REVIEW ARTICLE

Nutritional, therapeutical, and pharmaceutical uses of papaya: A review

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Abstract

This review article explains the nutritional and medicinal properties of papaya plant. This plant contains many natural antioxidants found in its leaves, fruits, and seeds. It contains a variety of chemical compounds that exhibit high antioxidant properties. Papaya skin, pulp, and seeds are important sources of bio-organic compounds such as carotenoids and polyphenols, papain, chymopapain, and cysteine proteases. The plant contains gallic acid, beta-carotene, calcium, protein, carbohydrates, phenol, phosphorus, vitamin A, vitamin B1, vitamin C, vitamin E, and tannin. The decoction of male papaya plant flowers helps to increase the level of insulin and stabilize the blood sugar of diabetic patients. *Carica papaya* seeds significantly reduce progesterone levels and disrupt the estrous pattern and reverse tissue changes in the uterine-ovarian tissue. This article highlighted the use of papaya as a source of natural antioxidant, antimicrobial, anti-parasitic, antioxidant, and immunomodulatory biological components. The leaves of the plant are antiviral, anti-diabetic, anti-cancer, anti-angiogenic, anti-parasitic, antibacterial, antiviral, and anti-malaria. This plant has nephroprotective, anti-fertility, and anti-implantation thrombosis effects. Green papaya fruit and its latex are rich in papain, which softens meat and has a wide range of industrial uses.

Key words: anti-cancer, anti-diabetic, *Carica papaya*, medicinal properties, nutritional

INTRODUCTION

Papaya or papita, *Carica papaya* is a cultivated tropical plant belonging to *Caricaceae*. Papaya is cultivated as cash crop in many countries of the world having tropical climate. Under genus *Carica* 21 plant species are grown for fruit production. Plant is grown in Indian subcontinent, Australia, southern Mexico, and Central America. This is a famous fruit worldwide, and its maximum production comes from tropical and subtropical areas.[1] India approximately produces 37.9% of the world's delivery of papayas. Papaya is a small tree with normal branches with spirally organized leaves, unmarried stem of approximately 10–30 toes tall. The lower part of stem bears large length result continue to be striking in group. Latex exudates from damaged leaves, plants, and unripe fruits[2] [Figure 1]. Wild populations of papaya plant are likewise located in tropical forests and rain forests of southern Mexico. Today, papaya is cultivated throughout the globe because of its adaptability to numerous climates.[3]

Plant shows dimorphism and male and woman are separate. Male plants have the stamens fused to the petals. There are special forms of papaya plants. The female plants have an advanced ovary, and 5 contorted petals loosely related on the base.[4] Papaya plant develops in 3 sexes: male, female, and hermaphrodite. The male produces simplest pollen, in no way fruit. The female plant produces small, inedible and is pollinated. The hermaphrodite can self-pollinate because its plants comprise each male stamens and female ovaries. Almost all business papaya orchards comprise simplest hermaphrodites.[5] Male and woman plants are borne with inside the leaf axils; the male plants are in multiflowered dichasia, and the woman ones are in few-flowered dichasia. The pollen grains are elongated and about 35 microns in length. The plants are candy-scented, open at night, and are wind or insect pollinated.[2,6,7] Both papaya fruits and leaves exudate latex that is wealthy in papain, a cysteine protease used for tenderizing meat and different proteins.[8]

For nutritional purposes, yellow fleshy pulp and some other with crimson or orange papaya are cultivated by gardeners.

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Figure 1: Aerial vegetative parts and fruits of *Carica papaya* plant

Both ripe and unripe papaya fruits possess huge quantities of herbal antioxidants. Its leaves, fruits, and seeds contain caffeic acid, myricetin, rutin, quercetin, α-tocopherol, papain, benzyl isothiocyanate (BiTC), and kaempferol. These correctly lessen reactive oxygen species (ROS) production.[9] *C. papaya* seeds brought about antifertility, anti-implantation, and reduced progesterone stage and estrus cycle.[10] Plant indicates a couple of organic sports, i.e., antiviral, anti-diabetic, anticancer, anti-angiogenic, antiparasitic, antibacterial, antiviral, and anti-malarial sports. Plants show multiple biological activities, i.e., antiviral, anti-diabetic, anticancer, anti-angiogenic, antiparasitic, antibacterial, antiviral, and anti-malarial activities. This plant also possesses nephroprotective, antifertility, anti-implantation thrombopoietic effects. Papaya pulp is used to manage burn injury, anemia, and stress release. In the present review article, nutritional benefits of papaya have been described with its phytoconstituents, biological activities, and therapeutic properties.

