedative and anxiolytic properties of the

genus *Passiflora*, however there are few publications on the examination of the anti-inflammatory properties of *Passiflora* species. (Zucolotto *et al.*, 2009) *P. edulis*' systemic injection demonstrated strong anti-inflammatory effects, which were by preventing the influx of leukocytes into the pleural cavity and connected to a clear blockage of Nitric oxide, IL-1, TNF, and myeloperoxidase levels When inflammation brought on by intracellular Carrageenan injection into the pleura. (Patel, 2009) Dexamethasone was less effective than *P. edulis* at reducing TNF and IL-1 levels. In light of this, *P. edulis* might be a source of fresh therapeutic options with a range of action comparable to that of modern anti-inflammatory steroids like dexamethasone. (Ingale and Hivrale, 2010) Through enhanced mononuclear cell infiltration, fibroblast proliferation, and granulation tissue, the treatment of *P. edulis* hydroalcoholic extract in rat colon anastomosis demonstrated an anti-inflammatory effect, improving colon repair. (Cazarin *et al.*, 2015) pectin is a component that is extract of passion fruit peel that play major role in anti-inflammatory activity (Cordova, Zibadi and Watson, 2012).

• Anti-anxiety

One of the most prevalent mental health issues in the general population is anxiety. *P. edulis* is a traditional treatment for anxiety. Due to its calming and tranquillizing properties, several *P. edulis* species have been used as folk medicine. If *P. Edulis* is proven to be safe and effective, it may be a treatment option for anxiety. The total flavonoid fraction showed anxiolytic-like activity but impaired motor activity, whereas the aqueous extract demonstrated anxiolytic-like activity with no discernible impact on the motor activity. (Patel, 2009) *P. edulis* was originally used as a soothing herb for anxiety, sleeplessness, convulsions, and hysteria in the Americas and subsequently in Europe. It is still employed today to treat insomnia and anxiety. Gamma aminobutyric acid (GABA), a substance found in *Passiflora edulis*, is produced in greater quantities in the brain. GABA makes you feel more at ease by reducing the activity of particular brain cells. (*Passiflora Information / Mount Sinai - New York*, no date)

• Anti-Hypertensive Activity

In rats with spontaneous hypertension, the anti-hypertensive properties of both purple and yellow passion fruit products have been demonstrated. Oral *Passiflora edulis* peel extract treatment lowered serum nitric oxide levels and hemodynamic parameters. (He *et al.*, 2020) cardiovascular disease continues to be the leading cause of morbidity and mortality globally despite advances in pharmacotherapies and mechanical treatments, and there is a good possibility

that this burden will rise. *Passiflora nepalensis*, a related species, is used in traditional medicine to alleviate hypertension, and *P. edulis* has also been shown to have antihypertensive properties. It significantly reduced the levels of blood triglycerides and total cholesterol, but had no discernible impact on HDL or liver cholesterol levels. (Patel, 2009) (Ingale and Hivrale, 2010) Nitric oxide production and angiotensin-II inhibition or antagonist activity were proposed as the mechanisms of action of *P. edulis* seed extracts' antihypertensive effects. (Kawakami *et al.*, 2022)

• Analgesic effect

The *Passiflora edulis* has been used as an analgesic, anti-spasmodic, anti-asthmatic, wormicidal, and sedative in Brazil; as a sedative and narcotic in Iraq; to treat hysteria and neurasthenia in Poland; and to treat diarrhea, dysmenorrhea, neuralgia, burns, hemorrhoids, and sleeplessness in America. Comparative investigations revealed that *P. edulis* leaf n-butanol extracts have a dose-dependent analgesic efficacy in a pain model of heat stimulation. The dried fruit of the *Passiflora edulis* polysaccharide reduced acetic acid-induced writhing and formalin-induced paw licking, although in the hot plate test, it did not result in a significant increase in reaction time., suggesting that the analgesic activity of polysaccharide is related to peripheral mechanisms. (He *et al.*, 2020) (Dhawan, Dhawan and Sharma, 2004) The *P. edulis* may be utilized as a complementary or alternative herbal medicine for the management of inflammatory and analgesic illnesses. The ethanol extract of *P. edulis* may work well with medications that have potent analgesic and anti-inflammatory properties. (Sasikala, Saravanan and Parimelazhagan, 2011)

