A Review on Pharmacological Activities of Carica Papaya

Dev Soni[1], Pankaj Mali[2], Mahendra Kumar[3], Vishal Joshi[4], Aavesh Mehta[5], Sandhya suresh[6], Dr. Raghvendra Singh Bhadauria[7], Ms.Sandhya Suresh[8]

[1-2-3-4-5]*Student B.Pharm, Sunrise College of Pharmacy, Umarada, Udaipur*

[6]*Associate Professor B.Pharm, Sunrise College of Pharmacy, Umarada, Udaipur*

[7]*Professor B.pharm Sunrise College of Pharmacy, Umarada, Udaipur*

[8] *Corresponding Author, Associate professor, Sunrise college of pharmacy, Near bari mata temple jamar kotra road, umarda, Udaipur, Rajasthan 313002*

Abstract- *Carica papaya* Linn., commonly known as papaya, is a well-known tropical plant extensively cultivated for its nutritional and medicinal properties. This review highlights the wide range of pharmacological activities associated with various parts of *C. papaya*, including its leaves, fruit, seeds, and roots. Phytochemical investigations reveal that *C. papaya* is rich in bioactive compounds such as alkaloids, flavonoids, tannins, saponins, and the proteolytic enzyme papain. These constituents contribute to its significant antioxidant, anti-inflammatory, antimicrobial, hepatoprotective, antidiabetic, anticancer, and immunomodulatory activities. Notably, the leaf extract has shown promise in managing dengue fever by improving platelet counts. The seeds exhibit potent anthelmintic and contraceptive effects, offering natural alternatives for parasite control and fertility regulation. Additionally, extracts from *C. papaya* have demonstrated wound healing, gastroprotective, and hepatoprotective effects in various experimental models. While preclinical studies have established a strong pharmacological basis, further clinical trials and standardization are necessary to ensure efficacy and safety for wider therapeutic use. This review aims to consolidate current findings, promote the understanding of the plant's therapeutic potential, and encourage future research to isolate, characterize, and develop novel formulations derived from *Carica papaya*. Expanding scientific validation and sustainable utilization could help harness this versatile plant as an affordable and accessible source of natural medicine.

Keywords: ***Carica papaya*, papain, pharmacological activities, antioxidant, anti-inflammatory, antidiabetic, antimicrobial, traditional medicine**

1. INTRODUCTION

1.1 History of *Carica papaya*

Carica papaya, commonly known as papaya, is a tropical fruit native to the Americas, particularly southern Mexico and Central America. With a rich history spanning centuries, papaya has become an important fruit, both for culinary and medicinal purposes, spreading across the globe through trade, colonization, and exploration. The earliest known use of papaya dates back to pre-Columbian times when it was utilized by indigenous peoples of the Americas for its nutritional and healing properties. In the 19th and early 20th centuries, scientific interest in papaya grew, especially regarding its enzyme *papain*, which was found to be beneficial for digestion and was utilized in industries such as food processing. By the mid-20th century, medical research expanded to explore papaya's antioxidant, anti-inflammatory, and antimicrobial properties, leading to modern applications of papaya in medicine. Today, papaya continues to thrive as a globally cultivated fruit and plays a significant role in agricultural economies. Its health benefits, both culinary and medicinal, make it a valuable plant whose influence continues to expand in the fields of nutrition, health, and natural therapies. (1)

Parts of the Papaya Plant Used Medicinally

Every part of the papaya plant has been used medicinally in some cultures for treating various ailments. These include the fruit, seeds, leaves, and latex, which all contain different bioactive substances with distinct therapeutic properties.

1. Fruit: The edible fruit is rich in dietary fibers, vitamins, and minerals. Its pulp has been extensively used in traditional medicine to aid digestion and relieve constipation due to the presence of papain and other enzymes. The fruit has also been shown to possess significant antioxidant and anti-inflammatory properties.
2. Seeds: Papaya seeds are another underutilized part of the plant, rich in beneficial compounds.

They have been used to treat intestinal parasites, liver diseases, and kidney problems in traditional systems of medicine.