NUTRACEUTICAL PROPERTIES

Papaya pulp carries water and carbohydrate in large quantities, i.e., 87% and 11% water and fats 0.26 and protein 0.47% only. *C. papaya* L. pulp carries highly important dietary nutrients, i.e., gallic acid, beta carotene, calcium, protein, carbohydrates, phenol, phosphorus, vitamins A, pantothenic acid and folate, C, E and tannins. Plants are wealthy in nutritional fiber [Table 1]. From 100 g of papaya fruit, approximately 43 kilocalories are obtained. *C. papaya* fruit flavonoids and phenolic compounds, along with BiTC, glucosinolates, tocopherols (α and δ), β-cryptoxanthin, β-carotene, and carotenoids, are determined with inside the seeds. The oil extracted from the seed mainly gives oleic fatty acid observed through way of means of palmitic, linoleic, and stearic acids, while the leaves have excessive contents of meal fibers and polyphenolic compounds, flavonoids, saponins, pro-anthocyanins, tocopherol, and

Table 1: Nutritional value of papayas, fruits, leaves, and seeds

Components nutritional value per 100 g (3.5 oz)	
Energy	179 kJ (43 kcal)
Carbohydrates	10.82 g
Sugars	7.82 g
Dietary fiber	1.7 g
Fat	0.26 g
Protein	0.47 g
Vitamins	Quantity %DV†
Vitamin A equiv. beta-Carotene lutein zeaxanthin	5% 47 µg 3% 274 µg 89 µg
Thiamine (B1)	2% 0.023 mg
Riboflavin (B2)	2% 0.027 mg
Niacin (B3)	2% 0.357 mg
Pantothenic acid (B5)	4% 0.191 mg
Vitamin B6	2% 0.038 mg
Folate (B9)	10% 38 µg
Vitamin C	69% 62 mg
Vitamin E	2% 0.3 mg
Vitamin K	2% 2.6 µg
Minerals	Quantity %DV†
Calcium	2% 20 mg
Iron	1% 0.25 mg
Magnesium	5% 21 mg
Manganese	2% 0.04 mg
Phosphorus	1% 10 mg
Potassium	6% 182 mg
Sodium	0% 8 mg
Zinc	1% 0.08 mg
Other constituents	Quantity
Water	88 g
Lycopene	1828 µg

BiTC. Moreover, vitamins determined in Papaya fruit comprise main nutritional components and feature useful consequences at the cardiovascular system, defensive it in opposition to cardiovascular ailments and stopping damage because of unfastened radicals [Table 1].

The use of raw papaya pulp functions as source of antioxidants and lowers down extra sugar and stops the formation of cholesterol. These antioxidant energetic materials found in papaya plants help to eliminate cancer cells with inside the patient's body. Beta carotene in plants additionally has the impact of nourishing blood, assisting to adjust the coronary heart and contribute to coronary heart health. Chymopapain is a polypeptide of 218 amino acid residues. It has considerable structural similarity with papain and papaya proteinase omega.[11] This is the primary and important advantage of male papaya plants. Drinking male papaya flower decoction allows to growth insulin degrees thereby stabilizing blood sugar of diabetics. Papaya pulp is used for the remedy of diabetes mellitus (DM) and high cholesterol. Diets with papaya leaf extract diminished serum urea.[12] Papaya waste is an opportunity protein feed aspect for poultry.

