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"A comprehensive study on *Mangifera indica* plant"

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Abstract:

Mangifera indica is a commonly used herb in Ayurvedic medicine. *Mangifera indica L.* belongs to the family of Anacardiaceous. Countries under tropical and subtropical zones are the top mango-producing countries. Leaves extracts of the mango plant have been studied for various health benefits, which are attributed to the excessive number of phytochemicals such as mangiferin, followed by benzophenones, phenolic acids, and other antioxidants such as flavonoids, ascorbic acid, carotenoids, and tocopherols. Its various pharmacological activities have been studied such as anti-cancer, anti-diabetic, anti-oxidant, anti-microbial, anti-obesity, lipid-lowering, hepato-protection, and anti-diarrheal. Various parts of the plant are used as a dentifrice, astringent, antiseptic, diaphoretic, stomachic, vermifuge, laxative, and diuretic and to treat diarrhea, dysentery, anemia, tonic, asthma, bronchitis, cough, hypertension, insomnia, rheumatism, leucorrhoea, hemorrhage, toothache, and piles. All parts are used to treat abscesses, broken, miscarriages, anthrax, blisters, wounds in the mouth, tympanitis, colic, diarrhea, glossitis, indigestion, bacillus's, bloody dysentery, liver, disorder, excessive urination, tetanus and asthma.

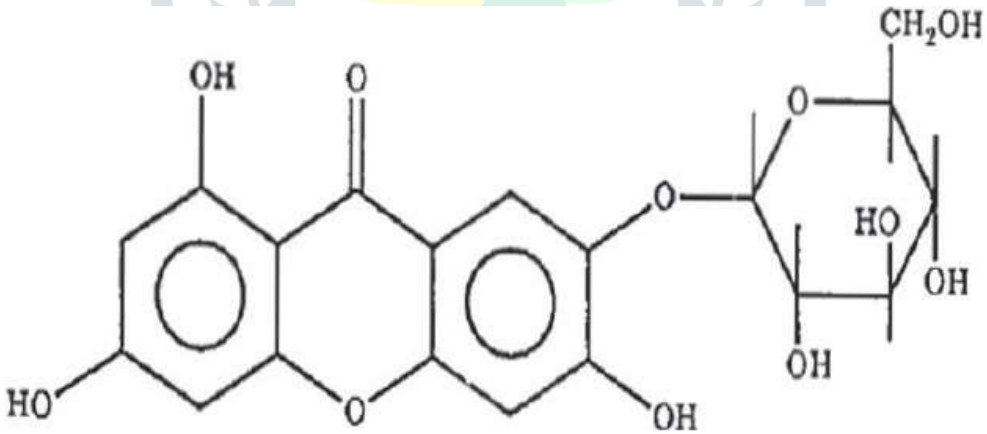
Synonyms:

- Hindi: Aam
- Sanskrit: Ambram
- Kannada: Mavu
- Tamil: Mankani
- Malayalam: Maambazham
- Kashmiri: Amb
- Bengali: Ama
- English: Mango
- Panjabi: Amb
- Gujarati: Ambo




Phytochemicals:

One of the most important phytochemicals of *Mangifera indica* is Mangiferin. It is a xanthone glycoside and its major bioactive constituents such as isomangiferin, tannins & gallic acid derivatives. The bark also contains phytochemicals such as protocatechuic acid, alanine, catechin, glycine, shikimic acid, kainic acid, etc. [1]



Structure of Mangiferin

Indicoside A and B, mangoleanone, manghopanal, friedelin, cycloartan-3β-30-diol and derivatives, mang sterol, mangocoumarin, manglupenone, n-metacone, n-triacontane, n-heneicosane and mangiferolic acid methyl ester and others isolated from stem bark of MI. [2] Mangostin, 29-hydroxy mangiferonic acid, and mangiferin have been isolated from the stem bark together with common flavonoids.[3]