3. Leaves: Papaya leaves have gained attention in modern medicinal practices due to their concentration of bioactive compounds like flavonoids, tannins, and alkaloids, as well as a high density of antioxidants. In particular, papaya leaf extracts have been used for their hepatoprotective, anti-inflammatory, and antimalarial properties. Recent studies suggest that papaya leaf juice may also assist in lowering blood platelet count and managing dengue fever symptoms.
4. Latex: The latex of papaya, primarily extracted from the tree's stem and unripe fruit, contains papain, an enzyme known for its ability to break down proteins. It is commonly used in digestive aids, though in concentrated forms, it is also utilized for its antifungal and antibacterial properties. (2)

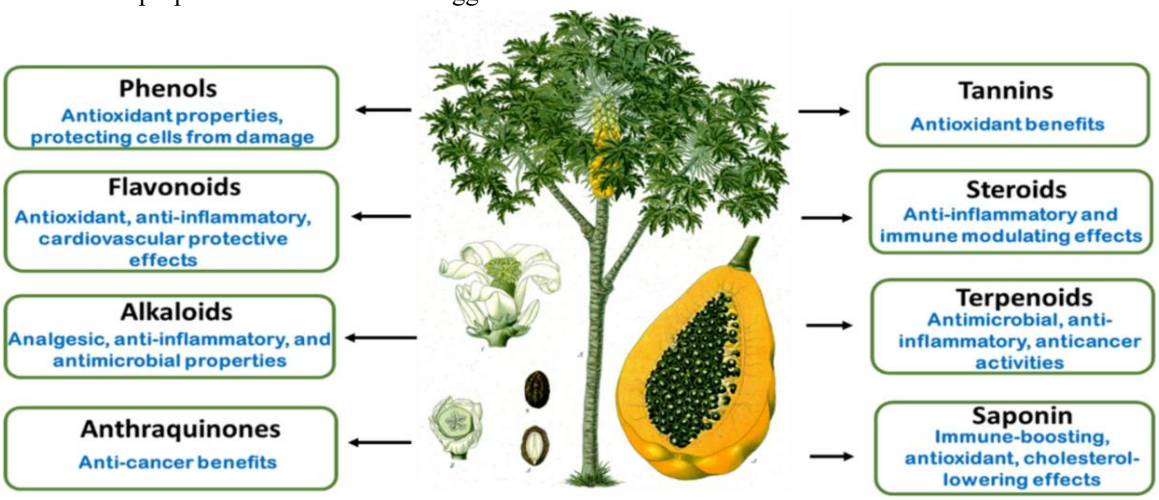

FIG:1 USES OF CONSTITUENTS IN DISEASES

1.2 Current Uses of *Carica papaya* in Modern Medicine

Carica papaya has long been recognized for its numerous medicinal benefits, and modern research has continued to highlight its potential as a therapeutic agent. In contemporary medicine, papaya is valued not only for its rich nutritional profile but also for the wide array of pharmacological properties attributed to its various components, including papain, carotenoids, flavonoids, and vitamins. Modern medicine has embraced the use of papaya in various forms, ranging from dietary supplements and functional foods to topical applications and therapeutic treatments. (3)