THERAPEUTIC USES

C. papaya L. active components showed therapeutic effects against dengue virus. These make prevention of thrombocytopenia and improve immunity in dengue fever patients.[13] *C. papaya* (papaya) leaf extract is traditionally used for treatment of dengue, malaria, and chikungunya.[14] Papaya white milk and pulp compounds motive pores and skin discoloration inflammation and broaden allergy. Its seeds are liable for miscarriage. Unripe papaya latex contains papain that breaks down proteins, carbohydrates, and fats. This is also used for respiratory problems or wheezing and helps nasal congestion. Papaya leaves concoction shows anti-dengue, anticancer, antidiabetic, neuroprotective, and anti-inflammatory activities.[15]

C. papaya L. pulp, leaves, and seeds gift antioxidant, anti-hypertensive, hypoglycemic, and hypolipidemic actions. These could be used for the prevention and remedy of weight problems and related metabolic disorders.[16] Papaya seeds contain active ingredients which assist in wound healing, it includes protein wealthy contents which display growth-promoting effect. These additionally display antimicrobial, antiparasitic, antioxidative, and immunomodulatory interest of papaya seed on poultry.[17]

The presence of phenolic acids, fragrant amino acids, and antioxidant chemical compounds in immature papaya fruit may motivate the anti-sickling effect. Papaya fruit and seeds induce hematopoiesis and are doubtlessly utilized in numerous conditions. Ayurveda texts and researches told the significance of papaya on human fitness as it improves numerous conditions, along with cancer, inflammation, aging, recovery of the pores and skin, and lifetime illnesses. Phytochemical chemicals found in *C. papaya* leaf are flavonoids, alkaloids, phenols, cardiac glycosides, tannins, terpenes, and saponins, These show immunomodulatory, antiviral, antidiabetic, anticancer, antimalarial, antiangiogenic, antibacterial, and antioxidant activities.[18] *C. papaya* extract (CPE)-loaded over polyurethane (PU)-based bio-nanofibrous is beneficial in burn injuries.[19]

SIDE EFFECTS

Intake of papaya in huge amounts is dangerous for the health, and it induces allergic reactions, pores and skin irritation, miscarriage, belly upset, respiration problems, and belly running. Papaya leaf in excess also lowers down sugar level. When papaya leaf extract is blended with artemisinin, it shows synergistic effect against malarial parasite.[20] Both papain and chymopapain help in the clearance of parasites from blood stream and show improvement in breathing problems or wheezing and nasal congestion but these are harmful to pregnant females.[21] Hence, personal treatment is harmful, it should be used under supervision and recommendation of a medical doctor for its therapeutic benefits.

PHYTOCHEMISTRY

Papaya pores and skin, pulp, and seeds include a whole lot of phytochemicals, consisting of carotenoids and polyphenols.[22] Ripening papaya fruits contain high amounts of BiTCs and benzyl glucosinolates.[22] Papaya fruit contains phenolic and carotenoid compouds[23] carotenoids, lutein, and beta-carotene are distinguished with inside the yellow pores and skin, even as lycopene is dominant with inside the crimson flesh [Table 1].[17] Papaya seeds additionally include the cyanogenic substance prunasin.[24] The inexperienced fruit carries papain, a cysteine protease enzyme used to tenderize meat. Papaya (Papita) aerial parts, leaves, seeds, and vegetation include variety of compounds, i.e., alkaloids (like choline and nicotine), flavonoids, tannins, and saponins.

Fruit pulp of papaya carries number one component proteolytic enzymes, along with papain and chymopapain. These induce digestion and display anti-inflammatory residences. Papaya female plant contains phenolic compounds, leaf, fruit, stem, and root yield a proteolytic enzyme, propin, malic acid, phosphokinase, and calcium maliate. The papaya plant additionally carries numerous chemical substances displaying massive antioxidant residences consisting of caffeic acid, myricetin, rutin, quercetin, α-tocopherol, papain, BiTC, and kaempferol.[9] Carpaine, ferulic acid, myricetin, and chlorogenic acid are numerous styles of vitamins. Papaya leaves, floral and fruits possess carpaine, kaempferol3-(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 active ingradients.[25] The dietary composition of male papaya vegetation includes gallic acid, beta carotene, calcium, protein, carbohydrates, phenol, phosphorus, diet A, diet B1, diet C, diet E, and tannins acid [Figure 2 and Table 2].

