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Mangifera indica L. A Miracle Plant: A Review

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ABSTRACT

Mangifera indica L. a miracle plant and member of the family Anacardiaceae is a wealthy source of various bioactive phytochemicals, which include polyphenols, carotenoids, sterols and terpenoids present in leaves, stem, bark, seed, flesh and peel. Various studies have demonstrated its numerous pharmacological activities, including anti-inflammatory, analgesic, antidiabetic, immunomodulatory, hepatoprotective, anti-tumor and antioxidant activities. Mangiferin (1,3,6,7-tetrahydroxyxanthone-C2-β-D-glucoside) the active constituent of *M. indica* L. has been detected as an effective therapeutic agent endorsing various properties along with phenols and flavonoids. This review summarized different pharmacological properties of *M. indica* L. plant and their potential mechanism of action to provide support for future developmental studies in this regard.

Keywords: *Mangifera indica* L.; Mango Tree; Phytochemicals of *Mangifera*; Anti-oxidant Activity; Structures of Chemical Constituents of *Mangifera indica* L.

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INTRODUCTION

Therapeutic plants provide a valuable approach to treatment for a wide variety of diseases in traditional societies and have performed a crucial character in exploring present-day drug substances along with their unique pharmacological constituents (Chan, 2003; Devi et al., 2008; Haider et al., 2004; Shirin et al., 2010).

The genus *Mangifera* belongs to the family Anacardiaceae: The sumac or cashew family. The Anacardiaceae family produces flowering plants that yield fruits that are drupes and sometimes also produce urushiol. It also bears some economically important species, which include sumac, smoke tree, poison oak, Lacquer tree, poison ivy, mango, marula, yellow mombin, poison sumac, cashew and cuachalalate. The family Anacardiaceae consists of about 22 genera and 600 - 700 species. Some of the species of the

genus are depicted in table 1.

Mangifera indica L. was discovered in the Burma region during the earlier period of the Cretaceous era, and it was first classified by Carl Linnaeus, due to which it is called *Mangifera indica* L. It then gradually spread to the tropical and subtropical regions of the world (Kannan, 2015). Today it is grown in almost 100 countries of the world with annual production of 25million tonnes (Damodaran et al., 2012; Nazish et al., 2017).

The continent of South Asia is the habitat of *Mangifera indica* L, where they have been growing for over 4,000 years. In the Indo-Pakistan subcontinent, *Mangifera indica* L. has been produced for over two thousand years. Pakistan is one of the largest producers of mango throughout the world. The provinces of Sindh and Punjab are the major producers. Among 1595 known varieties of *Mangifera*

indica L., only 30% are grown commercially. The varieties of *Mangifera indica* L. produced in Pakistan include Desi, Kala and Sufaid Chaunsa, Sindhri, Zafran, Langra, Dasehri,

Lahotia, Taimuria, Anwar Ratol, Saroli, Samar Bahisht, Desi Toota, Alphanso, Pari, Neelum, Fajri, Sanwal, Surkha, Sunera and Almas (Ferozi, 2017).

Table 1: Different species of genus *Mangifera*.

