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A Review on Utility of An Astonishing Fruit: Psidium Guajava (Guava)

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Abstract: *Guava (Psidium guajava L.) has a very special place owing to its nutrient content. Guava (Psidium guajava L.) is used in subtropical areas around the world not only as food but also as folk medicine because of its pharmacological activities. Nature has given Guava many nutritional and medicinal properties that show it to be an incredible fruit. It (Psidium guajava) has Antioxidant, Anti-diabetic, Anti-Diarrhoeal, Anti-Hypotensive, Analgesic & Anta Inflammatory, Anticancer, Anti-Hypertensive, Anti-Pyretic and High Nutritional value. For the overall growth of horticulture, the production of Guava was crucial. The article includes the usefulness of guava for the production of functional foods in the food and milk industries. For making drinks, fruit leather, cheese, whey and wine processing, desserts etc., guava pulp can be used. This paper summarises comprehensive exploration of the manufacturing, types, health benefits, and processing of guava products.*

Keywords*: guava, health benefits, antioxidant, Anti-diabetic, Anti-Diarrhoeal, Anti-Hypotensive*

I. Introduction

Guava (*Psidium guajava Linn.*) is native to tropical America and was launched in India in the early 17th century and has now occupied an area in India of more than 60,000 acres **(Sathe, 2015)**.

The Psidium genus consists of approximately 150 persistent leafy shrub species, and P. guajava is the most commonly known and distributed species worldwide. Seed propagation is used in the breeding programmes to develop the rootstock and to boost populations for screening at the early stages. Vegetative propagation method is used for cloning selected genotypes from these programmes and commercial orchards, as they perpetuate each cultivar's characteristics. **(Pereira *et al.*, 2016)**.

Guava is now grown in all parts of India. Guava is called by various names, including Amrud, Seed Pandu, Peru, Piyara, Koyya, Jamakaya, etc. Guava is among India's most popular commercial fruit crops. The fruit is often referred to as "The fruit of the poor guy" or "Tropical apple." It is a common tropical and subtropical fruit tree. In terms of sustainability, toughness, adaptability and vitamin C content, most other fruit crops excel. To the fruit lovers of the tropical and subtropical climates. In terms of sustainability, toughness, adaptability and vitamin C content, most other fruit crops excel. To those lovers of fruit who become acquainted with its penetrating fragrance. Guava is thought to be one of the most delightful and interesting fruits **(Adhau *et al.*, 2014).**

Thanks to its exceptional phenolic content and other bioactive components such as lycopene, it has gained the attention of the scientific community in recent years, so much so that some writers consider guava to be a 'superfruit' **(Corrêa *et al.*, 2014; Flores, Wu, Negrin and Kennelly 2015; Oliveira *et al.*, 2020)**.

Psidium guajava has been found to contain a large array of chemically diverse biologically active compounds which have tremendous therapeutic potential. Extracts of crude from different portions of P. Guajava has medicinal applications, modern medicinal products can only be produced after thorough research into their bioactivity, mechanism of action, pharmacotherapeutics, toxicity and proper standardisation. In folk medicine, gastroenteritis, wounds, vomiting, diarrhoea, toothache, cough , sore throat, and inflamed gums are handled with extracts of roots , bark, and leaves **(Barad *et al.*, 2013)**.

Yellow-fruited cherry guava, apple guava, strawberry guava, and red apple guava are among the popular guava types. Antibacterial, anti-diarrhoeal, anti-hypotensive, inflammatory analgesic & anta, anticancer, anti-hypertensive, antifungal, anti-pyretic and strong nutritional value. This plant's entire fruit is edible. It is possible to eat the fruit raw or even fried. For salads or desserts, fruits are sliced and used. Drinks are often made from fruit pulp. From the fruit are developed several varieties of delicacies, such as jam, guava paste, and guava cheese. The leaves are also nutritious and have properties that are medicinal. These essential fruits should be grown more to fulfil nutritional needs at a cheaper value **(Uzzaman *et al.*, 2018)**.

In samskrit guava is known as Paravata or Peruka. It is known as tridosha nashaka in ayurveda, and is suggested in atyagni. Its bark, leaves, roots and fruits are used to treat fever, diarrhea cough, constipation, gum issues, bad breath and many other health issues. It is hepatotonic and also good for liver, digestive system, heart and bowel. Diabetics and those suffering from kidney and liver related disorders may also consume Guava. Guava contains dietary fibre , protein, calcium , phosphorus, iron, vitamin B1, vitamin A, ascorbic acid, riboflavin, niacin, potassium, copper, and folic acid. It is high in antioxidants and protects against cell damage. With this wealth guava acts both as nutritional substitute as well as very useful medicine. Guava is now a success and a profitable one.
Quite often, commercialized fruit is used in the food industry. Guava is very popular today in soft drinks, jams, jellies, flavoured tea, ice creams, fruit salads. **(Kumari *et al.*, 2013).**

Guava fruits has significant phytoconstituents such as tannins, triterpenes, flavonoids: quercetin, guajanoic acid, saponins, carotenoids, lectins, leucocyanidin, ellagic acid, amritoside, beta-sitosterol, uvaol, oleanolic acid, and ursolic acid. It has been recorded as preventive agents in the pathogenesis of some deseases **(Kamath *et al.*, 2014)**.
Guava is a seasonal fruit with very limited shelf life, which restricts marketing methods, and is highly perishable. Under these conditions, cultivators of guava are struggling to obtain attractive returns and a lot of produce is going as waste. For further use, making number of processed products such as nectar, squash, clarified juice, concentrate, frozen, dehydrated sugar, jam, RTS, cheese and blends with other juices is a better choice. The use of surplus produce in fruit processing into different products is the best ways to minimize post-harvest losses **(Bons *et al.*, 2013); (Yadav, 2019)**.

