Subscription Agency
Exploring and Distributing Knowledge Globally

Journal of Advancement in Pharmacognosy
Volume 2 Issue 1; 2022

A Review on Pharmacognosy, Phytochemistry and Pharmacological Activity of *Carica papaya* (linn.)

***Tanya Sharma*[1, 2], *Wasim Raja*[1]**
[1]*Central Laboratory Facility, Chhattisgarh Council of Science and Technology, Raipur, Chhattisgarh, India*
[2]*Amity Institute of Biotechnology, Amity University, Math, Raipur, Chhattisgarh, India*
***Corresponding Author**
Email Id: tanyasharma3112@gmail.com

ABSTRACT

Plants are the "lungs" of our glorious universe, and they are Almighty God's greatest invention. Papaya (Carica papaya Linn.) is well known for its nutritional as well as medicinal value since long time. The medicinal properties of fruit and other parts of papaya are well known in the different system of traditional medicine including Ayurveda. Carica papaya is one such creation. It is of Caricaceae (caricaceae) family herbaceous plant. It is a dicotyledonous, polygamous, and diploid species with 35 species in four genera, the first three of which are from the United States (Carica, Jacaritia, and Jarilla). Plants are like a "treasure chest," with a profusion of active components that are crucial in the development of new medications and are readily available and affordable source of medication. Chemicals such as Vitamin C, tocopherols, total phenols, and -carotene are all abundant antioxidants in this tropical fruit-carica papaya, as well as there are bioactive phytochemicals with antioxidant activity (benzyl isothiocyanate). Its various parts has been reported for various disease conditions viz. fever, swellings, jaundice, gonorrhea, bilious fever, itches, eczema, and rheumatism cold, headache, whooping cough, asthma, chicken pox, and bronchitis in various traditional literature. This review includes pharmacological and phytochemical properties of leaves, barks, roots, latex, fruit, flowers, and seeds of C. papaya that are used in folk medicine to cure variety of diseases. The various remarkable researches on biological activities and medicinal application have been reported during past four decades and established it as an important nutraceuticals agent. Carica papaya Linn. leaf has been scientifically studied for various therapeutic activities like antibacterial, antioxidant, antipyretic, insecticidal, antimicrobial, anti-molluscal etc. In view of this leaves have been explored through several advanced techniques like phyto-extraction of heavy metals, phytoremediation of particulate pollution and many others. Various studies on phytoconstituents and chemical composition of leaves have been reported in last few decades. The present review aims an exploration of pharmacognostical, phytochemical and pharmacological studies of Carica papaya Linn till now.

Key words: *Carica papaya; antioxidants; phytochemical; pharmacological; carotenoids; flavonoids.*

INTRODUCTION

Plants have been used as a natural treatment in traditional medicine since antiquity. Traditional cultures, biodiversity, health care, and drug development all benefit from ethno botanical information on medicinal plants and their use by indigenous cultures. WHO is focusing its efforts on underdeveloped countries in order to encourage them to adopt herbal medicine, which they have done for generations. Carica papaya is known as Erandarkarkati in Sanskrit. People cook green fruits, leaves, young shoots and flowers of the papaya and dried papaya seeds after grinding are used as pepper. Many commercial products are developed from various

portions of the Carica papaya plant, the most well-known of which are papain and chymopapain, which are made from the latex of the immature fruit, stem, and leaves and are beneficial in tenderising meat and treating indigestion . Papaya is regarded as a nutritious powerhouse, and it is available throughout the year in all parts of the region. Vitamin C, A, and D, all of which are potent antioxidants, are abundant in papaya. Papaya contains almost no fat. [1-13].

Carica papaya Linn is a wonderful plant with a variety of medicinal characteristics that distinguishes it from the other 22 species. Caricaceae is a family of plants. It is belived to be originated and evolved in the United States. In the Americas' tropics, possibly in southern Mexico and Central America are close neighbours. It's true polygamous specie, which can only be specified at the blossoming season It has variable degrees of abrasion. 1st sex reversal. This plant's various sections are used to treat a variety of diseases [14] .

The average height is between 2 and 10 metres. The plant's leaves are spirally organised all the way up to the top stem. The leaves are usually large and oval in shape, with a diameter of 20–28 inches. White latex can be found in all regions of the plant. The flowers have five petals that are pale white in hue and are very dimorphic. The petals of both the male and female flowers are fused together. The ovary and its five petals are twisted loosely attached at the base of the female flowers. All parts of the papaya have therapeutic properties and have long been used to cure a variety of maladies around the world [15] . Carica papaya is grown for its fruits, which are eaten as breakfast by people in the tropics, and as components in jellies, preserves, and other dishes. The proteolytic enzyme papain has a wide range of industrial applications. Meat tenderizers and chewing gums include it [16]. This is known by a variety of names in different parts of the world.

Fig. 1. Carica Papaya

Source: Britanica

Table.1 Popular Names of Plant in Various Countries

Country	Name
Southern Asia and East Indies	Kapaya, kepaya, lapaya and tapaya
Brazil	Mamao (big breast) or tree melon
Australia and West Indies	Papaw or paw paw
France	Papaya (the fruit), papayer(the plant) or "figuier des Iles"
Vietnam	Du du
New Zealand	Papaw
India	Papita

Table 2: Taxonomical classification of *Carica papaya* [17]

RANK	SCIENTIFIC NAME AND COMMON NAME
Kingdom	Plantae – Plants
Subkingdom	Tracheobionta – Vascular plants
Superdivision	Spermatophyta – Seed plants
Division	Magnoliophyta – Flowering pants
Class	Magnoliopsida – Dicotyledons
Subclass	Dilleniidae
Order	Violales
Family	Caricaceae – Papaya family
Genus	*Carica* L. – papaya
Species	*Carica papaya* L. – papaya

Table 3: Medicinal uses of *C. papaya* plant Mentioned in Traditional Ayurvedic Literature [18].

