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Nutritional Values for Carica Papaya

[1] Navnath Subhash Chavan, [2]Prachee Kawade, [3]Pranali Ambilwade, [4]Satypal Chavan, [5]Vaishnavi Jakhad, [6]Neha Rathod

Valmik Naik College of Pharmacy Kannad

ABSTRACT

Carica papaya, commonly known as papaya, is a tropical fruit with significant nutritional and medicinal properties. This article presents an in-depth overview of the nutritional value, pharmacological effects, and various therapeutic uses of papaya. Papaya is rich in essential nutrients such as vitamins, minerals, and enzymes, including papain, which contributes to its digestive benefits. The fruit, along with other parts of the plant such as seeds, leaves, and latex, contains compounds with anti-viral, anti-bacterial, anti-fungal, anti-inflammatory, anti-cancer, and anti-parasitic activities. Traditional uses of papaya include treatment for helminthiasis, amoebiasis, and gastrointestinal disorders. Additionally, papaya's proteolytic enzymes have demonstrated effectiveness in controlling parasitic infections and promoting wound healing. Various extraction methods, including homogenization, Soxhlet, and maceration, have been employed to obtain bioactive compounds from papaya for pharmaceutical applications. The article also provides insights into the chemical composition of different papaya plant parts and highlights the promising role of papaya as a natural remedy in modern medicine.

Introduction:

Scientifically known as Carica papaya Linn, papayas are luscious, delicious fruits that belong to the Caricaceae family. It is cultivated in Europe, tropical America, and India, among other places. Papaya plants have specific cells called laticifers, which makes them laticeferous. The latex secreted by lactifiers was scattered across most plant tissues[1]. The papaya tree is essentially a short-lived Indian tree. Its buttery flavor and look made it an unusual fruit in the past. Because of its nutritional and therapeutic qualities, papaya was the first genetically engineered fruit that people ate [2].

Nutritional Value of Papaya:

The papaya is a big, tree-like plant that grows 5 to 10 meters (16 to 33 feet) tall on a single stem. Its spirally arranged leaves are restricted to the trunk. The leaves have seven lobes and are enormous, measuring 50–70 cm in diameter. The tree unusually limbless, unless it is lopped. As they develop into huge fruit, the blooms appear on the leaf axils. When a fruit is tender to the touch and has amber to orange skin, it is ripe [3].

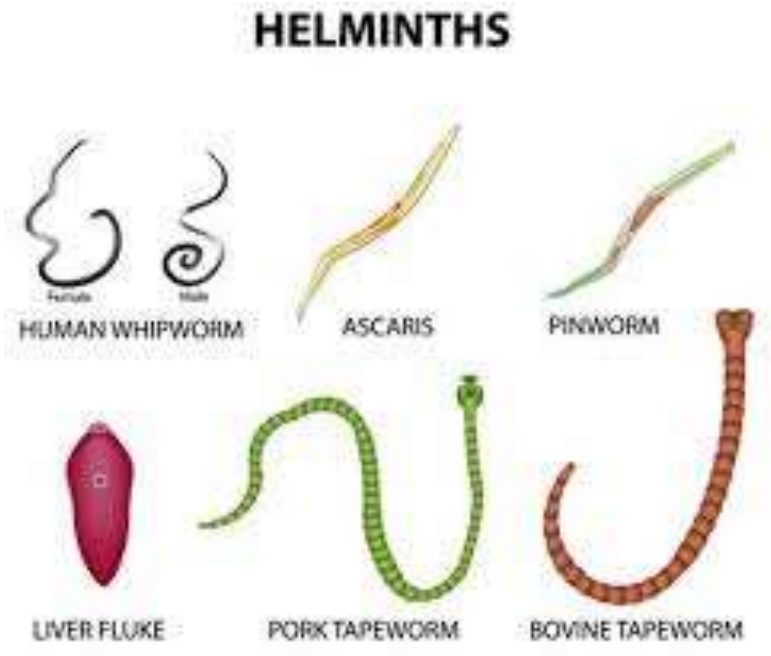
Helminthiasis:

A worm infection, or helminthiasis, is any disease that affects humans or other animals and is caused by parasitic worms called helminthes infected in a particular region of the body. Worms are classified into various groups:

The **first group** Platy helminths includes in the flatworms, tapeworms, and flukes.