This plant carries excessive quantities of natural antioxidants which could generally be discovered in their leaves and seeds. Fresh latex carries proteolytic enzyme papain, chymopapain, chemopapain, glutamine cyclotransferase, saccharose, dextrose, levulose, pectin, malic acid, citrate, and papain. Extracts of *C. papaya* (var. solo) protect SW872 and HepG2 cells against hydrogen peroxide-induced oxidative stress.[26] Plant leaves include alkaloids carpain, pseudocarpain and dehydrocarpain 1, 2, choline, caproside, diet C and E. Papaya bark contains β-sitosterol, glucose, fructose, galactose and xylitol. Papaya contains proteins, fat, carbohydrates, minerals, vitamins, and seeds including risky compounds, alkaloids, and glycosides. Juice of unripe papaya conatins N-butyric, n-hexanoic and n-octanoic acid, lipid, myristic, palmitic, stearic linoleic, linolenic acid and oleic acid. *C. papaya* fruit chymopapain while ripen fruit is rich in A, B, C, papain and caricain, peptidase A and B, lysosome that is highly digestive Phenolics and flavonoids of phenolics, flavonoids, tannins, terpenoids, and minerals.[27] Seeds contain fatty acids, crude protein, crude fibers, papaya oil, carpaine, BiTC, benzylthiourea, β-sitosterol, caricin, and enzyme myrosin. Papaya flowers contain beta carotene, phenol, and gallic acid [Figure 2 and Table 2].

BIOLOGICAL EFFECTS

Antioxidant

C. papaya L. leaves showed antioxidant activity.[15] *C. papaya* seeds inhibit the activity of α-amylase and α-glucosidase enzymes and provide protection against oxidative strain in postprandial hyperglycemia.[28] *C. papaya* leaves and seeds comprise excessive quantities of herbal antioxidants, i.e., caffeic acid, myricetin, rutin, quercetin, α-tocopherol, papain, BiTC, and kaempferol which counteract oxidative stress and fitness conditions. These compounds counteract pro-oxidants through several signaling pathways that either promote the expression of antioxidant enzymes or reduce ROS production. These signaling pathways activate the antioxidant defense mechanisms that protect the body against both intrinsic and extrinsic oxidative stress[9] [Table 2].

Antidiabetic Activity

C. papaya possesses life-saving novel antidiabetic phytochemicals which can be used for the treatment of DM.[29] They also remove diabetes-associated complications such as