• Sedative activity

In traditional medicine, the tea made from its leaves and fruit is mostly used as a sedative or tranquillizer, while it is also used to treat skin irritation and intermittent fever. There have been studies on the sedative and anxiolytic properties of the *Passiflora* genus. There is mounting evidence that *P. edulis* has sedative properties, which are acknowledged in its traditional folk medicine uses for treating insomnia. Using radiotelemetry, administering aqueous extracts orally of the pericarp and leaf of *Passiflora edulis* f. flavicarpa Degener at doses of 300 mg/kg, 600 mg/kg, and 1,200 mg/kg resulted in a quick start of effect and a dose-dependent reduction in locomotor activity in C57BL/6J mice. It is important to highlight that as compared to leaf extracts, pericarp aqueous extracts had more noticeable effects on locomotor activity. (Zucolotto *et al.*, 2009) (Klein *et al.*, 2014)

• Anti-Diabetics

Numerous research has shown that *P. edulis* peel flour, seeds and juice have the ability to treat diabetes

by lowering glucose tolerance in diabetic mice and rats. Passion fruit juice, given orally once daily for 30 days straight at a concentration of 580 mg/kg, dramatically decreased hyperglycemia in the offspring of streptozotocin-induced diabetic rats and the blood glucose levels of db/db mice, alloxan-induced diabetes mellitus in Wistar albino rats, or streptozotocin (STZ)-induced diabetic rats were also lowered after administration of seed or leaf extract from passion fruit. (Barbalho *et al.*, 2011) Pectin from *P. edulis* fruit peel was given orally to diabetic rats that had been given alloxan to cause diabetes for five days. This innovative therapy for type 2 diabetes reduced blood glucose levels. (Silva *et al.*, 2011)

• Anti-microbial activity

The fungus and bacteria that cause infectious illnesses in people and plants are resistant to the antifungal and antibacterial properties of the *Passiflora edulis*. *Trichoderma harzianum*, *Fusarium oxysporum*, *Aspergillus fumigatus*, *Colletotrichum lindemuthianum*, *Kluyveromyces marxianus*, *Candida albicans*, *Candida parapsilosis*, and *Saccharomyces cerevisiae* are all susceptible to the antifungal properties of the peptide from the seeds of passion fruit that is very similar to 2S albumins. (Agizzio *et al.*, 2003) (Pelegri *et al.*, 2006) (Ribeiro *et al.*, 2012) With lowest inhibitory doses ranging from 128 to 1024 mg/ml, the methanol extracts of the pericarp of *P. edulis* inhibited the development of several bacterial strains, including *Escherichia coli*, *Enterobacter aerogenes*, *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Providencia stuartii*. This could be because the methanol extracts include bioactive substances such as polyphenols, triterpenes, and sterols. (Dzotam, Touani and Kuete, 2016) *Escherichia coli*, *Salmonella enteritidis*, *Staphylococcus aureus*, and *Bacillus cereus* were all resistant to the antibacterial effects of oil from yellow passion fruit seeds. Unsaturated fatty acids, tocopherol, linoleic acid, and n-hexane were found to be the oil's main constituents. (Pereira *et al.*, 2019)

• Antidepressant Activity

In vivo testing has proven that stem and leaf extracts have antidepressant properties. Mice were given ethanol extracts of the aerial portions of *P. edulis* (equivalent to 10 and 2 g/kg of the plant materials) orally for 7 days, and this had an antidepressant-like effect on the mice by reducing their immobility time during the forced swim and tail suspension tests. Additional research revealed that the cycloartane triterpenoids cyclopassiflosides IX and XI had an antidepressant-like effect when administered at a dosage of 50 mg/kg, suggesting that these cycloartane triterpenoids may be the primary *P. edulis* bioactive chemicals. (Wang *et al.*, 2013)