Parts	Medicinal uses
Ripe fruits	Carminative, diuretic,
	chronic diarrhea, dysentery, ringworm
Unripe fruits	laxative, abortifacient ,diuretic, dried fruit reduces enlarged spleen and liver, used in snakebite to remove poison, anti-implantation activity and antibacterial activity
Seeds	Carminative, counter irritant, as a paste in the treatment of ringworm and
	psoriasis ,anti-fertility agents in males.
Roots	Anti-fungal activity,
	diuretic, piles
Leaves	Asthma, beriberi, fever, abortion, antibacterial
	activity, gonorrhea
Flower	Febrifuge, jaundice, pectoral
	properties

Stem bark	Anti-fungal activity,
	jaundice, sore teeth

TAXONOMY, BOTANICAL AND MORPHOLOGY DESCRIPTION

Taxonomy

Plant taxonomy is the science of discovering, identifying, describing, categorizing, and naming plants. Table 2. shows the Carica papaya taxonomy. Plant taxonomy and plant systematics are inextricably linked, and there is no clear distinction between the two. Plant systematics, in practise, entails relationships between plants and their evolution, particularly at higher levels.Plant taxonomy, on the other hand, is concerned with the actual handling of plant specimens [19].

Botanical Description

Carica branched as a result of the injury, and all portions of the plant contained white latex. Papaya is an evergreen, tree-like herb that grows 2-10 metres tall, usually unbranched, with noticeable leaf scars and spongy-fibrous tissue. Has a well-developed rooting system. Petiole up to 1 m long, hollow, greenish or purplish-green; lamina orbicular, 25-75 cm in diameter, palmate, deeply 7-lobed, glabrous, prominently veined; lobes deeply and broadly serrated. Female flowers 3-5 cm long, large functional pistil, no stamens, ovoid-shaped ovary; male flowers on long hanging panicles, with 10 stamens in 2 rows, gynoecium absent except for a pistillode; hermaphrodite flowers larger than males, 5-carpellate ovary; occurrence depends on the season or age of the tree; female flowers 3-5 cm long, large functional pistil, no stamens, ovoid-shaped ovary [20].

Large, cylindrical fruits with luscious orange pulp, hollow berry, thin yellowish skin when ripe, and a wide spectrum of colours. Female flowers produce oblong, spherical, and pear-shaped fruits, whereas hermaphrodite blooms produce long, obovoid, or pyriform fruits. Seeds are many, tiny, black, and spherical, with a gelatinous aril covering them. Small latex vessels can be found all over the tree, but they're especially plentiful in fruit that has achieved full size but hasn't yet begun to mature. Because of the resemblance of the leaves, the generic name is derived from the Latin ‘carica', which means ‘edible.

Carica papaya bears fruit in 5 months and has a lifespan of 4-5 years. Male and female flowers are usually found on separate trees, but some flowers are bisexual. Larger bees (Xylocarp,Trigona), honeybees, long-tongued sphinx moths (Sphingidae), humming-bird moths (Macroglossa), and wind are among the pollinating insects. A cultivar's individuality may be lost in a few generations due to open (uncontrolled) pollination [20].

C. papaya thrives in a variety of environments, from the equatorial tropics to moderate latitudes. It must, however, be grown in warm, sunny, wind-protected locations, especially below 1500 metres. Strong winds are harmful, especially to soils that can't compensate for huge amounts of transpiration loss. C. papaya is not frost tolerant; exposure to frost or cold wind causes leaf damage, which leads to the tree's demise. Waterlogged roots are extremely sensitive, and even brief episodes of flooding can kill the plant [20].

Morphology

The papaya is a polygamous flowering plant. Male (staminate), Hermaphroditic (bisexual), and Female (staminate) are the three basic sex kinds found in plants (pistillate). Furthermore, some

plants can produce multiple types of flowers at the same time. Also, some plants produce flowers that aren't of these fundamental types, but have varying degrees of male and female characteristics. Climate change, such as drought and fluctuating temperatures, appears to be the catalyst for this shift in sexual expression. At high temperatures, the tendency to generate male blooms appears to increase. Because male trees are unfruitful and fruit from bisexual plants is favoured in particular markets, choosing seed that will grow fruitful trees of the appropriate type is critical. Knowing the source of pollen and the type of blossom can help forecast the progeny quite well. Pollination studies have revealed that I pistillate flowers pollinated by staminate flowers produce an equal number of male and female progeny, (ii) pistillate flowers pollinated by pollen from bisexual flowers produce an equal number of female and bisexual progeny, and (iii) bisexual flowers that are self-pollinated or cross-pollinated with other bisexuals produce a ratio of one female to two bisexuals. Pollination of bisexual flowers by staminate flowers results in an equal number of female, male, and bisexual offspring. The second and third pairings will, without a doubt, yield the most fruit-bearing plan [21-22].

