



Papaya Leaf Extract Tablet For Dengue

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Introduction:

Papaya leaf has been traditionally used to treat dengue fever, especially to increase platelet count. The leaf extract has bioactive compounds like flavonoids, alkaloids, and glycosides. These compounds may help increase platelet production, lower inflammation, and balance the immune response.

Papaya is rich in nutrients and is available all year round. For ages, people have used the entire papaya plant, including its leaves, seeds, ripe and unripe fruits, and juice, in traditional medicine. Today, papaya is seen as a nutraceutical fruit because of its many health benefits. Its key medicinal properties include anti-fertility, diuretic, uretonic, anti-hypertensive, hypolipidemic, and anti-helminthic effects. It also promotes wound healing, and has antifungal, antibacterial, anti-tumor, and free radical scavenging activities.

Papaya is a great source of three powerful antioxidants: vitamin C, vitamin A, and vitamin E. It also contains minerals like magnesium and potassium, the B vitamin pantothenic acid, folate, and fiber. Additionally, it has a digestive enzyme called papain that effectively treats trauma, allergies, and sports injuries. All these nutrients together improve the cardiovascular system, protect against heart disease, heart attacks, strokes, and help prevent colon cancer. The fruit is also a rich source of beta-carotene, which protects cells from damage by free radicals, potentially preventing some types of cancer. It is reported to assist in preventing diabetic heart disease, and it cancer. It is reported to assist in preventing diabetic heart disease, and it helps lower high cholesterol levels because it is high in fiber.

Benefits: Papaya leaf extract is known to increase platelet count, reduce the duration of fever, and relieve symptoms linked to dengue fever.

1. **Boosts Platelet Production:** Papaya leaf extract may help stimulate platelet production, which lowers the risk of severe bleeding complications. Studies suggest it can raise platelet counts in dengue patients.
2. **Anti-Inflammatory Properties:** Papaya leaf contains compounds that may reduce inflammation, easing symptoms like joint pain, muscle aches, and swelling.
3. **Immune System Support:** The extract's antioxidants and bioactive compounds can strengthen the immune system, aiding the body's fight against the dengue virus.



4. **Antioxidant Effects:** The high antioxidant content in papaya leaf extract may reduce oxidative stress, helping prevent damage to cells and tissues.

5. **Digestive Support:** Papaya leaf contains papain, an enzyme that aids digestion and can help with digestive issues related to dengue fever.

6. **Natural Fever Reduction:** The cooling properties of papaya leaves may help relieve fever, a common symptom of dengue.

Proposed mechanisms of action:

Research on the compounds found in papaya leaves suggests several ways the extract may help with dengue-related symptoms:

Increased platelet production: Bioactive compounds like carpaine are thought to improve hematopoiesis and thrombopoiesis (the formation of megakaryocytes and platelets). Studies in animal models have shown that papaya leaf extract can increase platelet counts.

Antioxidant effects: The extract has antioxidant and free-radical scavenging properties, which can reduce oxidative stress and cellular damage during a dengue infection.

Membrane stabilization: Studies indicate that papaya leaf extract has membrane-stabilizing properties that could help protect blood cells, including platelets, from damage caused by stress.

Anti-inflammatory and immunomodulatory effects: Compounds like flavonoids and papain may help reduce inflammation and affect the immune response, assisting in managing the "cytokine storm" and immune-related platelet destruction in severe dengue cases.

Inhibition of viral replication: Some in vitro and in silico studies suggest that phenolic compounds in papaya leaf extract, such as flavonoids, can inhibit the dengue virus's replication and disrupt its assembly.