They also have good quality prepared squash, RTS, and jam from preserved guava pulp. Dairy products such as fermented milk are the most popular probiotic foods. They are live micro-organisms that confer health benefits when administered in sufficient quantities.

Habitat

The Guajava (*Psidium L.*) at an altitude of 2740 m above sea level, it thrives well. It prefers full sun, but requires partial sunlight at least. At average summer temperatures of over 150C, the plant grows best, but cannot withstand extreme heat. It can withstand only light frost. In areas with distinct winter seasons, it grows more berries. The needed annual precipitation is between 1000 and 20000 mm, although it is draught-tolerant. Tolerates several different types of soil, but prefers good drainage of slightly acidic soils. It tolerates 4.5-9.4 soil pH, but prefers a range of **(Gupta *et al.*, 2011).**

II. Nutritional Properties of Guava

The fruit contains the highest concentration of ascorbic acid (up to 228.3 milligram/100 g, fresh weight) in the unpeeled fruits. Large amounts of essential oils, triterpenes, phenols, flavonoids, saponins, lectins, fibre and pectin as well as fatty acids are also found in guavas. Fruit has significant mineral levels, including calcium, phosphorus, iron and vitamins such as niacin, pantothenic acid, thiamin, riboflavin and vitamin A. Guava contains both polyphenolic compounds and carotenoids that give their antioxidant pigments to the fruit making it one of the highest antioxidant values **(Omayio *et al.*, 2019)**.

Guava is a healthy protein source of 2.3%, carbohydrate of 12.16% and dietary fibre of 4.8%. Guava is a strong source of mineral calcium i.e. 17.63 mg/100 g. Guava is an outstanding source of ascorbic acid, i.e. 241.86 mg/100 g, which, in conjunction with different fruits, makes it a promising source for discovery and value addition in food products **(Bogha *et al.*, 2020).**

Nutritional Value per 100g

Nutrients	Amount
Carbohydrate	14-17g
Sugar	8-11g
Dietary fiber	5-7g
Fat	0.95-1.2g
Protein	2.5-3.0g

Iron	0.26mg
Calcium	18mg
Magnesium	22mg
Phosphorus	40mg
Potassium	417mg
Sodium	2mg
Zinc	0.23mg
Vitamin A equivalent	31µg
Vitamin B6	0.11mg
Beta carotene	374µg
Folate (Vitamin B6)	49µg
Thiamine (vitamin B1)	0.067mg
Choline	7.6mg
Riboflavin (Vitamin B2)	0.04mg
Vitamin C	228.3mg
Niacin (Vitamin B3)	1.084mg
Vitamin K	2.2µg
Panthonic acid (Vitamin B5)	0.45mg
Lycopene	5204µg

(Kumari *et al.*, 2013)

Varieties

The guava has various guava fruit varieties such as Lucknow 49 (roundish Ovate), Allahabad Safeda (roundish) and seedless fruits, while Banarsi (round), Chitridar (sub-globose), Apple colour (spherical), Behat coconut (round), Hafshi (spherical), Safed jam (roundish), etc. are considered to be excellent. The variety red the (roundish ovate) is known as poor quality fruit **(Sahu *et al.*, 2016)**. Allahabad Safeda, Lucknow-49, Chittidar, Nagpur Seedless, Bangalore, Dharwar, Akra Mridula, Arka Amulya, Harijha, Allahabad Surkha CISHG -1, CISHG-2, CISHG-3., etc. are the major varieties grown in India **(Chavan *et al.*, 2015)**. There are several varieties of guavas, some of the few varieties include common guava**,** or apple guava (*Psidium guajava*) which has the largest fruits of all and is the type generally available at the supermarket. "Homestead" is a popular pink-fleshed variety from Florida that is very sweet. "Ruby," a red-flesh variety, is known for its exquisite flavour and tropical aroma. Apple guavas have a firm texture, so they work well to slice and include on fruit platters. Strawberry guavas (*Psidium cattleianum*) which typically have smaller leaves and fruits than the common guava and a more shrub-like form. The most popular variety of lemon guava, known for its yellow skin and excellent flavour, and pineapple guavas (Feijoa sellowiana) which are cold and hard than the other types, tolerating temperatures up to 15 degrees or lower. They have an altogether different flavour, as their name suggests, and are a popular landscape plant in California **(Vora *et al.*, 2018)**.

Guava fruit exhibits a climacteric pattern of respiration and ethylene production so is highly perishable in nature and suffers great extent of post-harvest loss. Postharvest treatment of guava fruits with Boric acid had retained fair palatability value (more than 11) till 9 days of ambient storage while ascorbic acid was significant (upto 50%) till 12 days of storage **(singh *et al.*, 2017)**. For extending the guava production in tropical and subtropical areas a rapid and efficient method for clonal propagation of elite mature genotype is necessary. Micropropagation in Guava, was successfully done on the variety Allahabad safeda. Cytokinin (6-Benzylaminopurine) is the most frequently used for guava micropropagation **(Singh *et al.*, 2018)**.