Leaves

The leaves are placed spirally in a simple, 30-70 cm long terminal cluster. The ranges of the lobes vary considerably and vary from whole to ondulate to profoundly lobed. The leaves are arranged alternately and rounds in a contours 60-90 cm in the diameter, bundled on the apex between stem and rams, long pecíoloes. The base is very stringy with overlapping lobes and is of large sizes from 7-11 sizes, each of which has a large base or a slightly constrained sharp and sharp apex. The bundles of the leaves are dark-green to yellow-green, bright, visible with the blind-white nerves embedded and reticulated; the surfaces are pale green-yellow underneath, and the vascular structures are clearly prominent. The petioles are round and yellow-green, have sporadic purple or violet stains, are fragile, 25-100 cm long and 0.5-1.5 cm thick. Every leaf is 4-6 months in lifespan.

Flowers

The reproductive structure found in flowering plants is flowers. A flower's biological role is to make reproduction easy. In papaya plant six kinds of flowers are known.

Typical Female Flower

When closed when opening, its five petals spread from the base, it is a rather large conical flower. The ovary is wide with slightly ondulated, smooth or circular. Spherical or ovidic fruits produced by that flora have a form.

Similar to the above, but this type contains five short anther petals that also spread from the base, in their orientation. The ovary has five deep grooves, which remain until they mature. Fruit develops a globular to an egg form.

Hermaphrodite Intermediate Flowers

Petals can be fused up to two thirds of the length or free from the base. The organisation is not defined. The number of anthers varies between 2 and 10; the carpets vary between 5 and 10 with different fusion levels. It produces uncomplicated, carpelodic fruits with little commercial value. This floral type has low trade value. These flowers appear more frequently when ambient temperatures are 24.5 °C during the day and 15.5 °C at night.

Hermaphrodite Elongated Flower

Flour-type petals are fused from one fourth to three fourths of whole length; 10 long and five short anther-type petals are detected. The ovary is lengthy and the fruit shape ranges from

cylindrical to pear-shaped if it contains five or more carpets. This is the most commercially important of various varieties of hermaphrodite flowers.

Hermaphrodite Sterile Flower
It is like the former flora, but it does not produce an ovary; hence it is sterile, warm or watery. It can be considered to be a functional male flora because it exclusively produce pollen.

Typical Male Flower
The tall and slender corolla of this kind has anthers in two 5-series; one more series than the other. They are not stigmatic and functioning in a rudimentary pistil. The plants are dioecious in nature: male and female blooms are found in individual plants. Male flowers differ from female flowers morphologically. In multiflowing cymes on horizontal or pending stems up to 1 m in length, male inflorescences take hold. The flowers are 2-4 cm long, yellowish. The petals are merged into a long tube with ten viable stamina and a non-functional rudimentary ovary. Female inflorescences (only 3-4 cm) are substantially shorter and have fewer flowers. Female flowers are larger with five free petals, usually white or cream in colour. It's not stamens, but a big ovary with 5 stigmas in fan shape.

Many intermediate forms, including bisexual blooms, are cultivated. At least 15 floral forms (e.g. Pentandria–5 and functional ovary) have also been named and some forms have been selected by breeders, since they connect to distinct fruit attributes. Environmental factors could also impact on sexual expression and a plant's sexuality can change during or in the seasons. So a complex mix of genetic, developmental and environmental factors depends on the sexuality of any plant under cultivation.

FRUITS
A pyriform of ovoid-oblong berry, or virtually cylindrical, wide, meaty, juicy, grooved on upper, longer, green yellow or yellow or orange, with many parietal seed and a length of 10-25 cm or more and diameter 7-15 cm or more. The fruits are usually melon-like, oval, almost spherical, somewhat pyriform or club-like, 15-50 cm in length, and 10-20 cm in thickness, weighing up to 9 kg. Half-wild (naturalized) plants are 2.5 - 15 cm long and yield small fruit. The skin is thin and waxy, yet somewhat hard. It's rich in white latex when the fruit is green and rigid. When it matures, it externally becomes light and deep-yellow and its thick wall becomes aromatic, yellow, orange or several shades of salmon or red. It is thus juicy, sweet and slightly like a cantaloupe in the taste; extremely muscular in certain varieties. Small, black, eye-catcher, corrugated, spicy seeds approximately 3/16 in (5 mm) in length and each with translucent, gelatinous covering are attached to the wall lightly with a white, fibrous tissue [23,24,25].

Nutritive value of Carica Papaya Fruit
Papaya fruit is a great and robust vitamin C source, and 224 percent of the needed daily dose is provided by a single medium fruit. One medium papaya has about 120 calories, and does not contain cholesterol, 30 g of carbohydrate, five g of fibre and sixteen g of sugar, two g of protein. The papaya fruit is also a good source of folate, vitamin A, magnesium, copper. The fruit has B, alpha and beta-carotene, lutein and zeaxanthine, vitamin E, calcium, and so on. Powerful antioxidant most usually related to tomatoes, potassium, vitamin K and lycopene **[TABLE.5] .**

Seeds

The seeds represent around 16% of the fruit weight and each seed consists of sarcotesta and endosperm. Extracts of papaya seed had proven to be both therapeutic and nutritious A number of Caricaceae plants have been utilised to treat different conditions The experts argued that the overall health prevention of diseases is affected positively by every part of a pawpave plant, including the seeds, roots, rains, and fruits [26]. Many seeds are present, and they are black and contained in the sweet pulp of ripe fruit. Because seeds have a peppery flavour, they can be used in place of pepper. Anthelmintic, contraceptive, anti-inflammatory, analgesic, antifertility, and antibacterial action is all pharmacological properties of seeds. Papaya seeds are used as a proven natural cure for a variety of diseases in some traditional medicines. Seeds are also used to treat ringworm and stomachaches [27].