• Hypolipidemic Activity-

Some disorders that substantially harm human health, such as atherosclerosis, coronary heart disease, pancreatitis, and others, can be directly caused by hyperlipidemia. Passion fruit is crucial in the prevention of hyperlipidemia. When given to diabetic Wistar rat pups, the passion fruit juice at a dosage of 580 mg/kg once daily for 30 days straight dramatically decreased total cholesterol, triglyceride, and low-density lipoprotein cholesterol levels while increasing high density lipoprotein cholesterol levels. (Barbalho *et al.*, 2011) and Rats with diet-induced obesity were treated with peel flour of *P. edulis*, which reduced adiposity and leptin levels and elevated adiponectin. *P. edulis* seed-derived insoluble fibre decreased total cholesterol, serum triglyceride and liver cholesterol, and increased the total lipids, cholesterol, and bile acids levels in faeces of golden Syrian hamsters after oral ingestion of *P. edulis* fruit peel pectin for five days at the dose of 0.5 to 25 mg/kg. (Silva *et al.*, 2011) (Chau and Huang, 2004)

• Anti-fungal

A genuine global issue is the sharp rise in health issues and economic losses brought on by fungus. Numerous research has been focusing on the examination of fresh plant defence peptides with antifungal properties to address this issue. Low molecular weights and cationic charges are two characteristics that these peptides frequently share. Pe-AFP-1 (antifungal peptide from *P. edulis*), a peptide of new plant of 5.0 kDa, was isolated from the passion fruit seed (*P. edulis*) and studied by Pelegri *et al.* Pe-AFP-1 was able to stop the growth of the filamentous fungus *Fusarium oxysporum*, *Trichoderma harzianum*, and *Aspergillus fumigatus* in in vitro tests, with values of IC₅₀ of 32, 34, and 40 g/ml. The identification of Pe-AFP1 may soon aid in the creation of biotechnological items like antifungal medications and transgenic vegetation with improved resistance to harmful fungus. (Pelegri *et al.*, 2006)

• Hepatoprotective and Lung-Protective Activities

The identification of Pe-AFP1 may soon aid in the creation of biotechnological items like antifungal medications and transgenic vegetation with improved resistance to harmful fungus. (Zeraik *et al.*, 2016) and demonstrated substantial liver protection against CCl₄-induced liver damage. Fruit juices administered daily for 15 days to a mice might prevent ethanol-induced liver damage by lowering AST and ALT levels in the liver and reducing inflammation and oxidative stress (Zhang *et al.*, 2016) Additionally, the high fat diet fed rat's hepatic histology and liver hypertrophy were improved by the passion fruit seed extract, which avoids non-alcoholic fatty liver disease. Administration of passion fruit peel extract

significantly decreased mortality and weight loss in C57BL/6J mice with pulmonary fibrosis that had been induced by bleomycin, as well as the numbers of macrophages, inflammatory cells, neutrophils, lymphocytes. It also decreased MPO activity and reversed the bleomycin-induced reduction in SOD activity. (Ishihata *et al.*, 2016)

• Antitumor Activity

The antitumor activity of *P. edulis* has been the focus of the majority of pharmacological research. It was shown that ethanolic extract's increased concentration of polysaccharide and polyphenolic may be associated to the matrix-metalloprotease MMP-2 and MMP-9 inhibition. (Puricelli *et al.*, 2003) In vivo, the ethanolicly extracted yellow passion fruit reduced tumor growth with a 48.5% inhibition rate and prolonged the lives of male Balb/c mice by about 42% when Ehrlich carcinoma cells were injected into them. This can be explained by the existence of medium- and long-chain fatty acids, such lauric acid. (Mota *et al.*, 2018) Sarcoma 180 tumor development was inhibited by oral or intraperitoneal treatment of the polysaccharide and its inhibition ration lies between 40.59% and 48.73%. (Silva *et al.*, 2012)

