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A REVIEW OF THE THERAPEUTIC CHARACTERISTICS OF *CARICA PAPAYA LINN*

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ABSTRACT

Carica papaya L., commonly known as papaya, is a widely cultivated fruit tree in tropical and subtropical regions. Its fruit is consumed globally, either fresh or as a vegetable, and is also widely utilized in processed forms. Renowned for both its palatability and health benefits, nearly all parts of the plant – including the fruit, roots, bark, peel, seeds, and pulp – exhibit medicinal properties. These therapeutic effects are primarily attributed to the plant's rich content of vitamins A, B, and C, as well as proteolytic enzymes such as papain and chymopapain, which possess antiviral, antifungal, and antibacterial activities. Recent research has provided substantial insights into the biological functions and pharmacological potential of papaya, establishing it as a valuable nutraceutical resource. This review highlights the fruit's nutritional profile and explores the medicinal attributes of its various components.

KEYWORDS: *Nutritional value, Traditional and pharmacological properties*

INTRODUCTION

Papaya is a powerhouse of nutrients and is available throughout the year. It is a rich source of three powerful antioxidant vitamin C, vitamin A and vitamin E. The minerals, magnesium and potassium, vitamin B pantothenic acid and folate and fiber. In addition to all this, it contains a digestive enzyme-papain that effectively treats causes of trauma, allergies and sports injuries. All the nutrients of papaya as a whole improve cardiovascular system, protect against heart diseases, heart attacks, strokes and prevent colon cancer. The fruit is an excellent source of betacarotene that prevents damage caused by free radicals that may cause some forms of cancer. It is reported that it helped in the prevention of diabetic heart disease. Papaya lowers high cholesterol levels as it is a good source of fiber[1]. Papaya, *Carica papaya* (C. papaya) L., is one of the major fruit crops cultivated in tropical and sub-tropical zones.

Worldwide over 6.8 million tonnes of fruit were produced in 2004 on about 389 990 ha (FAO 2004). Of this volume, 47% was produced in Central and South America (mainly in Brazil), 30% in Asia and 20% in Africa. The papaya industry in Brazil is one of the world's largest that continues to show rapid growth. Do Carmo and Sousa Jr. (2003) reported on a 151% increase in total area cultivated over the past decade (16 012 ha in 1990 to 40 202 ha in 2000) and a 164% increase in the quantity produced during the same period (642 581 to 1 693 779 fruits from 1990 to 2000). During 11 years, the volume exported increased 560% from 4 071 t to 22 804 t in 2001 (SECEXMDIC 2002) and 38 760 t in 2005 (FAO 2005). Although papaya is mainly grown (>90%) and consumed in developing countries, it is fast becoming an important fruit internationally both as a fresh fruit and as processed products[2].

It is a tree reaching 3-10 m in height with the habit of a palm; the freshly stem marked by scars where leaves have fallen off, is surmounted by a terminal panache of leaves on long petioles and with 5-7 lobes. Flowers fragrant, male flowers in lax many-flowered, densly pubescent cymes at the tips of the pendulous, fistular rachis; females flowers large, solitary or in few flowered racemes, different types of enzymes. Papain, vegetable pepsin present in good amount in unripe fruit is an excellent aid to digestion, which helps to digest the protein in food at acid, alkaline or neutral medium. Thus it can be prescribed for dyspeptic patients, who cannot digest the wheat protein gliandin, can tolerate it, if it is treated with crude papain. Papaya has the property of tenderizing meat. This knowledge is being put to use by cooking meat with raw papaya to make it tender and digestible [3].

The fermented papaya fruit is a promising nutraceutical as an antioxidant. It improves the antioxidant defence in elderly patients even without any overt antioxidant deficiency state at the dose of 9 g/day orally[4,5].

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Introduction to Plant Profile

Plant profile of C. papaya is shown in Figure

Taxonomical Classification, Common Names and parts used

The papaya belongs to a small family-Caricaceae, having four genera in the world. The genus Carica Linn. is represented by four species in India, of which C. papaya Linna. is the most widely cultivated and best-known species. The taxonomical classification includes kingdom (Plantea), order (Brassicales), family (Caricaceae), genus (Carica), species (C. papaya). Common names include papaya, pawpaw, papaw, papita, arand-kharpuja, papaya, papayabaum, papaia. The parts used contain fruit, leaves and bark.

