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Phytochemical screening and nutritional values of *Carica papaya,* family Caricaceae: A review article

Tambe Satish Sampatrao
Assistant Professor, MGV'S Arts, Science and Commerce College, Manmad, Maharashtra, India

Abstract
Papaya (*Carica papaya*) is tropical fruits and it have commercial importance because of its high nutrition values and medicinal properties The papaya all plant parts have different medicinal properties Medicinal vegetation primarily based on traditional structures of medication is playing an important position in providing fitness care to a big section of the population, especially in developing nations. It's a far widely recognized fact that traditional systems of drugs constantly played an essential position in meeting the global health care wishes. Papaya leaves, seed latex, and end result possess excellent medicinal residences. The latex from stem, leaves, and fruit contents enzyme papain, other additives consist of exceptional secondary metabolites, sources of different vitamins

Keywords: *carica papaya*, pharmacognosy, photochemical, papain, caprine, pharmacology

Introduction
Carica papaya is also called as 'pawpaw' because it is an herbaceous luscious plant and belongs to Caricaceae family [1]. It is a fast growing lactiferous tree with a small, soft wooded tree up to 8 cm in height. It has the following characteristics like; straight cylindrical stem having leaf scars throughout and with a tuft of leaves at the top, leaves are extremely lobed, palm like characteristics, long hollow petiole, flowers are unisexual white or yellowish in color but rarely bisexual, males are in long dropping panicles, females are in short clusters [2]. The size of the fruit of the papaya is too large and secretes a milky sticky juice which contains remarkable property of accelerating the decomposition of muscular fiber [3]. Pharmacognosy, pharmaceuticals and pharmacology of *Carica papaya* plant and their medicinal role in different diseases and this may serve as a supporting reference for the future work.
The tree is about 20-30 feet long without branches, leaves are alternate, palmate and 7-partile, segments are oblong, acute, sinuate, the middle one is 3-fid, fruit is succulent, oblong and furrowed in nature, calyx is small, 5-toothed and the corolla is tubular in the male while 5 inched in female, divided nearly to the base into 5 segments.

Plant Botany
Common name: papaya, pawpaw
Vernacular names- English: Papaw tree, Papaya; Hindi: Pappya, Pappita; Sanskrit: Brahmairandah, Erandakarkati; Tamil: Pappali; Mal: Pappaya, Karmmusu, Pappali, Karmmatti; Kan: Pappaya, Peragi, Piranji [4]

Scientific Classification
Kingdom: Plantae
Sub-kingdom: Tracheobionta
Class: Magnoliopsida
Sub-class: Dilleniidae
Division: Magnoliophyta
Sub-division: Spermatophyta
Phylum: Stetophyta
Order: Brassicales
Family: Caricaceae
Genus: *Carica*
Botanical name: *Carica papaya* Linn [5]

Cultivation and Collection
It is cultivated in tropical and sub-tropical areas of America and other tropical zones of the world, which is accessible all over the year. It requires warm and humid climate. Plant growth and the fruit are affected by the low temperature. At 0° C both foliage and fruit get damaged [6]. Papaya is economically propagated by seed and

tissue culture plants. The seedling can be increased in nursery beds 3m long, 1m broad and 10 cm high in addition in pots or polyethylene bags. The seeds after used with 0.1% Monosan (phenyl mercuric acetate), ceresin etc are scattered 1 cm in rows 10 cm aside and covered with fine leaf mould. The nursery beds are enveloped with polyethylene sheets or dry paddy straw to preserve the seedlings [7]. Medium, fertile and well drained and lime free soil are best for papaya cultivation. Planting is done during spring season (February-March), monsoon season (June-July), autumn season (October- November) [8].