Table 5: Depth analysis of nutrients of Papaya fruit (Carica papaya) (Nutritive Value per 100g)

Principle	Nutrient Value	Percentage of RDA
Energy	43 Kcal	2%
Carbohydrates	10.82 g	8%
Protein	0.47 g	1%
Total Fat	0.26 g	1 %
Cholesterol	0 mg	0 %
Dietary Fiber	1.70 g	4 %
Vitamins		
Folates	37 µg	9 %
Niacin	0.338 mg	2 %
Pantothenic acid	0.218 mg	4 %
Pyridoxine	0.038 mg	3 %
Riboflavin	0.027 mg	2 %
Thiamin	0.023 mg	2 %
Vitamin A	950 IU	32 %
Vitamin C	60.9 mg	102 %
Vitamin E	0.30 mg	2 %
Vitamin K	2.6 µg	2 %
Electrolytes		
Sodium	8 mg	0.5 %
Potassium	182 mg	4 %
Minerals		
Calcium	20 mg	2 %
Iron	0.25 mg	3 %
Magnesium	21 mg	5 %
Phosphorus	10 mg	1 %
Zinc	0.08 mg	0.5 %
Phytonutrients		
Caarotene-β	276 µg	--
Cryptoxanthine- β	761 µg	--
Lutein-zeaxanthin	75 µg	--

Source: USDA National Nutrient Database

Phytochemical Composition of Various Parts of *Carica papaya* plant

Papaya is a highly important plant that is utilised for a variety of medical applications. Carica papaya leaves, fruits, and seeds are utilised in ethnomedicine [28]. The following are the chemical components of several parts of the papaya plant:

FRUITS

Protein, fat, fibre, carbohydrates, minerals, calcium, iron, phosphorus, thiamin, riboflavin, niacin, vitamin C, carotene, amino acids, citric acid and malic acid (green fruits), volatile chemicals such as linalool, benzyl isothiocyanate, cis and trans-2,6-dimethyl-3,6 epoxy-7octen-2-ol Carpaine, benzyl—dglucoside, 2-phenylethyl—D-glucoside, 4-hydroxyl-phenyl-2 ethyl—D glucoside, and four isomeric malonated benzyl—D glucosides are only a few examples of alkaloids.[29]

Juice

N-butyric, n-hexanoic, and n-octanoic acids, lipids, myristic, palmitic, stearic, linoleic, linolenic, and oleic acids are all found in papaya juice.

Seeds

Fatty acids, papaya oil, crude proteins, crude fibre, carpaine, benzyl isothiocyanate, benzyl glucosinolate, benzylthiourea, glucotropacolin, hentriacontane, -sistosterol, caricin, and the enzyme tyrosin can all be found in papaya seeds.

Roots

Arposide, carposide, and the enzyme myrosin are all found in the roots of the papaya plant.

Leaves

The papaya plant's leaves contain the highest concentrations of the alkaloids carpain, pseudocarpain, and dehydrocarpaine I and II, as well as choline, carposide, vitamin C, and vitamin E.

Bark

β -sitosterol, glucose, fructose, sucrose, galactose, and xylitol are all found in papaya bark.

Latex

Proteolytic enzymes, papain and chemopapain, glutamine cyclotransferase, chymopapain A, B, and C, peptidase A and B, and lysozymes are all found in the milky sap of unripe papaya [30].

Table 4: Phytochemical Composition of Various Parts Of Carica Papaya Plant [31]**:**

Part	Constituents
Fruit	protein, fat, fibre, carbohydrates, minerals, calcium, phosphorus, iron, vitamin C, thiamine, riboflavin, niacin, and caroxene, amino acid, citric acids and molic acid (green fruits), volatile compounds : linalol, benzylisothiocynate, cis and trans 2, 6-dimethyl-3,6 expoxy-7 octen-2-ol. Alkaloid, α; carpaine, benzyl-β-d glucoside, 2-phenylethl-β-D-glucoside, 4-hydroxyl -phenyl-2
Juice	N-butyric, n-hexanoic and n-octanoic acids, lipids; myristic, palmitic, stearic, linoleic, linolenic acids-vaccenic acid and oleic acids
Seed	Fatty acids, crude proteins, crude fibre, papaya oil, carpaine, benzylisothiocynate, benzylglucosinolate, glucotropacolin, benzylthiourea, hentriacontane, β-sistosterol, caricin and an enzyme nyrosin
Root	Arposide and an enzyme myrosin

Leaves	Alkaloids carpain, pseudocarpain and dehydrocarpaine I and II, choline, carposide, vitamin C and E
Bark	β-sitosterol, glucose, fructose, sucrose, galactose and xylitol
Latex	proteolytic enzymes, papain and chemopapain, glutamine cyclotransferase, chymopapain A, B and C, peptidase A and B and lysozymes

Pharmacological Studies

Antithrombocytopaenic Activities

On busulfan-induced thrombocytopenic Wistar rats, carpaine was found to have potent action in maintaining platelet counts up to 555.50 ± 85.17 × 109/L with no acute harm.[32]. through this study, the conclusion was made to appreciate the recommendation of *Carica papaya* L. leaf extract to boost thrombopoiesis and erythropoiesis in humans and animals where these cell lineages have been compromised [33].