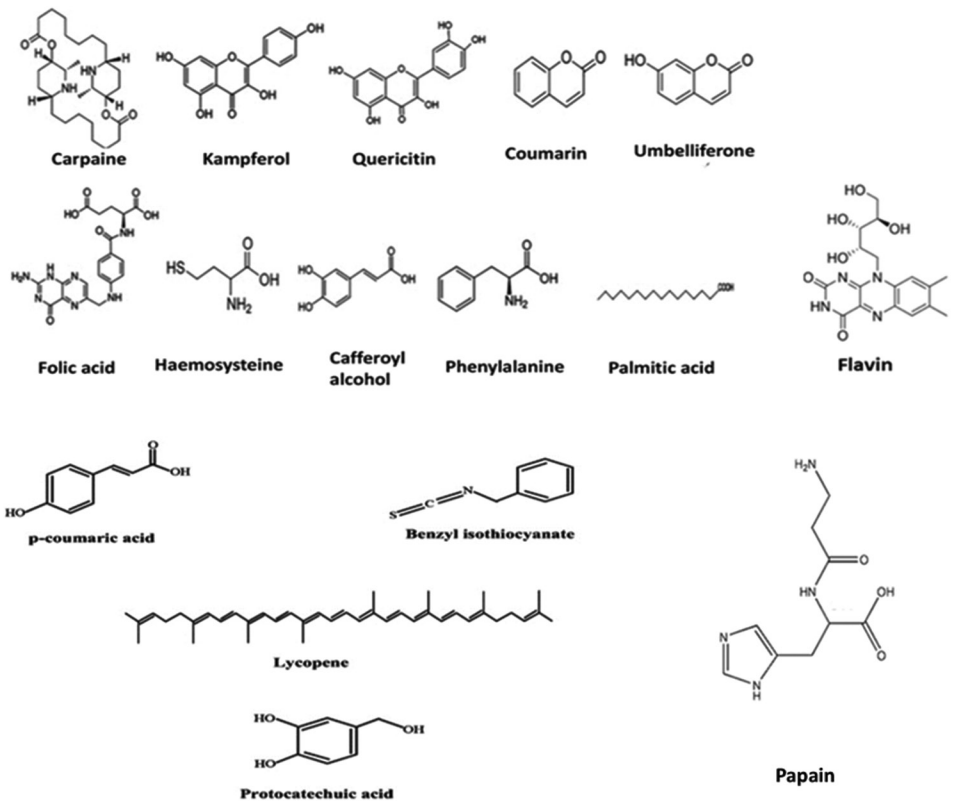

Figure 2: Important bioactive compounds isolated from *Carica papaya* leaf, stem, and seeds

Table 2: Nutraceutical, therapeutical, and pharmacological potential of *Carica papaya* plant

Plant part	Bio-organic constituent/s	Biological activities	References
Fruit	Caproside, vitamin C and E cyanogenic allosides and glucosides	Nutraceutical	Seigler *et al*., 2002
Fruit	Phenolic and carotenoid	Nutraceutical	Rivera-Pastrana *et al*., 2010
Latex	Papain a cysteine protease	Tenderizing meat and other proteins	Morton (1987)
Leaf extract	Phenolics	Diets with lowered serum urea	Hamid *et al*., 2022
Seeds	Phenolic and carotenoid	Antioxidant	Reuben *et al*., 2020
Leaf extract	Alkaloids carpain, pseudocarpain and dehydrocarpain 1,2, choline, caproside, vitamin C and E.	Increase insulin levels, antidiabetic, antioxidant	Alam *et al*., 2022
Leaf extract	Secondary metabolites	Regenerate pancreatic beta cells	Nyakundi *et al*., 2023
Leaf extract	Phenolic essential fatty acids, flavonoids, saponins, fucoidan, and phlorotannin	restoring the function of adipocytokines	Rebecca Roy *et al*., 2023
Immature fruit extract	Secondary metabolites	Healing of burn injuries and hemocompatible properties	Balaji *et al*., 2016
Leaf extract	Growth promoters	Feed additive to promote red hybrid tilapia fry growth	Hamid *et al*., 2022
Seeds	Phenolic contraceptives	Antifertility and anti-implantation	Memudu and Oluwole, 2021
Fruit pulp and seeds	Caffeic acid, myricetin, rutin, quercetin, α-tocopherol, papain, benzyl isothiocyanate	Anti-stress, wound healing,	Kong *et al*.
Leaf extract	Secondary metabolites	Nephroprotective effects reverse the paracetamol-induced changes in kidney structural components	Naggayi *et al*., 2015
Carica papaya seed oil	Cari-oil treated HbSSM	Anti-sickle cell anemia	Afolabi *et al*., 2012
Immature fruit	Tyrosine, glycine, and phenylalanine	Anti-sickling	
leaf-extract	Secondary metabolites carpaineand quercetin	Promote platelet production, inhibit platelet destruction, and maintain platelet membrane	Munir *et al*., 2022
Leaf-extract	Secondary metabolites	Thrombopoietic activity	Dharmarathna *et al*.
Leaf-extract	Secondary metabolites	Promotes megakaryocyte differentiation and increases platelet counts	Yang *et al*., 2023
Leaf juice	Secondary metabolites	Immunomodulatory	Mohd Abd Razak *et al*., 2021
Fruit pulp extract	Secondary metabolites	Inhibits the infection of ZIKV in human cells	Haddad *et al*.
Leaf juice	Secondary metabolites	Antibacterial protective effects Mycobacterium ulceransdisease	Tsouh Fokou *et al*.
Leaf juice	Carpaine and quercetin	Anticancer, anti-proliferation against sepsis infection	Usmani *et al*.
$scCO_2$-extracted freeze-dried leaf juice	Carpaine and quercetin	Cytotoxic activity in squamous cell carcinoma (SCC25) cells and colorectal cancer cells	Khaw *et al*., Mahrous and Noseer
Fruit rind	Secondary metabolites	Anti-malarial against Plasmodium berghei and protective effects in hepatocytes	Atanu *et al*.
Seed extracts	Carpaine and quercetin	Antiparasitic effects against blood trypomastigote and amastigote (intracellular stage) of Trypanosoma cruzi	Jiménez-Coello *et al*.