No.	Species	Place of Origin	Family
1	<i>Mangifera acutigemma</i>	Sikkim in India	Anacardiaceae
2	<i>Mangifera altissima</i>	Philippine and surrounding regions In Indonesia, Malaysia Papua New Guinea and the Solomon Islands	Anacardiaceae
3	<i>Mangifera amba</i>	Myanmar, Bangladesh and north eastern India	Anacardiaceae
4	<i>Mangifera aandamanica</i>	Andaman Islands in the Bay of Bengal India	Anacardiaceae
5	<i>Mangifera anisodora</i>		Anacardiaceae
6	<i>Mangifera applanata</i>		Anacardiaceae
7	<i>Mangifera austro-indica</i>	Karnataka and Tamil Nadu in India	Anacardiaceae
8	<i>Mangifera blommesteinii</i>	Peninsular Malaysia and Borneo	Anacardiaceae
9	<i>Mangifera bullata</i>	Indonesia and possibly Malaysia	Anacardiaceae
10	<i>Mangifera caesia</i>	Indonesia, Malaysia, Singapore, Brunei, Papua New Guinea and the Philippines	Anacardiaceae
11	<i>Mangifera campnospermoides</i>	Kalimantan in Indonesia	Anacardiaceae
12	<i>Mangifera camptosperma</i>		Anacardiaceae
13	<i>Mangifera casturi</i>	Kalimantan region of Borneo	Anacardiaceae
14	<i>Mangifera cochinchinensis</i>		Anacardiaceae
15	<i>Mangifera collina</i>	Chiang Mai, Thailand	Anacardiaceae
16	<i>Mangifera decandra</i>		Anacardiaceae
17	<i>Mangifera dewildei</i>	North Sumatra in Indonesia	Anacardiaceae
18	<i>Mangifera dongnaiensis</i>	Vietnam	Anacardiaceae
19	<i>Mangifera flava</i>	Cambodia	Anacardiaceae
20	<i>Mangifera foetida</i>	Indonesia, Malaysia, Myanmar, Singapore, Thailand, and Vietnam	Anacardiaceae
21	<i>Mangifera gedebi</i>	Javanese, Malay, Sumatra and Kalimantan	Anacardiaceae
22	<i>Mangifera gracilipes</i>	Indonesia and Malaysia	Anacardiaceae
23	<i>Mangifera griffithii</i>		Anacardiaceae
24	<i>Mangifera laljiwa</i>	Java and the Lesser Sunda Islands	Anacardiaceae
25	<i>Mangifera laurina</i>	Indonesia	Anacardiaceae
26	<i>Mangifera linearifolia</i>		Anacardiaceae
27	<i>Mangifera macrocarpa</i>	Indonesia, Malaysia, Singapore, and Thailand	Anacardiaceae
28	<i>Mangifera magnifica</i>	Sumatra and Borneo	Anacardiaceae
29	<i>Mangifera merrillii</i>		Anacardiaceae
30	<i>Mangifera indica</i>	Myanmar, Bangladesh, and northeastern India	Anacardiaceae
31	<i>Mangifera kemanga</i>	Southeast Asia	Anacardiaceae
32	<i>Mangifera minutifolia</i>	Vietnam	Anacardiaceae
33	<i>Mangifera monandra</i>	Philippines	Anacardiaceae
34	<i>Mangifera nicobarica</i>	Nicobar Islands	Anacardiaceae
35	<i>Mangifera odorata</i>	Southeast Asia, Peninsular Thailand, South Sulawesi, Philippines on South coast of Mindanao, in Sulu Archipelago and neighboring Islands	Anacardiaceae
36	<i>Mangifera orophila</i>	Peninsular Malaysia	Anacardiaceae

37	<i>Mangifera pajang</i>	Borneo,	Anacardiaceae
38	<i>Mangifera paludosa</i>	Indonesia, possibly Malaysia, and Singapore	Anacardiaceae
39	<i>Mangifera parvifolia</i>	Indonesia, Malaysia, and Singapore	Anacardiaceae
40	<i>Mangifera pedicellata</i>	Java in Indonesia	Anacardiaceae
41	<i>Mangifera pentandra</i>	Malaysia, Singapore, and possibly Thailand	Anacardiaceae
42	<i>Mangifera persiciformis</i>	China	Anacardiaceae
43	<i>Mangifera pseudoindica</i>		Anacardiaceae
44	<i>Mangifera quadrifida</i>	Peninsular Malaysia, Sumatra and Borneo	Anacardiaceae
45	<i>Mangifera reba</i>		Anacardiaceae
46	<i>Mangifera rubropetala</i>	Indonesia and Malaysia	Anacardiaceae
47	<i>Mangifera rufocostata</i>	Sumatra, Peninsular Malaysia and Borneo	Anacardiaceae
48	<i>Mangifera siamensis</i>	Myanmar, Bangladesh, Pakistan and northeastern India	Anacardiaceae
49	<i>Mangifera similis</i>	Indonesia	Anacardiaceae
50	<i>Mangifera sumbawaensis</i>	Indonesia	Anacardiaceae
51	<i>Mangifera superba</i>	Peninsular Malaysia	Anacardiaceae
52	<i>Mangifera swintonioides</i>		Anacardiaceae
53	<i>Mangifera sylvatica</i>	Bangladesh, Cambodia, China(Yunnan), India (Assam, Darjeeling, Sikkim), Myanmar,Nepal, Bhutan and Thailand	Anacardiaceae
54	<i>Mangifera taipa</i>	Maluku Islands	Anacardiaceae
55	<i>Mangifera torquenda</i>		Anacardiaceae
56	<i>Mangifera transversalis</i>	Maluku Islands in Indonesia	Anacardiaceae
57	<i>Mangifera zeylanica</i>	Sri Lanka	Anacardiaceae