Chemical Constituents

The different parts of papaya such as fruit, fruit juice, seed, root, leaves, bark, latex contain various chemical constituents, which are shown as follows: 1. Fruit-Protein, fat, fiber, carbohydrates, minerals: calcium, iron, vitamin C, thiamine, rivoflavin, niacin, and carotene, anino acid, citric acid and malic acids (green fruits), volatile compounds: benzylisothiocynate, cis and trans 2, 6-dimethyl-3,6 epoxy-7 octen-2-ol, alkaloids, carpaine. 2. Juice-N-butyric, n-hexanoic and n-octanoic acids, lipids; myristic acid, palmitic acid, stearic acid, linolenic acid, linoleic acid, oleic acid. 3. Seed-Fatty acids, crude protein, crude fibre, papaya oil, carpaine, caricin, glucotropacolin, and an anzyme myrosin. 4. Root-Carposides and an enzyme myrossin. 5 .Leaves-Alkaloids carpain, pseudocarpain, dehydrocarpaine I and II, choline, vitamine C and E, carposide. 6. Bark-Glucose, fructose, sucrose, xylitol, β-sitosterol. 7. Latex-Papain, chemopapain, peptidase A and B, lysozymes[6,7].

Nutritional value of 100 g of Papaya Fruit

The constituents of ripe papaya contain: energy (163 kj), protein (0.6 g), fat (0.1 g), minerals (0.5 g), fibre (0.8 g), carbohydrates (7.2 g), beta-carotene (888 µm), total carotene (2 740 µm), sodium (3 mg), iron (0.10 g), vitamin A (1 094 IU), vitamin E (0.73 mg), niacin (3 mg) and water (89%). These nutritional values of papaya help to prevent the oxidation of cholesterol. Papaya is rich in iron and calcium; a good source of vitamin A, B and G and an excellent source of vitamin C (ascorbic acid). The extract and fruit juice of C. papaya contain alkaloids, glycosides, flavonoids, carbohydrates, saponins, terpenoids, steroids and tannins.

Parts and Medicinal uses of C. Papaya

C. papaya is a pack of enzymes. Different parts contain different enzymes: unripe fruit (papain, chymopapain), fruits (B carotene, carotenoids, crytoxanthin, monoterpenoids, linalool), roots (carposides), seeds (papaya oil, glucosinolates, benzyl isothyocynate), leaves (Zn, Mn, Fe, K, minerals), shoots (flavanoids, kaemferol, myricetin, minerals, Ca, Mg, Fe) and leaves (vitamin C and E, alkaloids, carpaine).

Pharmacological properties of C. Papaya

The plant C. papaya has been proved for various medicinal activities like antioxidant, anti-hypertensive, wound healing, hepatoprotective, anti-inflamatory, antimicrobial, antifungal, anti-fertility, histaminergic, diuretic, antiamoebic, anti-tumor, anthelmintic, effect on smooth muscles, antimalarial, hypoglycemic activity, immunomodulatory activity, anti-ulcer activity, anti-sickling activity.

Antioxidant Activity

The methanolic extract of unripe fruits of C. papaya was evaluated in vivo for its effect on activities of some antioxidant enzymes which includes glutathione peroxidase (GPx), glutathione transferase (GST), glutathione reductase, catalase and glucose-6-phosphate dehydrogenase in mice treated with a orally dose of 100 mg/kg. There is significant increase in the activities glutathione reductase, GST, GPx, glucose-6-phosphate dehydrogenase due to the ethyl acetate fraction. Significant decrease in GPx was observed in kidney following administration of ethyl acetate fraction. It was suggested that quercetin and β-sitosterol may be responsible for the antioxidant potential[10]

Anti-Hypertensive Activity

The ethanolic extract of ripe fruit of C. papaya was used for the anti-hypertensive activity. The basal mean arterial blood pressure (MAP) were (93.8依4.5), (175.2依5.1), (181.3依6.2) mmHg in the normotensive, renal and DOCA-salt hypertensive animals. Both hydralazine (200 µL/100 g, i.v) and ethanolic extract of unripe fruit of C. papaya (20 mg/kg, i.v) produced a significant depression of MAP in normotensive, renal and DOCA-salt hypertensive animals groups as scompared to control. But the extract produced about 28% more depression of MAP than hydralazine in the hypertensive group. The study

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suggested that the unripe fruit of C. papaya had a potent anti-hypertensive activity[11].

Wound Healing Activity

The aqueous extract of C. papaya fruit [100 mg/(kg.d) for 10 d] for wound healing property in streptozotocin-induced diabitic rats using excision and dead space wound models. The aqueous extract shows 77% reduction in the wound area when compared to 59% contraction to wound of the controls. Thus the result suggested that the aqueous extract of C. papaya had a potent wound healing property[12].

