

A Review on parts, phytochemical, and biological activity of *Mangifera indica* (mango tree)

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ABSTRACT: Mangoes (*Mangifera indica*) are members of the flowering plant family Anacardiaceae and are part of the genus *Mangifera*, which includes roughly thirty species of tropical fruiting trees. It ranks second among tropical crops in terms of productivity and is grown on an area of about 3.7 million hectares worldwide.

Ayurveda attributes various therapeutic virtues to various portions of the mango tree. Mangos are rich in antioxidant, antiviral, anti-inflammatory, and anti-diabetic qualities. Numerous effects have also been examined, including immunomodulation, hypolipidemia, anti-microbial, hepatoprotective, anti-fungal, anthelmintic, anti-parasitic, anticancer, anti-HIV, Antione resorption, antispasmodic, antipyretic, antidiarrheal, and gastroprotective.

KEYWORDS: Antimalarial, Antimicrobial, Antidiabetic, Anticancer, Antibacterial, Hepatoprotective.

I. INTRODUCTION

Herbal medicine has grown rapidly in the past few years, and because to its natural origins and low side effects, it is becoming more and more popular in both developed and developing nations. Medicinal plants, minerals, and organic matter constitute the source of a large number of currently used traditional medicines^[1]. 21,000 plants are listed by the World Health Organization (WHO) as being used medicinally worldwide^[2]. Nowadays, plants are the source of at least 30% of pharmaceutical medications that are used today^[3]. Grown throughout the world, especially in tropical regions, the mango (*Mangifera indica* L.) is a luscious stone fruit that is a member of the Sapindales order and family Anacardiaceae. It is the national tree of Bangladesh as well as the national fruit of the Philippines and India.

There are more than a thousand mango types in the world. Just a small number of the known types are farmed commercially and traded^[4]. Currently, over 87 countries grow mangoes for commercial purposes^[5]. Mango cultivation currently takes place on about 3.7 million hectares

of land globally. As far as tropical crops go, mango fruit comes in second, only to bananas in terms of yield and acreage utilized^[6]. Mango fruits are an essential source of minerals, vitamins, and other compounds, as has been well-documented. Additionally, the fruits of the mango plant offer energy, dietary Fiber, carbs, proteins, lipids, and phenolic chemicals^[5], all of which are essential for the regular growth, development, and health of humans^[7].



FIGURE 1. MANGIFERA INDICA (MANGO TREE)

Taxonomical Classification

- Kingdom: Plantae
- Subkingdom: Tracheobionta
- Super division: Spermatophyta
- Division: Magnoliophyta
- Class: Magnoliopsida
- Subclass: Rosidae
- Order: Sapindales
- Family: Anacardiaceae
- Genus: *Mangifera*
- Species: *M. indica*

Plant Disruption

The tree is medium to big (10–40 m tall), evergreen, and has a symmetrical, circular canopy that can be upright and open or low and dense. Typically, dark grey-brown to black, bark is rather

smooth, superficially broken or barely fissured, and peels off in thick, irregular pieces. The tree develops a dense mass of superficial feeder roots in addition to a long, unbranched tap root that can reach a height of 6 to 8 meters. An eighteen-year-old mango tree's effective root system may be observed at a depth of 1.2 meters, with lateral spread up to 7.5 meters^[8]. The leaves range in length from 15 to 45 cm and are simply grouped in pairs. The petiole is always inflated at the base and ranges in length from 1 to 12 cm.

The forms of leaves can vary and include roundish-oblong, oval-lanceolate, lanceolate, ovate, obovate-lanceolate, and oblong^[9]. While the under surface is glabrous light green, the upper surface is shiny and dark green. Male and hermaphrodite flowers are produced in the same panicle, with the latter typically occurring in greater quantities. The diametric diameter of hermaphrodite and male flowers ranges from 6 to 8 mm. They smell nice, are sessile, and hardly ever pedicellate.

The sizes and morphologies of the pollen grains range from 20 to 35 microns^[10-11]. The fruit is a fleshy, roughly compressed drupe that varies greatly in size, shape, colour, Fiber content, flavour, taste, and other characteristics.