Morphology

Mangifera indica L. is an evergreen tree with a straight trunk and bifurcating branching pattern. It has an erected, broad, spherical and upright canopy. It has a height of 10-40 m and a crown radius of about 10 m. The tree can live more than 100 years. Its bark is usually grey, brown or black-colored, cracked and irregular.

The leaf of the *Mangifera indica* L. plant is simple with an entire margin without stipules and is alternately arranged. Petioles are of variable length, ranging from 1 to 12 cm, and swollen to provide support at the base. Leaves may vary in appearance from round to oval or oblong to lanceolate, along with a pointed and sharp apex. The leaves are entire-margined and slightly oscillated and wavy. Their length

may range from 15-50 cm with breadth ranging from 5-15 cm, relying on variety. The subsidiary veins are in pairs and clear and prominent. The leaf blade is shiny, glabrous prominently dark green coloured while the lower side is light green (Yadav et al., 2018). The colour of leaves may vary from one variety to the other. The roots of *Mangifera indica* L. are long, taproots which are branched below the ground level. The inflorescence is usually a broadly conical panicle bearing nearly 500-6000 flowers. Flowers are small and yellowish or reddish in colour and are of two forms: male and hermaphrodite. They have sweet smell. The fruit is kidney-shaped with fleshy and juicy mesocarp. Its colour, size and taste depend on the cultivar/variety. The seed is flat, kidney-shaped and centrally contained.

Table 2: Scientific classification and botanical description of plant *Mangifera indica* L.

Kingdom	Plantae
Subkingdom	Tracheobionta – Vascular plants.
Division	Magnoliophyta – Flowering plants
Class	Magnoliopsida – Dicotyledons
Subclass	Rosidae
Order	Sapindales

Family	Anacardiaceae (cashew family)
Genus	Mangifera – mango
Species	<i>Mangifera indica</i> L. – mango
Scientific Name	<i>Mangifera indica</i> L.
Distribution	tropical and subtropical regions
Size	height 15–30 m (50–100 ft)
Habitat	Grows from sea level to 1200 m (3950 ft) I
Growth rate	Fast, >1.5 m/yr (5 ft/yr) in ideal conditions.
Canopy	Evergreen canopies typically branched 0.6–2 m (2–6.5 ft) above the ground and developed an evergreen, dome-shaped canopy.
Leaves	smooth leathery leaves mostly crowded, ovoid and pointed or elliptical in shape, tapering towards the apex, 15-30 cm in length, 3-7 cm in width, apex tip is long, acuminate or acuminate, with wedge-shaped foundation, curled or crumpled margin, shiny and glabrous leaves, with almost 21-25 pairs of secondary veins, 3-6 cm long leaf blade
Bark	grey-brown bark brownish-green branchlets,
Roots	long taproot which is branched down to the ground level
Inflorescence	Usually a broadly conical panicle bearing nearly 500-6000 flowers
Flower	Small, and yellowish or reddish in color, and they are of two forms male and hermaphrodite, and have a sweet smell.
fruit	Kidney-shaped with fleshy and juicy mesocarp, colour, size and taste depend on the cultivar/variety.
Seed	flat, kidney-shaped and centrally contained
Varieties	1595 known varieties
Varieties produced in Pakistan	Kala, Sufaid Chaunsa, Sindhri, Zafran, Langra, Dasehri, Lahotia, Taimuria, Anwar Ratol, Saroli, Samar Bahisht, Toota Pari, Fajri, Neelum, Alphanso, Almas, Sanwal, Surkha, Sunera, Desi, etc

Chemical Constituents of *Mangifera indica* L.

