**A Review article on Mangifera indica**

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**Abstract:**

The review article comprises of the various aspects of *Mangifera indica* known as the “King of Fruits”. It is a traditional drug growing as a canopy spreading wide in an area being used since ages and has wide range of pharmacological activities including antioxidant, antilipid peroxidant, immunomodulator, cardiotonic, hypotensive, wound healing, antidegenerative and antidiabetic activities.

**Keywords:** Evergreen tree, cardiotonic, hypotensive, wound healing, antioxidant.

1. **INTRODUCTION:**

*Mangifera indica* (MI), also known as mango, aam, it has been an important herb in the Ayurvedic and indigenous medical systems for over 4000 years.

Mangoes belong to genus *Mangifera* which consists of about 30 species of tropical fruiting trees in the flowering plant family Anacardiaceae.

"**HISTORICAL REFERENCES:**

Mango (*Mangifera indica*) trees are mentioned more than once in the Ramayana - in the Kishkindha Kanda Sarga 1 of the Ramayana, as located on the banks of the Pampa lake; in the Aranya Kanda Sarga 15 as present
in the Panchavati; and, in the Aranya Kanda Sarga 73 as growing near the Matanga hermitage.

This species is also mentioned in the nusasana parva of the Mahabharata as located in King Kusika's country. This fruit is believed to have been tasted by Alexander (3rd century BCE) and Chinese pilgrim, Hieun Tsang (7th century CE). It is mentioned in the songs of 4th century CE Sanskrit poet, Kalidasa; and, in the 16th century Mughal Emperor, Akbar is known to have planted 100,000 mango trees in Darbhanga, Bihar at a place now known as Lakhi Bagh. Similarly, the Marathas and the Gonds planted mangoes and other useful trees along their marching routes and halting places, some of which are still surviving.

**SYMBOLOGY:**

In Hinduism, the perfectly ripe mango is often held by Lord Ganesha as a symbol of attainment, representing the potential perfection of devotees. It is also said to be a form of Prajapati, an epithet, which in the vedas, was originally applied to Savitri, Soma, Tvashtri, Hiranya-garbha, Indra, and Agni, but afterwards the name of a separate god presiding over procreation. The tree provides one of the pancha-pallava or aggregate of five sprigs used in Hindu ceremonial, and its flowers are used in Shiva worship on the Shivaratri. Mango blossoms are used in the worship of Goddess Saraswati. Mango leaves are used to decorate archways and doors in Indian houses and during weddings and celebrations like Ganesh
Mango motifs are widely used in different Indian embroidery styles and are found in Kashmiri shawls, Kanchipuram silk sarees etc.

**GEOGRAPHICAL DISTRIBUTION:**

*Mangifera indica* is among the most economically and culturally important tropical fruits, especially in Asia. It was originally found in the foothills of the Himalayas in northeastern India, Burma, and Bangladesh and domesticated thousands of years ago (possibly independently in Southeast Asia). It is now grown in most tropical countries and some subtropical ones (it is grown as far north as 35° to 37° N in southern Spain).

Many cultivars in India have been vegetatively propagated for hundreds of years. Early on, hundreds of years ago, mango was brought to Malaysia and other East Asian countries, then to East and West Africa, and finally to the New World.

The Portugese introduced the mango to Brazil from their colonies in Mozambique and Angola and mangoes were introduced to Mexico and Panama via the Philippines. Mangoes were introduced to the West Indies in the mid-to late 1700s, probably via Brazil. In the tropics, mangoes grow at elevation up to 1200 m.
India has long been a major mango producer, but as of 2009 China had risen to become the world's second largest mango producer, with India's production representing less than half the world total.

Fresh mangoes are now available in stores year-round in North America, Europe, and Japan. According to Evans and Mendoza, the majority of the mangoes imported by North America come from Mexico, Brazil, Peru, Ecuador, and Haiti.

India and Pakistan are the main suppliers of western Asia. Southeast Asia is supplied mainly by the Philippines and Thailand. Europe imports mangoes mainly from South America and Asia. India and Mexico each account for roughly a fifth to a quarter of world mango exports. World mango imports more than doubled between 1996 and 2005, with the United States accounting for a third of all mango imports.