Fig 1: Papaya plant [9]

Traditional Uses

The complete plant of the Carica papaya plant has a medicinal. Leaves can be used to treat dengue fever, most cancers cellular boom inhibition [10]. Seeds are used as a soft purgative for worms. Flower may be taken in an infusion to set off decoction and menstruation of the ripe fruit allows therapy diarrhea and dysentery, particularly in children. The ripe fruit act as a mild laxative. Latex is applied externally to accelerate the healing of wounds, ulcers, warts, and cancerous tumors [11]. Peel can be used as solar scream and soothing slave, powerful for dandruff, muscle relaxant, and so on. Roots may be used to remedy stomach problems or cramps [12]. Pharmacognostic Parameters of Carica papaya

Morphological Parameters

Papaya has a creamy, custard-like flesh with a complicated combination of tropical fruit flavors. They are maximum normally described as tasting like banana mixed with mango, pineapple, melon, berries, or different fruit [13]. Epicarp exhibits a single layer of thin-walled cells enveloped with thick cuticles externally. Mesocarp has an extensive sector inclusive of circular to oval-shaped parenchyma cells with dispersed and unbranched lactiferous cells. Endocarp is made up of 2 to three layers of skinny-walled parenchyma cells. Calcium oxalate crystals are located in the mesocarp vicinity of the fruit [14]. Flower of papaya exist in 3 kinds (female, hermaphrodite and staminate) [15]. the morphological traits (like fruit weight, fruit duration, fruit diameter, inner hollow space diameter, internal cavity form, skin colour, flesh coloration, and stalk quit fruit shape, fruit shelf-

life), physicochemical (like ph, overall soluble solids, titratable acid, and overall and general soluble solids/ titratable acid ratio), vitamins (ascorbic acid and β carotene) and organoleptic check [16].
Microscopically characters and powder evaluation of leaves. The papaya plant carries three types of plant life (woman, hermaphrodite and staminate) and the seeds-external (shape, length, hilum, micropyle, funicle, raphe, and testa) and internal traits (endosperm and embryo).

Chemical composition of papaya
Papaya plants has medicinal values and used as ethno medicine (Table no 1)

Table 1: Chemical composition of various plant parts of papaya (17, 18, 19, 20)

S.No	Part of the Plant	Constituents
1	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 ethyl-B-D glucoside and four isomeric malonated benzyl-β-D glucosides
2	Juice	N-butyric, n-hexanoic and n-octanoic acids, lipids; myristic, palmitic, stearic, linoleic, linolenic acids-vaccenic acid and oleic acids
3	Seed	Fatty acids, crude proteins, crude fibre, papaya oil, carpaine, benzylisothiocynate, benzylglucosinolate, glucotropacolin, benzylthiourea, hentriacontane, β-sistosterol, caricin and an enzyme nyrosin
4	Root	Arposide and an enzyme myrosin
5	Leaves	Alkaloids carpain, pseudocarpain and dehydrocarpaine I and II, choline, carposide, vitamin C and E
6	Bark	β-sitosterol, glucose, fructose, sucrose, galactose and xylitol
7	Latex	proteolytic enzymes, papain and chemopapain, glutamine cyclotransferase, chymopapain A, B and C, peptidase A and B and lysozymes

Table 2: Nutritional Values of Papaya

Nutrient		Value per 100 g	References
Proximates	Water	88.06 g	21,22
	Energy	43 kcal	21,22
	Energy	179 Kj	21,22
	Protein	0.47 g	21,22
	Total lipid (fat)	0.26 g	21,22
	Ash	0.39 g	21,22
	Carbohydrate, by difference	10.82 g	22
Carbohydrates	Sugars, total	7.82 g	22
	Sucrose	0	22
	Glucose(dextrose)	4.09 g	22
	Fructose	3.73 g	22
	Lactose	0	22
	Maltose	0	22
	Galactose	0	22
	Starch	0	22
Minerals	Calcium, Ca	20 mg	21,22,26,27
	Iron, Fe	0.25 mg	21,22,26,27
	Magnesium, Mg	21 mg	21,22,26,27
	Phosphorus, P	10 mg	21,22,26,27
	Potassium, K	182 mg	21,22,26,27
	Sodium, Na	8 mg	21,22,26,27
	Zinc, Zn	0.08 mg	21,22,26,27
	Copper, Cu	0.045 mg	21,22,26,27
	Manganese, Mn	0.04 mg	21,22,26,27
	Selenium, Se	0.6 µg	21,22,26,27
Vitamins	Vitamin C, total ascorbic acid	60.9 mg	21,22,26,27
	Thiamin	0.023 mg	21,22
	Riboflavin	0.027 mg	21,22