Numerous phytochemicals such as triterpenoids, flavonoids, xanthenes, and polyphenolic gallotannins are present in the leaves, fruit peel, pulp, branches and in barks of *Mangifera indica* L. (Jhaumeer Laulloo et al., 2018) including quercetin, gallic acid, tocopherol, 3-methyl gallate, catechin, epicatechin and D-glucose (Onaolapo & Onaolapo, 2019). *Mangifera indica* L. leaves contain Mangiferin: selected anthocyanidins including delphinidin, peonidin and cyanidin: leucoanthocyanins: and gallic tannins. Queretin, gallic acid, ellagic acid, catechins, kaempferol, protocatechuic acid, propyl and methyl gallate, rhamnetin are important phenolic components present in *Mangifera indica* L. The number of polyphenols relies greatly on variety as well as part of the *Mangifera indica* L. plant. *Mangifera indica* leaves also contain nutrient minerals like calcium, magnesium, potassium, sodium, zinc, cadmium, copper and phosphorus. Furthermore, studies have revealed that *Mangifera indica* leaves are a potent source of ascorbic acid, riboflavin, niacin and thiamine (Samanta et al., 2019). *Mangifera indica* leaves oil is a wealthy source of sesquiterpenes and also contains β -selinene, β -caryophyllene, δ -3-carene and α -gurjunene.

Mangiferin is an important polyphenolic compound which has been studied on large scale for its diverse biological properties. It is a polyphenol and bioactive glucosyl xanthone with potent anti-inflammatory, antioxidant and immunomodulatory properties along with wound healing, anti-diabetic, anti-lipid peroxidation, wound healing and curing effects as reported by the researchers in some studies (Onaolapo & Onaolapo, 2019). The Mangiferin content depends on the variety of plant and geographic source, while extracts of leaves contain approximately 60% Mangiferin (Stohs et al., 2018).

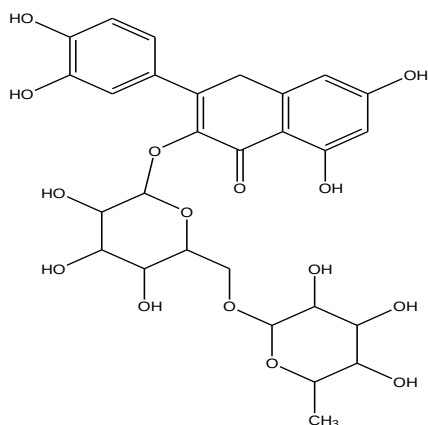
Medicinal Significance

Previous studies have reported that different parts of *Mangifera indica* L. plants produce diverse health benefits. They contain various therapeutic effects which include analgesic, anti-inflammatory (Garrido et al., 2001), immunostimulant (Garcia et al., 2002; Garcia et al., 2003b; Makare et al., 2001), spasmolytic, antidiarrheal (Sairam et al., 2003), dyslipidemic (Anila & Vijayalakshmi, 2002), antiamebic (Tona et al., 2000), anthelmintic, antiallergic (Garcia et al., 2003a), antidiabetic (Aderibigbe et al., 1999a;2001) and antibacterial applications (Bairy et al., 2002).

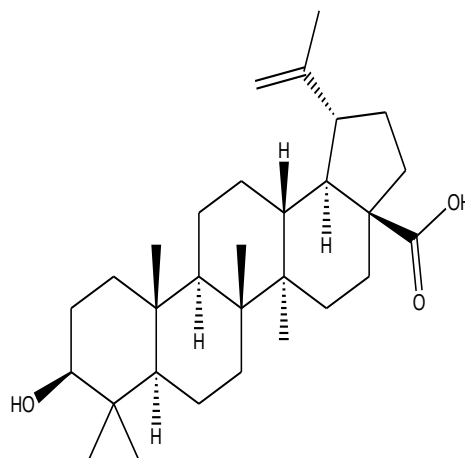
Latest study shows that parts of plant are able to treat high

blood pressure, diarrhea, bronchitis, dysentery, insomnia, asthma, anemia, leucorrhoea, rheumatism and piles. They are also utilized as tonic, antiseptic, astringent, dentrifices, diaphoretic, stomachic, vermifuge, laxative (Kalita, 2014). Plant is capable to cure broken horn, tumors, rabid dog bite or jackal bite, snakebite, scorpion sting, abscesses, datura