The peel of the fruit and other parts of the mango can cause contact dermatitis in some people, as is the case for many species in the plant family Anacardiaceae.

**HABITAT:**

It is native tropical Asia and has been cultivated in the Indian subcontinent for over 4000 years and is now found naturalized in most tropical countries.

**TAXONOMICAL CLASSIFICATION:**
SYNONYMS:

Sanskrit: Ambrak; Madhuulii; Madhuula; Madhuulaka;

English: Mango; Hindi: Aam; French: mangot; mangue; manguier;

Portuguese: manga; mangueira;

Dutch: Manja;

Tamil: Ambiram; Mambazham; Mambalam; Mangai;

Punjabi: Amb; Wawashi; Gujarati: Ambo, Keri; Marvo (unripe);

Kashmiri: Amb; Malayalam: Amram; Choothaphalam; Manga;

Manpalam; Mavu; Marathi: Amchur; Amba

MORPHOLOGY:
The trees may reach 40 m or more in height and live for several hundred years. They bear rosette of evergreen leaves (red or yellow at first) and dense panicles up to 30 cm long of small (5 to 10 mm) reddish or yellowish flowers. In deep soil, the tap root descends to a depth of 20 ft (6 in), the profuse, wide-spreading, feeder root system also sends down many anchor roots which penetrate for several feet. Trunk stout, 90 cm in diameter; bark brown, with many thin fissures; thick, becoming darker, rough and scaly or furrowed; branchlets rather stout, pale green and hairless. Inner bark light brown and bitter. A whitish latex exudes from cut twigs and a resin from cuts in the trunk.

The fruits, which range from 2.5 cm to more than 30 cm in length, depending on the cultivar, vary in shape (from round to oval, egg-shaped, or kidney-shaped) and color (green, yellow, red, purple) with a dotted skin. Single mature mango tree can produce 2000 to 2500 ripe fruits

**petiole:** 2-6 cm, grooved apically, inflated basally  
**Leaf blade**  Oblong to oblong-lanceolate, 12-30 × 3.5-6.5 cm, alternate, leathery, deep green adaxially, light green abaxially, glabrous on both sides, base cuneate to obtuse, margin entire, undulate, apex acute to long acuminate, lateral veins 20-25 pairs, midrib prominent on both sides, reticulate venation obscure. 
The leaves are spirally arranged on branches, linear-oblong, lanceolate, elliptical, pointed at both ends, the leaf blades mostly about 25-cm long and 8-cm wide, sometimes much larger, reddish and thinly flaccid
when first formed and release an aromatic odour when crushed. Leaves are alternate, simple, leathery, oblong-lanceolate, 16-30 x 3-7 cm, on flowering branches, up to 50 cm on sterile branches, curved upward from the midrib and sometimes with edges a little wavy. Young leaves red, aging to shiny dark green above, lighter below, with pale and conspicuous midrib, yellow or white venation; petioles 4.5 cm long, striate and swollen at the base. Full-grown leaves may be 4 to 12.5 in (10-32 cm) long and 3/4 to 2 1/8 in (2-5.4 cm) wide. The inflorescence occurs in panicles consisting of about 3000 tiny whitish-red or yellowish – green flowers.

The fruit is a well known large drupe, but shows a great variation in shape and size.

It contains a thick yellow pulp, single seed and thick yellowish – red skin when ripe.

The seed is solitary, ovoid or oblong, encased in a hard, compressed fibrous endocarp.

Inflorescence: 16 cm or more in length, a much-branched panicle bearing many very small (4 mm) greenish-white or pinkish flowers.

Flowers:

Hundreds and even as many as 3,000 to 4,000 small, yellowish or reddish flowers, 25% to 98% male, the rest hermaphroditic, are borne in profuse, showy, erect, pyramidal, branched clusters 2 1/2 to 15 1/2 in (6-40 cm)
high, radially symmetrical, usually have 5 spreading petals, 3-5 mm long, 1-1.5 mm broad, streaked with red, imbricate, with the median petal prolonged like a crest at the base, finely hairy and fragrant, partly male and partly bisexual; stalk short; 5 stamens, 1 fertile, the other 4 shorter and sterile, borne in a disc, paniculate, terminal, 20-35 cm, glabrous to tomentose-pilose; bracts ca. 1.5 mm, lanceolate, pubescent, pedicel: 1.5-3 mm, articulate, sepals are ovate-lanceolate, 2.5-3 × ca. 1.5 mm, glabrous to pubescent, acuminate.