Nature has provided many nutritional and medicinal properties to Guava. Depending on the species (red, strawberry, and off-white) the fruits are 4-12 cm long with circular or oval shape. The systematic use of allopathic medications in the treatment and prevention of diseases has contributed to the rapid growth of drug resistance. Not only is the use of natural therapy safe, readily accessible and economical in the treatment and prevention of disease. Also physicians or practitioners are currently looking for alternative medicines to cure different diseases, so the production of traditional herbal medicine from natural resources must be significant. The pink guava variety has the highest therapeutic qualities (when dissected). Both fruits and leaves have many health benefits, including antidiarrheal, antihypertensive, antilipedemic, anticancer, and so on **(Kafle *et al.*, 2018)**.

For crop improvement, characterization of germplasm is essentialThe variability in the useful information provided by the characters could be used to select parents for an advanced guava breeding programme. The variability could be used for more guava germplasm breeding programmes **(Methela *et al.*, 2019)**.

The highest pectin was demonstrated by the hybrid Allahabad Safeda x Apple Colour. Hybrids for total soluble solids and pectin content, Allahabad Safeda x Chittidar, Allahabad Safeda x Apple Colour and Allahabad Safeda x Tehsildar have emerged as successful performing hybrids **(Nagar *et al.*, 2017).**
The Lucknow-49 and Pant Prabhat varieties were found superior in terms of physical and chemical parameters, respectively in the garhwal region **(Mehta *et al.*, 2018)**.

Fruit Guava cv. Apple Color reaches optimum maturity between 105-135 days after fruit set, it will be suitable at this stage to harvest the fruits for remote transport to avoid post-harvest losses, while 150 day stage is ideal for fresh consumption of guava fruits **(Dube *et al.*, 2015**).

Random amplified polymorphic DNA (RAPD) analysis of molecular markers is useful and reliable for investigating the distribution of commercial guava or local guava. In the fingerprinting of each guava sample, the RAPD analysis is helpful. RAPD is useful for high-economy discrimination of uncultivated cultivars of *P. guajava* **(Ahmed *et al.*, 2011)**.

The crystal guava contains carbohydrates, vitamins (A, B1, and C), minerals, proteins, water, lipids, and fibre. Antioxidants are substances that play an important role in defending against free radicals that emerge from the body's metabolic processes or enter the body from the outside. Crystal guava has high vitamin C in it. Vitamin C is found in various fruits, with the altitude of the fruit plant growing areas being one of the reasons. To raise antioxidants, crystal guava can be used **(Lubis *et al.*, 2017; Guntarti *et al.*, 2019)**.

III. Production Countries

Guava is a perennial tree believed to originate in Central America and the southern part of Mexico. It is grown commercially in Pakistan, Bangladesh, India, Thailand, Mexico , Brazil, the United States and in a number of tropical and subtropical countries around the world due to its broader adaptibility. It is important to identify the promising varieties by involving the appropriate cultivars either by selection or hybridisation among the established cultivars of the superior genotype. In the current research, the Sweta, Lucknow-49 and Philippines varieties were found to be superior **(Sarkar *et al.*, 2016)**.

India, Sudan, Egypt, Pakistan, Brazil, Mexico, Indonesia and Bangladesh are the world's main growing guava countries. The technological levels are used for the production of nursery trees, orchards and post-harvest management vary considerably among countries **(Pereira *et al.*, 2016)**.

It is originated in tropical America, extending from Mexico to Peru, and in many countries such as Brazil, Mexico, China, Malaysia, Hawaii, Cuba and India, it eventually became a crop of commercial significance. Due to its high nutritional value, pleasant aroma, good taste and availability at a moderate price, the crop has gained considerable prominence in our country in general and the state of Karnataka in particular **(Singh *et al.*, 2017)**.
Guava (*Psidium guajava L.*) is a fruit with a climate character. As it ripens rapidly it is highly perishable. At room temperature, its shelf life ranges from two to three days.

The most widely cultivated species are the common guava (*P. guajava L.*) and the other cultivated species are the Cattely guava or Strawberry guava (P. Cattleianum Sabine), the Brazilian guava (P. guineense Sw.) and the Chinese guava (P. friedrichsthalianum Niedenzu), respectively. Psidium chinensis was the most morphologically complex. Due to their high acidity, and this sp, the fruits of P. friedrichsthalianum are excellent for jelly making. Wilt and nematode (Meloidogyne incognita) is also reported to be immune. Random Amplified Polymorphic DNAs (RAPD) is useful for genetic diversity assessments because of their simplicity, speed and relatively low cost. Indian guava's genetic base can be regarded as being moderate to high in diversity. RAPD markers were used earlier to estimate guava genotype molecular diversity **(Pandey *et al.*, 2017)**.

After mango, banana and citrus it is the fourth most important fruit in region and production. Brazil, the U.S., and China are the world's leading Guava production countries. It is one of the most important fruit trees grown in India in an area of 2.19 lakh hectares, with an output of 25.71 lakh tonnes. The most potent tools to manipulate tree growth, flowering, yield and fruit quality, particularly fruit size, as well as fruit maturation control, are plant growth regulators as foliar applications. The use of bio-regulators has resulted in excellent achievements on many crops in terms of quality and yield increase. **(NHB Base of results, 2014; Jayalakshmi *et al.*, 2017)**.
In India, in states like Uttar Pradesh, Maharashtra, Bihar, Madhya Pradesh, West Bengal, Punjab, Gujarat, Andhra Pradesh, Orissa, Karnataka and Tamil Nadu, guava cultivated commercially.