hyperlipidemia, insulin insensitivity, and the degeneration of pancreatic beta cells.[30] *C. papaya* reverts the consequences in the fatty tissue of type 2 diabetic rats through way of means of restoring the adipocytokines and the gene expression.[31] Aqueous leaf extract of *C. papaya* suggests hypoglycemic consequences in streptozotocin-triggered diabetic rats. It correctly controls blood glucose levels and improves lipid profile in diabetic rats.[32] In addition, it improves metabolic features of each liver and pancreas.[33] *C. papaya* leaf extract incorporates crucial secondary metabolites nutrients A, C, B, and E complexes, polysaccharides, phenolic compounds, vital fatty acids, flavonoids, saponins, fucoidan, and phlorotannin. *C. papaya* reverts the consequences in fatty tissue of type 2 diabetic rats through way of means of restoring the adipocytokines and the gene expression[10] [Table 2].

Supplementation of standardized fermented papaya preparation (FPP) recuperation consequences on wounds in person overweight diabetic (db/db) mice.[34] FPP can accurate respiration burst overall performance of T2DM PBMC through an Sp-1-dependant pathway.[35] These additionally accurate bizarre NADPH oxidase pastime in blood-derived mononuclear cells from Type II DM Patients [Table 2].

Anti-stress

The addition of papaya leaf extract in feeding uncooked substances in rooster feed complements the burden to sell boom and enhance feed usage for inbred hybrid tilapia. It improves body weight and feed performance without adversely affecting blood parameters levels among 1% and 2% of the papaya leaf extract is usually recommended as a feed additive to sell purple hybrid tilapia fry boom[2] [Table 2].

Antifertility and Anti-implantation

Aqueous extract of *C. papaya* suggests contraceptive consequences in woman rats. *C. papaya* administered for 7 and 21 days triggered the animals to have extra proestrus and diestrus stages as in comparison to the manipulated animals. The estrous cycle has become irregular, with extended diestrus and proestrus phase. The aqueous extract of *C. papaya* seeds triggered antifertility, anti-implantation, through way means of a discount in progesterone level, disruption of estrus sample, and histological alteration of utero-ovarian tissue[2] [Table 2].

Nephroprotective

Screening of *C. papaya* confirmed the presence of nephroprotective phytochemicals. Paracetamol management ended in a great elevation of renal characteristic markers. CPE ameliorated the impact of paracetamol through way of means of lowering the markers in addition to reversing the paracetamol-induced modifications in kidney structural components.[36]

Anti-sickle Cell Anemia

Cari-oil handled HbSSM and HbSSF blood had notably multiplied ($P < 0.05$) peroxidase hobby in comparison with controls. *C. papaya* seed oil (Cari-oil) as opposed to *C. papaya* seed oil and *Ipomoea involucrata* exhibited specific anti-sickling residences coupled with the ability to lessen pressure in sickle cell patients. Each plant for my part or in aggregate can be beneficial for the control of sickle cell disease[37] [Table 2].

THROMBOPOIETIC ACTIVITY

C. papaya leaf indicates precise healing ability toward thrombocytopenia. *C. papaya* leaves its own secondary metabolites carpaine and quercetin which sell platelet production, inhibit platelet destruction, and hold platelet membrane through gene expression hobby and the ceasing of viral proteases.[18] Fresh *C. papaya* leaf extract notably multiplied the platelet and RBC counts. These also are endorsed as a medicinal drug to reinforce thrombopoiesis and erythropoiesis. *C. papaya* leaf extracts improve thrombocyte counts both in human and murine animal models by in dengue patients.[38] *C. papaya* leaf extract promotes megakaryocyte differentiation and growth platelet counts *in vivo*.[39] *C. papaya* induces *in vitro* thrombopoietic cytokines secretion through the way of means of mesenchymal stem cells and hematopoietic cells.[40] In addition, the leaf juice of papaya helps to increase the platelet counts of dengue fever patients[41] [Table 2].