	Niacin	0.357 mg	21,22
	Pantothenic acid	0.191 mg	21,22
	Vitamin B-6	0.038 mg	21,22
	Folate, total	37 µg	21,22
	Folic acid	0	
	Folate, food	37 µg	21,22
	Folate, DFE	37 µg	21,22
	Choline, total	6.1 mg	21,22
	Vitamin B-12	0	21,22
	Vitamin B-12, added	0	21,22
	Vitamin A, RAE	47 µg	21,22,25,29
	Retinol	0	
	Carotene, beta	274 µg	21,22,25,29
	Carotene, alpha	2 µg	22.25
	Cryptoxanthin, beta	589 µg	21,22,25,29
	Vitamin A, IU	950 IU	21,22,25,29
	Lycopene	1828 µg	22,25,26
	Lutein + zeaxanthin	89 µg	22,25,30
	Vitamin E (alpha-tocopherol)	0.3 mg	22
	Tocopherol, beta	0.02 mg	22
	Tocopherol, gamma	0.09 mg	22
	Tocopherol, delta	0.01 mg	22
	Vitamin D (D2 + D3)	0	31
	Vitamin D	0	31
	Vitamin K (phylloquinone)	2.6 µg	31
Other	Alcohol, ethyl	0	
	Caffeine	0	
	Theobromine	0	
Flavones	Apigenin	0	28
	Luteolin	0	28
Flavonols	Kaempferol	0	26
	Myricetin	0	26,28
	Quercetin	0	26,28
Isoflavones	Daidzein	0	22
	Genistein	0	22
	Total isoflavones	0	22

Source: (National Nutrient Database for Standard Reference Release 28, 2016 USDA

Phytochemical screening, physiological analysis

Physicochemical analysis and quantitative microscopy of leaves are shown in Tables 3 and 4

Several phytochemicals with different extracts are shown in table 5. Several primary and secondary metabolites identified in different extracts of Carica papaya are shown in table 5. And 6. [32-33]

Table 3: Quantitative microscopy of leaf of *Carica papaya*

Parameter	Result
Stomatal index (male plant)%	32.57+_3.21
Stomatal index (female plant)%	34.46+_ 3.41

Table 4: Physiochemical analysis of leaves of *Carica papaya*

Parameters	Results
Ash value	08.63%
Acid insoluble value	00.79%
Water soluble ash value	05.30 %w/w
Foaming index	Less than 1 cm
Swelling index	Less than 100
Loss on drying	09.41%
Resin content	03.08%

Table 5: Phytochemical analysis of papaya extract with different reagents

Material	Reagent	Color Change	Phytochemical
Carica papaya extract	Meyer	Cream ye llow ppt	Alkaloid
	Wagner	Brown ppt	
	FeCl3	Greenish	Tannins
	KOH	Dirty white ppt	
	NaoH+AlCl3+H2SO4	Yellow ppt	Flavonoid
	Olive oil	Stable emulsion	Saponin
	Distilled water	Persistant foam	
	Fehling solution	Brick ppt	
	Distilled water, H2SO4 and Fehling solution	Brick red ppt	Glycosides

Table 6: Phytochemicals detected in different extract of *Carica papaya*

Plant Part Used	Type of Extract	Phytochemicals Found
Leaf	Methanol	Kaemoferol-3(2Grhamnosylrutinoside
Leaf	Ethanol, methanol and water	Flavonoids
Seed	Hexane, chloroform, diethyl ether and methanol	p-hydroxybenzoic acid, salicylic acid, hyperoside gentisyl alcohol, kaemferol hexosides
Leaf	Methanol	Carpaine, kaempferol 3-(2G-glucosylrutinoside), kaempferol 3-(2″-rhamnosylgalactoside), 7-rhamnoside, kaempferol 3-rhamnosyl-(1->2)-galactoside-7-rhamnoside, luteolin 7-galactosyl-(1->6)-galactoside, orientin 7-O-rhamnoside, 11-hydroperoxy-12,13-epoxy-9-octadecenoic acid, palmitic amide, and 2-hexaprenyl-6-methoxyphenol
Leaves, bark, root and pulp	n-hexane, dichloromethane, ethyl acetate, ethanol, methanol, n-butanol and water	Phenolics and flavonoids
Seeds	Petroleum ether, ethanol and aqueous	Phenolics and flavonoids
Seeds	Methanol	Carotenoids and α-tocopherol
Flower	Ethanol	Triterpenoid/steroids
Seeds	Methanol	Total phenolic content
Seeds	Methanol	Kaempferol-3-glucoside, p-coumaric acid ferulic acid, caffeic acid, phydroxybenzoic acid, quercetin-3-galactoside Seeds Hexane, ethyl acetate, methanol and aqueous DPPH, FRAP, TBARS Octadecanoic acid, oleic acid, n-hexadecanoic acid, 14- methyl-, methyl ester, 11-octadecenoic acid, methyl ester, and pentadecanoic acid
Peel	Aqueous	Proteins and phenolic groups