**Petals:** Light yellow with prominent red tree-shaped pattern adaxially, oblong or oblong-lanceolate, 3.5-4 × ca. 1.5 mm, glabrous, recurved at anthesis, fertile stamen 1, ca. 2.5 mm, with ovate anther; staminodes 4, 0.7-1 mm. Disk inflated, fleshy, 5-lobed. Ovary oblique, ovate, ca. 1.5 mm in diam. at anthesis; Style: 2.5 mm, eccentric. The flower has a conspicuous 5-lobed disc between the petals and stamens. **Calyx:** yellow-green, very short, deeply 5-lobed; 5 sepals, each 2-2.5 mm long × 1-1.5 mm broad, green with whitish margin, or yellowish-green, hairy outside.

**Fruit:**

A ovoid-oblong drupe, green when young, on ripening yellow; seed solitary. There is great variation in the form, size, color and quality of the fruits. Drupe oblong to sub reniform, greenish yellow to red, 5-10 × 3-4.5 cm; fleshy mesocarp bright yellow; endocarp ± compressed. These drupes may be nearly round, oval, ovoid-oblong, or somewhat kidney-shaped,
often with a break at the apex, and are usually more or less lop-sided. They range from 2 1/2 to 10 in (6.25-25 cm) in length and from a few ounces to 4 to 5 lbs (1.8-2.26 kg). The skin is leathery, waxy, smooth, fairly thick, aromatic and ranges from light-or dark-green to clear yellow, yellow-orange, yellow and reddish-pink, or more or less blushed with bright-or dark-red or purple-red, with fine yellow, greenish or reddish dots, and thin or thick whitish, grey or purplish bloom, when fully ripe. Some have a "turpentine" odor and flavor, while others are richly and pleasantly fragrant. The flesh ranges from pale-yellow to deep-orange. It is essentially peach-like but much more fibrous (in some seedlings excessively so-actually "stringy"); is extremely juicy, with a flavor range from very sweet to sub acid to tart. There is a single, longitudinally ribbed, pale yellowish-white, somewhat woody stone, flattened, oval or kidney-shaped, sometimes rather elongated. It may have along one side a beard of short or long fibers clinging to the flesh cavity, or it may be nearly fiberless and free. Within the stone is the starchy seed, monoembryonic (usually single-sprouting) or polyembryonic (usually producing more than one seedling). "Some of these varieties are cultivated for their fruit, while others may be used as rootstocks.

**TRADITIONAL MEDICINE:**

In ayurveda, it is used in a Rasayana formula (q.v.), clearing digestion and acidity due to pitta (heat), sometimes with other mild sours and shatavari (Asparagus racemosus) and guduchi (Tinospora cordifolia). In this
oriental system of traditional medicines, varied medicinal properties are attributed to different parts of the mango tree, both as food and medicine. It is anti-diuretic, anti-diarrheal, anti-emetic and cardiac herb.

**PHYTOCHEMISTRY:**

Although not confirmed scientifically, mango peel pigments may have biological effects, including carotenoids, such as the provitamin. A compound, beta-carotene, lutein and alpha-carotene, polyphenols such as quercetin, kaempferol, gallic acid, caffeic acid, catechins, tannins, and the unique mango xanthonoid, mangiferin, which are under preliminary research for their potential to counteract various disease processes.

The different chemical constituents of the plant, especially the polyphenolics, flavonoids, triterpenoids. Mangiferin a xanthone glycoside major bio-active constituent, isomangiferin, tannins & gallic acid derivatives.