Toxicity

Numerous studies demonstrate that passion fruit has no negative side effects. Oral injection of 550mg/kg of the ethanol extract of unripe fruit peel of *P. edulis* showed no deleterious impact on the rats, according to acute and subacute in vivo toxicity experiments. Even at a level of 2,000 mg/kg, *P. edulis* leaf aqueous extract administration was determined to be safe. Importantly, there was no aberrant change in the mice's behavior or hematologic markers such platelets, RBC, WBC, Hb, MCH, MCV, lymphocytes and neutrophils. The aqueous extract was neither hepatotoxic nor nephrotoxic and had no adverse effect on bone marrow function according to the subacute investigation. The findings offer a foundation for further research into the therapeutic use of passion fruit. However, further in-depth research is still required to determine its toxicity and bioavailability in both people and animals. (Thokchom and Mandal, 2017)

Conclusion

Passiflora edulis is generally found throughout the world. *P. edulis* is basically from Brazil. Its application is anti-inflammatory, antibacterial, lipid-lowering, anti-oxidant, and anti-tumor treatments has been documented by studies. The effective application of *P. edulis* extract against the pathologies such diabetic mellitus, myocardial ischemia, renal ischemia, and neurodegenerative disorders, where oxidative stress of protein damage appears to play a significant role, requires more research. Therefore, more research may be done to demonstrate the plant's potential. Since the

plant is now an endangered species, more effort may be put into improving the agricultural and climatic conditions in order to cultivate it.

References

- Agizzio, A.P. *et al.* (2003) 'A 2S albumin-homologous protein from passion fruit seeds inhibits the fungal growth and acidification of the medium by *Fusarium oxysporum*', *Archives of Biochemistry and Biophysics*, 416(2), pp. 188–195. Available at: [https://doi.org/10.1016/S0003-9861\(03\)00313-8](https://doi.org/10.1016/S0003-9861(03)00313-8).
- Barbalho, S.M. *et al.* (2011) 'Effects of *passiflora edulis* on the metabolic profile of diabetic wistar rat offspring', *Journal of Medicinal Food*, 14(12), pp. 1490–1495. Available at: <https://doi.org/10.1089/jmf.2010.0318>.
- Cazarin, C.B.B. *et al.* (2015) 'Intake of *Passiflora edulis* leaf extract improves antioxidant and anti-inflammatory status in rats with 2,4,6-trinitrobenzenesulphonic acid induced colitis', *Journal of Functional Foods*, 17, pp. 575–586. Available at: <https://doi.org/10.1016/j.jff.2015.05.034>.
- Chau, C.F. and Huang, Y.L. (2004) 'Characterization of passion fruit seed fibres - A potential fibre source', *Food Chemistry*, 85(2), pp. 189–194. Available at: <https://doi.org/10.1016/j.foodchem.2003.05.009>.
- Cordova, F.M., Zibadi, S. and Watson, R.R. (2012) *Antioxidant and anti-inflammatory actions of passion fruit peel extract in modifying osteoarthritis, hypertension, and asthma*. 1st edn, *Bioactive Food as Dietary Interventions for Arthritis and Related Inflammatory Diseases: Bioactive Food in Chronic Disease States*. 1st edn. Elsevier Inc. Available at: <https://doi.org/10.1016/B978-0-12-397156-2.00255-6>.
- D. Bagul, P., N. Badar, C. and J. Tiwari, K. (2022) 'Zika Virus: A Review', *Research Journal of Pharmacology and Pharmacodynamics*, 14(3), pp. 171–173. Available at: <https://doi.org/10.52711/2321-5836.2022.00029>.
- Dhawan, K., Dhawan, S. and Sharma, A. (2004) 'Passiflora: A review update', *Journal of Ethnopharmacology*, 94(1), pp. 1–23. Available at: <https://doi.org/10.1016/j.jep.2004.02.023>.
- Dzotam, J.K., Touani, F.K. and Kuete, V. (2016) 'Antibacterial and antibiotic-modifying activities of three food plants (*Xanthosoma mafaffa* Lam., *Moringa oleifera* (L.) Schott and *Passiflora edulis* Sims) against multidrug-resistant (MDR) Gram-negative bacteria', *BMC Complementary and Alternative Medicine*, 16(1), pp. 1–8. Available at: <https://doi.org/10.1186/s12906-016-0990-7>.
- Freitas, C.M.P. *et al.* (2020) 'Extraction of Pectin from Passion Fruit Peel', *Food Engineering Reviews*, 12(4), pp. 460–472. Available at: <https://doi.org/10.1007/s12393-020-09254-9>.
- He, X. *et al.* (2020) 'Passiflora edulis: An Insight Into Current Researches on Phytochemistry and Pharmacology', *Frontiers in Pharmacology*, 11(May), pp. 1–16. Available at:

