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An Ayurvedic And Modern Overview Of Carica Papaya As An Anti-Ulcer Agent-A Review Article

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ABSTRACT: Papaya, scientifically known as Carica papaya is a member of family caricaceae.Papaya is a tropical plant which is being used in various ayurvedic formulations since ancient times and also shows commercial importance because of it's high nutritive and medicnal value.Papaya plant extracts has been found to show various functions like anti-inflammatory, antioxidant, diuretic antibacterial, vermifuse, abortifacient, hypoglycaemic, antihelminthic, and immunomodulatory etc.

Ulcers are basically the open sores that can develop on the lining of the stomach, small intestine or oesophagus. Anti-Ulcer activity refers to the mechanism or substances that prevent or heal ulcers in the GI tract. Various drugs and natural compounds exerts anti-ulcer effect by different mechanisms. Carica papaya has been explored for its potential anti ulcer properties due to its rich nutritional profile & bioactive compounds. Carica papaya contains various enzymes in its different parts like fruits, leaves, roots, latex etc. which are pharmacologically active in nature. So, this review enlightens the various pharmacological actions shown against ulcer conditions and mechanisms by which it has been found to be effective against ulcers.

KEY WORDS : Carica papaya , gastroprotective , anti-ulcer , papain , anti-oxidant

1. INTRODUCTION:

Carica papaya, commonly known as papaya, is a tropical fruit that has been recognized for its medicinal values from centuries. Both in historical practices and in Ayurvedic medicine, papaya has been widely used to treat various diseases, including ulcers. Different parts of papaya , such as the seeds, leaves, and latex, have been utilized for their healing properties in treating ulcers. Carica papaya has been evaluated for its gastroprotective and healing effects of the methanolic extract of the seed of the papaya Carica papaya L. in rats(4)

The latex of the unripe papaya fruit extract has been found to contain proteolytic enzymes, such as papain, which has been traditionally well known for their wound-healing properties. The presence of papain in papaya latex allows effective breakdown of dietary proteins, which may improve nutrient absorption and digestive efficiency.(7)

Historical Uses of Carica Papaya for Ulcers

Historically, Carica papaya has been used in traditional medicine systems across various cultures for its therapeutic properties. In folk medicine, the use of papaya was not only limited to treating digestive issues but also extended to treating ulcers. The unripe fruit, seeds, and leaves were commonly used in poultices and herbal concoctions to treat external and internal ulcers.(6)

Indiginious Medicines: In many indigenous cultures, mainly the in tropical regions, papaya leaves and fruits have been used as herbal treatment material for digestive issues, including ulcers. Traditional shamans often suggested the consumption of ripe papaya to soothe the internal lining of stomach.

Ayurvedic Medicines: In Ayurveda, papaya was identified for its potential capacity to balance digestive health. The fruit was believed to posses soothing properties, helping to treat symptoms of gastric ulcers.

Caribbean Folk Medicine: In Caribbean countries, the leaves of the papaya plant were often used in teas was thought to cure digestive disorders, including ulcers.(6)

Ayurvedic Perspective-

The anti-ulcer properties of Carica papaya in Ayurvedic medicine, are related to its rich biochemical composition and antioxidant activities. Research indicates that various parts of the plant, significantly its leaves and seeds, play a crucial role in preventing gastric damage and oxidative stress. Carica papaya contains potent antioxidants such as flavonoids, phenols, and enzymes, which help reduce oxidative stress by free radical scavenging.(8)(9)

Furthermore, the seeds of Carica papaya are known to possess anti-inflammatory and antimicrobial properties, which help in treating infections related with ulcer and various other conditions. Ayurvedic formulations sometimes include papaya seeds to cleanse the gastrointestinal tract, reduce bacterial load, and promote healing of the stomach and intestinal lining.(1)

Modern Research and Applications-

The modern day studies on Carica papaya's use in ulcer treatment highlights its significant anti-ulcerogenic and antioxidant activities, contrasting with traditional methods that often depends upon on pharmaceutical interventions. Recent studies demonstrate that extracts from both the leaves and seeds of papaya effectively reduce ulcer formation and promote healing. Research on the ethanolic extracts of leaves of Carica papaya effectively reduce inflammation and ulcerogenic activity in animal.(11)

Aqueous extracts of papaya leaves have shown protective effects against alcohol-induced gastric damage, reducing ulcer indices and oxidative stress.(12) In Jamaica, topical use of unripe papaya fruit for treatment of chronic ulcers is prevalent, with 75% of surveyed patients reporting its effectiveness in promoting healing and reducing odor.(13)

The effects of Carica papaya Linn on exogenous ulcer and histamine-induced ulcers were studied in rats. The latex of unripened fruit of Carica papaya significantly reduced the acid secretion induced by intravenous infusion of histamine in chronic gastric fistulated rats thereby effectively treating exogenous ulcers. Papain was also found to be effective in preventing the exogenous ulcer and in decreasing the histamine-induced acid secretion in rats.(14)