India is the world's largest cultivator of guava. In India, with an output of 4083 thousand million tones and productivity of 16.3 metric tonnes / ha, the region under guava accounts for 251 thousand ha **(Shivraj *et al.*, 2017)**.
Guava fruit exhibits a respiratory climate pattern and production of ethylene, so it is extremely perishable in nature and experiences a considerable amount of post-harvest loss. Storage of guava fruits is commercially appropriate and economically feasible by using chemicals such as GA3, salicylic acid, NAA, potassium permanganate and boric acid

as post-harvest treatment. The shelf life of guava fruits processed under atmospheric conditions had been significantly affected by both boric acid and NAA **(Singh *et al.*, 2017)**.

IV. Prayagraj Production

Allahabad, Varanasi, Lucknow, Kanpur, Aligarh and Agra are the main guava-producing regions in Uttar Pradesh. Allahabad is renowned in India as well as in the world for output of the highest standard. Guava cultivation in Uttar Pradesh is so naturalized that it's hard to believe it isn't native to India. **(Singh *et al.*, 2019)**.

Guava production was important to Horticulture's overall growth as it contributed to almost 4 per cent of the total production of fruit. Any part of the Guava tree had much economic value. While India had been the world's leading Guava producer, Guava's productivity in India was the lowest among the Guava producing countries. Its production costs are also low as its need for fertiliser, irrigation and plant safety is not much further its very high nutritional value. Hence it is an ideal food protection fruit. Guava is also regarded to a large degree as the black yard fruit. Uttar Pradesh has good quality guavas, especially in the region of Allahabad **(Singh *et al.*, 2017)**.

Guava is also grown in large measure as a fruit in the backyard. India ranks first on guavas production. In India, in terms of the area under guava production among guava producing states, Uttar Pradesh was 1st. The best quality guavas, particularly in the Allahabad area, are produced in Uttar Pradesh. New or processed Guava fruits are consumed **(APEDA, 2019; NHB, 2017; Kumar *et al.*, 2019)**.

Allahabad district has a lot of potential to develop in guava farming because Allahabad guava is world-renowned and Kaudihar block itself has strong production while Phulpur block has less production but can still be increased only after a little effort because guava yields fruit twice a year **(Upadhyay *et al.*, 2018)**.

V. Health Benefits

Psidium guajava L applications in ethno-medicine. Over the past decade, leaves have been checked in many studies against several illnesses, demonstrating their ability in the treatment of the most prevalent diseases worldwide. In guava leaves, phenolic compounds have been credited with controlling blood-glucose levels. Moreover, the leaves' effects were linked to individual compounds such as catechin, quercetin, vescalagin, peltatoside, hyperoside, isoquercitrin, gallic acid and guaijaverin **(Cerio *et al.*, 2017)**.

Many countries have a long tradition of medicinal use of guava. This plant finds applications to treat diarrhoea, hypertension, gastroenteritis, dysentery, diabetes, caries and pain relief and to improve coordination of locomotives. The extract of leafs are used as a remedy for cough, diarrhoea and oral ulcers, as well as for certain swollen gums. Guava is good source of ascorbic acid, A, iron, calcium. as well as phosphorus. It comprises high amounts of inorganic and organic compounds such as secondary metabolites, e.g. antiviral compounds, antioxidants, polyphenols, and anti-inflammatory compounds, terpenes, p-selinene and caryophyllene oxide, have relaxation effects. There are several compounds in guava leaves that serve as fungistatic agents and bacteriostatic agents. Guava has a high content of essential antioxidants and an ability to protect against radiation. Quercetine in the guava leaves is known to be the most potent antioxidant and is responsible for its spasmolytic activity. The extract of ethyl acetate will halt germ infection and the development of thymus. Guava has activities that are anti-inflammatory, anti-plaque, anti-viral and anti-mutagenic. Guava extract exhibits antinociceptive activity, and is also effective in inflammation and serum development of liver damage. The phenolic compounds in guava help to heal cancer cells and prevent premature ageing of the skin. Guava ethanolic extract can improve the quantity and quality of sperm and can be used to treat infertile males **(Naseer *et al.*, 2018)**.

Psidium guajava possesses nature's cure for debilitating menses and diarrhoea. Guava leaf is widely used for a number of disorders, including diabetes mellitus, diarrhoea, cough and hypertension. In particular, guava leaf extract has historically been used in East Asia and other countries for the treatment of diabetes. It is also used in the treatment of tooth decay, gum infection, sore throat, wound disinfection and antiseptic. Guava is digestive, carminative, providing heart , lungs and whole body with vigour & strength. It is an important aphroid, increases blood circulation, and when eaten with nuts, it aids in regular bowel evacuations by supplying roughage to the diet. This fruits are rich source of fibre and antioxidants. It is the fruit of a poor man, since it is very inexpensive. A guava carries away a doctor a day **(Chaudhary *et al.*, 2014)**.

White flesh guava has been found to possess higher antioxidant properties, total polyphenolic and flavonoid content compared to pink guava flesh (Yeshiwas et al , 2018).

Vitamins such as vitamin C and vitamin B, minerals such as calcium , magnesium, phosphorus and iron, are a healthy source of guava leaves. But Vitamin C and Potassium concentrations were higher in fruit. Guava leaves contain vitamin B complex that helps to boost circulation of blood to the brain, promote cognitive function

and relax the nerve. Guava leaves can consume against diseases such as osteoporosis, hypocalcemia, hypophosphatemia etc, due to the high concentration of calcium and phosphorus **(Thomas *et al.*, 2017)**.