- <https://doi.org/10.3389/fphar.2020.00617>.
Health Benefits of Passion Fruit (no date). Available at: <https://www.webmd.com/food-recipes/passion-fruit-health-benefits> (Accessed: 27 September 2022).
- Hu, Y. et al. (2018) 'A new C-glycosyl flavone and a new neolignan glycoside from *Passiflora edulis* Sims peel', *Natural Product Research*, 32(19), pp. 2312–2318. Available at: <https://doi.org/10.1080/14786419.2017.1410809>.
- Ingale, A.G. and Hivrale, A.U. (2010) 'Pharmacological studies of *Passiflora* sp. and their bioactive compounds', 4(10), pp. 417–426.
- Ishihata, A. et al. (2016) 'Vascular- and hepato-protective effects of passion fruit seed extract containing piceatannol in chronic high-fat diet-fed rats', *Food and Function*, 7(9), pp. 4075–4081. Available at: <https://doi.org/10.1039/c6fo01067a>.
- Jusuf, N.K., Putra, I.B. and Dewi, N.K. (2020) 'Antibacterial activity of passion fruit purple variant (*Passiflora edulis* Sims var. *edulis*) seeds extract against propionibacterium acnes', *Clinical, Cosmetic and Investigational Dermatology*, 13, pp. 99–104. Available at: <https://doi.org/10.2147/CCID.S229743>.
- Kawakami, S. et al. (2022) 'Constituent characteristics and functional properties of passion fruit seed extract', *Life*, 12(1). Available at: <https://doi.org/10.3390/life12010038>.
- Kimbonguila, A. et al. (2019) 'Effect of Physical Treatment on the Physicochemical, Rheological and Functional Properties of Yam Meal of the Cultivar "Ngumvu" From *Dioscorea Alata* L. of Congo', *International Journal of Recent Scientific Research*, 10(C), pp. 30693–30695. Available at: <https://doi.org/10.24327/IJRSR>.
- Klein, N. et al. (2014) 'Assessment of sedative effects of *Passiflora edulis* f. *flavicarpa* and *Passiflora alata* extracts in mice, measured by telemetry', *Phytotherapy Research*, 28(5), pp. 706–713. Available at: <https://doi.org/10.1002/ptr.5043>.
- López-Vargas, J.H. et al. (2013) 'Chemical, Physico-chemical, Technological, Antibacterial and antioxidant properties of dietary fiber powder obtained from yellow passion fruit (*Passiflora edulis* var. *flavicarpa*) co-products', *Food Research International*, 51(2), pp. 756–763. Available at: <https://doi.org/10.1016/j.foodres.2013.01.055>.
- Lourenço, S.C., Moldão-Martins, M. and Alves, V.D. (2019) 'Antioxidants of natural plant origins: From sources to food industry applications', *Molecules*, 24(22), pp. 14–16. Available at: <https://doi.org/10.3390/molecules24224132>.
- Matsuda, H. and Higuchi, H. (2020) 'Effect of Temperatures on Passion Fruit Flowering', *Tropical agriculture and development*, 64(2), pp. 54–60. Available at: <https://doi.org/10.11248/jsta.64.54>.