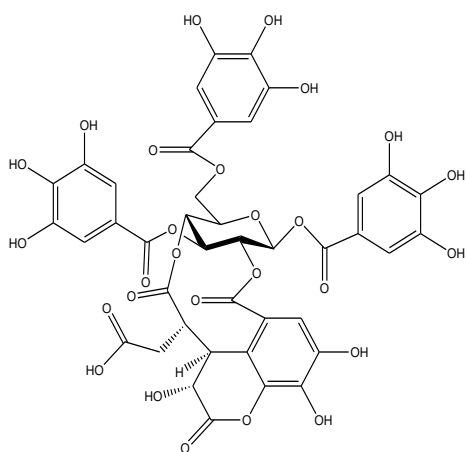
poisoning, miscarriage, anthrax, blisters, wounds in the mouth, tympanitis, colic, heat stroke, glossitis, indigestion, bloody dysentery, excessive urination, liver disorders, bacillosis, and tetanus. In Ayurveda system, it's one of the major uses is countering indigestion and acidity caused heat (Kalita, 2014; Yoshimi et al., 2001).



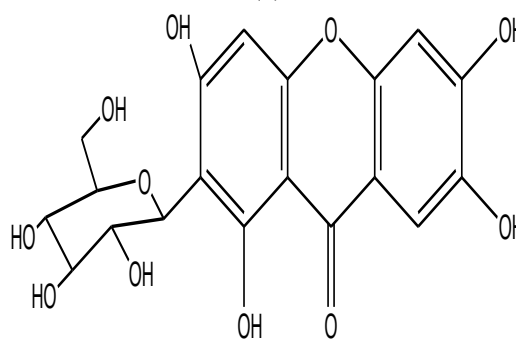
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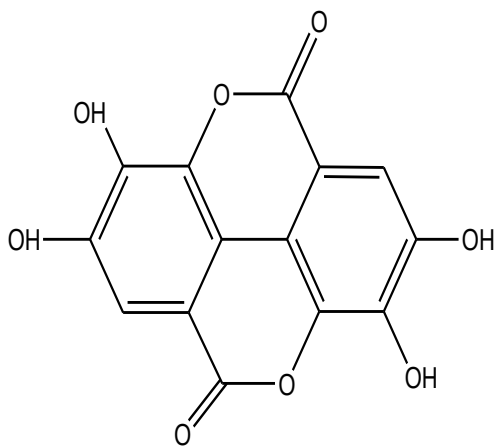
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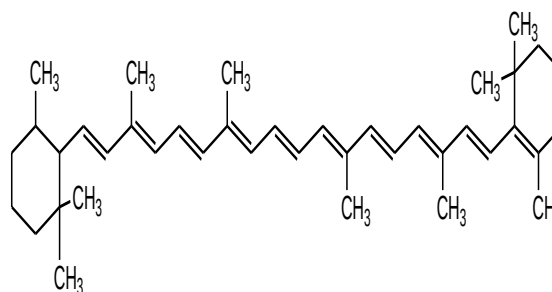
(c)



(d)



(e)



(f)