Psidium guajava L applications in ethno-medicine. Over the last decade, leaves have been tested against several diseases by many studies. Furthermore, individual compounds such as quercetin, catechin, gallic acid, peltatoside, hyperoside, isoquercitin, and guaijaverin were associated with the effects of the leaves. Its skin contains several fruit phytochemicals that are rich in vitamins (A & C), iron, phosphorus, calcium, and minerals. Quercetin is one of the most abundant guava leaf flavonoids found. These flavonoids account for much of the medicinal function of guava. Quercetin is thought to contribute to guava's anti-diarrhoeal effect; it can relax the smooth intestinal muscle and suppress bowel contractions. Guava leaf extract has also demonstrated anti-proliferative activity. The guava phenolic compounds help heal cancer cells and avoid skin ageing before time. The leaves contain several bacteriostatic and fungal agents, as well as essential oxidants **(Prabhudesai *et al.*, 2019).**

Phytochemical research has shown that leaves of Guava are rich in a broad variety of polyphenolic compounds (Phenol, Flavonoids, and Tannin). Since the polyphenolic compounds have antimicrobial property, it may be the most likely source of guava leave antifungal and antibacterial activity. In addition to the antimicrobial property, guava leaves can be used as bio preservative in the pharmaceutical industry as well as in the food industry **(Das *et al.*, 2019)**.

Guajava leaves possess the potential to be a successful candidate in finding a natural antimicrobial agent against B-caused infections and/or diseases. S. and Cereus **(Biswas *et al.*, 2013)**.

Guajava leaf aqueous extract has antiglycation activity and prevents neurodegenerative and cardiovascular disease and also shows activity of antiprostate cancer. As compared to other solvent extracts, aqueous extract indicates that it is commonly used in medicine, but methanol extract shows the highest yield because aqueous extracts are much safer than acid and alcohol. Guajava tea is a really good drink since it is a herbal tea. For natural medicines, the Guajava tree is very useful **(Porwal *et al.*, 2012).**

The guava leaf's active compounds supposed to have immunostimulative function were not possibly just polyphenolic antioxidant compounds. The presence of active compounds may be used as a source of functional ingredients in food plants or herbs which are beneficial for health. Additional research is required to determine the active compounds that act as immunostimulatory agents from guava leaf extract **(Laily *et al.*, 2015).**

The transmission of antioxidants can be blocked or reduced by free radicals. It have been known fruit red guava containing different forms of natural antioxidant. It can increase the levels of haemoglobin and VO2max in maximum physical activity by giving Guava Juice during an exercise programme **(Sinaga *et al.*, 2015)**.

Guava pomace fruits have disclosed waste material to provide its fibre as a useful material. It has been found that, along with the other useful stems, waste material can provide lucrative fibre in substantial quantities. In the digestion of food in the stomach, dietary fibre available in fruit plays an significant role. Pomace can be used as a commodity for guava fruits. The extruded material will include such fibre products that in the dietary system will be beneficial **(Kumar *et al.*, 2018).**

Phytochemicals naturally exist in leaves, stem bark, fruits and roots of medicinal plants that have a defence mechanism and defend against various diseases. Red-fleshed guava, skin, seed, and pulp are strong sources of antioxidant phytochemicals and lycopene. There is greater initial lycopene in the dried red guava pulp powder, which has been kept below 60 ° C after drying. The abundance of phytochemical components found in the skin, seed and pulp of a fresh red guava. Heat treatment leads to an improvement in Lycopene content that can be due to increased human body availability of these components **(Rani *et al.*, 2017)**.

Anemia is one of the nutritional problems caused primarily by a deficiency in iron. In developed countries and poor nations, iron deficiency anaemia has a significant effect on puberty and premenopausal women. Red guava juice has the ability to raise erythrocyte index values. Compared to before consuming guava juice, the value of the erythrocyte index after consuming guava juice increased. This is due to iron content, vitamin C, amino acids (tryptophan, lysine), calcium , phosphorus, sulphur, vitamin A and vitamin B1 in red guava fruits[8]. Red guava contains two to four times higher vitamin C than oranges so it can help with iron absorption. Additionally , vitamin C can also help to improve non-heme iron absorption by as much as fourfold. Red guava juice intake is more efficient at rising the index of erythrocytes. Red Guava juice can be an adjunct to avoid adolescent anaemia **(Hardimarta *et al.*, 2018)**.

Extracts of ethanol and water from guava leaves have antibacterial activity against L. Acidophilus is as effective as 0.2 percent chlorhexidine with a 20 percent ethanolic extract. Natural products such as guava leaves with antibacterial activity can be used as an affordable and sufficient adjuvant to synthetic medicines and compounds, and their judicious use may not only help inhibit the side effects of synthetic drugs, but may also prove cost-effective in developing economies **(Gurnani *et al.*, 2016)**.

In methanol extract, total phenol and flavonoid content, and antioxidant activity were found to be higher than in ethanol extract. It has found positive antibacterial activity against B. S. and Cereus. Epidermis for extracts of ethanol, and against B. Cereus Cereus S. From the epidermis, E. Uh, coli, S. In the case of methanol extracts, aureus, P. vulgaris, Both ethanol and methanol extracts showed positive response against C in the case of antifungal activity. Albicans while P.crysogenum is highly extract resistant **(Chetia *et al.*, 2014)**.