Dengue:

Key facts:

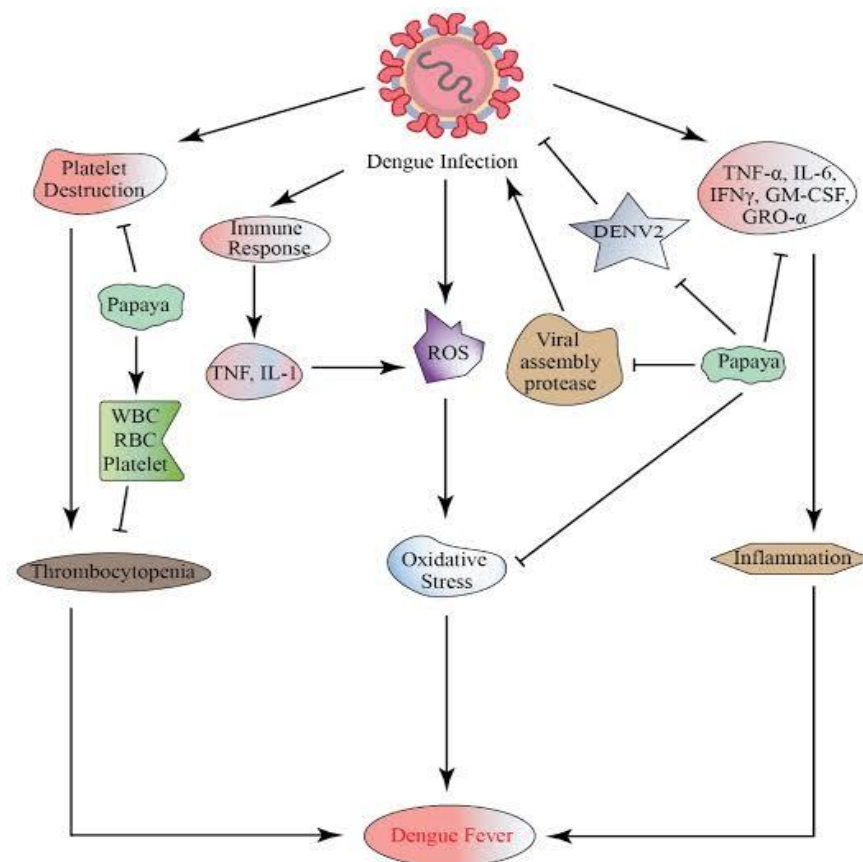
Dengue is a viral infection caused by the dengue virus (DENV), transmitted to humans through the bites of infected mosquitoes.

Currently, about half of the world's population is at risk of dengue, with an estimated 100 to 400 million infections occurring each year.

Dengue is prevalent in tropical and sub-tropical regions worldwide, especially in urban and semi-urban areas.

While many DENV infections are asymptomatic or produce mild illness, some cases can become severe and even fatal.

Preventing dengue relies on controlling mosquito populations. There is no specific treatment for dengue or severe dengue, but early detection and access to proper medical care can significantly reduce fatality rates.



Overview:

Dengue, also known as break-bone fever, is a viral infection spread from mosquitoes to people. It is more common in tropical and subtropical areas than in temperate regions.

Most people who contract dengue do not show symptoms. For those who do, common symptoms include high fever, headache, body aches, nausea, and rash. Most patients improve within 1 to 2 weeks. However, some develop severe dengue and may require hospitalization. You can reduce your risk of dengue by avoiding mosquito bites, especially during the day. Currently, dengue is managed through pain relief since there is no specific treatment available.

Symptoms:

Most people with dengue have mild or no symptoms and will recover in 1 to 2 weeks. In rare cases, dengue can be severe and may lead to death.