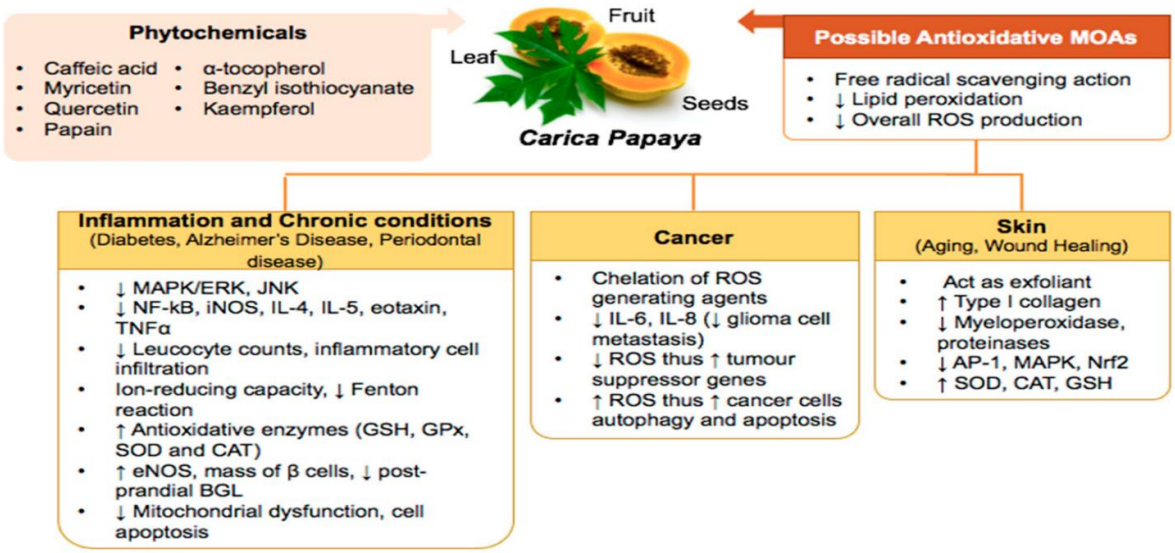

FIG:2 ANTIOXIDATIVE MOA

1.3 Toxicity and Safety Profiles of Carica Papaya

Carica papaya, while widely regarded as a nutritious fruit and potent medicinal plant, has raised some concerns regarding its toxicity and safety profiles when consumed or applied in excess. The safety of papaya use largely depends on factors such as the part of the plant being used (fruit, seeds, leaves, or latex), the dosage, individual sensitivities, and underlying health conditions. The fruit of Carica papaya is generally considered safe to consume and is rich in vitamins, minerals, antioxidants, and dietary fiber. However, while papaya fruit itself is rarely associated with toxicity, there are a few precautions for certain populations.

- Allergic Reactions: Some individuals may experience mild allergic reactions when consuming papaya. These reactions can range from skin rashes to more severe symptoms, such as swelling or itching, particularly in individuals allergic to latex. This is due to cross-reactivity between the proteins in papaya and latex, which may trigger allergic responses.
- Pregnancy and Lactation: There is some evidence to suggest that consuming excessive amounts of unripe papaya, especially in early pregnancy, can cause complications. Unripe papaya contains higher levels of latex, which contains an enzyme that can stimulate uterine contractions and may cause miscarriage. Therefore, pregnant women are generally advised to avoid consuming unripe papaya during the first trimester. However, ripe papaya, when consumed in moderation, is considered safe during pregnancy and lactation. Always consult with a healthcare provider regarding dietary choices during pregnancy.
- High Potassium Content: Papaya is a good source of potassium, which is essential for heart and muscle function. However, individuals with kidney disease should exercise caution, as excessive potassium intake can lead to hyperkalemia, a condition that can disrupt heart rhythms and cause muscle weakness.
- Liver Health and Dosage Control: Excessive intake of papaya leaf extracts can put stress on the liver, especially when consumed in large doses or over prolonged periods. There is limited evidence of the hepatotoxicity of papaya leaves, but it is important to monitor liver function and consult a healthcare provider before beginning papaya leaf-based therapies.
- Blood Sugar Levels: The hypoglycemic (blood sugar-lowering) properties of papaya have been used to help manage diabetes. While moderate consumption of papaya leaves or extracts may help control blood sugar, excessive use can lead to overly low blood sugar levels, especially in individuals taking antidiabetic medications. Monitoring blood sugar regularly and adjusting medication dosages in consultation with a doctor is essential for diabetic patients using papaya as a supplemental treatment. (4)

1.4 Drug Interactions

- Anticoagulants: There is some evidence to suggest that papaya leaf extract, due to its potential effects on platelet function, may interact with blood-thinning medications, such as warfarin or aspirin. People using anticoagulant therapy should exercise caution and consult their healthcare providers before using papaya products to avoid bleeding complications.
- Hypoglycemic Drugs: Due to its effects on blood sugar regulation, papaya, particularly papaya leaf, may interact with diabetic medications, leading to an increased risk of hypoglycemia (low blood sugar). Diabetic individuals should inform their healthcare providers if they plan to consume papaya-based supplements or products.
- Other Drug Interactions: Due to the presence of enzymes such as papain in papaya, there may be some interference with the absorption of drugs, particularly protein-based drugs or antibiotics. This could either enhance or reduce their efficacy, depending on the specific drug in question.(5)