The Linna guajava psidium. For the production of different industrial and pharmaceutical goods, plant parts are used. In the traditional medicine method, the medicinal properties of Psidium guajava Linn leaves are also well known. The extracts of Guava leaves showed better results than other pathogens against Salmonella typhi. Extract of leaves from Psidium guajava Linn. Plant results against used bacterial pathogen were shown to be successful and efficient. The leaves of Psidium guajava can be a good source of antibacterial agents **(Garode *et al.*, 2014)**.

Biomolecules such as lipids, proteins and DNA are affected by excess metal ions in the human body. The chelating operation of plants helps to suppress excess metal ions by interrupting the oxidising chain reaction. Psidium guajava methanol extract has greater chelating ability compared with aqueous and petroleum ether extracts **(Daberao *et al.*, 2017).**

The Psidium guajava bark phytochemical screening showed the existence of metabolites and compounds such as alkaloids , glycosides, sugar reduction, phenolic compounds, steroids , terpenoids, carbohydrates, amino acids, flavonoids , tannins, and saponin glycosides. It may exhibit so many medicinal and pharmacological properties due to the existence of number of phytoconstituents **(Mishra *et al.*, 2017).**

VI. Processing of Guava Products

It is usually a good source of beta-carotene, lycopene, ascorbic acid, fat, protein, starch, fibres , minerals, vitamin B & B2 and is an outstanding source. Guava (Psidium guajava Linn.) is a rather common fruit. Tannins, phenols, triterpene, flavonoids, essential oils, saponins, carotenoids, lectins, vitamins, fibre and fatty acids are enriched with guava. In the treatment of infantile rotaviral agents, guava leaf extracts and fruit juice are very pleasant. During the growing season, harvesting, handling, fungal infections on Guava fruit may occur. Storage diseases contribute to economic loss by reducing damaged fruit quality and marketability, or can result in complete loss of stored fruit. Due to its great taste and health benefits, the fruit as well as its juice are readily eaten. Scientific analysis has confirmed a number of common applications **(Infant *et al.*, 2015)**.

In recent years the global market for functional foods and customer desire for a healthier lifestyle is increasing. Guava's more diversified products, such as nectar, RTS and guava leather / bar, are of great importance. The products produced were excellent in taste, rich in nutritional content, preserving the original flavour of the fruit and healthy for consumption. Developing such nutritious products using pilot-scale facilities would not only minimise post-harvest losses but also offer less appreciated fruits value. Processed guava pulp can be transformed into a novel product "guava leather / bar" developed by CIPHET, Ludhiana / Abohar, adding 3-4 times fruit value. Therefore, by setting up a small scale processing plant, manufacturing of such prod-ucts would provide sufficient avenues for job generation in the rural masses **(Kadam *et al.*, 2012)**.

Guava is just a tasty and nutritious table fruit but can also be used to make items such as jam, jelly, cheese, juice, ice cream, canned segments, nectar, dehydrated slice of RTS beverage, flakes, toffee, guava lather sauce, puree of baby food, etc. The most commercially used guava, however, is for the preparation of jelly. For treating diarrhoea and for dying & tanning, guava leaves are also used **(Singh *et al.*, 2019)**.

Due to excellent taste, high digestive and nutritional value, high palatability and abundance of guava fruits, guava fruits usually eaten as fresh as a dessert fruit show great potential for processing into useful products that have both nutritional and health benefits.

Cocoa-mulhati guava toffee / bar / nuggets are condensed products that have strong nutritional value, appeal and are readily eaten as a commodity of confectionery. For the formulation of the cocoa-mulhati guava product, different amounts of ingredients such as sugar, skim milk powder and mulhati were added to the guava pulp. Guava is often called as "super-fruits," rich in high nutrient content and thus supplemented with mulhati to provide medicinal benefits and sweetness **(Pawar *et al.*, 2017)**. Guava is often referred to as "super-fruits"

Thanks to the inclusion of alternative sweeteners and functional ingredients to achieve health benefits, guava cheese can be used as a balanced fruit snack. Adding pectin to guava cheese enhanced versatility by improving both antioxidant ability and physical properties. Guava Cheese (GC) is a condensed, semi-solid fruit product that can be eaten as a snack. Shelf stable guava cheese (GC) has been developed to assess exotic guava fruit utilisation. The hardness and phytochemical content were improved by the addition of pectin to the GC. The shelf life stability and antioxidant capacity of guava cheese were improved by Pectin **(Patel *et al.*, 2016).**

The processing of Guava fruits into nectar and jam ensures the protection and consistency of the products without much loss of nutritional and antioxidant benefits, which due to its perishable nature is not feasible with Guava fruit as such. The processing of Guava fruit pulp into jam and nectar resulted in a substantial increase in physico-chemical properties such as TSS and TA but decreased the pH and mineral composition considerably **(Tanwar *et al.*, 2014**).

