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Critical review on pharmacological properties of Erandakarkati (Carica papaya)

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ABSTRACT:

Erandakarkati, commonly known as papaya, is an evergreen plant native to tropical and subtropical regions. It has been used for therapeutic purposes since ancient times. This critical review explores the phytochemical constituents and pharmacological properties of various parts of the papaya plant. The leaves resemble castor oil leaves, and the fruit resembles a cucumber. Papaya is abundant in digestive enzymes, aiding absorption and assimilation of food. Rich in vitamins (B complex, A, and C) and minerals (sodium and potassium), it offers various health benefits. Ayurvedically, papaya balances pitta dosha, promotes liver function, and supports pancreatic health. The fruit, leaves, seeds, bark, and latex play essential roles in disease management. Active components such as alkaloids, glycosides, tannins, saponins, and flavonoids contribute to its therapeutic activity. Papaya exhibits anti-inflammatory, antimicrobial, antioxidant, anti-cancer, and anti-diabetic properties. Notably, papaya leaf juice increases platelet counts in dengue fever patients. This comprehensive overview highlights the multifaceted potential of Carica papaya in traditional and modern medicine.

Key words: Erandakarkati, Carica papaya

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Introduction:

Erandakarkati (Carica papaya)[1]

Family: Passifloraceae

Latin Name: Carica (erroneously thought to have come from "carica" - karikos, a province in Asia minor); papaya = "popai," Papaw.

Sanskrit Names: Erandakarkati, Talapatri, Chhatrapatra, Saptangulpaha, Ashakhaviksha, Dugdha, Pachani, Mansapachani.

Botanical Description:[2] Papaya originally from South America and Brazil. Papaya, scientifically known as Carica papaya, is a tropical fruit-bearing tree with distinct features. It reaches a height of 7 to 8 meters and lacks branches. The palm-like trunk is not as woody as typical trees. The crown consists of deeply lobed leaves, sometimes 60 cm across, borne on hollow petioles (leaf stalks) 60 cm long. Papaya is normally dioecious, with male and female flowers on separate plants. Male flowers are funnel-shaped and whitish, while female flowers are larger and have five fleshy petals. The fruit is commonly spherical to cylindrical, 75 to 500 mm in length, and sometimes weighs as much as 9 to 11.5 kg. The juicy flesh is deep yellow or orange to salmon-colored, and numerous round, wrinkled black seeds line the central cavity. Unripe fruit contains a milky juice with the protein-digesting enzyme papain. Papaya's unique characteristics make it valuable in both traditional medicine and modern pharmacology.

A. Properties of Raw Papaya (Carica papaya):[3,4]

Guna (Qualities): Laghu (light), Ruksha (dry), Tikshna (sharp).

Rasa (Taste): Katu (pungent), Tikta (bitter).

Vipak (Post-digestive taste): Katu (punget).

Veerya (Potency): Ushna (hot).

Dosha Affinity: Ripe papaya: Pittashamak (balances pitta). Raw papaya: Vata-kaphashamak (balances vata and kapha).

2. Uses: **Latex**: Used locally for throat disorders, glossitis, skin diseases, and glandular enlargements. Applied to scorpion bites.

Leaves:Tied over affected areas in vata disorders. Paste applied in filaria.

Seeds: Useful in paralysis and facial palsy. Deworming agent.

Digestive Property: One part of latex can digest meat 250 times its weight. Dried latex digests half a liter of milk easily.

Cardiovascular Effects: Carpine present in the leaves reduces heart rate and increases relaxation period.

Respiratory and Expectorant Use: Used in cough and asthma.

Urinary Disorders: Hot infusion of leaves for dysuria.

Female Health: Used in amenorrhea and dysmenorrhea.

3. Caution: Raw papaya can cause abortions. Pregnant women should avoid raw papaya due to the risk of abortion.

4. Dosage: Powder 3-5 gms., Juice 20-50 ml., Fruit-edible.

5. Srotogamitva (Targeted Systems):

Dosha: Raw papaya balances vata and kapha; ripe fruit balances pitta.

Dhatu (Tissue): Useful for amenorrhea and dysmenorrhea (rasa).

Mala (Excreta): Hot infusion for dysuria (mutra), latex for worms (purisha).

Special Note: Pregnant women should avoid raw papaya to prevent the possibility of abortion. Locally applied latex is effective for scorpion bites.