The bark is reported to contain protocatechic acid, catechin, mangiferin, alanine, glycine, $\gamma$-aminobutyric acid, kinic acid, shikimic acid and the tetracyclic triterpenoids cycloart-24-en-3$\beta$,26-diol, 3-ketodammar-24 ($E$)-en-20S,26-diol, C-24 epimers of cycloart-25 en 3$\beta$,24,27-triol and cycloartan-3$\beta$,24,27-triol.
**Structure of Mangiferin:**

Indicoside A and B, manghopanal, mangoleanone, friedelin, cycloarten-3β-30-diol and derivatives, mangsterol, manglupenone, mangocoumarin, n-tetacosane, n-heneicosane, n-triacontane and mangiferolic acid methyl ester and others isolated from stem bark Mangostin, 29-hydroxy mangiferonic acid and mangiferin have been isolated from the stem bark together with common flavonoids. The flower yields alkyl gallates such as gallic acid, ethyl gallate, methyl gallate, n-propyl gallate, n-pentyl gallate, n-octyl gallate, 4-phenyl gallate, 6-phenyl-n-hexyl gallate and dihydrogallic acid. Root of mango contains the chromones, 3-hydroxy-2-(4'-methylbenzoyl)-chromone and 3-methoxy-2-(4'-methyl benzoyl)-chromone. The leaf and flower yield an essential oil containing humulene, elemene, ocimene, linalool, nerol and many others. The fruit pulp contains vitamins A and C, β-carotene and xanthophylls. An unusual fatty acid, cis-9, cis-15-octadecadienoic acid was isolated from the pulp lipids of mango. Phenolic antioxidants, free sugars and polyols isolated and analyzed from Mango stem bark. All structures are elucidated by ES-MS and NMR spectroscopic methods.

Quantitative analysis of the compounds has been performed by HPLC, and mangiferin was found to be the predominant component. Polyphenols have been characterized in mango puree concentrate by HPLC with diode array and mass spectrometric detection.
A rapid method was developed for quantitative determination of beta-carotene, including cis-isomers, in dried mango.

HPLC method has been developed to determine carotenoids in Taiwanese mango. 5-alkyl- and 5-alkenylresorcinols, as well as their hydroxylated derivatives, extracted from mango peels, purified on polyamide and characterized by high-performance liquid chromatography/atmospheric pressure chemical ionization mass spectrometry for the first time.

Xanthophyll esters, carotenes, and tocopherols have been identified and quantified in the fruit of seven mexican mango cultivars by liquid chromatography-atmospheric pressure chemical ionization-time-of-flight mass spectrometry. A simple, precise, and rapid HPTLC method was established for quantitative determination of the bioactive marker compound mangiferin in the stem bark & leaves of mango.

The natural C-glucoside xanthone mangiferin [2-C-β-Dgluco-pyranosyl-1,3,6,7-tetrahydroxyxanthone; C$_{19}$H$_{18}$O$_{11}$; Mw, 422.35; melting point, anhydrous 271°C has been reported in various parts of leaves, fruits, stem bark, heartwood and roots.

**USES:**

Mango is one of the most popular of all tropical fruits.

Mangiferin, being a polyphenolic antioxidant and a glucosyl xanthone, it has strong antioxidant, anti lipid peroxidation, immunomodulatory, cardiotonic, hypotensive, wound healing, antidegenerative and antidiabetic
activities. Various parts of the plant are used as a dentrifice, antiseptic, astringent, diaphoretic, stomachic, vermifuge, tonic, laxative and diuretic and to treat diarrhea, dysentery, anaemia, asthma, bronchitis, cough, hypertension, insomnia, rheumatism, toothache, leucorrhoea, haemorrhage and piles. All parts are used to treat abscesses, broken horn, rabid dog or jackal bite, tumour, snakebite, stings, datura poisoning, heat stroke, miscarriage, anthrax, blisters, wounds in the mouth, tympanitis, colic, diarrhea, glossitis, indigestion, bacillosis, bloody dysentery, liver disorders, excessive urination, tetanus and asthma. Ripe mango fruit is considered to be invigorating and freshening. The juice is restorative tonic and used in heat stroke. The seeds are used in asthma and as an astringent. Fumes from the burning leaves are inhaled for relief from hiccups and affections of the throat. The bark is astringent, it is used in diphtheria and rheumatism, and it is believed to possess a tonic action on mucus membrane. The gum is used in dressings for cracked feet and for scabies. It is also considered anti-syphilitic. The kernels are converted into flour after soaking in water and eliminating the astringent principles. Most parts of the tree are used medicinally and the bark also contains tannins, which are used for the purpose of dyeing.

