

CARICA PAPAYA IN LIVER DISORDERS: A COMPREHENSIVE SCIENTIFIC AND HOMEOPATHIC REVIEW

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ABSTRACT

Background: Liver diseases are a global health challenge with rising incidence due to toxic exposures, viral hepatitis, drug-induced liver injury (DILI), and lifestyle-related conditions such as NAFLD. Natural hepatoprotective agents are increasingly explored for safety and efficacy. Carica papaya—used in Ayurveda, ethnomedicine, and homeopathy—has evidence of hepatoprotective, antioxidant, anti-inflammatory, and immunomodulatory effects.

Objective: To present a comprehensive, structured review of Carica papaya in liver disorders, integrating botanical, phytochemical, pharmacological, pre-clinical, clinical, and homeopathic evidence.

Methods: Narrative literature review of peer-reviewed experimental studies, human trials, meta-analyses, and homeopathic publications.

Results: Preclinical models demonstrate significant hepatoprotection: reduction in ALT/AST/ALP, suppression of NF- κ B, TNF- α , IL-6, mitigation of oxidative stress, fibrosis, apoptosis, and restoration of hepatic architecture. Leaf, seed, latex, and fruit extracts all show therapeutic potential. Human dengue studies confirm immunomodulation and thrombopoietic effects; liver benefits remain secondary observations. Homeopathic mother tincture (Carica papaya Q) shows potential adjunctive value, but controlled liver-focused trials are lacking.

Conclusion: Carica papaya is a promising hepatoprotective botanical with mechanistic justification and preliminary clinical relevance. Homeopathic usage is biologically plausible at low potencies, but robust liver-specific evidence is absent. Dedicated clinical research is needed.

Keywords: Carica papaya; Hepatoprotection; Liver disorders; Oxidative stress; Homeopathic mother tincture.

1. INTRODUCTION

Liver disorders constitute a significant global health burden, contributing to millions of deaths each year. Etiologies range from viral hepatitis and alcoholic liver disease to NAFLD, metabolic syndrome, environmental toxins, and adverse drug reactions. The liver's vulnerability stems from its central role in metabolism, detoxification, and immune regulation.

Despite availability of conventional hepatoprotective drugs—such as N-acetylcysteine for paracetamol toxicity or silymarin for hepatocellular protection—these do not cover the wide spectrum of liver disorders and may have limitations in long-term use.

In contrast, plant-based hepatoprotective agents have received increasing attention for their safety, availability, and poly-phytochemical actions. Carica papaya (Linn.), commonly known as papaya, is widely used in traditional medicine for hepatic, digestive, and inflammatory conditions.

Over the last two decades, scientific interest has expanded due to:

- Its antioxidant-rich phytochemical profile
- Clinical use in dengue with hepatic involvement
- Its emerging role in integrative medicine
- Its use in homeopathy as Carica papaya Q for liver and spleen enlargement, jaundice, and post-infectious weakness

This review aims to integrate diverse streams of knowledge into a cohesive academic document,

analyzing its relevance to modern hepatology and homeopathy.

2. Botany and Phytochemistry of Carica papaya

Carica papaya is a soft-wooded perennial herbaceous tree belonging to the family Caricaceae. Native to Central America, it is cultivated globally in tropical and subtropical regions.

2.2 Phytochemical Profile

Phytochemicals vary by plant part (leaf, seed, latex, fruit), enabling diverse therapeutic actions.

Compound Class	Examples	Therapeutic Relevance
Flavonoids	Quercetin, kaempferol	Antioxidant, anti-inflammatory, anti-fibrotic
Phenolics	Caffeic acid, ferulic acid	Free radical scavenging
Alkaloids	Carpaine	Cardio-metabolic modulation
Carotenoids	β -carotene, lycopene	Cytoprotection
Terpenoids & Saponins	Various	Anti-inflammatory, membrane stabilization
Vitamins C & E	High concentration in leaves	Antioxidant replenishment

3. Literature Review Summary

To provide a structured overview, key findings from major research studies are summarised below.

Table 1. Summary of Key Literature Related to Carica papaya and Liver Disorders

Author & Year	Study Type	Plant Part	Key Findings	Relevance
Awodele et al., 2016	Animal hepatotoxicity	Leaf & fruit	↓ALT, AST, ALP; ↑antioxidants	Strong hepatoprotection
Shaban et al., 2023	CCl ₄ toxicity	Seed extract	↓NF- κ B, TNF- α , IL-6; ↓fibrosis	Anti-inflammatory, anti-fibrotic
Ajibade et al., 2019	Diabetic liver	Leaf extract	Improved hepatic architecture	Useful for NAFLD/metabolic disease
Wahfar et al., 2021	Anti-TB toxicity	Seed ethanol extract	Restored enzymes	Prevents DILI
Attah et al., 2020	Paracetamol toxicity	Seed extract	↓MDA; ↑SOD	Oxidative stress protection
Norahmad et al., 2019	Dengue model	Leaf juice	↓Inflammatory liver genes	Dengue-associated hepatitis
Charan et al., 2016	Human RCT	Leaf extract	Platelet rise; mild LFT improvement	Indirect hepatic benefit
Rajapakse et al., 2019	Meta-analysis	Mixed	Platelet and recovery benefit	Liver data inconsistent

2.1 Botanical Description

- Height: 2–10 meters
- Stem: Unbranched, soft, hollow
- Leaves: Large, palmate, deeply lobed
- Latex: Present in leaves, stems, fruit
- Flowers: Dioecious or hermaphroditic
- Fruit: Berry containing numerous seeds embedded in mucilage

Author & Year	Study Type	Plant Part	Key Findings	Relevance
Bhatt et al., 2022	Homeopathic clinical	Papaya Q	Platelet improvement	No liver markers reported
Rajpal et al., 2010	Homeopathic proving	Potentised	GI-related symptoms	Liver-digestive relevance
Kong et al., 2021	Review	Whole plant	Identified key bioactives	Mechanistic hepatoprotection

4. Experimental Evidence for Hepatoprotective Activity

Preclinical studies demonstrate convincing hepatoprotective activity across toxicological and pathological models.