Mango roots are also reported to contain the chromones, 3-hydroxy-2-(4'-methylbenzoyl)-chromone and 3-methoxy-2-(4'-methyl benzoyl)-chromone. The leaf and flower also yield some essential oils containing humulene, elements, ocimene, nerol, linalool, and many others. The fruit pulp contains vitamins A and C, xanthophylls, and β-carotene.[4]

Phenolic Antioxidants, Free Sugars, and Polyols were isolated and analyzed from Mango (MI) Stem Bark. All the structures were elucidated by NMR spectroscopic methods. Quantitative analysis of the compounds has been performed by HPLC, and mangiferin was found to be the predominant component.[5]

Pharmacology:

Although many pharmacological investigations have been carried out based on the ingredients present, a lot more have to be explored, exploited, and utilized.

Anti-oxidant:

Reactive oxygen species (ROS) possess very strong oxidizing effects and induce damage to biological molecules such as proteins, lipids, and DNA, with naturally occurring changes in their structure and function.[6] The major nutritional antioxidants, vitamin C, vitamin E, and β-carotene, may help prevent several chronic disorders [7] considerable interest has arisen in the possible reinforcement of antioxidant defenses, both for chemoprevention and treatment purposes.[8] The extract showed a powerful scavenging activity of hydroxy radicals and acted as a chelator of Fe^{2+}. It also shows a significant inhibitory effect on the peroxidation of rat brain phospholipids and also prevents DNA damage caused by bleomycin or copper-phenanthroline systems.[9]

Anti-diabetic:

The 50% ethanolic leaf extract of MI shows a significant hypoglycemic effect at a dose of 250 mg/kg, both in normal and streptozotocin-induced diabetic animals. It causes stimulation of β-cells to release insulin which was thought to be part of the mechanism of action.[10] The effect of the aqueous leaf extract of MI on blood glucose levels is normoglycemic, glucose-induced hyperglycaemic, and streptozotocin (STZ)-induced diabetic rats has been assessed. The result indicates that the aqueous leaf extract of MI possesses hypoglycaemic activity. This action may be due to an intestinal reduction of the absorption of glucose.[11] The leaves of MI were used for antidiabetic properties using normoglycemic, glucose-induced hyperglycemia, and streptozotocin (STZ) induced diabetic mice. The aqueous extract of the leaf of MI possesses hypoglycaemic activity.[12] The aqueous extract of stem bark of MI was used to examine the analgesic, anti-inflammatory, and antidiabetic properties. The different chemical constituents of the plant, especially the polyphenolics, triterpenoids, flavonoids, mangiferin, and other chemical compounds present in the plant may be involved in the observed anti-inflammatory, analgesic, and hypoglycaemic effects of the plant's extract.[12] The result of these experimental animal studies leads to pharmacological credence to the suggested folkloric uses of the plant in the management and control of painful, arthritic, and other inflammatory conditions, as well as in the management of adult-onset type 2 diabetes mellitus in some rural African communities.[13]

Antiviral activity:

In vitro, the effect of mangiferin was studied against *Herpes simplex* virus type 2; mangiferin, which does not directly inactivate HSV-2 but also inhibits the late event in HSV-2 replication.[14] *In vitro,* mangiferin was also able to inhibit HSV-1 virus replication within the cells[15] and to antagonize the cytopathic effects of HIV.[16]

Anti-allergenic and Anthelmintic activity:

Anthelminthic and antiallergic activities of *Mangifera indica* stem bark components Vimang and mangiferin were investigated in mice experimentally infected with nematodes, *Trichinella spiralis*.[17] The study was carried out to find out the anti-allergic properties of vimana and mangiferin, a C-glucosylxanthone isolated from the extract of MI. The results constitute the anti-allergic properties of Vimang on allergic models, as well as suggesting that these natural extracts could be successfully used in the treatments of allergic disorders. Mangiferin, the major compound of Vimang, mainly contributes to the anti-allergic effects of the extract.[18]