1.5 Potential Risks from Overuse

Overuse of papaya-based products, such as fruit, seeds, or extracts, may lead to toxicity or undesirable side effects. It is crucial to adhere to recommended dosages and guidelines set by healthcare professionals or product manufacturers to avoid complications. Regular consultations with a healthcare provider are essential, especially when papaya is used for medicinal purposes, to ensure proper usage and prevent any harmful interactions or toxic effects. (6)

2. REVIEW OF LITERATURE

2.1 Antimicrobial and Antibacterial Activity

Papaya seeds are well-known for their potent antimicrobial effects. Studies have shown that papaya seed extracts exhibit strong antibacterial activity, particularly against common pathogens such as Escherichia coli, Salmonella typhimurium, Staphylococcus aureus, and Pseudomonas aeruginosa. This antimicrobial activity is primarily attributed to the presence of benzyl isothiocyanate, which disrupts the growth of bacteria by inhibiting their cell wall synthesis and interfering with their metabolic processes. Furthermore, papaya seeds also demonstrate antifungal activity against dermatophytes and other fungal pathogens, making them a useful tool for treating fungal infections such as ringworm and candidiasis.(7)

2.2 Anthelmintic Activity

One of the traditional uses of papaya seeds is for expelling intestinal worms. Papaya seed extracts have shown remarkable anthelmintic properties, especially against roundworms, hookworms, and tapeworms. Reported that papaya seeds, due to their enzymatic and chemical properties, effectively eliminate intestinal parasites by disrupting the larvae and egg formation of worms, thereby facilitating their removal from the gastrointestinal tract. (8)

2.3 Anti-inflammatory and Antioxidant Effects

Papaya seeds exhibit significant anti-inflammatory and antioxidant activities due to the presence of phenolic compounds and flavonoids. Studies indicate that papaya seed extract can reduce inflammation by downregulating pro-inflammatory cytokines and modulating the oxidative stress pathways. The high levels of antioxidants in the seeds, including flavonoids such as quercetin, aid in neutralizing free radicals, which helps protect against oxidative stress and cellular damage linked to chronic diseases such as heart disease, cancer, and neurodegenerative disorders. (9)

2.4 Hepatoprotective Activity

Research on papaya seed extracts has highlighted their potential hepatoprotective effects, showing that these seeds can reduce liver toxicity and support detoxification. In a study on rat models, papaya seed extract was found to protect against liver damage induced by chemical agents like carbon tetrachloride, helping to restore liver enzyme levels and enhance liver function. This makes papaya seeds an interesting candidate for the prevention and management of liver-related disorders such as hepatitis and cirrhosis. (10)

2.5 Immunomodulatory Effects

The immunomodulatory properties of papaya leaves are also well-documented. Research suggests that papaya leaf extracts can enhance immune system responses by boosting the production of cytokines, stimulating macrophage function, and increasing the overall white blood cell count. This makes papaya leaves valuable for managing diseases associated with immune deficiency, such as viral infections, including dengue fever. Studies have shown that papaya leaf extract can increase platelet counts in individuals suffering from dengue, contributing to its role in reducing the severity of the disease. (11)

2.6 Anticancer and Antitumor activity

Papaya leaf extracts have been investigated for their potential anticancer and antitumor properties. According to studies by, papaya leaf extract induces apoptosis (programmed cell death) in cancer cells by modulating various cell signaling pathways and inhibiting tumor growth in vitro and in vivo

. The leaf's bioactive compounds, including flavonoids and glycosides, help reduce the proliferation of cancerous cells and may offer an adjunctive treatment for cancers like leukemia, breast, and cervical cancers. (12)

2.7 Antiviral Activity

Papaya leaves demonstrate potent antimicrobial properties against a range of pathogens. Studies have confirmed its activity against bacteria such as Escherichia coli, Staphylococcus aureus, and Salmonella typhimurium, as well as fungal species including Candida albicans. In addition, papaya leaf extract exhibits antiviral activity, especially against viruses like the dengue virus, by boosting immunity and enhancing platelet production. The antimicrobial properties of papaya leaves are mainly

attributed to alkaloids and flavonoids, which disrupt microbial growth and inhibit their spread. (13)