The **second group** contains threadworms, roundworms, and hookworms. This phylum is called Nematoda.

The **third group** contains worms having segmented bodies, which are separated into rings or segments. The name of this phylum is Annelida. Some of these include the sea bristle worms and the earthworms. Also known as helminths, worms.



Domain	Flowering Plant
Kingdom	Plantae
Class	Magnoliopsida
Division	Magnoliophyta
Phylum	Steptophyta
Order	Brassicales
Family	Caricaceae
Genus	Carica
Botanical Name	Carica papaya Linn.

Table 1. Botanical Classification of Papaya

Pharmacological effects :

Anti-viral effect, Anti-fungal effect, Anti-amoebic effect, Anti-helminthic effect, Anti-diabetic effect, Anti-inflammatory effect, Anti-septic effect, Anti-microbial effect, Anti-parasitic effect, Anti-hypertensive effect, Anti-bacterial effect, Anti-cancer effect, Anti-hyperlipidemic effect.

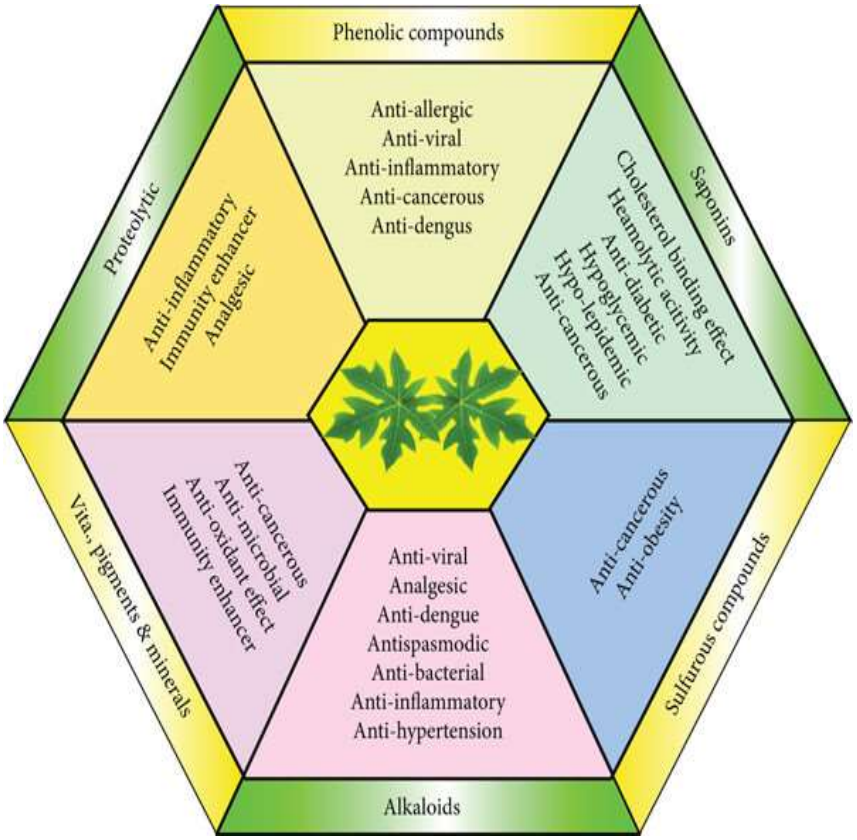
Phyto-constituents of Papaya:

Papaya fruit's sweetness, nutritional value, and digestive capabilities have earned it widespread appreciation.[4]. The papain (EC3.4.22.2) enzyme, a cysteine protease, is present when it is unripe and functions similarly to the pepsin in stomach juice. To extract the papain-containing latex from unripe fruit, an incision is made on the fruit's surface over the course of four to five days, and the latex is collected until it stops running. The papain is more active in greener fruits. Caricain (EC 3.4.22.30), papaya protease IV (EC 3.4.22.25), and chymopapain (EC 3.4.22.6) are three more cysteine proteases that have been extracted from papaya latex [5]. These have been purified and biochemically characterized [6].

Papain

It is a proteolytic enzyme that is essential to numerous essential biological functions in all living things and is a member of the papain superfamily. With its broad proteolytic action against proteins, short-chain polypeptides, amino acid ester, and amide bonds, papain finds widespread use in both the food and medical industries. It preferentially breaks down peptide bonds made up of basic amino acid [7].