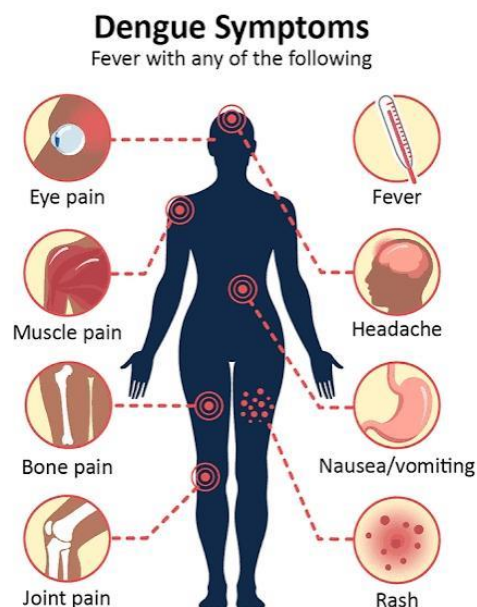
If symptoms do appear, they usually start 4 to 10 days after infection and last for 2 to 7 days. Symptoms can include:

- high fever (40°C/104°F)
- severe headache
- pain behind the eyes
- muscle and joint pain
- nausea
- vomiting
- swollen glands

People who get infected a second time have a higher risk of severe dengue. The symptoms of severe dengue often occur after the fever has ended and may include:

- severe abdominal pain
- persistent vomiting
- rapid breathing
- bleeding gums or nose
- fatigue
- restlessness
- blood in vomit or stool
- extreme thirst
- pale and cold skin
- feeling weak.

Extracting papaya leaf for a tablet involves industrial processes that focus on concentrating and standardizing the leaf's active compounds into a stable, measured dose. This contrasts with simple home preparation methods, like blending fresh leaves into juice.



1. Preparation and cleaning

Fresh, healthy, and mature papaya leaves are selected and washed thoroughly to remove dirt, pesticides, and other contaminants.

Papaya leaf cleaning and primary processing:

Select fresh leaves: Choose young, fresh, dark-green *Carica papaya* leaves from a healthy plant. Avoid yellowed or dried leaves, as their therapeutic potency may decrease.

Sort and inspect: Visually check the fresh leaves to remove any foreign matter, including untargeted plants, insects, animal waste, soil, or stones.

Wash thoroughly: Rinse the leaves under running potable water to eliminate surface dirt, debris, and possible pesticide residues. Use clean hands and sterile equipment to prevent microbial contamination.

Pat dry: Gently pat the leaves dry with a clean cloth or paper towel, or air-dry them in a sterile, shaded environment. Avoid excessive direct sunlight or high heat, as these can degrade the active compounds.

Remove stalks: Cut off tough stalks and stems to reduce bitterness and maximize the concentration of the active leaf material.

Chop or crush: Finely chop the cleaned and dried leaves into smaller pieces. This increases the surface area, aiding in the drying and extraction phases.

2. Drying and pulverization

The cleaned leaves are air-dried at room temperature in the shade to preserve the active compounds, which can be sensitive to heat. Once dried, the leaves are ground into a fine powder using a food processor or pulverizing machine.

Types of Drying:**Freeze-drying:**

This method involves freezing the papaya leaf juice and then removing the moisture by sublimation under a vacuum.

Process: Extract the papaya leaf juice, freeze it, and place it in a vacuum chamber. The vacuum and low temperature cause the water to sublime, resulting in a powdered concentrate.

Pros: This is the best method for preserving heat-sensitive bioactive compounds like carpine and other antioxidants, leading to a product with the highest stability and longest shelf life.

Cons: This method is costly and complex, making it impractical for large-scale production.

Low-temperature vacuum drying:

This method combines low heat and a vacuum to remove moisture, minimizing the degradation of heat-sensitive compounds.

Process: Dry papaya leaves at low temperatures (e.g., 40–50°C) under reduced pressure. The low pressure allows water to boil at lower temperatures, reducing heat exposure.

Pros: This method improves the retention of bioactive compounds compared to traditional hot air drying and is more time-efficient than freeze-drying.

Cons: It can be more expensive and requires specialized equipment compared to conventional oven drying.

Shade drying:

This simple, low-cost traditional method relies on air circulation at room temperature.

Process: Spread washed leaves in a thin layer in a well-ventilated area away from direct sunlight. Turn the leaves periodically to promote even drying.