2.8 Hepatoprotective Effects

Papaya leaves have demonstrated potential hepatoprotective properties. Studies have shown that papaya leaf extract can help protect the liver from damage caused by chemical toxins, alcohol consumption, and other liver-toxic agents. In animal studies, papaya leaf extract reduced elevated liver enzyme levels and promoted hepatocyte regeneration. This supports the use of papaya leaves for liver detoxification and in treating conditions like hepatitis and cirrhosis. (14)

2.9 Antioxidant Properties

Papaya flowers exhibit potent antioxidant activity, largely attributed to their high content of phenolic compounds, flavonoids, and carotenoids. Antioxidants are essential for neutralizing free radicals in the body, thereby preventing cellular damage and the development of various diseases, including cancer, cardiovascular diseases, and neurodegenerative disorders. Demonstrated that papaya flowers possess significant radical-scavenging abilities, effectively reducing oxidative stress and providing cellular protection against oxidative damage.(15)

2.10 Antidiabetic Effects

Papaya flower extracts have been shown to possess antidiabetic properties. Studies on Carica papaya flower's role in controlling blood sugar levels have confirmed that its bioactive components can reduce hyperglycemia. Papaya flower extracts helped lower blood glucose levels in diabetic rats, likely through the enhancement of insulin sensitivity and β-cell regeneration. The flowers' high content of flavonoids and alkaloids is believed to mediate these effects by regulating metabolic pathways associated with glucose metabolism.(16)

2.11 Analgesic and Antipyretic Properties

Traditional medicinal practices have also highlighted the analgesic (pain-relieving) and antipyretic (fever-reducing) effects of papaya flowers. The presence of alkaloids and other PLANT PROFILE bioactive compounds may contribute to the attenuation of pain and fever. This study indicates that the analgesic effects of papaya flower extracts were comparable to those of standard nonsteroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen. Furthermore, the flowers' antipyretic activity suggests potential applications for reducing fever, particularly in infectious diseases. (17)

2.12 Digestive Health

One of the most notable therapeutic benefits of papaya fruits is their ability to support digestive health. The fruit contains a potent enzyme called papain, which helps break down proteins and improve digestion. Scientist found that papaya fruit's papain enzyme is particularly beneficial for individuals with digestive issues, including indigestion and bloating, by aiding in the breakdown of proteins and improving nutrient absorption. Papaya's high fiber content also promotes healthy bowel movements and alleviates constipation.(18)

2.13 Cardioprotective Effects

The cardioprotective effects of papaya fruit are mainly attributed to its antioxidant content and its ability to reduce oxidative stress. Antioxidants such as lycopene and flavonoids contribute to the protection of blood vessels, reduction of cholesterol levels, and prevention of atherosclerosis. Papaya fruit helps in reducing the levels of LDL cholesterol and triglycerides, contributing to a healthier cardiovascular system. This is further supported by the fruit's ability to lower blood pressure and reduce inflammation, which are key factors in heart disease prevention. (19)

2.14 Wound Healing Properties

The proteolytic enzymes in papaya latex, particularly papain, have been linked to improved wound healing. Papain's enzymatic action helps in debriding necrotic tissue and promoting the healing of chronic wounds, ulcers, and burns. According to the application of papaya latex significantly accelerated wound healing and reduced infection in both clinical and animal studies, demonstrating its efficacy as a natural topical remedy for skin lesions.(20)

FIG.3 CARICA PAPAYA (ALL PARTS)

3.1 CLASSIFICATION

- Kingdom: Plantae
- Phylum: Angiosperms
- Class: Eudicots
- Order: Brassicales
- Family: Caricaceae
- Genus: Carica
- Species: Carica papaya

Common Name: Papaya, Pawpaw, Papali, Papai etc

Origin: Native to tropical America; widely cultivated in tropical and subtropical regions.

3.2 Distribution and Habitat

Native to tropical America, papaya originates from southern Mexico and Central America. Papaya is also considered native to southern Florida, introduced by predecessors of the Calusa no later than AD 300. Spaniards introduced papaya to the Old World in the 16th century. Papaya cultivation is now nearly pantropical, spanning Hawaii, Central Africa, India,

3.3 Morphology

1. Habit:

- Small, fast-growing, soft-wooded, semi-woody herbaceous plant.
- Lifespan: Typically 4-5 years.
- Wild populations of papaya are generally confined to naturally disturbed tropical forests.
- Papaya cultivation is now nearly pantropical, spanning Hawaii, Central Africa, India, and Australia.