Analgesic Activity

The analgesic effectiveness of three extracts of Carica papaya L. leaves was tested in a mouse model of acetic acid-induced pain (Siegmund method). When compared to aspirin (taken as the standard drug), these three extracts (n-hexane, ethyl acetate, and ethanol extracts) showed considerable analgesic effect at all three dose levels (0.175, 0.35, and 0.70 mg/kg bw orally) [34].

Antiplasmodial Activity

Carica papaya L. leaf extracts have significant antiplasmodial efficacy and low cytotoxicity. Three alkaloids demonstrate this action. Bioactivity of compounds was investigated in vitro against four parasites (Trypanosoma brucei rhodesiense, Trypanosoma cruzi, Leishmania donovanii, and Plasmodium falciparum), as well as in a Plasmodium berghei animal model.[35,36,37]. The antiplasmodial action of papaya leaves was validated in this investigation, and it may be linked to alkaloids. Carpaine was the most active and selective of these alkaloids in vitro [38].

Antisickling Activity

Unripe papaya fruit extract offers antisickling properties, according to recent studies. Carica papaya leaf extract was found to have substantial antisickling action. 5 and 10 mg/ml extract concentrations are effective doses [39,40].

Antihypertensive

The ethanolic extract of Carica papaya ripe fruit has antihypertensive properties. The normotensive, renal, and DOCA-salt hypertensive mice had basal meal arterial blood pressures of (93.8 ± 4.5), (175.2 ± 5.1)and (181.3±6.2) mmHg, respectively. In comparison to control, both hydralazine (200 mg/kg, iv) and an ethanolic extract of the unripe fruit of Carica papaya (20 mg/kg, iv) significantly reduced MAP in normotensive, renal, and DOCA-salt hypertensive rats. Within the hypertensive group, however, the extract induced around 28% higher MAP depression than hydralazine. According to the findings, papaya's unripe fruit has powerful antihypertensive properties [41].

Antifertility

The goal of the study was to see if Carica papaya Linn's antifertility effects on methanol leaf extracts in male Wistar rats. The findings of the study suggest that these leaves should be used with caution in traditional illness treatment. The medicine, on the other hand, could be an effective method of birth control. It was also demonstrated that the papaya leaves were

responsible for the modifications in the sperm, as well as the identification of specific components of the extract with antifertility effects [42].

Anti-Obesity

It was determined that 250 grammes of wet papaya seeds yielded 25.1 grammes of papaya seed powder. The beneficiaries praised the ‘coffee' made from papaya seeds for its colour, texture, scent, and flavor. Pancreatic lipase is inhibited by gramme of papaya seed powder. As a result, the powdered papaya seeds are utilized as an obese "coffee" drink [43].

Anti-diarrheal

The current study's findings revealed that Carica papaya fruit extracts have high effectiveness against the enteric pathogens tested. The chloroform extract of raw fruit (MIC & MBC – 25 mg/mL) and the acetone extract of ripe fruit (MIC & MBC – 25 mg/mL) both demonstrated high action against enteric bacteria [44]. Raw C. papaya chloroform extract (25 mg/mL) and ripe C. papaya acetone extract (25–0.39 mg/mL) both demonstrated antidiarrheal action against the gut pathogens. The antidiarrheal activity of ripe C. papaya extract against Plesiomonas shigelloides was widely observed, with concentrations ranging from 50 mg/mL to 0.39 mg/mL. DAS77 (herbal mixture made from dried papaya root and young Mangifera indica bark) is beneficial in the treatment of diarrhoea. DAS77 was tested on mice, and the results revealed that it has antidiarrheal properties. DAS77 was tested on mice, and the results revealed that it has antidiarrheal properties. In another study, the antidiarrheal activity of C. papaya leaf aqueous extract was examined in a rat model, and the extract was reported to have good antidiarrheal action and to be safe at 200 mg/kg in the rat model [45,46,47].

Wound Healing Activity

Papaya can be used to treat a variety of skin conditions as well as wounds. The wound healing efficacy of ethanolic papaya seed extract was investigated in Sprague Dawley rats. The seed extract aids wound healing in rats, according to the findings. Electrospinning was used to make C. papaya loaded PVA/Gelatin nano fibre from the leaves of the plant. The wound healing activity of the produced nano fibres was demonstrated. It was also effective against Gram-positive and Gram-negative bacteria, including *S. aureus* and *E. coli.* The effect of an aqueous extract of the root of C. papaya on wound healing in albino rats was tested in a research study, and root extract indicated wound healing activity. The extract-treated wounds, like conventional FSC wounds, showed significant wound healing activity (Framycetinsulpha cream) [48,49].

Anticancer Activity

The pharmaceutical preparation contains a variety of proteolytic enzymes, such as papain, which are used to treat cancer. According to studies, oral administration of polyenzymes preparations causes cytokine production in human peripheral blood nuclear cells. In vitro investigations revealed that it has anticancer potential and can treat a variety of cancer cell lines. The papaya enzyme papain has anti-cancer properties. Lycopene enzyme, which is reactive to oxygen and free radicals, is also found in papaya. These enzymes stop cancer cells from forming and growing [50].