ANTIVIRAL ACTIVITY

C. papaya leaves are primarily based totally silver nanoparticles and supercritical fluid extract of *C. papaya* leaves confirmed sturdy antiviral activity and dengue and chikungunya virus[42] and arboviral diseases. Pulp extracted from *C. papaya* fruit inhibits the contamination of Zika virus (ZIKV) in human cells without lack of cell viability. It effectively possesses antiviral hobby toward ZIKV and the fermentation manner has a mild impact on the antiviral impact.[43] Silver nanoparticles organized from inexperienced leaves of *C. papaya* confirmed cytotoxic impact in Hela, BHK-21, and Vero cell line at most doses[44] [Table 2]. Papaya leaf extract increases the platelet count in chronic immune thrombocytopenic purpura.[45] It shows immunomodulatory activities to finish symptomatic effects of dengue fever.[46] *C. papaya* latex component interacts with the 50S Ribosomal Protein L17.Capsid Protein Fragment of a Fusagra-like Virus.[47]

ANTIBACTERIAL ACTIVITY

C. papaya energetic components inside the extracts confirmed the defensive consequences *Mycobacterium ulcerans*

disease.[48] Papain remoted from *C. papaya* exhibited anti-necrotic consequences on tissues and healing consequences in opposition to ulcers and gangrene.[49] It addition, indicates defensive consequences in opposition to H_2O_2-triggered mutagenesis.[49] *C. papaya* leaf contains energetic additives inclusive of alkaloids, glycosides, tannins, saponins, and flavonoids, which can be liable for its medicinal pastime. Green synthesis of iron oxide nanoparticle in the usage of *C. papaya* leaf extract additionally confirmed sturdy antibacterial pastime *Klebsiella* spp., *Escherichia coli*, *Pseudomonas* spp., and *Staphylococcus aureus* bacterial strains. The extracts of *C. papaya* inhibited the boom of microorganism and the antimicrobial impact becomes located to be statistically vast on the neat/general concentration (a hundred μg/mL).[50] Papaya leaves possess antibacterial and cytotoxic activity and help in the control of sepsis.[51] Similar activity is reported in green nanoparticles (superparamagnetic iron oxide nanoparticles) synthesized from *C. papaya* latex.[52] *C. papaya* reducing leaves, pulp, and root extracts is used to cure infection caused by microorganisms, especially bacteria[53] [Table 2].

ANTICANCER ACTIVITY

Phytochemical research of the hydromethanolic extract of *C. papaya* Linn. leaves *Caricaceae*) chemical ingredients, namely carpaine (1), methyl gallate (2), loliolide (3), rutin (4), clitorin (5), kaempferol-3-O-neohesperidoside (6), isoquercetin (7), nicotiflorin (8), and isorhamnetin-3-O-β-d-glucopyranoside (9). The compounds 2, 3, 5–7 and 9 have been remoted for the primary time from the genus *Carica* from *C. papaya* Linn. leaves as ability cytotoxic, EGFRwt, and aromatase (CYP19A) inhibitors. Methyl gallate and clitorin tested the maximum amazing cytotoxic activities with an IC_{50} of 1.11 ± 0.06 and 2.47 ± 0.14 μM, respectively.[54] *C. papaya* leaf decoction possesses recuperation talents in opposition to most cancers. It additionally indicates a more potent cytotoxic impact on squamous cell carcinoma (SCC25) most cancer cells and defensive consequences in non-cancerous human keratinocyte HaCaTcells.[55] Phytochemicals of carpaine and quercetin found in *C. papaya* plant show anti-proliferative and cytotoxic activity.[56] The ethyl acetate fraction of *C. papaya* leaves confirmed anticancer ability in opposition to breast and lung most cancers cell lines, MCF-7 and A549.[57] Similarly, supercritical carbon dioxide-extracted freeze-dried leaf juice of *C. papaya* becomes located pastime in opposition to SCC25 cells.[58] *C. papaya* seed extract indicates healing ability in opposition to colorectal most cancers.[59] Finally, nutritional use of *C. papaya* stem and leaves is anticancer in nature and precise for health[60] [Table 2].