2 Seeds

- Seeds are anchorage and nutrient absorption.

3. Stem:

- Hollow, cylindrical, soft, and succulent.
- Scars from fallen leaves are visible as prominent rings on the stem.

4. Leaves:

- Large, palmate (hand-shaped), deeply lobed, and spirally arranged at the top of the stem.
- Petiole: Long and hollow.

5. Flowers:

- Type: Dioecious or sometimes hermaphrodite (depending on variety).
- Male Flowers: Produced in clusters on long peduncles.
- Female Flowers: Solitary or in small clusters, larger than male flowers.
- Color: Creamy white or yellowish.

6. Fruit:

- Type: Berry.

- Large, oval to cylindrical, fleshy, and juicy.
- Smooth skin, green when unripe, turning yellow/orange when ripe.
- Contains numerous black seeds enclosed in a gelatinous aril.
- Rich in papain enzyme, vitamin C, and A. (21)

3.4 Cultivation

- Climate: Warm, tropical climates; sensitive to frost.
- Soil: Well-drained, sandy loam with pH 6-6.5.
- Propagation: Seeds or vegetative propagation.
- Irrigation: Requires regular watering; avoid waterlogging.
- Fertilization: Rich in nitrogen, phosphorus, and potassium
- Propagation: Seeds or vegetative propagation.
- Irrigation: Requires regular watering; avoid waterlogging.
- Fertilization: Rich in nitrogen, phosphorus, and potassium

3.5 Production

In 2024, global production of papayas was 13.8 million tonnes, led by India with 38% of the worldwide. Global papaya production grew significantly over the early 21st century, mainly as a result of increased production in India and demand by the United States. The United States is the largest importer of papayas worldwide. In South Africa, papaya orchards yield up to 100 tonnes of fruit per hectare.

3.6 Uses

- Anthelmintic: Traditionally used to expel intestinal worms.
- Diuretic: Used to promote urination and treat urinary disorders.
- Anti-inflammatory: Used for swelling and joint pain.
- Dengue Treatment: The leaves are known for increasing platelet count in dengue fever.
- Antimalarial: Used in some regions as a treatment for malaria.
- Digestive Aid: Known to improve digestion due to papain enzyme.
- Antioxidant: Used to detoxify and purify the blood.
- Skin Health: Crushed leaves applied externally for skin ailments and wounds.
- Digestive Aid: Contains papain, an enzyme used to aid digestion and break down proteins.
- Wound Healing: Applied topically for burns and wounds due to antimicrobial properties.
- Anthelmintic: Used to treat intestinal worms.
- Skin Treatment: Used for skin conditions like acne, warts, and corns.
- Contraceptive: In some traditional practices, it has been used for its contraceptive properties.
- Digestive issues: Papaya is rich in proteolytic enzymes, which help with digestion. Papaya can treat constipation, dyspepsia, hyperacidity, and dysentery.
- Skin issues: Papaya juice can treat warts, corns, and thickened skin. Papaya latex can treat psoriasis and ringworm, and can be used as an antiseptic or to heal burns.
- Pain relief: Papaya leaves can be used as a poultice to treat nerve pains and elephantoid growths. (21)

4. AIM

The aim of this comprehensive investigation is to explore and critically assess the various pharmacological aspects of *Carica papaya* (papaya), focusing on its medicinal potential across different parts of the plant, including the fruit, leaves, stem, flowers, and seeds.

OBJECTIVES

1. To analyze, evaluate and explore therapeutic properties the pharmacological properties of *Carica papaya* fruit, leaves, stem, flower and seeds:
2. To understand the mechanisms by which *Carica papaya* exerts its pharmacological effects.
3. To assess the safety and toxicity profiles of *Carica papaya*.
4. To provide a comprehensive review of current research on *Carica papaya*'s pharmacological applications.
5. To explore the potential of *Carica papaya* as a valuable medicinal resource.