Underutilized guava fruits can be effectively blended into organoleptically suitable fruit leather and processed. To improve acceptability and storage stability, fruit leathers are manufactured from fruit puree and other ingredients such as sugar and citric acid. They are nutrient dense; the addition of nuts or spices will further improve their calories and acceptability. In addition to preventing post-harvest losses, blending fruit purees to produce fruit leathers increases the nutritional consistency. In addition to enhancing the nutritional quality, combining papaya with guava will also harmonise and complement the final product in terms of nutritional quality, sensory qualities and customer preferences **(Vasanthakaalam *et al.*, 2018)**

Various processing methods for the development of white, green, green tea-low caffeine and black tea in guava leaves yield more than 60% free radical scavenging activity due to the rich polyphenol content of guava leaves. Compared to other methods of processing, the green tea processing system generates the highest total phenols, tannins, and total flavonoid content. Guava leaves can be produced as a herbal tea beverage that provides health benefits and contains natural antioxidant compounds and has a higher price than fresh or dry (bulbs). **(Yuniartini and others, 2015).**

An suitable fruit bar with aonla-guava was established as a health food. Not only will the established fruit bar help increase the processing performance of both Guava and underused yet highly nutritious Aonla, but it also serves the purpose of improving customer nutritional status **(Mahawar *et al.*, 2017).**

Herbal gel has been prepared using various amounts of powdered guavava leaves and Carbopol 934, Propylene glycol as a base of gel. For the treatment of mouth ulcer, the evolved herbal formulation was stable and efficient over tosynthetic formulations **(Shaikh *et al.*, 2018)**.

Guava wine can prove to be a quality wine with alcohol (stimulant) and high content of phenols and ascorbic acid (antioxidants) in addition to enhancing Indian farmers' economic status particularly during glut time. Thanks to its ease of cultivation, high nutritional value and popularity of processed Guava products, Guava has great potential for extensive commercial use. The addition of N and P increases the production of ethanol and the consistency parameters for guava wine. The sensory and organoleptic properties of guava wine are also enhanced by the racking and ageing of guava wine **(Singh *et al.*, 2014)**.

For volume reduction, prolongation and preservation of its shelf-life, spray drying of pink guava puree is essential. It is very good source of antioxidants that are responsible for its pink colour, particularly lycopene. Quality powder was found to be delivered at drying temperature of 150 ° C with 15 percent maltodextrin in terms of final moisture content, particle size, powder yield, bulk density, tapped density, flowability and colour **(Shishir *et al.*, 2014)**.

Guava jams enriched by the addition of concentrated grape juice, formulated either with sucrose (SF) or sweeteners (DF), are products of promising microbiological and sensory quality that could satisfy current market demand for foods of high nutritional value, as well as being an alternative to minimize the loss of guava fruit **(Oliveira *et al.*, 2020)**.

Treatment of guava mash combined with ultrasound and cellulase improved both juice yield and consistency. In the manufacture of guava juice processing, the use of ultrasound and cellulase preparation was very likely **(Nguyen *et al.*, 2013).**

Mature and ripe guavaes with their high composition of fermentable reducing sugars such as glucose, sucrose and fructose could serve as substrates for fruit wine production using wine yeast (*Saccharomyces cerevisiae*), thus transforming a perishable products to more stable and value added product. Therefore, production of wine from this fruit can help increase wine variety and reduce post-harvest losses **(Minh *et al.*, 2019)**.

Fresh Guava Whey Juice fortified with Moringa oleifera leaves aqueous extract could be considered as a significant source of antioxidant, free radical scavenger and shelf-life prolonger. It was applicable, successful and accessible to utilize moringa crop when producing many pleasant and preferable manufactured products. fortification of *Fresh Guava Whey Juice* with 1.5 or 2.0% of M.O.A.E. was the exact ratios for using Moringa Olivera leaves' extract in such juices. Epicatechin (EP), rutin (RU), quercetin (QU), benzoic acid (BE) and chlorogenic acid (CH), were predominant phenolic compounds in F.G.W.J fortified with M.O.A.E. whereas, the others are dominant phenolic constituents **(Hashemi *et al.*, 2018)**.

Water extract of guava and green tea leaves combination have anti-diarrheal activity. Water extracts of guava and green tea leaves combination had significant differences in increased stool consistency, stool weight,

onset and diarrhea duration, and intestinal transit time. Combination water extract of guava leaves and water extract of green tea is the best combinations **(Dewi *et al.*, 2013).**

Medically guava serves as source of some vitamins and antioxidants to human, so people are advised to consume guava as source of vitamins especially vitamin C. Although guava is a good source of Ascorbic Acid content and some fruits stores and retains their Ascorbic Acid more in one condition than other storage conditions from the findings, refrigeration condition is the best condition for the storage of fruits and vegetables. Fruits storage technology and transportation methods have developed so well that fresh fruits, grown not only in the country concerned, but also in widely scattered part of the world are available throughout the year. And also storage under room temperature open can also serve as a storage condition for guava **(Dauda *et al.*, 2017)**.

The sugar-prepared guava leather 750 g, salt 5 g and citric acid 2 g per kg of guava pulp showed better organoleptic properties and good storage stability under storage conditions (both ambient and refrigerated) for up to 3 months of storage **(Chavan *et al.*, 2015)**.

During food processing and storage, physicochemical properties are an important factor. Retention and improvements in physicochemical properties depend on the processing procedure. Relative to conventionally heated juice, ohmic heated juice maintains the physicochemical properties for a longer time. This study concludes that in guava juice preservation and processing, ohmic heating can be used as an alternative technique **(Chakraborty *et al.*, 2014)**.

The implication of the red guava juice potential with its antioxidant content as an inhibitor of xanthine oxidase formation and free radical chain breaker, which consequently, prevents an increase of blood uric acid and creatinine level. Further research is needed to explain more about the mechanism of RGJ in the human body as an antihyperuricemic agent **(Aprillinda *et al.*, 2018)**.

Guava juice concentrate was produced from fruits obtained both in spring and autumn seasons. Guava concentrate made from autumn fruit contained 1.13 times brix content, higher pH and 3.9% higher vitamin C compared to concentrate made from guava spring season. In the autumn season, the concentrate prepared from guava harvested was nutritionally better than the concentrate prepared in the spring season from guava harvested **(Akbar *et al.*, 2016)**.