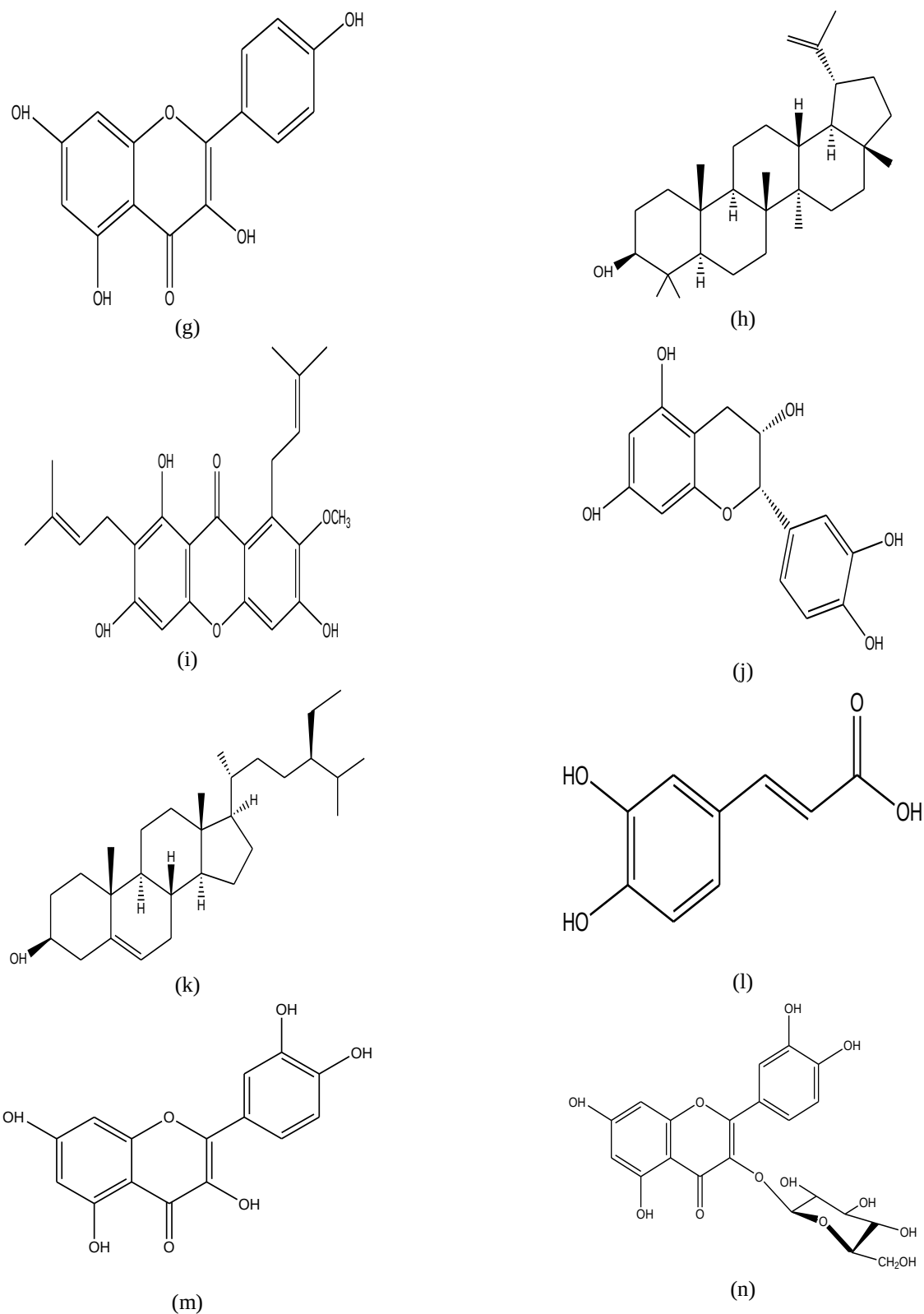


Figure 1: (a)Rutin; (b) Betulinic acid; (c) Chebulinic acid; (d) Mangiferin; (e) Ellagic acid; (f) Beta carotene; (g) Kaempferol; (h) Lupeol; (i) Mangostin; (j) Epicatechin; (k) Sitosterol; (l) Caffeic acid; (m) Quercetine; (n) Quercetin-3-o-glucoside-isoquercitrin-3.

The leaves of *Mangifera indica* L. are astringent, hepatoprotective, anti-apoptotic, anti-oxidant (Martínez et al., 2000; Martínez Sánchez et al., 2003; Sánchez et al., 2000), cytoprotective (Pokorski, 2013) free radical scavenging, constipating, refrigerant styptic and restorative. They can be utilized in ulcers, wounds, hyperdipsia, burning sensations, hemorrhages, haemoptysis, haemorrhoids, pharyngopathy and stomachopathy. Ash can be beneficial when applied to burns and scalds. Its powder can be used in conditions of diarrhoea and diabetes. Leaves smoke can be inhaled to alleviate hiccups and throat infections. They have been used as traditional medicine by a number of people from centuries (Shah et al., 2010).

Mangifera indica L. leaf extracts can be added to food and cosmetics as an organic antioxidant and can replace harmful synthetic ones commercially. It can be used as an anti-ageing agent and skin protectant against ultraviolet radiation. It prevents and decrease the impact of heat on the skin, lips and hair (Ponce et al., 2013).