II. APPLICATIONS IN ETHNOMEDICINE

For thousands of years, different portions of the mango have been employed for a wide range of traditional medical purposes^[12].

Bark and Roots: Used as a vulnerary, anti-emetic, constipating, styptic, anti-syphilitic, astringent, acrid, and refrigerant. In cases of pitta, metrorrhagia, calonorragia, pneumonia, leucorrhoea, syphilis, uteritis, sores, ulcers, and vomiting, they are helpful. Fresh bark juice has a noticeable effect on mucous membranes, causing diarrhoea, bleeding piles, leucorrhoea, and menorrhoea.

Leaves: Used as vulnerary, constipating, styptic, astringent, and refrigerant. Additionally, they are helpful in treating vitiated disorders such as hiccups, coughing, hyperdipsia, burning sensation, haemorrhages, haemoptysis, haemorrhoids, wounds, ulcers, dysentery, diarrhoea, pharyngoplasty, and stomachopathy. Burns and scalds can benefit from the ash from burned leaves. In order to treat throat ailments, one can breathe the smoke produced by burning leaves.

Flowers: Have astringent, cooling, styptic, vulnerary, constipating, and haemostatic properties. Pitta-vitiated illnesses such as haemorrhages,

haemoptysis, wounds, ulcers, anorexia, dyspepsia, uro-edema gleet, bladder catarrh, diarrhoea, chronic dysentery, and anaemia can benefit from the usage of dried flowers.

Fruits: Unripe fruits have antiscorbutic, acidic, acrid, refrigerant, digestive, and carminative properties. They help with urethrorrhea, vaginopathy, eruptions, and dysentery ophthalmia. Ripe fruits have the following properties: they are laxative, sweet, emollient, cardiotoxic, haemostatic, aphrodisiac, and tonic. In vitiated disorders including anorexia, dyspepsia, cardiopathy, haemoptysis, haemorrhages from the uterus, lungs, and intestine, emaciation, and anaemia, they are also employed.

Stone: The seed kernel is an abundant source of gallic acid and protein (8.5%). It has astringent, acrid, sweet, vulnerary, refrigerant, anthelmintic, constipating, haemostatic, and uterine tonic properties. The vitiated conditions of pitta and cough, helminthiasis, haemorrhages, haemoptysis, haemorrhoids, ulcers, bruising, menorrhagia, diabetes, heat burn, and vomiting can all benefit from it.

III. NUTRITION AND PLANT-BASED CHEMICALS

The energy content of an ounce (3.5 g) is 250 kJ (60 kcal), while an ounce (100 g) of apple mango has 79 kcal. Mangos are rich in minerals^[14] and a range of phytochemicals^[13]. Other substances found in mango peel and pulp include omega-3 and -6 polyunsaturated fatty acids, colour carotenoids, and polyphenols^[15]. ~ 3 ~Journal of Pharmacognosy and Phytochemistry biological effects of mango peel pigments include carotenoids^[16-18] polyphenols^[17-18] such as quercetin, kaempferol, gallic acid, caffeic acid, catechins, tannins, and the unique mango xanthone, Mangiferin^[19], which are being investigated in preliminary studies for their potential to prevent different disease processes^[20-21]. Mango cultivars appear to differ in terms of phytochemical and nutritional content^[22]. Mango pulp has been shown to contain up to 25 distinct carotenoids, the densest of which was found to be beta-carotene, which is responsible for the yellow-orange coloration seen in most mango cultivars^[23].

Nutritional Composition Table:

Parameter	Content (g/100g of dry fruit weight basis)
Water	78.9-82.8
Ashes	0.34-0.52
Lipid	0.30-0.53
Protein	0.36-0.40
Carbohydrate	16.20-17.18
Dietary fibre	0.85-1.06
Energy(kcal)	62.1-190

IV. APPLICATIONS IN PHARMACOLOGY**Anticancer**

Polyphenolic extracts from various mango kinds were compared for their anticancer effects in cancer lines, such as Molt-4 leukaemia, A549 lung, MDA-MB-231 breast, LnCap prostate, SW-480 colon cancer cells, and the non-cancer colon cell line CCD-18Co^[24]. The bioactive fraction from the crude extract displayed antiproliferative activities with an IC₅₀ value of less than 10µg/ml, while Ali et al. (2012) and Timsina et al. (2015) found that ethanol extract had considerable cytotoxicity to HeLa cells^[25-26].