Anti-inflammatory

Papaya contains a diverse range of secondary metabolites, including alkaloids, tannins, flavonoids, and saponins, all of which have been found to have a significant impact on chronic inflammation. Proteolytic enzymes found in papaya, such as papain and chymopapain, have

been shown to have anti-inflammatory and immunomodulatory properties. In osteomyelofibrosis, rheumatoid arthritis, and herpes zoster, papain in conjunction with other proteolytic enzymes such as trypsin and chymotrypsin reduces TGF1 levels. Papaya alkaloids like choline and nicotine have anti-inflammatory properties. Fruit was studied in vivo to see if it has any immunomodulatory properties [51].

Anti fungal

The latex of Carica papaya and fluconazole work together to prevent Candila albicans from growing. The cell wall is partially degraded as a result of the synergistic actions. Latex protein has antifungal properties and requires only a small amount of protein to produce full suppression [52].

Anti-bacterial

Using the disc diffusion method, researchers tested the antibacterial activity of fresh and dried papaya leaf extracts (acetone, aqueous, and ethanol). Aqueous extracts were less effective than organic extracts, according to the findings. A fresh sample was also found to be more effective against Gramnegative bacteria, while the dry sample was effective against both Grampositive and Gramnegative bacteria. The leaf extracts of papaya extract were found to have antibacterial activity in ethyl acetate, chloroform, hexane, methanol, acetone, hot water, ethanol, and petroleum ether [53,54,55].

Anti malariatic

The raw papaya fruit petroleum ether extract has the strongest antimalarial activity against Plasmodium berghei and could be used as a lead chemical in the development of a novel antimalarial medication. As a result, further research revealed that the chemical and metabolomic profile of active compounds from the papaya plant is similar to that of other plants [56].

Sedative and Anxiolytic Properties

In mice, an ethanolic extract of Carica papaya had anxiolytic and sedative effects. The anxiolytic and sedative effect of an ethanolic extract of Carica papaya pulp was tested in this study, and the results showed that the extract at 100 mg/kg had anxiolytic activity [57].

CONCLUSION

The papaya plant is grown all over the world. The therapeutic value of the fruit extends throughout the entire plant, including the leaves, seeds, roots, peel, and stem. It is made up of vitamins, minerals, enzymes, and flavonoids, all of which have biological and therapeutic effects. Each portion of the papaya plant has been the subject of a variety of studies. It can be used by both children and adults as a dietary supplement. According to the findings of the study, phytoconstituents obtained from c. papaya are the greatest alternative for fighting illnesses. This is one of the most adaptable plants, having been utilised for both medical and domestic reasons. Plant parts have been utilised in the prevention and treatment of a wide range of ailments. Various extracts have been discovered to have various pharmacological properties. The current literature evaluation backs up the broad range of activity seen in Carica papaya leaves.

ACKNOWLEDGEMENT

The authors are grateful to Mr. Mudit Kumar Singh, IFS, Director General, Chhattisgarh Council of Science and Technology, Raipur for his encouragement and providing necessary facilities to carry out this work.

REFERENCES

1) Ayurvedic Formulary of India, Ministry of Health and Family Planning, Government of India. The Controller of Publications: New Delhi; 2001.
2) Manwar JV, Mahadik KR, Sathiyanarayanan L, Paradkar AR, Patil SV. Comparative antioxidant potential of *Withania somnifera* based herbal formulation prepared by traditional and non-traditional fermentation processes. Integr Med Res. 2013; 2:56-61.
3) The Wealth of India. A dictionary of Indian raw materials and industrial products- raw materials publications and information, Directorate Council of Scientific and Industrial Research, New Delhi, India; 1962; pp: 207-215.
4) Manmode R, Manwar J, Vohra M, Padgilwar S, Bhajipale N. Effect of preparation method on antioxidant activity of ayurvedic formulation kumaryasava. J Homeop Ayurv Med. 2012; 1:114.
5) Padgilwar S, Manwar J, Vohra M, Banginwar Y. Traditional Uses, Phytochemistry and Pharmacology of *Oroxylum Indicum*: A Review. International Journal of Pharmaceutical and Phytopharmacological Research. 2014; 3 (6):483-486.
6) Manwar JV, Mahadik KR, Paradkar AR, Takle SP, Sathiyanarayanan L, Patil SV. Determination of withanolides from the roots and herbal formulation of *Withania somnifera* by HPLC using DAD and ELSD detector. Der Pharmacia Sinica. 2012; 3:41–46.
7) Manwar J, Mahadik K, Paradkar A, Patil S, Sathiyanarayanan L, Manmode R. Gas chromatography method for the determination of non-ethanol volatile compounds in herbal formulation. International Journal of Analytical and Bioanalytical Chemistry. 2013; 3(1):12-17.
8) Badukale NA, et al. Phytochemistry, pharmacology and botanical aspects of *Madhuca indica*: A review. Journal of Pharmacognosy and Phytochemistry. 2021; 10(2): 1280-1286.
9) Manwar J, Mahadik K, Paradkar A, Sathiyanarayanan L, Vohra M, Patil S. Isolation, biochemical and genetic characterizations of alcohol-producing yeasts from the flowers of *Woodfordia fruticosa*. J Young Pharm. 2013;5(4):191-194.
10) Sahare AY, Padgilwar SS, Chaudhari Y, Manwar JV. *Hypericum perforatum:* A Medicinal plant. Plant Archives. 2007; 7(2):463-468.
11) Khadatkar S, Manwar J, Bhajipale N. In-vitro anthelmintic activity of root of *Clitoria ternatea* Linn. Pharmacognosy magazine.2008; 4 (13):148-150.
12) Khadatkar SN, Manwar JV, Sahare AY. Preparations and evaluation of microcapsules of capsaicin. International Journal of Chemical Sciences. 2007; 5(5):2333-2341.
13) Sahare AY, et al. Antimicrobial activity of *Pseudarthria viscida* roots. Asian Journal of Microbiology Biotechnology & Environmental Sciences. 2008; 10(1):135-136.
14) Bedi R: Bedi vanaspati kosh. Kitabghar publication, New Delhi; First edition 2005; 1: 440-453.
15) Mohammad AH, Sabtu Hitam. Pharmacological and toxicological activities of the extracts of papaya leaves used traditionally for the treatment of diarrhoea. Journal of King Saud University- Science.2020; 32:962–969.
16) Oloyede O. Chemical Profile of Unripe Pulp of *Carica papaya*. Pakistan Journal of Nutrition.2005; 4(6):379-381.