Pros: This gentle process better preserves carpine and antioxidant activities than hot air drying. It is also the most affordable and low-tech method.

Cons: The drying time is significantly longer than mechanized methods, and the process may be affected by environmental conditions, potentially leading to microbial contamination.

Oven drying:

This conventional method uses a hot air oven to circulate heated air over the leaves.

Process: Place leaves in an oven at a controlled temperature (e.g., 50–70°C). Some studies suggest temperatures as low as 40–50°C improve the retention of biochemical properties.

Pros: This method is faster than shade drying and cost-effective for industrial manufacturing.

Cons: High temperatures can significantly degrade heat-sensitive compounds like carpine and lower antioxidant activity. A study found that oven-dried samples retained significantly less carpine than freeze-dried and shade-dried samples.

3. Extraction:

The most critical step involves using an appropriate solvent to extract key active ingredients.

Aqueous extraction: The powder can be extracted with water through boiling or simmering.

Ethanol extraction: To achieve a higher concentration of certain compounds, soak the leaves in a specific concentration of ethanol, which can later be removed.

Supercritical fluid extraction (SFE): Advanced industrial processes may utilize supercritical carbon dioxide as a solvent for a high-quality, more potent extract.

Extraction Methods:

1. Aqueous extraction: This method involves boiling papaya leaves in water or using cold-water maceration to create a liquid extract. It is straightforward but less efficient in isolating specific compounds. Wash, chop, and boil the raw leaves until the water reduces by half. For tablet production, filter the resulting liquid and dry it into a concentrated form.

2. Maceration: This technique involves soaking dried, powdered papaya leaves in a solvent for a set time, often with agitation. Ethanol and methanol are common solvents, and the concentration can vary (e.g., 70% or 96% ethanol). This method typically yields more bioactive compounds than water-based techniques.

3. Ultrasound-assisted extraction (UAE): UAE uses ultrasonic waves to create bubbles that break down plant cell walls, releasing active compounds into the solvent. This can lead to higher yields and faster extraction times compared to traditional maceration.

4. Supercritical fluid extraction (SFE): This advanced technique employs a supercritical fluid, such as carbon dioxide, as the solvent. SFE efficiently isolates specific compounds, especially volatile and heat-sensitive ones, leaving no toxic solvent residues in the final product.

5. Bioactive compounds extracted: The goal of these extraction techniques is to isolate the phytochemicals believed to offer therapeutic benefits for dengue. These include:

- Alkaloids, including carpine: Carpine may help regulate blood pressure and normalize rapid heart rates.
- Flavonoids: Compounds like quercetin and kaempferol are antioxidants that may inhibit viral replication and stabilize cell membranes.
- Phenolic compounds: These compounds have antioxidant and anti-inflammatory properties.
- Papain and chymopapain: These enzymes aid digestion and may reverse immune-mediated platelet destruction in some studies.

4. Concentration and isolation

After extracting the active compounds into the solvent, filter the liquid to separate the solid plant matter. Evaporate the solvent under vacuum to concentrate the extract into a paste or highly concentrated liquid. This paste often undergoes further refinement to isolate and concentrate the most beneficial compounds, such as certain flavonoids (e.g., quercetin and kaempferol) and alkaloids (carpaine).

5. Formulation into tablets

The final concentrated extract is blended with excipients, which are inactive substances used to create the tablet. This process includes several steps:

Drying: The extract may be further dried to achieve a specific moisture content.

Mixing: The dried extract is combined with binders (to hold the tablet together), fillers (to add bulk), and lubricants (to prevent sticking to the machinery).

Compacting: Press the blended powder mixture into a solid, circular form using a tablet press.

Coating : The tablets may be coated to mask the bitter taste and protect the active ingredients.

Quality control: Test the final tablets to ensure they contain the correct amount of active ingredient and meet safety and quality standards.