Additionally, the breast cancer cell lines MCF 7, MDA-MB-435, and MDA-N; colon cancer cell line SW-620; renal cancer cell line 786-0)^[27] and K562 leukaemia cells^[28] have all been shown to be very cytotoxic by mango. Whole mango juice and juice extracts have been shown to have anticancer properties by Percival S et al. (2010). They also observed that incubating HL-60 cells with whole mango juice and mango juice fractions inhibited the cell cycle during the G₀/G₁ phase^[20]. Additionally, studies suggest that mangiferin may have hampered or interfered with the development or operation of microtubule filaments or components of the cellular matrix, impairing or obstructing the capacity of cells to adhere and adhere^[28-32]. Other potential actions of mangiferin included enhancing cellular apoptosis^[30, 33] and inhibiting the telomerase and gene^[30]. Kim and colleagues (2012) also looked into the anti-proliferative properties of mango meat and peels^[34].

Antidiabetic

Rats with Type-2 diabetes respond powerfully and strongly to a single oral dose of 250 mg/kg body weight, according to research by Bhowmik et al. (2009)^[35]. Reda MY, (2010) found a similar finding^[36]. Two weeks following the

administration of a high dose (1 g/kg/d) of the powdered portion, aqueous extract, and alcoholic extract of *Mangifera indica* leaves, a significant drop in the mean concentration of plasma glucose was seen^[37]. In a different investigation, Wadood et al. (2000) discovered that alcoholic extract of *Mangifera indica* leaves, at doses of 50, 100, 150, and 200 mg/kg body weight in rabbits, had anti-diabetic benefits^[38]. Researchers have found that the leaves of *Mangifera indica* (MI) have antidiabetic effects^[39-42]. Additionally, it was noted by Mangola EN (1990) and Miura T et al. (2001) that diabetic rats clearly displayed a hypoglycaemic effect when exposed to an aqueous extract from mango leaves^[43-44]. Additional researchers discovered that the stem bark of *Mangifera indica* has antidiabetic properties^[45-46]. Mango bark and root extracts considerably reduced the blood sugar level of hyperglycaemic rats, according to Oliver-Bever B's 1986 study^[47].

Anti inflammatory

In 2016, Dhananjaya BL and Shiva Lingaiah S reported that the standard aqueous stem bark extract of *Mangifera indica* had anti-inflammatory action, as evidenced by up to 98% inhibition of Group IA sPLA₂ enzyme activity at ~40 µg/ml concentration^[48]. The anti-inflammatory properties of mangiferin have been linked to the suppression of iNOS and cyclooxygenase-2 production, according to Beltrana AE et al. (2004)^[49]. The overwhelming anti-inflammatory cytokines and proinflammatory mediators, inhibition of inflammatory cellular activations, regulation of inflammatory gene expressions, and enhancement of cellular resistance against inflammatory injuries are some of the potential anti-inflammatory mechanisms of mangiferin^[50-52]. The subcellular targets of the anti-inflammatory actions are the lysosomal membrane, which lowers hydrolase activity in isoprenaline-induced cardiac necrosis^[54], and the thermoregulatory neural centres, which reduce prostaglandin synthesis in fever^[53]. Numerous other studies have also reported the anti-inflammatory properties of mangos^[54-58].

Hepatoprotective

Mango, scientifically named *Mangifera indica*, is not only a tasty fruit, but it also appears to have some medicinal benefits for the liver.

Research has looked into *Mangifera indica* possible hepatoprotective qualities and found that it may help protect the liver from a variety of assaults, including as medicines and poisons. Mango's hepatoprotective benefits are thought to be

facilitated by the presence of bioactive substances such as flavonoids and polyphenols.

Nithitanakool et al. (2009) investigated the hepatoprotective properties of mango seed kernels. Mango pulp extract's (MPE) chemopreventive qualities were assessed in relation to liver alterations in Swiss albino mice. Through the modulation of cell-growth regulators, MPE was found to be efficient in preventing oxidative stress-induced cellular injury in the liver of mice^[59].