Anti-Diabetic Activity

The *Mangifera indica* L. plant exhibits promising anti-diabetic activity (Aderibigbe et al., 1999b) by reducing postprandial high levels of glucose through inhibition of the activity of alpha-amylase (Sekar et al., 2019). Alpha-amylase is one of the important enzymes that participates in the hydrolysis of glycosidic linkages present in carbohydrates, therefore disintegrating them to cross intestinal epithelium for GI absorption. In hyperglycaemic patients these enzymes are produced at a higher than normal levels due to hyperactivity. *Mangifera indica* L. inhibits alpha-amylase restricting the possibility of the development of diabetes, which is dose-dependent. In a study, conducted by V. Sekar, S. Chakraborty, S. Mani, V.K. Sali, and H.R. Vasanthi the enzyme inhibitory activity of mangiferin, the active Phytoconstituent of *Mangifera indica* L. has been confirmed (Sekar et al., 2019).

Some of the studies have reported that *Mangifera indica* L. leaf extract specifically at a concentration of 200 µg/mL has decreased GI adsorption of glucose. The decreased adsorption capacity has been linked to the presence of various soluble and insoluble fibers that decrease the transit of sugars into intestinal cavity. *Mangifera* plant contains diverse quantities of phytochemicals such as flavonoids, phenols and terpenoids which increase glucose uptake and decrease its release in intestinal viscera. Therefore, all these effects anticipate considerable hypoglycemic activity (Ngo et al., 2019).

Anti-Oxidant and Free Radical Scavenging Activity

Free radicals and reactive species such as superoxide anions, singlet oxygen species, hydroxyl radials, nitric oxides and

per oxynitrite are produced in response to metabolic reactions. When produced in excess quantity, they may cause increased oxidative stress, which is extremely harmful and can lead to various degenerative diseases. The *Mangifera indica* L. plant is one of those naturally occurring substances capable of donating its hydrogen atom to stabilise these reactive species (Zuraini et al., 2021). This free radial scavenging and antioxidant activity is exhibited due to the presence of phenolic hydroxyl groups present.

Analgesic and Anti-Inflammatory Activity

During the process of inflammation, macrophages produce free radicals which are involved in the conversion of arachidonic acid into inflammatory mediators. Inhibition of synthesis of cyclooxygenase enzyme, bradykinin, prostaglandin and arachidonic acids leads to inhibition of those inflammatory mediators and production of analgesia and reduction in inflammation. Further, polyphenolic components of *Mangifera indica* L. plant attenuate analgesic and anti-inflammatory responses by reducing the production of reactive oxygen species due to the presence of hydroxyl groups. (Khumpook et al., 2019)

Immunomodulatory Effect

The process in which the immune system response is adjusted upon any change that is due to any foreign body is said to be immunomodulation. It can be stimulation or suppression of the immune system. Stimulation cause, activation of macrophages, granulocytes and lymphocytes to act against foreign substance, whereas suppression will cause a decrease in their activity. According to the study conducted by Garrido et al. (2005) *Mangifera indica* L. plant extract can produce immunomodulatory effects (Guha et al., 1996) by inhibition of transcription factors NF- κB and T-cells which plays a key role in regulating the immune response to infection and T-cells are drivers of inflammation and autoimmune diseases.

Bronchodilatory Effect

Gbeassor et al., (2005) demonstrated the broncho-dilatory effect of the *Mangifera indica* L. plant stem/bark extract and suggested that the plant can block histaminic and muscarinic receptors, thus capable of treating asthma (Parvez, 2016). The study focused that M. indica. aqueous extract at 2 mg/ml has reduced the contractions induced by histamine and acetylcholine at various experimental conditions. (Agbonon et al., 2005)

Anti-Tumour Effects

The presence of polyphenolic content and mangiferin, a C-glycosyl Xanthone, can effectively inhibit tumor cell progression by captivating cell cycle progression during initial phases. In a study, (Telang, 2013) it has been demonstrated that mangiferin can inhibit transcription of

nuclear factor κ B and cyclooxygenase-2 (COX-2) protein expression, causing apoptosis of tumor cells; therefore can effectively induce anti-tumour activity. Signalling pathways, including NF- κ B signaling and cyclooxygenase-2 (COX-2) protein expression inhibition are involved in the antitumor effects of mangiferin.(Du et al., 2018).