5. RESULT AND DISCUSSIONS

The review of available literature highlights *Carica papaya* as a plant with extensive pharmacological potential attributed to its diverse phytochemical

constituents, including alkaloids (e.g., carpaine), flavonoids, phenolics, saponins, and enzymes like papain and chymopapain. Multiple in vitro and in vivo studies have demonstrated its effectiveness across various pharmacological domains. Antioxidant activity of *Carica papaya* has been consistently reported due to the presence of high levels of vitamin C, flavonoids, and β-carotene, which scavenge free radicals and reduce oxidative stress. Leaf extracts, in particular, showed significant free radical inhibition in DPPH and ABTS assays. Antimicrobial studies also reveal potent activity of leaf, seed, and latex extracts against Gram-positive and Gram-negative bacteria, such as *Staphylococcus aureus* and *Escherichia coli*, attributed to the presence of alkaloids and tannins. In terms of anti-inflammatory and analgesic properties, ethanolic extracts of the leaves and seeds have demonstrated notable inhibition of pro-inflammatory mediators such as TNF-α, IL-6, and prostaglandins in animal models. Antidiabetic effects are particularly prominent, with multiple studies confirming significant reduction in blood glucose levels and improvement in insulin sensitivity in diabetic rodent models. These effects are likely mediated through α-amylase inhibition and pancreatic β-cell protection. Furthermore, the plant exhibits wound healing activity, likely due to papain's debridement property and enhanced collagen synthesis. The anticancer potential of *C. papaya* is emerging, with leaf extracts inducing apoptosis and cell cycle arrest in various cancer cell lines, including breast and cervical cancers, largely through mitochondrial pathways and ROS-mediated damage. Moreover, immunomodulatory activity, especially in dengue patients, has gained attention, as papaya leaf extract appears to enhance platelet count and reduce viral load. Overall, *Carica papaya* presents a rich pharmacological profile validated through both traditional use and modern scientific studies. However, clinical trials remain limited, and standardization of extract doses is necessary to translate these findings into therapeutic applications.

6. CONCLUSION

Carica papaya has demonstrated a wide array of pharmacological properties, making it a plant of significant medicinal importance. The leaves, seeds, fruits, stem, flower and latex contain a variety of bioactive compounds such as alkaloids, flavonoids, tannins, enzymes (e.g., papain), and vitamins that contribute to its antioxidant, antimicrobial, anti-inflammatory, antidiabetic, hepatoprotective, anticancer, and wound-healing activities. These findings support the traditional uses of papaya in folk medicine and highlight its therapeutic potential in modern pharmacology. Despite promising preclinical evidence, further research is essential to validate these effects in clinical settings. Standardization of extracts, determination of effective dosages, and toxicity profiling are crucial steps before its widespread therapeutic use. Overall, *Carica papaya* stands out as a natural candidate for drug development and integrative medicine, warranting deeper scientific exploration.

REFERENCE

[1] Koul B, Pudhuvai B, Sharma C, Kumar A, Sharma V, Yadav D, Jin JO. Carica papaya L.: a tropical fruit with benefits beyond the tropics. Diversity. 2022 Aug 20;14(8):683.

[2] Ugbogu EA, Dike ED, Uche ME, Etumnu LR, Okoro BC, Ugbogu OC, Adurosakin OE, Chinma CE, Ohaeri E, Iweala EJ. Ethnomedicinal uses, nutritional composition, phytochemistry and potential health benefits of Carica papaya. Pharmacological Research-Modern Chinese Medicine. 2023 Jun 1;7:100266.

[3] Babalola BA, Akinwande AI, Otunba AA, Adebami GE, Babalola O, Nwufo C. Therapeutic benefits of Carica papaya: A review on its pharmacological activities and characterization of papain. Arabian Journal of Chemistry. 2024 Jan 1;17(1):105369.

[4] Ismail Z, Halim SZ, Abdullah NR, Afzan A, Abdul Rashid BA, Jantan I. Safety evaluation of oral toxicity of Carica papaya Linn. leaves: a subchronic toxicity study in sprague dawley rats. Evidence-Based Complementary and Alternative Medicine. 2014;2014(1):741470.

[5] Lim XY, Chan JS, Japri N, Lee JC, Tan TY. Carica papaya L. Leaf: A Systematic Scoping Review on Biological Safety and Herb-Drug Interactions. Evidence-Based Complementary and Alternative Medicine. 2021;2021(1):5511221.