These substances may be able to reduce inflammation, fight oxidative stress, and even aid in the restoration of damaged liver cells. Furthermore, the antioxidants in mangos may help to counteract free radicals, which can seriously harm the liver. Recall, however, that additional studies are necessary to completely comprehend the scope of *Mangifera Indica* hepatoprotective effect and its possible uses, even though the preliminary results are encouraging. Eating mangoes as part of a well-balanced diet is always an excellent idea for general health!

Anti haemorrhage

It appears that the adaptable *Mangifera indica* mango may have additional merits, such as anti-haemorrhagic characteristics. Mango extracts have been studied for their ability to treat bleeding. This is believed to be a result of the bioactive substances found in mangoes, such as flavonoids and tannins. These substances might have vasoconstrictive properties, which would lessen bleeding by lowering blood flow. It's important to remember, though, that even though these results are intriguing, additional investigation is required to determine whether *Mangifera indica* is useful in treating bleeding. It's always a good idea to proceed cautiously when dealing with such material and to wait for additional scientific confirmation.

Mangoes are delightful, but while you're enjoying them, consider the notion that they could be more than just a nice treat—they might be able to help manage bleeding. Best of nature's pharmacy!

Mango extract's anti-haemorrhagic and anti-dermonecrotic properties against snake venoms were assessed by Pithayanukul et al. (2009) and Leanpolchareanchai et al. (2009)^[60-61].

Anti-tetanus

The humble mango, *Mangifera indica*, keeps revealing its potential superpowers. According to specific research on the fruit's anti-tetanus properties, mangoes may help prevent

tetanus by containing certain chemicals. The bacteria *Clostridium tetani*, which causes tetanus, secretes a toxin that damages the nerve system. *Mangifera Indica* antimicrobial qualities, which may aid in preventing bacterial growth and activity, are thought to be linked to its anti-tetanus action. Mangoes' bioactive substances, such as flavonoids and tannins, may contribute to their antibacterial properties. It's important to remember, though, that even though these results are exciting, additional research is required to completely comprehend *Mangifera Indica* potential for tetanus management or prevention.

It appears that nature has a lot in store for us, and one of its delectable prescriptions may be the mango!

According to Godfrey SB et al. (2007), MI leaf extracts have anti-*Clostridium tetani* action, which is linked to numerous deaths worldwide. The anti-*Clostridium tetani* activity of ether and ethanolic leaf extracts was demonstrated with MIC values of 6.25 and 12.5 mg/ml, respectively^[62].

Analgesic and anti-pyretic

Mangoes may provide some physical relief in addition to being a delicious treat for your palate. Studies have looked into *Mangifera Indica* analgesic (pain-relieving) and anti-pyretic (fever-reducing) properties. These characteristics are believed to be influenced by the bioactive substances found in mangoes, such as tannins, flavonoids, and polyphenols. These substances may be able to reduce fever and relieve discomfort because of their anti-inflammatory and antioxidant properties. Even though these results are fascinating, we must proceed cautiously when interpreting them. To completely comprehend the scope of *Mangifera Indica* antipyretic and analgesic properties, as well as to identify any possible therapeutic uses, more research is required.

Thus, you may be providing your body with a natural dose of potential pain and fever alleviation while savouring a luscious mango. Surprises abound in Mother Nature's medicinal closet. The antipyretic effect of MI stem bark extract on mice was assessed. The extract also reduced the amount of hyperpyrexia caused by yeast^[63].

Kidney damage

It appears that the mango tree has drawn the interest of scientists looking into possible health advantages, including the area of kidney health, in addition to its wonderful fruits. Mango leaves have

been shown to have an impact on renal function in certain trials. It is thought that bioactive substances with anti-inflammatory and antioxidant qualities, such as flavonoids and polyphenols, are present in mango leaves. These characteristics might contribute to the kidneys' defences against harm. It's crucial to treat this material with caution, though. Although there is some preliminary evidence that mango leaves may have a protective effect, further research is necessary to determine the precise effects of mango leaves on kidney health as well as the underlying mechanisms.