Hepatoprotective Activity

The aqueous and ethanol extract of dried fruit of C. papaya for its hepatoprotective activity in rats against CCl4- induced hepatotoxicity in rats. The aqueous (250 mg/kg, p.o) and ethanol (250 mg/kg, p.o) extracts of C. papaya showed significant hepatoprotection by lowering the biochemical parameters such as SGPT, SGOT, serum bilirubin, akaline phosphatase[13].

Anti-Inflamatory Activity

The ethanolic extract of C. papaya leaves in rats using carrageenan induced paw oedema, cotton pallet granuloma and formaldehyde induced arthritis models. The ulcerogenic activity of the extract was also investigated. The result showed that the extract at the dose of 25-250 mg/kg p.o exhibited significant reduction in the paw oedema in the carrageenan test. The extract produced slight mucosal irritiation at higher doses[14].

Antimicrobial Activity

The aqueous extract of C. papaya leaves and roots at different concentrations (25, 50, 100, 200 mg/mL) showed antimicrobial activity against some human pathogenic bacteria using the agar diffusion method[15].

Antifungal Activity

The latex of C. papaya and fluconazole has synergistic action on the inhibition of Candida albicans growth. This synergistic effect results in partial cell wall degradation. Latex proteins appear to be responsible for antifungal action and minimum protein concentration for producing a complete inhibition was reported as about 138 mg/mL[16]

Anti-Fertility Activity

The crude extract of bark of C. papaya [5-10 mL/(kg. d), p.o for 4 weeks] on the seminiferous tubules of rats showed complete loss of fertility attributing to decline in sperm motility and alteration in their morphology. Thus the bark showed the safe and could serve
as an effective male contraceptive in animals[17]

Histaminergic Activity The crude extract of C. papaya (0.5-512 µg/mL) caused concentration-dependent contraction of ileal strips suspended in tyrode solution which was mediated via H1- receptor and is dependent on extracellular Ca 2+ influx[18].

Diuretic Activity

Aqueous root extract of C. papaya when given orally at the dose of 10 mg/kg to rats produced significant increase in urine output and showed similar profiles of urinary electrolyte excretion to that of hydrochlorothiazide[19].

Anthelmintic

The dried papaya seeds given as elixir with honey have shown significant effect on the human intestinal parasites, without significant side effects. Benzylisothiocynate, present in seeds is the chief anthelmintic[22-25]. The latex of papaya has anthelmintic efficacy against Heligmosomoides polygyrus in experimentally infected mice, which suggests in potential role as an anthelmintic against potent intestinal nematodes of mammalian hosts[26]. It has also anthelmintic activity against natural infection of Ascaris suum in pigs and found to be 100% effective at the dose of 8 g/kg body weight[27].

Anti-Malarial Activity

The petroleum ether extract of the rind of raw papaya fruit at concentration ranging from 0.05-1 000 µg/mL. The extract exhibited significant anti-malarial activity[29]

Additional Benefits of Papaya

Papaya fruit is a rich source of nutrients such as provitamin A caroteniods, vitamin C, B, lycopine, dietry minerals, dietry fibre. Danielone is a phytoalexin found in papaya fruit. This compound showed high antifungal activity against Colletotrichum gloesporiodes, a pathogenic fungus of papaya enzymes to our diet and improved our digestive health. The other benefits of papaya include increase in appetite, relieve nausea, as an acne medicine, ease mensutral pain, lowering the fever, used as an sunscreen and smoothing slave, meat tenderizer and fight from dandruff. The fruit of papaya can also be used as cosmetics such as improvement of pimples and wrinkles by rubbing the white pulp, good bleaching agent, an important ingredient in bath soap, astringent, hand washes, detergent bars, help in removing dead worn-out skin cells, lightening the colour of our skin.

Papaya in Case of Pregnancy

The main constituents of papaya are papain and chymopapain present in latex showing teratogenic and abortificent (can induce an abortion) effects. This can cause increase in the chances of uterine contraction as the papain acts like prostaglandin and oxytocin which are known to put a mother's body into labour and hence can cause the adverse effect on babies and mothers health. The latex can also cause the oedema and haemorrhage placentas, resulting in severe complications in pregnancy and normally an early delivery.

CONCLUSION

Carica papaya is recognized for its comprehensive medicinal potential, as all parts of the plant possess therapeutic value. The presence of diverse vitamins and bioactive enzymes contributes to its classification as a nutraceutical species. Papaya exhibits a broad spectrum of pharmacological properties and has long been regarded in traditional medicine as a potent therapeutic agent. Considerable research has been conducted on its biological activities. This review aims to provide a

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comprehensive overview of the pharmacological effects and applications of the plant's chemical constituents.

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