- Mota, N.S.R.S. et al. (2018) 'In vivo antitumor activity of by-products of *Passiflora edulis* f. *flavicarpa* Deg. Rich in medium and long chain fatty acids evaluated through oxidative stress markers, cell cycle arrest and apoptosis induction', *Food and Chemical Toxicology*, 118(May), pp. 557–565. Available at: <https://doi.org/10.1016/j.fct.2018.06.010>.
- Narain, N. and Nigam, N. (2010) 'Narain2010-1'. *Passion fruit (fruit)* - Wikipedia (no date). Available at: [https://en.wikipedia.org/wiki/Passion_fruit_\(fruit\)#cite_note-morton-1](https://en.wikipedia.org/wiki/Passion_fruit_(fruit)#cite_note-morton-1) (Accessed: 27 September 2022).
- Passion Fruit Tea: Benefits & How to Make | Organic Facts* (no date). Available at: <https://www.organicfacts.net/passion-fruit-tea.html> (Accessed: 27 September 2022).
- Passionflower Information | Mount Sinai - New York* (no date). Available at: <https://www.mountsinai.org/health-library/herb/passionflower> (Accessed: 27 September 2022).
- Patel, S.S. (2009) 'Morphology and pharmacology of *Passiflora edulis*: A review', *Journal of Herbal Medicine and Toxicology*, 3(1), pp. 1–6.
- Pelegrini, P.B. et al. (2006) 'An antifungal peptide from passion fruit (*Passiflora edulis*) seeds with similarities to 2S albumin proteins', *Biochimica et Biophysica Acta - Proteins and Proteomics*, 1764(6), pp. 1141–1146. Available at: <https://doi.org/10.1016/j.bbapap.2006.04.010>.
- Pereira, M.G. et al. (2019) 'Effect of Extraction Process on Composition, Antioxidant and Antibacterial Activity of Oil from Yellow Passion Fruit (*Passiflora edulis* Var. *Flavicarpa*) Seeds', *Waste and Biomass Valorization*, 10(9), pp. 2611–2625. Available at: <https://doi.org/10.1007/s12649-018-0269-y>.
- Puricelli, L. et al. (2003) 'Preliminary evaluation of inhibition of matrix-metalloprotease MMP-2 and MMP-9 by *Passiflora edulis* and *P. foetida* aqueous extracts', *Fitoterapia*, 74(3), pp. 302–304. Available at: [https://doi.org/10.1016/S0367-326X\(03\)00023-6](https://doi.org/10.1016/S0367-326X(03)00023-6).
- Ribeiro, S.F.F. et al. (2012) 'Antifungal and other biological activities of two 2S albumin-homologous proteins against pathogenic fungi', *Protein Journal*, 31(1), pp. 59–67. Available at: <https://doi.org/10.1007/s10930-011-9375-4>.
- Rudnicki, M. et al. (2007) 'Antioxidant and antiglycation properties of *Passiflora alata* and *Passiflora edulis* extracts', *Food Chemistry*, 100(2), pp. 719–724. Available at: <https://doi.org/10.1016/j.foodchem.2005.10.043>.
- Sasikala, V., Saravanan, S. and Parimelazhagan, T. (2011) 'Analgesic and anti-inflammatory activities of *Passiflora foetida* L.', *Asian Pacific Journal of Tropical Medicine*, 4(8), pp. 600–603. Available at: [https://doi.org/10.1016/S1995-7645\(11\)60155-7](https://doi.org/10.1016/S1995-7645(11)60155-7).
- Shimada, A. et al. (2017) 'Effect of temperature on photosynthesis characteristics in the passion fruits "summer queen" and "Ruby star"', *Horticulture Journal*, 86(2), pp. 194–199. Available at:

<https://doi.org/10.2503/hortj.OKD-023>.

Silva, D.C. *et al.* (2011) 'Pectin from *passiflora edulis* shows anti-inflammatory action as well as hypoglycemic and hypotriglyceridemic properties in diabetic Rats', *Journal of Medicinal Food*, 14(10), pp. 1118–1126. Available at: <https://doi.org/10.1089/jmf.2010.0220>.

Silva, D.C. *et al.* (2012) 'Polysaccharide isolated from *Passiflora edulis*: Characterization and antitumor properties', *Carbohydrate Polymers*, 87(1), pp. 139–145. Available at: <https://doi.org/10.1016/j.carbpol.2011.07.029>.

da Silva, J.K. *et al.* (2013) 'Antioxidant activity of aqueous extract of passion fruit (*Passiflora edulis*) leaves: In vitro and in vivo study', *Food Research International*, 53(2), pp. 882–890. Available at: <https://doi.org/10.1016/j.foodres.2012.12.043>.

Tanabe, E. *et al.* (2021) 'Beneficial in vitro effects of the passion fruit seed extract against placental Zika virus infection', *Placenta*, 112(September), p. e42. Available at: <https://doi.org/10.1016/j.placenta.2021.07.136>.

Thokchom, R. and Mandal, G. (2017) '(PDF) Production Preference and importance of passion fruit (*Passiflora Edulis*): A review', *Journal of Agricultural Engineering And Food Technology*, 4(September), pp. 27–30. Available at: https://www.researchgate.net/publication/319313789_Production_Preference_and_importance_of_passion_fruit_Passiflora_Edulis_A_review.

Viera, W. *et al.* (2022) 'Phytochemical Composition and Antioxidant Activity of *Passiflora* spp. Germplasm Grown in Ecuador', *Plants*, 11(3), pp. 1–19. Available at: <https://doi.org/10.3390/plants11030328>.

Wang, C. *et al.* (2013) 'Cycloartane triterpenoid saponins from water soluble of *Passiflora edulis* Sims and their antidepressant-like effects', *Journal of Ethnopharmacology*, 148(3), pp. 812–817. Available at: <https://doi.org/10.1016/j.jep.2013.05.010>.

Xu, F.Q. *et al.* (2016) 'Protective effects of cycloartane triterpenoides from *Passiflora edulis* Sims against glutamate-induced neurotoxicity in PC12 cell', *Fitoterapia*, 115, p. 122. Available at: <https://doi.org/10.1016/j.fitote.2016.09.013>.

Yuan, T.Z. *et al.* (2017) 'Chemical Constituents of Leaves of *Passiflora edulis*', *Chemistry of Natural Compounds*, 53(6), pp. 1165–1166. Available at: <https://doi.org/10.1007/s10600-017-2227-5>.

Zeraik, M.L. *et al.* (2016) 'Oral administration of purple passion fruit peel extract attenuates blood pressure in female spontaneously hypertensive rats and humans', *Journal of Ethnopharmacology*, 94(1), pp. 408–416. Available at: <https://doi.org/10.1016/j.jep.2004.02.023>.

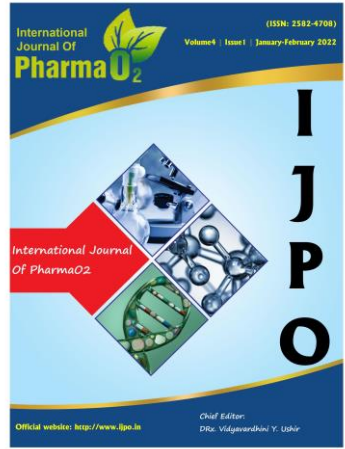
Zhang, J. *et al.* (2013) 'Glycosidic inhibitors of melanogenesis from leaves of *Passiflora edulis*', *Chemistry and Biodiversity*, 10(10), pp. 1851–1865. Available at: <https://doi.org/10.1002/cbdv.201300181>.

Zhang, Y.J. *et al.* (2016) 'The effects of *syzygium*

samarangense, *passiflora edulis* and *solanum muricatum* on alcohol-induced liver injury', *International Journal of Molecular Sciences*, 17(10), pp. 1–11. Available at: <https://doi.org/10.3390/ijms17101616>.

Zibadi, S., Argüelles, M. and Watson, R.R. (2008) 'Passion fruit (*Passiflora edulis*): composition, efficacy and safety. ', *Botanical medicine in clinical practice*, 1(3), pp. 761–766. Available at: <https://doi.org/10.1079/9781845934132.0761>.

Zucolotto, S.M. *et al.* (2009) 'Bioassay-guided isolation of anti-inflammatory C-glycosylflavones from *passiflora edulis*', *Planta Medica*, 75(11), pp. 1221–1226. Available at: <https://doi.org/10.1055/s-0029-1185536>.



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