Table no. 1 Medicinal Properties of Various Parts of Carica Papaya[5,6]

Sr no.	Various plant parts	Medicinal Use

1.	**Ripe fruits**	carminative, diuretic, expectorant, sedative, preventive action against dysentery, skin diseases, psoriasis, and ringworm.
2.	**Unripe fruits**	Laxative, ulcers, and impotence, reduce enlarged spleen and liver and it is used in snakebite to remove poison.
3.	**Seeds**	NephroProtective Activity, antibacterial properties, anthelmintic and anti-amoebic
4.	**Roots**	Antifungal activity, diuretic, piles, diuretic
5.	**Leaves**	Dengue fever, Cancer Cell Growth Inhibition, Antimalarial, and Antiplasmodial Activity, Facilitate Digestion, Antibacterial activity, relieve nausea, Meat tenderizer
6.	**Flowers**	Febrifuge, jaundice, pectoral properties, emmenagogue
7.	**Stem bark**	Antifungal activity, jaundice, sore teeth, anti-hemolytic activity

B. Karma (Actions) of Erandakarkati (Carica papaya) in Ayurveda [7]

1. **Pachana (Digestive)**: Papaya aids digestion due to its enzymatic properties, especially papain. It helps break down proteins and fats, promoting efficient digestion.
2. **Vatanulomana** : Papaya balances vata dosha, making it useful in conditions related to excess vata and remove constipation
3. **Yakrduttejaka (Liver Stimulant)**: Papaya supports liver function, enhancing detoxification and metabolism.
4. **Krimighana (Anthelmintic)**: Papaya seeds possess anthelmintic properties, effectively expelling intestinal worms.
5. **Shothahara (Anti-inflammatory)**: Papaya's anti-inflammatory action helps reduce swelling and inflammation.
6. **Raktashodhaka (Blood Purifier)**:Papaya promotes blood purification, aiding in skin health and overall detoxification.
7. **Kaphanihsaraka** It balances kapha dosha, reducing excess mucus and congestion.
8. **Mutrala (Diuretic)**: Papaya increases urine production, supporting kidney function.
9. **Artavajanana (Menstrual Regulator)**: Papaya has an influence on the female reproductive system, regulating menstrual cycles.
10. **Stanyajanana (Galactagogue)**: Papaya supports lactation in nursing mothers.
11. **Svedajanana (Diaphoretic)**: It induces sweating, aiding in fever management.
12. **Kusthaghna (Anti-skin Disorders)**:Papaya's properties benefit skin health, especially in skin disorders.
13. **Jvaraghna (Anti-febrile)**: It helps reduce fever and associated symptoms.
14. **Balya (Strength Promoter)**: It enhances overall strength and vitality.
15. **Vedanasthapana (Analgesic)**: Papaya provides relief from pain and discomfort.

Discussion

Pharmacological Activities of Carica Papaya

Antimicrobial Activity: [8]Papaya leaves and seeds exhibit antimicrobial properties against various pathogenic bacteria. Extracts from papaya roots and leaves show bacteriostatic activity, with greater effectiveness against gram-positive bacteria. Extracts from different parts of papaya demonstrate high antibacterial potential compared to conventional medications. Unripe endocarp acetone extracts exhibit efficient antibacterial activity against both gram-positive and gram-negative bacteria.

Antifungal Activity: [9]Ethanol extracts from papaya leaves and seeds demonstrate antifungal efficacy against phytopathogenic fungi. Papaya latex sap exhibits antifungal action against Candida albicans.

Anti-inflammatory Activity: [10]Ethanolic extracts from papaya leaves show significant reduction in paw edema in rats.Papaya seeds exhibit anti-inflammatory effects in experimental models. Phytochemicals present in papaya are linked to anti-inflammatory properties.

Antidiabetic Activity:[11] Chloroform extract from papaya leaves significantly reduces serum glucose levels in diabetic rats.Ethanolic leaf extracts normalize hyperglycemic levels in diabetic mice and improve various biochemical parameters, suggesting potential benefits in managing diabetes and its complication.

Antioxidant Activity:[12] Methanolic extract of C. papaya leaves exhibits antioxidant activity by scavenging DPPH radicals, with the concentration of free radicals being directly proportional to the extract's concentration. Aqueous extract of C. papaya seeds acts as an antioxidant, protecting human skin fibroblasts from hydrogen peroxide-induced oxidative damage.

Analgesic Activity:[13] Various extracts from C. papaya leaves demonstrate significant analgesic effects in mouse models, with ethanol extract showing the highest efficacy comparable to aspirin.

Wound Healing Activity:[14] Aqueous extract of C. papaya fruit promotes wound healing in diabetic rats, significantly reducing wound area compared to control. Papaya latex in Carbopol gel is effective in treating burns and promoting wound healing.

Antimalarial Activity:[15] Extracts from the rind of raw papaya fruit and seeds of S. macrophylla exhibit antimalarial properties against Plasmodium falciparum and other strains, suggesting potential for commercial antimalarial use.

Anthelmintic Activity:[16] Papaya seeds and latex demonstrate anthelmintic effects against parasitic nematodes and gastrointestinal worms, suggesting their use in traditional medicine for treating helminth infections.

Anti-sickling Activity:[17] Extracts from unripe papaya fruit and leaves exhibit anti-sickling properties, potentially beneficial for managing sickle cell disease by inhibiting sickle hemoglobin polymerization and protecting erythrocytes from osmotic stress-induced hemolysis.