Pharmacological Investigation and Molecular Research

Anti-Helminths Hobby

Proteolytic enzymes gift inside the Carica papaya can digest the nematode cuticle. it has been used as a traditional medicinal drug in opposition to gastrointestinal nematodes. Carica papaya carries papain rapidly digest the ascaris [31]. Papaya leaves have the tendency to spark off the hormone prolactin because it contains quercetin (one of the galactagogue) and additionally increases the breastmilk [34]

Anti-Malarial Activity

Carpaine became the energetic alkaloid extract in dichloromethane leaf extract and exhibited suitable hobby towards each lines of Plasmodium falciparum. This alkaloid is extremely selective in opposition to the parasite and non-poisonous to properly-uninfected R.B.C moreover; methanol, chloroform, petroleum ether extract of fruit rind, and roots of papaya were examined towards Plasmodium berghei in mice for his or her anti-plasmodial pastime. Ashutosh Sharma et.al found out that petroleum ether and chloroform extract of C. papaya fruit rind has

sustainable antiplasmodial pastime in a dose-established manner however petroleum ether extract had the most important antimalarial interest [32].

Anti-Tumor Hobby

Carica papaya Linn has been consistently used as ethnomedicine for one-of-a-kind sicknesses, along with cancer. Norika Otsuki *et al*. tested the effect of aqueous extracted CP leaf fraction at the increase of numerous tumor cell traces in addition to human lymphocytes. The proliferative responses of tumor cellular traces and human peripheral blood mononuclear cells (PBMC) and cytotoxic sports of PBMC had been acquired by way of [(3)H]-thymidine incorporation. The manufacturing of IL-2 and IL-four become reduced by means of the addition of CP extract in the case of PBMC [33]. In step with investigators, most cancers may be cured by way of using papaya leaf tea extract because it appears to improve the manufacturing of Th1-kind cytokines, which assist to govern the immune system. The papaya fiber has the ability to attach with a toxin which leads to colon cancer and maintains them away from the healthful colon cells [35].

Effect of Carica Papaya on Metabolic Syndrome

Weight problems are determined because of the buildup of frame fats, which may be diagnosed by various factors like several ethnological, social, behavioral, environmental, cultural, physiological, metabolic, and genetic factors [36]. Uncontrolled fats accumulation can be an essential situation in the improvement of metabolic disorders, like arterial hypertension, dyslipidemia and insulin resistance, diabetes mellitus type 2, cardiovascular illness [37]. Tumor necrosis issue (TNF-α), interleukin 6 (IL6), monocyte chemoattractant protein, leptin, adiponectin, and resistin are the adipokines secreted by way of adipose tissues [38]. The accumulation of adipose tissue is without delay proportional to adipokines. This results in a variant in their secretion, with raised seasoned-anti-inflammatory and decreased adipokines, stimulating the systemic and neighborhood anti-inflammatory procedure, giving to the development of insulin resistance. Metabolic syndrome is related to the generation of reactive oxygen species (ROS), which could convince insulin resistance [39]. Lidani F. Santan et. al envisioned that the presence of vitamins, bioactive compounds, and lipids within the Carica papaya may be appropriate for the treatment of metabolic dysfunction [40].

Anti-Fertility Effect

It became tested that the Carica papaya shows the anti-fertility impact by using feeding pregnant rats with dissimilar additives of the fruit. No attempt became assembled to force-feed the animal and the final results are distinct that the immature fruit the estrous cycle and cycle and convince abortion. The over ripped Carica papaya does no longer has this form of effect [41].