Good quality cheese can be prepared using fleshy guava varieties. it is the chewable confectionery items containing sugar and butter as the, major ingredients. Cold pulping of the material is easier and more convenient than hot pulping. Seeds are eliminated and fine pulp is made. The guava cheese was prepared such that the chemical analysis containing good sources of vitamin C and minerals was carried out. The prepared guava cheese has good texture, color and taste. In the prepared guava cheese the carbohydrates were found to be higher where as the fat content found to be lower **(Adhau *et al.*, 2014)**.

Guava is easy to culture, possesses high nutritive value. Wine is one of the functional fermented foods with many health benefits such as anti-aging effects, lung function enhancement (from white wine antioxidants), reduction of coronary heart disease, production of healthy blood vessels and reduction of ulcer-causing bacteria. Most wines are made from fruits with medicinal value. Guava wine may prove to be a quality wine with alcohol (stimulant) and high contents of phenols and ascorbic acid (antioxidants) besides increasing the economic status of Indian farmers especially during period of glut. **(Kocher *et al.*, 2011**).

VII. Use In Dairy Products

Guava has tremendous bioactive potential, and is a good source of prebiotic dietary fibre. Combining it with probiotic fermented dairy foods such as yoghurt, curd and shrikhand, it will grow high-value commodities to increase the use of guava in functional foods **(Chauhan *et al.*, 2015).**

The processing of whey into soft drinks is one of the most desirable ways for the dairy industry to use whey. Developed a paneer whey and guava beverage. Here the diversification of goods using whey as a partial replacement of water is rather, without much quality improvement. Such drinks can be helpful to people suffering from gastrointestinal tract disorders, and astherapeutic soft drinks may be used. Guava probiotic dairy beverages are used to enhance the commodity, to manufacture better goods, to varying degrees of use and to use "whey" dairy wastes, providing an economic benefit. In general, the whey content of the drink with 35 percent whey had an effect on the maximum acceptance of customer acceptance **(Hamad *et al.*, 2015)**.

Whey is a source of minerals and vitamins as well as a source of high-quality proteins, of which sulphur amino acids are especially valuable because of their anticancer activity Over the years, various approaches have been taken in an attempt to turn a large amount of whey into products suitable for use as food. Guava whey drinks prepared with 40 percent guava pulp and 60 percent sweet whey (blend 5) may be used in the preparation of such a favourite blend **(Moussa *et al.*, 2019).**

The use of guava pulp in whey-based beverage processing has been of great benefit to the dairy industry. Whey from coagulated milk paneer can be used to prepare a high quality guava beverage. This drink has a high content of protein and vitamin C; it will be cost-effective and hit the poorer parts of consumers who are deprived of such nutrient-enriched drink **(Singh *et al.*, 2014)**.

For the production of whey based guava drinks with optimum sensory characteristics, Whey can be found to be effective. Up to some degree the nutritious beverages with better storage life could be produced by adding whey. Guava based whey beverage has excellent colour, flavour and stability was calculated to be high , meaning that guava juice was very effective in covering unpleasant whey taste. The product's sweetness seems to be a widely valued attribute that needs to be connected to customer behaviours **(Yonis *et al.*, 2014)**.

A stronger medium for fermentation with probiotics may be fruit juices. The suitability of Guava fruit beverage with lactic acid bacteria isolated from milk, curd, whey and Lactobacillus plantarum for the production of probiotic juice has been investigated. The Probiotic Guava fruit beverage could serve as a balanced drink for consumers with dairy allergy, beneficial to gut health, diarrhoea prevention and the best source of nutrients for vulnerable populations under-nourished. During diarrhoea the alkaline astringent compound found in Guava fruit binds the intestines **(Sai *et al.*, 2014).**

Guava pulp enriched misthi dahi can be successfully prepared from toned milk with highly appropriate sensory scores and can be stored for 3 days at 4±10C without any major microbiological and sensory consistency degradation **(Jitender *et al.*, 2016).**

Adding fruit to the ice cream adds more nutrients, colour and taste. Fruits such as guava can be added to increase the ice cream's beta carotene content. Guava can be added in pulp form. The product (ice-cream) made from cow milk and guava pulp contained higher nutrition content followed by buffalo milk and coconut milk. The nutrition present in different prepared product using different milk and guava pulp was substantially different with each other **(Patel *et al.*, 2015).**

VIII. Conclusion

Guava has immense potential and has the ability to affect different fields such as biochemistry, nutrition , food science, product growth, and pharmaceutical sciences positively. Guava (Psidium guajava Linn.) is well recognised around the world for its food and nutritional values. Guavas were also included among the different superfruits because they were abundant in folic acid, dietary fibre , potassium and dietary minerals. In the traditional medical method, the medicinal properties of guava fruit , leaves and other parts of the plant are also well-known. Since each part of the guava tree has economic value; it is cultivated on a commercial scale. Guava plant has been accomplished considerable process regarding the biological activity and medicinal application of guava and the fruit considered a poor man apple of tropics. Parts of the guava plant are used to produce various industrial and pharmaceutical products.

Processing guavas into commercial goods will increase the value of the crop, raise household incomes for farmers and increase their use. Great progress has been made in the discovery of possible pharmacological agents from natural sources in a decade of systematic research. Because of its unique activity and low toxicity a variety of natural products were used as lead compounds.

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