ANTIMALARIAL ACTIVITY

C. papaya is utilized in conventional remedy used as an antimalarial remedy on Papua Island.[61] *C. papaya* fruit rind had the very best antimalarial pastime.[62] More often, substances determined in it confirmed antimalarial capability toward *Plasmodium berghei* and showed defensive consequences in hepatocytes.[63,64] Ethanolic extract of *C. papaya* leaf confirmed larvicidal pastime to *Aedes* sp. scientific pest of dengue hemorrhagic fever.[65]

ANTIPARASITIC ACTIVITY

The seed extracts of *C. papaya* (from ripe fruit) are capable of lessening the range of parasites from each parasite stages, blood trypomastigote, and amastigote (intracellular stage) of *Trypanosoma cruzi*.[66] A huge discount ($P < 0.05$) with inside the range of blood trypomastigotes is found in animals treated.[67] *C. papaya* fruit rind and roots confirmed antimalarial pastime toward *P. berghei* in mice. *C. papaya* root exhibited a parasite suppression impact (48.11%) but methanol fraction of the plant elements produced much less chemo-suppressive impact.[68] Papaya seeds fortified porridge had a huge impact on the discount of *Ascaris lumbricoides* burden. These vitamins shield toward infant fungal infections than albendazole. It reasons a huge discount in *Tinea capitis* (ringworm).[69] Polyphenols and terpenoids confirmed anthelmintic pastime in livestock, associated animals, and humans. *C. papaya* leaf extract additionally confirmed anthelmintic pastime in livestock. Active components from papaya inhibit egg hatching, larval migration inhibition, and paralysis.[70] *C. papaya* aqueous extracts of SF-WT and SF-23 precipitated immunity toward cysticercosis and nematicidal pastime toward the nematode *Haemonchus contortus*.[71] *C. papaya* seed hexane extract against *Strongyloides venezuelensis* showed ovicidal and larvicidal activity against *S. venezuelensis*.[72] Similar activity is reported in papaya seed hexane extract against the sheep parasite *H. contortus* [Table 2].[73]

CONCLUSION

C. papaya Linn. fruit, leaf, seed, and roots are true for fitness as those own useful metabolites together with carbohydrates, proteins, and fatty acids with required quantities of minerals, water, and nutrients. Papaya is historically used to deal with quite a few sicknesses together with malaria, cancer, and cardiovascular sicknesses. *C. papaya* L. is a superb supply of nutrients A, C, and E, B complicated nutrients, together with pantothenic acid and folate, and minerals, together with magnesium and potassium, in addition to meal fibers. Its end result is wealthy in flavonoids and phenolic compounds, together with BiTC, glucosinolates, tocopherols (α and δ), β-cryptoxanthin, β-carotene, and carotenoids which can be of remarkable healing value. The oil extracted from the seed basically provides oleic fatty acid palmitic, linoleic, and stearic acids, while the leaves have excessive contents of meal

fibers and polyphenolic compounds, flavonoids, saponins, pro-anthocyanins, tocopherol, and BiTC. Moreover, vitamins discovered in papaya fruit comprise predominant nutritional ingredients and positioned useful results at the cardiovascular system, shielding it toward cardiovascular ailments and stopping damage resulting from unfastened radicals. Papaya pulp is used with inside the remedy for DM and with inside the discount of low-density lipoprotein cholesterol levels. Diets with papaya leaf extract diminished serum urea. No doubt flora displays a couple of healing results and is a superb supply of nutritional vitamins for all ages. Besides, useful healing results papaya plant additionally carries show facet results: intake of papaya in huge amount is dangerous for the fitness, and it reasons allergic reactions, pores and skin irritation, miscarriage, belly upset, respiratory difficulties, and belly running.

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