Nutritional Composition Of Carica Papaya in Relation To ANTI-ULCER Activity:-

PARTS	COMPOSITION	REFERENCE
a)Latex	Papain,lipases Saponins & Cardenolides	16)
b)Leaves	bioactive compounds, including flavonoids and phenolic acids. essential vitamins and minerals	15)
c)seeds	β-sitosterol and hexadecanoic acid	17)
d)Fruits	87-94% water, 2-12% carbohydrates, and significant levels of sugars (sucrose, glucose, fructose) and vitamins, particularly vitamin C and A	18)
e)Roots	roots contain significant levels of saponins and cardenolides Essential minerals such as potassium, sodium, calcium, and iron are present, with	19)

	potassium being notably abundant	

1.Fruit (Ripe and Unripe Papaya)

The fruit of Carica papaya, both ripe and unripe, contains a variety of compounds that contribute to its pharmacological activities.

Chemical Constituent-

Carotenoids: Include β-carotene, lycopene, and cryptoxanthin, which are responsible for the fruit's orange to red color. Lycopene is particularly abundant in ripe papaya.

Vitamin C: Papaya is rich in ascorbic acid (vitamin C) and vitamin A

Flavonoids: Quercetin, possess antioxidant and anti-inflammatory properties.

Folic Acid: i.e vitamin B9,important for cell division and tissue formation.

Dietary Fiber: The fruit contains soluble and insoluble fibers, which aid in digestion and promote gut health.

Papain: This proteolytic enzyme is mainly concentrated in the unripe fruit and it has been found to show digestive and anti-inflammatory properties.

Properties:

Antioxidant: Carotenoids and vitamin C provide protection against oxidative stress.

Digestive Aid: Papain helps in protein digestion, making it useful for digestive health.

Anti-inflammatory: Flavonoids and papain help reduce inflammation in the body.

Immune Support: Vitamin C and carotenoids enhance immune function.

2. Seeds

Papaya seeds are small, black, and peppery in taste, containing a wealth of bioactive compounds.

Chemical Constituents:

Fatty Acids: Papaya seeds contain oleic acid, palmitic acid, and linoleic acid, which are beneficial for heart health.

Polyphenols: These include compounds such as flavonoids, which have antioxidant properties.

Proteins and Amino Acids: Seeds contain essential amino acids like lysine and glycine.

Properties:

Antimicrobial: broad-spectrum antimicrobial activity.

Anti-inflammatory:Isothiocyanates and polyphenols reduce inflammation.

Digestive Health: Seeds help in digestion and are used traditionally to treat intestinal parasites.

3. Leaves

Papaya leaves are rich in medicinal compounds and are often used in herbal remedies.

Chemical Constituents:

Alkaloids:leaves contain alkaloids such as carpaine, which has antimalarial and cardiovascular effects.

Flavonoids: Includes , quercetin known for its anti oxidant activity

Phenolic Compounds: Antioxidant activity.

Saponins: possess anti-inflammatory properties.

Papain: Also found in the leaves, though in smaller amounts compared to the latex and fruit.

Properties:

Antioxidant: Flavonoids and phenolic compounds provide significant antioxidant activity.

Anti-inflammatory: Saponins and flavonoids help to reduce inflammation.

4. Latex

The milky latex of the papaya tree is a rich source of enzymes and other biologically compounds.

Chemical Constituents:

Papain:The primary enzyme in papaya latex, known for its proteolytic (protein-digesting) properties.

Chymopapain: Another proteolytic enzyme similar to papain but with distinct substrate specificities.

Alkaloids: Latex contains small amounts of alkaloids with pharmacological activity.

Properties:

Proteolytic Activity: Papain and chymopapain helps to breakdown proteins, making latex useful in treating digestive disorders.

Wound Healing:The enzymes in latex aid in promoting faster wound healing.

Anti-inflammatory: enzymes reduce inflammation and swelling when applied topically or taken internally.

5. Roots

Though less commonly used, papaya roots also contain beneficial compounds.

Alkaloids:Similar to the leaves, the roots also contain alkaloids like carpaine.

Saponins: Found in the roots, these compounds contribute to the immunity.

Properties:

Anti-inflammatory:The roots also exhibit anti-inflammatory activity, helping in the treatment of inflammatory conditions.

2.ANTI-ULCER ACTIVITY IN CARICA PAPAYA

Carica papaya, identified for its medicinal applications, contains various constituents which contribute to its anti-ulcer activity. Constituents like enzymes, phytochemicals, and antioxidants works coactively to protect gastric mucosa and reduce ulcer development in the body.