Impact of Carica papaya on dengue fever: in line with the investigators, Dengue hemorrhagic fever is identified by using a thrombocyte count, it could be liable for dengue-induced thrombocytopenia-impaired thrombopoiesis and peripheral platelet demolition. Many researchers have proposed that weakened thrombopoiesis is typically the end result of reduced megakaryopoiesis at the onset of contamination. The direct exposure of the virus at the megakaryocytes of the impact at the stromal cells (connective tissue cells of any organ) might be the motive for the release of cytokines and control of megakaryopoiesis [42]. The raised peripheral platelet demolition can be the alternative vital motive of thrombocytopenia. That is resulting from an autoimmune response, wherein antibodies generated via the host towards the dengue virus create activation and destruction of platelets [43].

Impact of Carica papaya on hepatic and renal toxicity: The Carica papaya leaf extract indicates an antimicrobial pastime at the inhibition of some human pathogens like Escherichia coli, Pseudomonas aeruginosa, Kleibseilla pneumonia, Staphylococcus aureus, and Proteus mirabilis [44].

Impact of Carica Papaya on COVID-19

The Coronavirus can be spread inside the form of respiration droplet nuclei, other frame fluids, and secretions like feces, saliva, urine, semen, and tears. it is typically unfolds by way of the respiration droplet formed at the same time as coughing, sneezing, and speaking of an infected person [46]. According to the researchers, Carica papaya reduces interleukin IL-6 and TNF-alpha in people and animals. Interleukin IL-6 and TNF-alpha are specifically answerable for generating irritation of the lungs main to pneumonia. TNF-alpha is an anti-inflammatory cytokine generated via macrophages/monocytes in the course of acute infection main to necrosis or apoptosis. TNF-alpha shows numerous results by using binding, as a trimer to either a kDa mobile membrane receptor called TNF-1 or a 7 kDa mobile membrane receptor known as TNF-2 [47]. Cytokine storm is the top mechanism that results in the death of a COVID-19 infected character. In line with the scientist, massive manufacturing of a bunch of arbitrators which includes interleukins, interferon, tumor necrosis component (TNF), and macrophage takes place. These mediators are combined together like cytokines or chemokines and this reasons an extreme effect on the lungs of the infected individual observed by the demise of the inflamed mobile with the aid of apoptosis and necrosis. Because of this, multiple organ failure takes place [48]. Papain is discovered in papaya latex. Papain is a cysteine proteinase that has the capability to break an extensive sort of necrotic tissue at P^H 3.0-12.0 this factor might also help in wound recovery and may lower oxidative tissue harm; similarly, they display burn recovery homes because of the increment inside the hydroxyproline content [49]. Chen *et al*. observed that papain from Carica papaya latex was very efficient in curing histamine-precipitated ulcers inside the rat via obstructing the acid secretion [50].

Impact of *Carica papaya* on Sickle Mobile Disorder (SCD)

Mutation in hemoglobin within the RBC is the main reason for Sickle mobile disease (SCD) wherein glutamic acid in the 6th position is changed with the aid of valine. Anjali buddy *et al*. stated the strong antisickling assets of Carica papaya leaf extract of unripe fruit in a dose-dependent way [51].

Rheumatoid Arthritis

Papaya protects the human against anti-inflammatory polyarthritis, a form of Rheumatoid arthritis regarding two or extra joints [52].

Promote Lung Health

Papaya is a rich source of diet A and may assist your lung wholesome and safe in existence [53].

Allows to Save You Assault or Stroke

Cysteine or methionine is the folic acid observed in papaya that converts homocysteine into amino acids. Homocysteine can injure blood vessel partitions, maybe the cause of coronary heart attack and stroke [53].

Conclusion

Carica papaya is a very nutraceutical plant that suggests both the dietary and medicinal values. The carica papaya additionally consists of a huge range of pharmacological properties like anticancer, anti-inflamatory, antispasmodic, and anticoagulant and especially in dengue fever and also COVID-19. Carica papaya is a nutraceutical plant as it includes a wide variety of enzymes, nutrients, amino acids, flavonoids, alkaloids and different chemical ingredients. Papain, chymopapain are powerful in treating severe sicknesses like allergies and osteoarthritis. Carica papaya leaf extract additionally effective against various Bacteria like Escherichia coli, Pseudomonas aeruginosa, Kleibseilla pneumonia, Staphylococcus aureus and Proteus mirabili. The prevailing assessment is based on the Pharmacognosy, phytochemicals and pharmacological activity of Carica papaya.

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