4.1 Carbon Tetrachloride and Acetaminophen Models

CCl₄ and paracetamol are standard hepatotoxicity models.

- Awodele et al. (2016) showed that leaf and fruit extracts significantly reduced liver enzymes, restored antioxidant enzymes (SOD, CAT, GSH), and improved liver histology.
- Shaban et al. (2023) showed papaya seed extract reduced oxidative stress, inflammation, fibrosis (TGF-β), and apoptosis (p53), indicating multi-mechanistic hepatoprotection.

4.2 Drug-Induced Liver Injury (DILI)

Table 2. Selected Experimental and Clinical Studies on Carica papaya Relevant to Liver Health and Homeopathic Practice

S. No.	Study	Model / Population	Preparation & Dose	Findings	Conclusion
1	Awodele et al., 2016	Rats (CCl ₄ & acetaminophen toxicity)	Leaf/fruit extract	↓ALT/AST; ↑GSH	Strong hepatoprotection
2	Shaban et al., 2023	Rats (CCl ₄ injury)	Seed extract	↓TNF-α, NF-κB, IL-6, fibrosis	Anti-inflammatory & therapeutic
3	Ajibade et al., 2019	Diabetic rats	Leaf extract	Improved liver histology	Useful for metabolic disorders
4	Wahfar et al., 2021	DILI (anti-TB drugs)	Seed extract	Restored hepatic biomarkers	Prevents DILI

Anti-tubercular drugs (isoniazid & rifampicin) commonly induce hepatotoxicity.

- Wahfar et al. (2021) showed papaya seed extract restored liver biomarkers, suggesting protective effects against DILI.

Paracetamol toxicity induces oxidative stress:

- Attah et al. (2020) demonstrated papaya seed extract reduced lipid peroxidation and raised SOD levels.

4.3 Metabolic Liver Injury Models

- Ajibade et al. (2019) reported that papaya leaf extract improved liver architecture and biochemical markers in diabetic liver, implying benefits for NAFLD.

5. Expanded Summary: Experimental & Clinical Studies Table

The following table integrates preclinical, clinical, and homeopathic evidence.

S. No.	Study	Model / Population	Preparation & Dose	Findings	Conclusion
5	Attah et al., 2020	Paracetamol toxicity	Seed extract	↓MDA, ↑albumin	Oxidative stress protection
6	Norahmad et al., 2019	Dengue-infected mice	Leaf juice	↓Inflammatory liver genes	Viral hepatitis relevance
7	Charan et al., 2016	Dengue patients	Leaf extract	Platelet improvement	Indirect hepatic benefit
8	Rajapakse et al., 2019	Systematic review	Dengue	Mixed	Supported platelet recovery
9	Bhatt et al., 2022	50 dengue patients	Carica papaya Q	Platelet improvement	No liver outcomes
10	Rajpal et al., 2010	Homeopathic proving	Healthy volunteers	Potentised	GI symptom picture

6. Carica papaya in Dengue and Liver Involvement

Dengue virus often induces hepatocellular injury, with AST/ALT elevations in 60–90% of patients.

Studies show:

6.1 Preclinical (Dengue Animal Models)

- Papaya leaf juice normalises cytokine storm responses (Norahmad et al., 2019).
- Reduced viral load in the liver.

6.2 Human Clinical Trials

- RCTs demonstrate statistically significant platelet increases (Charan et al., 2016).
- Some studies report improvement in liver enzymes, although not consistently measured.

6.3 Relevance to Hepatitis

Although primarily studied for thrombocytopenia, papaya leaf extract may support liver recovery in dengue-associated hepatitis.

7. Homeopathic Perspective

7.1 Indications

Carica papaya Q is used in homeopathy for:

- Enlarged liver and spleen
- Jaundice
- Dyspepsia
- Worm infestation
- Post-infectious debility (Similia India, n.d.)

7.2 Homeopathic Proving

- Rajpal et al. (2010) documented GI, digestive, and constitutional symptoms.

7.3 Posology

- Mother tincture (Q) retains phytochemicals.
- Low potencies (1X, 3X) may mirror herbal pharmacology.
- High potencies (30C) lack biological plausibility for liver protection.

7.4 Clinical Evidence

- Bhatt et al. (2022): Carica papaya Q improved platelets in dengue.
- No homeopathic study has evaluated LFTs or liver fibrosis markers yet.

8. Critical Evaluation

8.1 Strengths

- Strong preclinical consistency
- Multi-pathway hepatoprotection

- Safe short-term use in clinical populations

8.2 Limitations

- Lack of RCTs in chronic liver disease (NAFLD, hepatitis B/C)
- No homeopathic liver-specific clinical trials
- Variability in extract preparation
- Liver outcomes often secondary

9. Conclusion

Carica papaya is a scientifically validated hepatoprotective botanical in preclinical studies. It reduces oxidative stress, inflammation, fibrosis, and viral load in liver tissue. Homeopathic usage (Q, 1X) is plausible due to retained phytochemicals. However, dedicated human trials are necessary. Carica papaya remains a promising adjunct, but not an established primary hepatoprotective therapy.

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