Papain & Chemopapain :

Papain is an important chemical compound which has been extracted from fruit, stem, & latex of the plant carica papaya and is commonly used for brewing, wine making and in textile & tanning industries.Papain has been found to be effective in reducing both the pylorus ligation induced gastric ulcer and ethanol induced gastric ulcers which are the most effective and main techniques used in the evaluation and study of anti ulcer activity of Carica papaya.[20]Both Papain and Chemo-papain found in the latex of unripe papaya, had shown to significantly reduce the histamine induced acid secretion and protect against exogenous ulcers. It drastically reduce the gatric acid secretion stimulated due to intravenous infusion of histamine in chronic gastric fistulated rats.[21]

Papain exhibits significant anti-ulcer activity through various molecular mechanisms, mainly involving its proteolytic properties and interactions with gastric mucosal constituents.

Enzymatic Activity and Proteolysis: Papain, a cysteine protease, which induces the hydrolysis of peptide bonds, which helps in the digestion of proteins and potentially reduce gastric acid induced irritation.[22]There is presence of thiol group at the catalytic site of the enzyme papain which is crucial for its activity and its interactions with substrates are found to be impacted by pH and structural conformations.[23]

Anti-oxidant Mechanism: The antioxidant properties of papain also contribute to its protective anti-ulcer activity. By reducing oxidative stress, papain helps to maintain gastric mucosal integrity.[24]

Cooperative interaction: The cooperative nature of papain's substrate interactions enhances its catalytic efficiency, allowing for effective proteolysis under different conditions, this further supports to healing of mucosa.[25][26]

Phytochemicals:

The leaves and seeds of the Carica papaya contain alkaloids, flavonoids, saponins, & tannins, which exhibit antioxidant activities which helps to attenuate oxidative stress associated with ulcer development.[8]Oxidative stress is a result of disturbance of balance between antioxidants and pro-oxidants which drastically affects on redox signaling, leading to cell and tissue damages. Oxidative stress may lead to inflammation, impaired wound healing, chronic diseases . These conditions can be managed properly with the help of antioxidants. papaya has been found to have high contents of natural antioxidants which may be found in their leaves, fruits and seeds .It contains various chemical compounds showing significant antioxidant properties including myricetin, rutin, quercetin, α-tocopherol, papain, benzyl isothiocyanate (BiTC), and kaempferol etc.These chemicals either promote the expression of antioxidant enzymes or decreases ROS production.[9]

These signaling pathways activate the antioxidant defense mechanisms that protect the body against both intrinsic and extrinsic oxidative stress. Carica papaya can be incorporated into medications or supplements to help manage the health conditions navigated by oxidative stress and further studies are needed to investigate the potential of its chemical components to manage various other chronic diseases.[9]

3.CURRENT TRENDS AND FUTURE DIRECTION FOR ENHANCING ANTI-ULCER ACTIVITY IN PAPAYA:

The current focus in improving the anti-ulcer properties of Carica papaya extracts is on investigating the plant's parts, such as the leaves, fruits, and seeds, which are rich in bioactive chemicals. Recent research has shown that unripe papaya fruit extracts, both aqueous and methanolic, have strong anti-ulcer properties, especially against ulcers caused in animal models by ethanol and indomethacin.(27)
Furthermore, there has been a noticeable decrease in gastric acid secretion and ulcer index with the use of dried fruit extracts.(28) Additionally, the leaves have gastro-protective qualities that are on par with those of common drugs like omeprazole.(29) Future directions for these phytochemicals, which include flavonoids, terpenoids, and alkaloids, include refining extraction techniques and examining the unique mechanisms of action of these compounds.(30)

Important Bioactive Compounds: Flavonoids- Known for their anti-inflammatory and antioxidant qualities, which help prevent ulcers.Terpenoids- These substances have the potential to strengthen papaya extracts' cytoprotective properties.Alkaloids- Found in different plant components, these compounds may help lessen stomach acidity.

Research and Development: Ongoing investigation of extraction methods to optimise bioactive component production and effectiveness.
clinical studies to evaluate papaya extracts' efficacy and safety in human subjects.
Even while research on Carica papaya's therapeutic potential is currently the main focus, it is crucial to take into account the necessity of thorough safety assessments and any possible negative consequences from consuming it, as several studies have shown.(30)(31)

Conclusion

Carica papaya is a plant with a rich diversity of chemical constituents spread across its various parts. These bioactive compounds, including enzymes, flavonoids, alkaloids, and isothiocyanates, contribute to the plant's wide range of medicinal properties, such as anti-inflammatory, antimicrobial, antioxidant, and digestive health benefits. The various parts of the plant—fruit, seeds, leaves, latex, and roots—each have unique chemical profiles that make them valuable in traditional and modern medicine.Enzyme papain and chemopapain are the important components for anti ulcer activity in carica papaya.(Khatun et al., 2023)

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