As always, savouring mangoes and their leaves as part of a well-rounded diet is a delightful method to investigate the possible health advantages. However, it's advisable to speak with a healthcare provider for specific guidance and treatment if you have serious kidney difficulties.

Amien AI et al. (2015) found that enhancing kidney function by lowering serum creatinine, urea, and uric acid had a substantial preventive impact against renal damage. Glutathione (GSH) and superoxide dismutase (SOD) activity were markedly elevated in rats treated with 500 and 1000 mg/kg MPS extract, although total malondialdehyde (MDA) and glutathione-S-transferase (GST) levels were notably lowered^[64].

Antiulcer

The fruit that never stops giving— mangos! *Mangifera indica* has been studied for possible antiulcer action in addition to its taste. Mangos include chemicals including flavonoids, tannins, and polyphenols that may help explain some of their antiulcer properties, according to some research. These bioactive substances may help shield the stomach lining from harm brought on by things like high gastric acid production or the presence of dangerous bacteria like *Helicobacter pylori*. These chemicals are thought to possess antioxidant and anti-inflammatory qualities. Even if the preliminary results seem encouraging, it's important to proceed cautiously when interpreting this data. To completely comprehend the mechanisms and efficacy of *Mangifera indica* in treating ulcers, more research is required.

Neelima N et al. (2012) assessed the antiulcer potential of petroleum ether and ethanol extracts of mango leaves against in vivo aspirin-induced stomach ulcer. The ulcer index was dramatically lowered by the 250 mg/kg petroleum ether and 250 mg/kg ethanol extracts of mango tree leaves^[65]. According to additional research,

mangiferin protects the stomach from harm by acting through antioxidant and antisecretory pathways^[66].

Lipid profile

Rats treated with an aqueous extract of *Mangifera indica* leaves showed a large rise in high density lipoproteins and a significant decrease in total serum cholesterol, triglycerides, low density lipoprotein, and very low-density lipoprotein. On the other hand, treatment with an aqueous extract of mango leaves (200 mg/kg body weight) resulted in a significant increase in high density lipoprotein (HDL-C) and a significant decrease in elevated triglyceride (TG), low density lipoprotein (LDL-C), and very low-density lipoprotein (VLDL)^[67].

Anti-bone resorption

Mangoes' potential health advantages never cease to amaze me! *Mangifera indica* has been shown in several studies to exhibit anti-bone resorption activity, suggesting that some of the chemicals in mangos may help to maintain bone health. Mango bioactive components, such as flavonoids and polyphenols, are thought to possess antioxidant and anti-inflammatory qualities. These characteristics may contribute to the inhibition of bone resorption, the breakdown and release of bone tissue into the bloodstream.

Even while these results are fascinating, it's crucial to remember that this field of study is still in its infancy. To completely comprehend *Mangifera Indica* effects on bone health and to ascertain whether it may be used to prevent disorders linked to bone resorption, more research is required.

It has been demonstrated that mangiferin inhibits mice's parathyroid hormone-stimulated bone resorption^[68].

Antidiarrheal

Mangoes have a lot of talents! Studies on the possible antidiarrheal properties of *Mangifera indica* have revealed several chemicals in mangos that may be able to relieve diarrhoea. Mangoes are thought to possess bioactive components, including tannins, flavonoids, and polyphenols, which may play a role in their ability to prevent diarrhoea. Due to their potential antibacterial and anti-inflammatory qualities, these substances may be able to lessen the intensity and length of diarrhoea. Even though these results are fascinating, we should proceed cautiously when interpreting them. To completely comprehend the workings and

efficacy of *Mangifera indica* in treating diarrhoea, more investigation is required.

Sairam K et al., 2003^[69] investigated the possible anti-diarrheal effect of methanolic and aqueous extracts of *M. indica* seeds. Mango kernel aqueous extract's anti-diarrheal properties were investigated by Alkizim et al. (2012)^[70] at doses of 0.25 to 0.50 mg/ml.