17) Subenthiran S, Choon TC, Cheong KC, Thayan R, Teck MB, et al. (2013) Carica papaya leaves juice significantly accelerates the rate of increase in platelet count among patients with dengue fever and dengue haemorrhagic fever. Evidence-Based Complementary and Alternative Medicine 2013(16): 616737.
18) Aravind G, Bhowmik D, Duraivel S, Harish G (2013) Traditional and medicinal uses of Carica papaya. Journal of Medicinal Plants Studies 1: 7-15.
19) Jaime A, et al. Papaya (Carica papaya L.) Biology and Biotechnology. Tree and Forestry Science and Biotechnology. 2007; 1(1):47-73.
20) Gunde M, Amnerkar N, Nutritional, medicinal and pharmacological properties of papaya (*Carica papaya linn.):* A review. Journal of Innovation in pharmaceuticals and biological science. 2016; 3(1):162-169.
21) Yogiraj VA, Goyal PK, *Carica papaya* Linn: An Overview. International journal of Herbal Medicine 2014; 2(5):01-08.
22) Sharma A, Joshi A, Sharma P, Bachheti R, Husen Azamal. Phytochemistry, pharmacological activities, nanoparticle fabrication, commercial products and waste utilization of *Carica papaya* L.: A comprehensive review. Current Research in Biotechnology. 2020; 2:145-160
23) Yogiraj VA, Goyal PK, *Carica papaya* Linn: An Overview. International journal of Herbal Medicine 2014; 2(5):01-08.
24) Sharma A, Joshi A, Sharma P, Bachheti R, Husen Azamal. Phytochemistry, pharmacological activities, nanoparticle fabrication, commercial products and waste utilization of *Carica papaya* L.: A comprehensive review. Current Research in Biotechnology. 2020; 2:145-160
25) Peter J, Kumar Y, Pandey P, Masih H, Antibacterial Activity of Seed and Leaf Extract of *Carica Papaya* var. Pusa dwarf Linn. Journal of Pharmacy and Biological Sciences. 2014;9(2):29-37.
26) Jaime A, et al. Papaya (Carica papaya L.) Biology and Biotechnology. Tree and Forestry Science and Biotechnology. 2007; 1(1):47-73.
27) Agarwal A, Vyas S, Agarwal DP. Therapeutic benefits of *Carica papaya* a leaf extracts in dengue fever patients. Scholars Journal of Applied Medical Sciences 2016; 4(2A):299-302.
28) Roshan A, Verma NK, Anubha Gutpa. A brief study on *Carica papaya*-A review. International Journal of Current Trends in Pharmaceutical Research. 2014; 2(4): 541-550.
29) Yogiraj V, Goyal PK, Chetan, Chauhan S, Goyal A, Bhupendra Vyas B. *Carica papaya* Linn: An Overview. International Journal of Herbal Medicine. 2014; 2(5):01-08.
30) AK Nadkarni. Indian Materia Medica, K M Nadkarni, 1st Edition Popular Prakashan, Pvt Ltd, Bombay, 1954, 273-277.
31) Aishwarya Shinde, Dipali Kolhe, Dr. Dinesh P. Hase* and Dr. M. J. Chavan, A BRIEF INTRODUCTION ABOUT CARICA PAPAYA LINN., World Journal of Pharmaceutical Research ,SJIF Impact Factor 8.084 ,Volume 9, Issue 12, 237-244. Review Article ISSN 2277– 7105
32) Vishwanath Z, Prasad DR, Mehul J, Trivedi B and Nivsarkar M: Antithrombocytopenic activity of carpaine and alkaloidal extract of *Carica papaya* Linn. leaves in busulfan induced thrombocytopenic Wistar rats; journal of ethanopharmacology 2016; 181(2): 20-25.
33) Dharmarathna SLCA, Wickramasinghe S, Waduge RN, Rajapakse RPVJ and Kularatne SAM: Does *Carica papaya* L. leaf extract increase the platelet count? An experimental study in a murine model; Asian Pacific Journal of Tropical Biomedicine 2013; 3(9):720-724.