PHARMACOLOGICAL ACTIVITIES:

Although a lot of pharmacological investigations have been carried out based on the ingredients present but a lot more can still be explored,
exploited and utilized. A summary of the findings of these studies is presented below.

**ANTI-OXIDANT:**

Reactive oxygen species (ROS) possess a strong oxidizing effect and induce damage to biological molecules, including proteins, lipids and DNA, with concomitant changes in their structure and function. The major nutritional antioxidants, vitamin E, vitamin C and β-carotene, may be beneficial to prevent several chronic disorders. Considerable interest has arisen in the possible reinforcement of antioxidant defenses, both for chemoprevention and treatment purposes. The extract showed a powerful scavenging activity of hydroxy radicals and acted as a chelator of iron. It also showed a significant inhibitory effect on the peroxidation of rat brain phospholipid and prevented DNA damage caused by bleomycin or copper-phenenthroline systems. The interaction of Vimang (MI extract) with Fe (III) was studied and the results justify the high efficiency of Vimang as an agent protecting from iron-induced oxidative damage.

*In vitro* antioxidant and free radical scavenging properties of a stem bark aqueous extract of mango tree, whose formulations are used in Cuba as food supplements under the brand name of Vimang, Luminol-enhanced chemiluminescence was used to elucidate the effect of this extract on the generation of reactive oxygen species in PMA- or zymosan-stimulated human polymorphonuclear leukocytes and on superoxide radicals.
generated in the hypoxanthine–xanthine oxidase reaction. Part of this extract antioxidant activity could be ascribed to the presence of mangiferin as its main component. The iron-complexing ability of Vimang as a primary mechanism for protection of rat liver mitochondria against Fe\(^{2+}\)-citrate-induced lipoperoxidation was reported. The results are of pharmacological relevance since Vimang could be a potential candidate for antioxidant therapy in diseases related to abnormal intracellular iron distribution or iron overload. The protective abilities of MI stem bark extract (Vimang) 50-250 mg kg\(^{-1}\), mangiferin 50 mg kg\(^{-1}\) and selected antioxidants (vitamin C 100 mg kg\(^{-1}\), vitamin E 100 mg kg\(^{-1}\) and beta-carotene 50 mg kg\(^{-1}\)) against the 12-O-tetradecanoylphorbol-13-acetate (TPA)-induced oxidative damage in serum, liver, brain as well as in the hyper-production of reactive oxygen species (ROS) by peritoneal macrophages was compared.

**ANTI-DIABETIC:**

A 50% ethanolic extract of the leaves produced a significant hypoglycemic effect at a dose of 250 mg/kg, both in normal and streptozotocin-induced diabetic animals. The stimulation of β-cells to release insulin was thought to be part of the mechanism of action. The effect of the aqueous extract of the leaves on blood glucose level in normoglycaemic, glucose induced hyperglycaemic and streptozotocin (STZ)-induced diabetic rats has been assessed. The results indicate that the aqueous extract of the leaves of MI possess hypoglycaemic activity. This
action may be due to an intestinal reduction of the absorption of glucose. The leaves of MI used for antidiabetic properties using normoglycaemic, glucose-induced hyperglycaemia and streptozotocin (STZ) induced diabetic mice. The aqueous extract of the leaves possess hypoglycaemic activity. The effect of mango (MI) ingestion on blood glucose levels of normal and diabetic rats has been studied. The results from this research suggest that mango flour can possibly help in the treatment of diabetes. The stem-bark of aqueous extract was used to examine the antiinflammatory, analgesic and antidiabetic properties. The different chemical constituents of the plant, especially the polyphenolics, flavonoids, triterpenoids, mangiferin, and other chemical compounds present in the plant may be involved in the observed antiinflammatory, analgesic, and hypoglycemic effects of the plant's extract.

The results of this experimental animal study lend 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. Investigations were carried out to evaluate the effect of MI on glucose absorption using a rat intestinal preparation in situ.