Skin Protectant

The alpha-glycosidase enzymes hydrolyse linkages present between polysaccharides for converting them into simpler sugar forms. These sugars, when synthesised in higher-than-normal quantity due to any diseased condition, react with free amino group to form intermediates (advanced glycan end products) that can initiate reactions forming irreversible linkages between proteins present in skin collagen, thus producing some deleterious effects such as sagging, wrinkling and ageing of skin. Further excessive exposure of skin to UV radiations can also cause deterioration of skin protein producing similar side effects. Mangiferin inhibits alpha-glycosidase enzyme therefore capable of exhibiting skin protection. In a study conducted by Jae Hyoun Song^{1,2}, Eun Young Bae¹, Goya Choi¹, Jin Won Hyun³, Mi Young Lee¹, Hye Won Lee¹ & Sungwook Chae, it was confirmed that *Mangifera indica* L. protects and reduces side effects of heat on hair, skin and nails (Song et al., 2013) furthermore, flavonoids, caratenoids and polyphenols present in *Mangifera india* L. plant due to their anti-oxidant activity and can further enhance protection of skin against UV-rays.

Iron Chelating Activity

Thalassemia is a condition in which patient suffer from chronic anemia, which is compensated by continuous blood transfusion (Ebrahimzadeh et al., 2009). This transfusion is accompanied by iron overload in various organs, as humans do not have the ability to excrete out the iron produced during the breakdown of RBCs. Accumulation of iron results in some serious complications which could be life-threatening. Such patients are given iron chelators which deploy these iron complexes through urine and faeces in order to improve patients' quality of life. The metal ions of Fe²⁺ contain ability to transfer electrons and form reactive and non-reactive radicals. Flavonoids obtained from plant sources are of particular structures with substituted hydroxyl groups in the molecule and can act as proton donors (Chai, 2014).

The *Mangifera indica* L. plant has proven to be an effective iron chelator. Its active constituent, mangiferin, has the ability to form complexes with Fe (III). This complex is capable of preventing formation of free radical species. It also enhances excretion of free iron molecules through urinary and faecal excretions. Synthetic chelates with

several limitations are available in the market but a drug with a natural origin can be a better alternative in this perspective (Badria et al., 2018; Estuningtyas, 2019).

Anti-Diarrheal Activity

In a study conducted by it, it has been postulated that *Mangifera indica* L. plant has an ability to enhance water absorption and reduce intestinal motility. In another study (Alkizim, 2012) it was postulated that the extracts can directly act on the colon and stimulate the absorption of water and electrolyte and can decrease the motility of the large intestine or can mediate an anti-secretory mechanism. Therefore, the plant possesses potent anti-Diarrheal activity that proves its ethnomedicinal use. In another study (K. De & Pal, 2011) it was revealed that the aqueous extract of leaves of *M. indica* L. inhibited 5 different types of Gram (-) bacteria, and the growth inhibition was dose-dependent. Hence, it could be concluded that the leaf extract of *M. indica* L. can be utilised in the management of gastro-intestinal diseases.

The pharmacological profiling of *Mangifera indica* L. has notable similarities with several medicinal plants such as *Curcuma longa* as both the plants contain compounds that modulate key inflammatory mediators and pathways. Similarly, antimicrobial and antidiabetic properties of *Mangifera indica* L. are comparable to *Azadirachta indica* L. which contain azadiractin and some flavonoids contributing to its therapeutic properties. Furthermore, antioxidant capacity resembles closely to that of *Camellia sinensis*. Similar to catechins present in green tea constituents of *Mangifera indica* L. such as quercetin, mangiferin and gallic acid efficiently scavenge reactive oxygen species.

CONCLUSION

Mangifera indica L. possesses significant therapeutic potential, which supports wide range if its pharmacological activities. Along with its strong ethnomedicinal background different medicinal systems, including Ayurvedic system, have been using this miracle plant from ages to acquire therapeutic efficacy in various ailments. Despite so much progress in phytochemical profiling of this plant majority of the existing studies are limited to in vitro experiments and animal models. Additionally, variability in phytochemical composition of different cultivars, and absence of standardised dosing regimens compromise the results. Limited of safety and toxicity data further highlight critical research gaps. Moreover, synergistic interactions with other medicinal plants may broaden the clinical applications and integration of *Mangifera indica* L. in modern medicine.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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