Anti-diarrhoeal:

The potential of anti-diarrhoeal activity of methanolic (MMI) and aqueous (AMI) extracts of seeds of MI has been evaluated in experimental diarrhea, inducing castor oil and magnesium sulfate in mice. The results illustrate that the extracts of MI have significant anti-diarrhoeal activity and part of the activity of MMI may be attributed to its effect on intestinal transit.[19]

Anti-bacterial and antifungal activity:

In this *in vitro* agar diffusion technique, mangiferin shows activity against 7 bacterial species, *Bacillus pumilus, B. cereus, Staphylococcus aureus, S. citrus, Escherichia coli, Salmonella agona, Klebsiella pneumoniae,* 4 fungi (*Thermoascus aurantiacus, Trichoderma reesei, Aspergillus flavus* and *A. fumigatus*) and 1 yeast (*Saccharomyces cerevisiae*).[20]

Hepatoprotective:

Chemopreventive properties of lupeol and mango pulp extract (MPE) were evaluated against 7, 12-dimethylbenz (a) anthracene (DMBA) induced alteration in the liver of Swiss albino mice. Lupeol/MPE was found to be effective in combating oxidative stress-induced cellular injury of mouse liver by modulating cell growth regulators.[21]

Anti-inflammatory:

A 95% ethanolic seed extract of MI exhibited significant anti-inflammatory activity in acute, subacute, and chronic cases of inflammation. The MI leaf extract also exhibited antibacterial activity against Staphylococcus albus, Bacillus subtilis, and Vibrio cholerae.[22] Analgesic and anti-inflammatory effects of MI extract have been studied. The polyphenols found in the extract, account for the activity reported [23] *In vivo* and *in vitro* anti-inflammatory activity of MI extracts was also investigated. The result was found an important contribution to elucidating the mechanism involved in the anti-inflammatory effects of MI extract.[24]

Conclusion:

The extensive literature survey revealed that MI is an important source of many pharmacologically and medicinally important chemicals such as mangiferin, mangiferonic acid, hydroxy mangiferin, polyphenols, and carotenes. Many different pharmacological activities, antioxidant, immunomodulatory, anti-allergic, radioprotective, anti-inflammatory, antitumor, antidiabetic, lipolytic, anti-bone resorption, monoamine oxidase-inhibiting, antimicrobial and antiparasitic, have been reported for mangiferin. All these studies indicate that a wide part of activities acknowledged to preparation based on MI bark could be attributed to this C-glucosyl-xanthone (mangiferin). Based on the knowledge of the many properties of mangiferin, phytomedicines should be adequately standardized regarding this active compound. MI has successfully been used in Ayurvedic medicine for centuries, more clinical trials should be conducted to support its therapeutic use.

Summary:

Mangifera indica (MI), also known as mango, aam, has been an important herb in the Ayurvedic and indigenous medical systems for over 4000 years. Mangoes belong to the genus *Mangifera* which consists of about 30 species of tropical fruiting trees in the flowering plant family Anacardiaceous. According to Ayurveda, varied medicinal properties are attributed to different parts of the mango tree. Mango possesses various pharmacological properties like antidiabetic, anti-oxidant, anti-viral, cardiotonic, hypotensive, and anti-inflammatory. Various effects like antibacterial, anti-fungal, anthelmintic, anti-parasitic, anti-tumor, anti-HIV, anti-bone resorption, antispasmodic, antipyretic, antidiarrhoeal, antiallergic, immunomodulation, anti-microbial, hypolipidemic, hepatoprotective, gastroprotective which has also been studied. Pharmacologically and medicinally important chemicals such as mangiferin, being a polyphenolic antioxidant and a glucosyl xanthone, have strong antioxidant, anti-lipid peroxidation, immunomodulation, cardiotonic, hypotensive, wound healing, antidegenerative and antidiabetic activities.

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