Pharmacological properties:



Antihelmintic activity:

Numerous plants and plant extracts have long been used to treat helminthe infections. One such plant is papaya, which has been used for decades in traditional medicine to treat gastrointestinal nematodes because it is high in proteolytic enzymes that break down nematode cuticles and have low toxicity [8]. A papain preparation made from C. papaya latex was shown to have worm-digesting properties in 1940, as they quickly broke down the ascaris cuticle.

Anti-amoebic activity:

When applied to Entamoeba histolytica, the cold macerated aqueous extract of mature papaya seeds exhibited antiamoebic action[9].

Antibacterial activity:

It was shown that the seeds of the Carica papaya exhibited bacteriostatic activity against a number of enteropathogens, including Salmonella typhi, Salmonella escherichia coli, Staphylococcus, Proteases vulgaris, Pseudomonas aeruginosa, Klebsiella pneumonia, and Bacillus subtilis. Gram-negative bacteria were more vulnerable to the extract than gram-positive bacteria among the tested bacteria[10].

Antifungal activity:

Fluconazole and papaya latex work together to prevent the growth of Candida albicans.[11]. Because there are insufficient polysaccharide ingredients in the fungal cell wall's outermost layers, this synergistic impact causes partial cell wall disintegration and the release of cell debris into the cell culture.Latex proteins seem to have antifungal properties, and it has been observed that a minimum protein concentration of 138 mg/dl is necessary to provide a full inhibition.[12].

Anticancer activity:

Pharmaceutical preparations comprising different proteolytic enzymes (papain) were first utilized as adjuvants in the treatment of cancerous disorders, even though their exact mechanism of action was unknown. The effects of oral administration of polyenzyme preparations are linked to the stimulation of human peripheral blood mononuclear cells to produce cytokines, according to experiments [13].

According to in vitro research, papaya has anticancer properties and can treat a variety of cancer cell lines. Papaya's papain enzyme is useful against cancer. Papain converts protein and fibrin from cancer cell walls into amino type of acid. It contains lycopene, which is extremely reactive with oxygen and free radicals, in addition to papain. Isothiocyanate is useful against leukemia and diseases of the breast, lung, colon, pancreatic, and prostate. These enzymes have the ability to stop cancer cells from forming and growing.

Part	**Constituent**
Fruit	Protein,fat,carbohydrate,mineral
Seed	Crude fibre,crude protein,papaya oil,fatty acid
Root	Caproside and enzyme myrosine
Leaves	Vit C,Vit E,alkaloids carpain
Bark	Glucose,fructose,galactose,xylitol
Latex	Proteolytic enzyme papain,peptidase A and B
Juice	Lipid,palmitic acid,stearic acid,oleic acid

Table 2. Chemical composition of various parts of Papaya plant

Extraction procedures :

a. Plant tissue homogenization

Researchers have utilized solvent-based plant tissue homogenization extensively. Fresh plant parts that have been dried or wet are ground into fine particles in a blender, added to a specific amount of solvent, and shaken rapidly for five to ten minutes or left for twenty-four hours. The extract is then filtered. To find the concentration, the filtrate may then be dried at lower pressure and redissolved in the solvent. Nonetheless, in order to clarify the extract, some researchers centrifuged the filtrate[14].

b. Serial exhaustive extraction

It is another popular extraction technique that uses a series of extractions with solvents of increasing polarity, starting with a non-polar solvent (hexane) and ending with a more polar solvent (methanol), in order to extract a wide spectrum of compounds. Using an organic solvent, some researchers use soxhlet extraction to remove dried plant material. Because prolonged heating might cause compounds to degrade, this approach cannot be applied to thermolabile substances[14]

c. Soxhlet extraction

Soxhlet extraction is only necessary when the impurity is insoluble in a solvent and the target product has a limited solubility in that solvent. Simple filtering can be used to separate the desired component from the insoluble substance if it is highly soluble in a solvent. This system has the advantage of recycling a single batch of solvent rather than going through the sample in multiple sections of heated solvent. Using this approach on thermolabile chemicals is not possible since prolonged heating can cause the compounds to degrade.[15].