Antibacterial

According to research, there is significant activity of the mango leaf and stem aqueous and ethanol extract at 50 and 25 mg/mL against the following bacteria: *Staphylococcus aureus*, *Streptococcus pyogenes*, *Streptococcus pneumoniae*, *Pseudomonas aeruginosa*, *Candida albicans*, and *Enterococcus faecalis*^[71]. The antibacterial properties of the extract were also seen against *Escherichia coli*, *Listeria monocytogenes*, and *Salmonella enterica*^[72]. At a concentration of 100µl/ml, Sahrawat A et al. (2013) investigated the antibacterial properties of *Mangifera indica* leaf extract on methanol, ethanol, and benzene extract against a variety of bacteria, including *Proteus vulgaris*, *Pseudomonas fluorescens*, *Shigella flexneri*, *Klebsiella pneumoniae*, and *Salmonella typhi*^[73]. Mango extracts have also been shown to have antibacterial action against gram-positive, gram-negative, and yeast *Candida albicans*^[74-75]. It is believed that the antibacterial activity of mango extract is caused by the presence of Gallo-tannin and mangiferin^[76].

Antifungal:

The mango, *Mangifera indica*, appears to have a very broad range of uses! Research on the antifungal properties of mango extracts has shown that some of the chemicals in mangoes may really have an inhibitory effect on fungi. Mangoes are thought to possess antifungal characteristics due in part to the presence of bioactive chemicals including flavonoids and polyphenols. Because of these components, mango extracts have the potential to be a natural antifungal agent by preventing the growth and development of fungi. It's crucial to remember that, even if these results are encouraging, more investigation is still required to completely comprehend the range of antifungal action and the precise processes at play. It's important to proceed cautiously with this natural therapy, as with any other, until further scientific data becomes available. At a dosage of 6.25 mg/mL, the antifungal properties of methanol,

ethanol, and aqueous extracts were discovered to be effective against *Alternaria alternata*^[72].

Antiviral:

In the plant kingdom, the mango, *Mangifera indica*, appears to be an all-around superhero! Studies looking into the antiviral properties of mango extracts have revealed certain of the fruit's chemicals may be able to suppress the growth of viruses. It's thought that mangoes' bioactive substances, such as polyphenols, flavonoids, and tannins, contribute to their antiviral qualities. Mango extracts are a promising option for antiviral applications since these components may hinder the reproduction of viruses and their ability to enter host cells. But it's crucial to approach this knowledge with a healthy dose of cautioned optimism. Even if the preliminary results are intriguing, more investigation is required to completely comprehend the range of antiviral activity and the precise mechanisms at play. The antiviral qualities can differ, and the effect on different viruses might not be equivalent.

Mangiferin was regarded as an antiviral drug for hepatitis B, HIV, and herpes simplex^[77-78, 79]. The effect of mangiferin on Herpes simplex virus (HSV-2) was investigated in vitro by Zhu XM et al. in 1993. The results showed that while mangiferin does not directly inactivate HSV-2, it did decrease the late event in HSV-2 replication^[78]. Additionally, mangiferin has the ability to counteract the cytopathic effects of HIV^[80] and prevent the replication of the HSV-1 virus within cells^[77].

Anti-amoebic:

The delicious tropical fruit known as mangoes may also help prevent amoebic infections. Studies on *Mangifera Indica* possible anti-amoebic properties have revealed that some of the chemicals in mangoes may have amoebas-inhibiting properties. It is thought that some of the bioactive substances in mangoes, such as flavonoids and polyphenols, are responsible for their anti-amoebic qualities. Mango extracts may be a natural treatment for amoebic infections due to these components' capacity to disrupt amoebas' proliferation and activity. It's crucial to view these findings cautiously, as with many alternative therapies. Further research is necessary to fully understand the degree of *Mangifera Indica* anti-amoebic activity and its prospective applications, even though the preliminary research seems

encouraging. Tona L et al. (2000) assessed the anti-amoebic properties of mango extract ^[81].

Anthelmintic:

Mangoes' potential health advantages never cease to amaze us! Research on the anthelmintic action of *Mangifera indica* has shown that certain of the chemicals in mangos may have antiparasitic effects on parasitic worms.