The ethanol extracts of stem-barks reduced glucose absorption gradually during the whole perfusion period in type 2 rats. In glucose-loaded normal rats, mangiferin induces a significant improvement in oral glucose tolerance but without alteration of basal plasma glucose levels these
studies show that mangiferin (10 and 20 mg/kg, i.p.) exhibits potent antidiabetic, antihyperlipidemic, antiatherogenic and antioxidant properties without causing hypoglycaemia; mangiferin would then offer a greater therapeutic benefit for the management of diabetes mellitus and diabetic complications associated with abnormalities in lipid profiles. It has been reported that long standing hyperglycaemia with diabetes mellitus leads to the formation of advanced glycosylated end-products which are involved in the generation of ROS, leading to oxidative damage, particularly to heart and kidney.

**ANTIVIRAL ACTIVITY:**

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

**ANTHELMINTIC AND ANTI-ALLERGENIC ACTIVITY:**

Anthelmintic and antiallergic activities of stem bark components Vimang and mangiferin were investigated in mice experimentally infected with nematodes, *Trichinella spiralis*. The anti-allergic properties of Vimang on allergic models, as well as suggesting that this natural extract could be successfully used in the treatment of allergic disorders. Mangiferin, the
major compound of Vimang, contributes to the anti-allergic effects of the extract.

ANTIPARASITIC ACTIVITY:

In a neonatal mouse model, mangiferin at 100 mg/kg has a similar inhibitory activity on Cryptosporidium parvum than the same dose (100 mg/kg) of an active drug, paromomycin.

ANTIBONE RESORPTION:

Four water extracts of Kampo formulae were screened for their inhibitory effect on bone resorption induced by parathyroid hormone in organ culture of neonatal mouse parietal bones. Mangiferin isolated and tested in vitro showed a significant inhibitory effect on this model.

ANTI-TUMOR/ANTI-HIV:

The significant cytotoxic activities has been demonstrated by the stem bark extract of mango against the breast cancer cell lines MCF 7, MDA-MB-435 and MDA-N, as well as against a colon cancer cell line (SW-620) and a renal cancer cell line (786-0). The ethanol/water (1:1) extract of dried aerial parts of mango administered intraperitoneally to mice at a dose of 250.0 mg/kg was inactive on Leuk-P 388. In vitro, mangiferin dose- and time-dependently inhibited the proliferation of K562 leukemia cells and induced apoptosis in K563 cells line, probably through down-regulation of bcr/abl gene expression. These results suggest that mangiferin has a potential as a naturally-occurring chemopreventive agent.
ANTISPASMODIC AND ANTIPYRETIC ACTIVITY:

The stem bark extract was evaluated for antiplasmodial activity against *Plasmodium yoelii nigeriensis*. The extract was also screened for antipyretic activity in mice. The extract exhibited a schizontocidal effect during early infection, and also demonstrated repository activity. A reduction in yeast-induced hyperpyrexia was also produced by the extract. The *in vitro* antimalarial activity of chloroform: methanol (1:1) extract of MI was evaluated. The extract showed a good activity on *P. falciparum in vitro* with a growth inhibition of 50.4% at 20 µg/mL.

IMMUNOMODULATORY:

Immunomodulatory activity of alcoholic extract of stem bark was investigated in mice.

It is concluded that test extract is a promising drug with immunostimulant properties. Mangiferin mediates the down-regulation of NF-κB, suppresses NF-κB activation induced by inflammatory agents, including tumor nuclear factor (TNF), increases the intracellular glutathione (GSH) levels and potentiates chemotherapeutic agent-mediated cell death; this suggests a possible role in combination therapy for cancer. It is likely that these effects are mediated through mangiferin, ROS quenching and GSH rising; increased intracellular (GSH) levels are indeed known to inhibit the TNF-induced activation of NF-κB.

ANTI-DIARRHOEAL:
The potential anti-diarrhoeal activity of methanolic (MMI) and aqueous (AMI) extracts of seeds has been evaluated in experimental diarrhoea, induced by castor oil and magnesium sulphate in mice. 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.

ANTI-INFLAMMATORY:

An ethanolic (95%) extract of the seed kernel exhibited significant anti-inflammatory activity in acute, subacute and chronic cases of inflammation. The leaf extract exhibited antibacterial activity against *Bacillus subtilis, staphylococcus albus and vibrio cholera*. Analgesic and anti-inflammatory effects also has been studied. The polyphenols found in the extract were found to account for the activity reported. The results represent an important contribution to the elucidation of the mechanism involved in the anti-inflammatory and anti-nociceptive effects reported by the standard MI extract VIMANG.