34) Suwendar PH and Ernasari GI: Analgetic activity of Papaya (*Carica papaya* L.) leaves extract; Procedia Chemistry 2014; 13: 147-149.
35) Raj, KPS and Patel MR: Some medicinal plants of Cambay and its immediate vicinity and their uses in Indian indigenous system of medicine. Indian drugs 1978; 15: 145-152, 160.
36) Banerjee AK and Banerjee: A survey of medicinal plants in Shevaroy hills. J Econ Tax Bot. 1986; 8: 271-290.
37) Pal SC and Srivastava SN: Preliminary notes on the ethnobotany of Singhbhum District, Bihar. Bull. Bot. Surv. India 1976; 18: 247-250.
38) Tasqiah: HPLC- based activity profiling for antiplasmodial compounds in the traditional Indonesian medicinal plant *Carica papaya* L. Journal of Ethnopharmacology 2014; 155(1): 426-434.
39) Odula T, Adeniyl FA, Ogunyemi EO, Bello IS, Idowu IO. Anti-sickling agent in an extract of unripe pawpaw (*Carica papaya*): is it real? African Journal of Biotechnology. 2006; 5(20):1947-1949.
40) Imaga NOA, Gbenle GO, Okochi VI, Akanbi SO, Edeoghon SO, V Oigbochie V *et al*. Antisickling property of *Carica papaya* leaf extract. African Journal of Biochemistry Research. 2009; 4(4):102-106
41) Eno AE, Owo OI, Etam EH, Konya RS. Blood pressure depression by the fruit juice of Carica papaya (L.) in renal and DOCA-induced hypertension in the rat. Phytotherm Res. 2000; 14(4):235-239.
42) Nkeiruka UE, Chinaka NO. Antifertility effects of *Carica papaya* Linn: Methanal leaf extracts in male Wistar rats. Journal of Pharmacology and Toxicology. 2013; 8(1):35-41.
43) Subandi and Nurowidah A. The potency of Carica papaya L. seeds powder as anti-obesity 'coffee' drinks. Materials Science and Engineering. 2019; 575:1-7.
44) AKSHATA KRISHNA PRABHU1, SUGANTHI MARTENA DEVADAS2, RICHARD LOBO3, PADMANABHA UDUPA4, KIRAN CHAWLA1, MAMATHA BALLAL1, 2*,.Antidiarrheal Activity and Phytochemical Analysis of *Carica papaya* Fruit Extract., Akshata Krishna Prabhu et al /J. Pharm. Sci. & Res. Vol. 9(7), 2017, 1151-1155.
45) Sani MA, Bakar J, Rahman RA, Abas F. Effects of coated capillary column, derivatization, and temperature programming on the identification of *Carica papaya* seed extract composition using GC/MS analysis. Journal of Analysis and Testing 2020; 4(1):23–34.
46) Sharma SC, ZnO nano-flowers from *Carica papaya* milk: degradation of alizarin red-S dye and antibacterial activity against Pseudomonas aeruginosa and *Staphylococcus aureus*. Optik. 2016; 127(16):6498–6512.
47) Singh O, Ali M. Phytochemical and antifungal profiles of the seeds of *Carica papaya* L. Indian J. Pharm. Sci. 2011; 73:447–451.
48) Singh PG, In vitro antioxidant, anti-inflammatory and anti-microbial activity of *Carica papaya* seeds. Glob. J. Med. Res. 2020; 20:19–38.
49) Singh, S.P, Kumar, S, Mathan, S.V, Tomar, M.S, Singh, R.K, Verma, P.K, Kumar, A,Kumar, S, Singh, R.P, Acharya, A, 2020. Therapeutic application of *Carica papaya* leaf extract in the management of human diseases. DARU J. Pharm. Sci.
50) Gunde MC, Amnerkar MD. Nutritional, medicinal and pharmacological properties of papaya (*Carica papaya* Linn): A Review. Journal of Innovations in Pharmaceutical and Biological Sciences 2016; 3(1):162-169.
51) Pandey S, et al. Anti-inflammatory and immunomodulatory properties of Carica papaya. J. Immunotoxicol. 2016; 13:590–602.

52) Vij T, Prashar Y. A review on medicinal properties of *Carica papaya* Linn. Asian Pacific Journal of Tropical Disease. 2015; 5(1):1-6.
53) Tarkang PA, et al. Antioxidant potential of a polyherbal antimalarial as an indicator of its therapeutic value. Advances in Pharmacological and Pharmaceutical Sciences. 2013; 1(1):1-9.
54) Singh P, Rawat P. Evolving herbal formulations in management of dengue fever. Journal of Ayurveda and Integrative Medicine. 2017; 8(3):207-210.
55) Mabley J, Gordon S, Pacher P. Nicotine exerts an anti-inflammatory effect in a murine model of acute lung injury. Inflamation. 2011; 34(4):231–237.
56) Gemechu Z, Kebeb D, Mulisa E, Gashe F. *In vitro* antimalarial activity of the solvent fractions of fruit find and root of *Carica papaya* Linn (Caricaceae) against Plasmodium berghei in mice. Journal of Parasitology Research, 2017, 1-9.
57) Athesh K, Karthiga D, Brindha P. Anti-obesity effect of aqueous fruit extract of *Carica papaya* L. in rat fed on high-fat cafeteria diet. International Journal of Pharmaceutical Sciences. 2012; 4(5):327-330.