d. Maceration

When macerating (for fluid extract), whole or coarsely ground plant material is kept in contact with the solvent in a sealed container for a predetermined amount of time while being constantly stirred until the soluble material dissolves. This approach works better with medications that are thermolabile.[16].

e. Decoction

The crude medication is boiled in water for 15 minutes, cooled, strained, and enough cold water is passed through the drug to create the necessary volume in order to remove the water-soluble and heat-stable ingredients[17].

f. Infusion

The easily soluble ingredients of the crude medications are present in this diluted solution. Cold or hot water is used to macerate the solids for a brief amount of time in order to create fresh infusions[17].

h. Percolation

The most common method for removing active components from tinctures and fluid extracts is this one. Typically, a narrow, cone-shaped jar with open ends is called a percolator. A suitable quantity of the designated menstrum is used to moisten the solid ingredients, which are then let to stand in a tightly

sealed container for around four hours. The mass is then packed and the percolator's top is sealed. After adding more menstrum to create a shallow layer above the mass, the mixture is left to macerate for twenty-four hours in the closed percolator. The liquid inside is then allowed to trickle gradually when the percolator's outlet is opened. Menstruation is added as needed until the percolate equals around three-quarters of the final product's volume. After pressing the marc, the liquid that was expressed is added to the percolate. Menstrum is added in sufficient amounts to create the necessary volume, and the combined liquid is then clarified either by filtering or by standing and then decanting [18].

Screening of phytochemicals

1.Detection of alkaloids:

Extracts were dissolved individually in dilute Hydrochloric acid and filtered.

a. **Mayer's Test:**

Filtrates were treated with Mayer's reagent (Potassium Mercuric Iodide). Formation of a yellow coloured precipitate indicates the presence of alkaloids.

b. **Wagner's Test:**

Filtrates were treated with Wagner's reagent (Iodine in Potassium Iodide). Formation of brown/reddish precipitate indicates the presence of alkaloids.

c. **Hager's Test**:

Filtrates were treated with Hager's reagent (saturated picric acid solution). Presence of alkaloids confirmed by the formation of yellow coloured precipitate.

2. Detection of glycosides:

Extracts were hydrolysed with dil. HCl, and then subjected to test for glycosides.

a. Modified Borntrager's Test:

Extracts were treated with Ferric Chloride solution and immersed in boiling water for about minutes. The mixture was cooled and extracted with equal volumes of benzene. The benzene layer was separated and treated with ammonia solution. Formation of rose-pink colour in the ammonical layer indicates the presence of anthranol glycosides.

b. **Legal's Test:**

Extracts were treated with sodium nitropruside in pyridine and sodium hydroxide. Formation of pink to blood red colour indicates the presence of cardiac glycosides.

3.Detection of flavonoids

a.Alkaline Reagent Test: Extracts were treated with few drops of sodium hydroxide solution. Formation of intense yellow colour, which becomes colorless on addition of dilute acid, indicates the presence of flavonoids.

b. Lead acetate Test : Extracts were treated with few drops of lead acetate solution. Formation of yellow colour precipitate indicates the presence of flavonoids.

Common indigenous plant having activity against helminth

Carica papaya

- **Common name:** Papita, Pawpaw
- **Active principle:** Papain, Chymopapain, Benzyl isothiocynate
- **Plant parts used:** leaves, Fruits

Conclusion

In conclusion, Carica papaya is a highly versatile plant that offers a wealth of nutritional and therapeutic benefits. Its rich composition of vitamins, minerals, and proteolytic enzymes, particularly papain, makes it valuable for digestive health and a range of medicinal uses. The fruit and other parts of the plant—such as seeds, leaves, and latex—demonstrate remarkable pharmacological properties, including anti-inflammatory, anti-cancer, anti-bacterial, anti-fungal, and anti-parasitic effects. These qualities support its traditional use in treating digestive disorders, parasitic infections, and inflammatory conditions, while also offering promising potential for modern pharmaceutical applications. The ongoing research into papaya's bioactive compounds further underscores its importance as a natural remedy with diverse health benefits. As interest in natural and plant-based treatments continues to grow, Carica papaya stands out as a valuable resource in both traditional and contemporary medicine, with potential for further exploration in clinical settings.

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