ANTI-BACTERIAL AND ANTIFUNGAL ACTIVITY:

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

Chemopreventive properties of lupeol and mango pulp extract was evaluated against 7, 12-dimethylbenz (a) anthracene (DMBA) induced alteration in 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.

GASTROPROTECTIVE:

A novel gastroprotective agent, mangiferin, a naturally occurring glucosylxanthone from MI (Anacardiaceae), was evaluated in mice on gastric injury induced by ethanol and indomethacin. The effects of mangiferin on gastric mucosal damage were assessed by determination of changes in mean gastric lesion area or ulcer score in mice and on gastric secretory volume and total acidity in 4-h pylorus-ligated rats. Mangiferin affords gastroprotection against gastric injury induced by ethanol and indomethacin most possibly through the antisecretory and antioxidant mechanisms of action.

OTHER ACTIVITY:

Ethanolic extracts of Punica granatum, MI, Boerhaavia diffusa, Embelia ribes, Phyllanthus maderaspatensis, and Withania somnifera, has been tested for their effect on α-amylase activity (in vitro). P. granatum and MI were found to exhibit interesting α-amylase
inhibitory activity. The ethanolic extracts of *Lawsonia inermis* leaves, *Holarrhena antidysenterica* bark, Swertia chirata whole plant and MI bark was tested for *in-vitro* α-glucosidase inhibitory activity. The extract was found to be the most potent, with an **IC**<sub>50</sub> value of 314 µg/ml. The effects of mangiferin (a C-glucosylxanthone of Vimang) on the inducible isoforms of cyclooxygenase (cyclooxygenase-2) and nitric oxide synthase (iNOS) expression and on vasoconstrictor responses in vascular smooth muscle cells and mesenteric resistance arteries, has investigated respectively, and spontaneously hypertensive (SHR) rats. The antiinflammatory action of would be related with the inhibition of iNOS and cyclooxygenase-2 expression, but not with its effect on vasoconstrictor responses. Ether and ethanolic leaf extracts were obtained by sequential extractions. The chemical tests showed that the ether extract had saponins, steroids and triterpenoids, while the ethanol extract had alkaloids, anthracenosides, coumarins, flavonones, reducing sugars, catechol and gallic tannins, saponins, steroids and triterpenoids. Both the ethereal and ethanolic fractions showed anti-clostridium tetani activity with an MIC of 6.25 and 12.5 mg ml–1, respectively. The cytotoxic effects of Vimang on rat hepatocytes, possible interactions of the extract with drug-metabolizing enzymes and its effects on GSH levels and lipid peroxidation was studied. The
effect of the extract (50–400 µg/mL) on several P₄₅₀ isozymes was evaluated.

CONCLUSION:

The extensive survey of literature revealed that *Mangifera indica* is an important source of many pharmacologically and medicinally important chemicals such as mangiferin, mangiferonic acid, hydroxymangiferin, polyphenols and carotenes.

Many different pharmacological activities, antioxidant, radioprotective, immunomodulatory, anti-allergic, anti-inflammatory, antitumor, antidiabetic, lipolytic, antionbe 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. *Mangifera indica* has been used successfully 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, it has been an important tree in the Ayurvedic and indigenous medical systems for over 4000 years. Mangoes belong to genus *Mangifera* which consists of about 30 species of tropical fruiting trees in the flowering plant family Anacardiaceae. According to ayurveda, varied medicinal properties are attributed to different parts of mango tree. Mango possesses antidiabetic, anti-oxidant, anti-viral, cardiotonic, hypotensive, anti-inflammatory properties. Various effects like antibacterial, anti fungal, anthelmintic, anti parasitic, anti tumor, anti HIV, antbonre resorption, antispasmodic, antipyretic, anti diarrhoeal, antiallergic, immunomodulation, hypolipidemic, anti microbial, hepatoprotective, gastroprotective have also been studied. Pharmacologically and medicinally important chemical such as mangiferin, being a polyphenolic antioxidant and a glucosyl xanthone, it has strong antioxidant, anti lipid peroxidation, immunomodulation,
cardiotonic, hypotensive, wound healing, antidegenerative and antidiabetic activities.

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