Mangoes are thought to possess bioactive components, including polyphenols, tannins, and flavonoids, which are responsible for their anthelmintic properties. Mango extracts may offer a natural remedy for helminthic illnesses since these components may hinder the survival, growth, or reproduction of parasitic worms. It's crucial to treat this material cautiously, though. Further investigation is necessary to completely comprehend the processes and efficacy of *Mangifera indica* in suppressing parasitic worms, even though the preliminary results are promising. In mice that were experimentally infected with *Trichinella spiralis* worms, the anthelmintic properties of the MI stem bark component mangiferin were examined ^[82].

Antimalarial:

The ant plasmodial activity of MI's stem bark extract against *Plasmodium yoelii* nigeriensis was assessed. In addition to showing repository action, the extract had a schizonticides effect during the early stages of infection ^[63]. The antimalarial properties of MI's chloroform: methanol (1:1) extract were assessed in vitro. In vitro, the extract exhibited considerable action against *P. falciparum*, inhibiting growth by 50.4% at 20 µg/mL ^[83].

Radio protective:

At 2 mg/kg dosage, mangiferin has been shown to have radioprotective effects on radiation-induced immunocytes without altering the sensitivity of malignant cells ^[84-85].

Immunoregulation:

Immunoregulators have been proposed as potential uses for mangiferin. As an immunostimulant, it prevented the immunological depression brought on by cyclophosphamide, including the atrophy of lymphoid organs, a reduction in cellular responsiveness, a drop in IgM specific to specific antigens, an increase in lipid peroxidation, and a decrease in superoxide dismutase activities. Additionally, it significantly

raised the mice's serum haemolysis IgG and IgM levels ^[86]. Its immunological modulatory mechanisms may be linked to the suppression of activation-induced T-cell mortality, and the activated macrophage's cellular skeleton produced lengthy extensions, intercellular connections, and cytoplasmic dissemination ^[87].

Cardio protective:

Devi et al. (2006) looked into how mangiferin affected rats' myocardial infarction caused by isoproterenol. It was discovered that mangiferin prevented the production of lipid peroxide, lessened the impact of isoproterenol-induced degenerative alterations, and maintained myocardial marker enzyme activity at or above normal levels. The data above show that mangiferin has a cardioprotective effect ^[88].

Osteoporosis prevention:

Mango has been found to enhance not just bone mineral density but also bone quality, as evidenced by improvements in microarchitecture and strength ^[89].

Recognition of memory:

In vitro, mangiferin generated a considerable rise in the levels of nerve growth factor (NGF) and tumour necrosis factor (TNF)- α in the supernatant of human U138-MG glioma cells, while also stimulating cell proliferation. The findings suggest that mangiferin improves recognition memory via a process that may entail elevated levels of cytokines and neurotrophins ^[90].

Bronchodilator:

The impact of an aqueous extract of the stem bark of *M. indica* (mangiferin) on rats' trachea contracted by histamine and acetylcholine was investigated by Gbeassor et al. in 2005. These tests revealed that the rat trachea's histaminic and muscarinic receptors could be blocked by the aqueous extract of *M. indica* (mangiferin), indicating a possible application for the drug in the management of asthma ^[91].

Laxative:

Mangiferin significantly accelerated gastro intestinal tract (GIT) movement at oral doses of 30 mg/kg and 100 mg/kg by 89% and 93%, respectively ^[92].

V. CONCLUSION

One of the most significant sources of medicinal materials is plants. Around the world,

medical plants have long been known to support people's health in handling uncomfortable and challenging circumstances. This has been the case since antiquity. The fight against the prevalence of infectious diseases like malaria, HIV/AIDS, and chronic illnesses like cancer, cardiovascular disease, and age-related degenerative diseases is one of the main objectives of the Millennium Development Goals (MDGs). Secondary metabolites are abundant in medicinal plants and have the potential to be important therapeutic agents. The application of plant extracts as medicinal agents is gaining traction. The "king of fruits," the mango, has the potential to be a cure-all pharmacologically. According to a review of the research, mangos have been shown to have antibacterial, anticancer, anti-diabetic, and anti-inflammatory properties. They are also thought to have heart- and radio-protective and memory-enhancing properties.

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