[6] Adebiyi A, Adaikan PG, Prasad RN. Papaya (Carica papaya) consumption is unsafe in pregnancy: fact or fable? Scientific evaluation of a common belief in some parts of Asia using

a rat model. British Journal of Nutrition. 2002 Aug;88(2):199-203.

[7] Anibijuwon II, Udeze AO. Antimicrobial activity of Carica papaya (pawpaw leaf) on some pathogenic organisms of clinical origin from South-Western Nigeria. Ethnobotanical leaflets. 2009;2009(7):4.

[8] Satrija F, Nansen P, Murtini S, He S. Anthelmintic activity of papaya latex against patent Heligmosomoides polygyrus infections in mice. Journal of ethnopharmacology. 1995 Nov 3;48(3):161-4.

[9] Nafiu AB, Rahman MT. Anti-inflammatory and antioxidant properties of unripe papaya extract in an excision wound model. Pharmaceutical biology. 2015 May 4;53(5):662-71.

[10] Nopelia H, Alifiar I, Nurfatwa M. Hepatoprotector Effect of Papaya (Carica Papaya L.) Ethanol Extract on Male Wistar Rats Induced by Acetaminophen. In2nd Bakti Tunas Husada-Health Science International Conference (BTH-HSIC 2019) 2020 Jun 8 (pp. 61-66). Atlantis Press.

[11] Amin AH, Bughdadi FA, Abo-Zaid MA, Ismail AH, El-Agamy SA, Alqahtani A, El-Sayyad HI, Rezk BM, Ramadan MF. Immunomodulatory effect of papaya (Carica papaya) pulp and seed extracts as a potential natural treatment for bacterial stress. Journal of food biochemistry. 2019 Dec;43(12):e13050.

[12] Nguyen TT, Shaw PN, Parat MO, Hewavitharana AK. Anticancer activity of C arica papaya: A review. Molecular nutrition & food research. 2013 Jan;57(1):153-64.

[13] Adel A, Elnaggar MS, Albohy A, Elrashedy AA, Mostafa A, Kutkat O, Abdelmohsen UR, Al-Sayed E, Rabeh MA. Evaluation of antiviral activity of Carica papaya leaves against SARS-CoV-2 assisted by metabolomic profiling. RSC advances. 2022;12(51):32844-52.

[14] Nopelia H, Alifiar I, Nurfatwa M. Hepatoprotector Effect of Papaya (Carica Papaya L.) Ethanol Extract on Male Wistar Rats Induced by Acetaminophen. In2nd Bakti Tunas Husada-Health Science International Conference (BTH-HSIC 2019) 2020 Jun 8 (pp. 61-66). Atlantis Press.

[15] Zhou K, Wang H, Mei W, Li X, Luo Y, Dai H. Antioxidant activity of papaya seed extracts. Molecules. 2011 Jul 25;16(8):6179-92.

[16] Solikhah TI, Setiawan B, Ismukada DR. Antidiabetic activity of papaya leaf extract (Carica Papaya L.) isolated with maceration method in alloxan-induces diabetic mice. Systematic Reviews in Pharmacy. 2020 Sep 1;11(9):774-8.

[17] Alyas S, Zahra N, Ahmad MI, Zahid N, Nisar A, Hafeez MM, Alam R, Parveen A. Anti-inflammatory, antipyretic and analgesic activities of ethanol extract of Carica papaya. Journal of Wildlife and Biodiversity. 2020 Jul 30;4(3):18-23.

[18] Iseal S, Oluwaseyi J, Owen J, Frank E. The Benefits of Papaya for Digestive Health and Weight Loss.

[19] Mannaa FA, Abdel-Wahhab KG, Abdel-Wahhab MA. Prevention of cardiotoxicity of aflatoxin B 1 via dietary supplementation of papaya fruit extracts in rats. Cytotechnology. 2014 Mar;66:327-34.

[20] Gurung S, Škalko-Basnet N. Wound healing properties of Carica papaya latex: in vivo evaluation in mice burn model. Journal of Ethnopharmacology. 2009 Jan 21;121(2):338-41.

[21] Vij T, Prashar Y. A review on medicinal properties of Carica papaya Linn. Asian Pacific Journal of Tropical Disease. 2015 Jan 1;5(1):1-6.