Antiplasmodial Activity:[18] Carica papaya leaf extracts exhibit significant antiplasmodial efficacy with low cytotoxicity, potentially attributed to alkaloids like carpaine. In vitro studies demonstrate the effectiveness of papaya leaf extracts against various parasites, including Plasmodium berghei, suggesting a potential role in malaria treatment. The presence of compounds like flavonoids, alkaloids, and terpenoids in papaya extracts may contribute to their antiplasmodial effects.

Anticancer Activity:[19] Papaya contains enzymes like papain, which may aid in cancer treatment by breaking down tumor cells. Compounds like lycopene and isothiocyanate found in papaya possess anticancer properties, potentially inhibiting the progression of malignant cells. Papaya leaf extracts have shown promise in

slowing the progression of cancer cells and reducing key biochemical markers associated with malignancy. Various extracts from papaya aerial parts demonstrate anticancer effects against melanoma, renal, and breast cancer cells, with specific efficacy observed in breast cancer. Extracts from papaya seeds, particularly from ripe papaya, show potential in reducing prostate cancer cell proliferation.

Hepatoprotective Activity:[20] Ethanol and aqueous extracts of papaya fruit exhibit hepatoprotective properties against carbon tetrachloride-induced liver damage in rats. These extracts reduce liver damage as evidenced by biochemical markers and histological evaluations, though the exact mechanism and active ingredients remain unclear.

Anti-fertility Activity:[21] Ethyl acetate extract of papaya seeds shows anti-fertility effects on white rat spermatozoa, affecting motility, viability, and abnormalities. Histological studies reveal negative impacts on male rat gonads at high doses of papaya seed extract, including degeneration of germinal epithelium and Leydig cells.Crude extract of papaya bark induces complete loss of fertility in rats, attributed to decreased sperm motility and morphology, suggesting potential as a contraceptive agent.

Anti-ulcer Activity:[22] Aqueous seed extract of C. papaya reduces stomach acidity and shows potential in treating alcohol-induced acute stomach injury and oxidative stress. Ethanolic extract of papaya leaves demonstrates effectiveness against ulcers in rats. Aqueous and methanol extracts of unripe papaya fruit exhibit antiulcer potential, with the aqueous extract showing efficacy against ethanol-induced stomach ulcers. Papaya seed oil contains benzyl isothiocyanate and papain, which possess potent antiulcer properties.

Anti-dengue Activity:[23] Chloroform, methanol, and aqueous extracts of C. papaya latex demonstrate dose-dependent effectiveness against larvae of C. quinquefasciatus and Aedes aegypti mosquitoes. Clinical trials suggest that C. papaya leaf extracts increase platelet counts in patients with dengue fever, potentially through the activation of platelet-forming genes.

Antiprotozoan Activity:[24] Petroleum ether extract of papaya seeds exhibits activity against the ciliate protozoan Ichthyophthirius multifiliis, reducing parasite populations in infected fish both in vivo and in vitro. Papaya plant extracts may have antiprotozoal activity, showing promise in controlling parasites effectively.

Molluscicidal Activity:[25] Papain, present in various parts of the C. papaya tree, demonstrates toxicity against freshwater snails like Lymnaea acuminate, which serve as intermediate hosts for parasitic diseases like fasciolosis and schistosomiasis. Latex from unripe papaya fruit skin contains higher concentrations of papain, contributing to its molluscicidal activity.

Anti-diarrheal Responses:[26] Chloroform extract of raw papaya and acetone extract of ripe papaya exhibit antidiarrheal activity against gut pathogens. DAS77, an herbal mixture containing dried papaya root, shows promise in treating diarrhea, while aqueous extract of papaya leaf demonstrates good antidiarrheal action in rats.

Conclusion

Ayurveda recognizes papaya as a "Sattvic" fruit, symbolizing purity, clarity, and vitality upon consumption. Papaya's diverse pharmacological activities highlight its substantial potential as a valuable medicinal plant. Ranging from antioxidant properties to anti-ulcer, anti-dengue, and antiprotozoan activities, papaya demonstrates a broad spectrum of benefits. Its role in anticancer, hepatoprotective, and anti-diarrheal responses underscores its versatility in addressing various health concerns. The antiplasmodial efficacy of papaya leaf extracts, particularly against malaria parasites, suggests a promising avenue for further research and

therapeutic development. Additionally, its anti-inflammatory and analgesic properties contribute to effective pain management and inflammation reduction. Furthermore, papaya's potential in reducing symptoms of sickle cell disease and its anti-fertility effects warrant careful consideration and further investigation. Its anti-ulcer activity and ability to promote wound healing highlight its potential for gastrointestinal health and tissue repair. Moreover, papaya's anti-dengue, antiprotozoan, and molluscicidal activities underscore its effectiveness against vector-borne diseases and parasitic infections, while its anti-diarrheal responses emphasize its utility in gastrointestinal disorder management and digestive health promotion. Overall, Carica papaya's multifaceted pharmacological activities underscore its significance as a natural remedy with diverse therapeutic potential.

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