Review Article

Ethanomedical, Chemical, Pharmacological, Toxicological Properties of *Mangifera indica*: A Review

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ABSTRACT

Ayurvedic medicine is one of the world's oldest medical systems. It originated in India more than 3,000 years ago and remains till now. The Sanskrit meaning of "Ayurveda" is the knowledge for long life. Medicinal plants existing even before human being made their appearance on the earth. Plants are rich source of many natural products, most of which have been extensively used for human welfare.The raw materials for Ayurvedic medicine were mostly obtained from plant sources in the form of crude drugs.There has been a rich heritage of ethno botanical usage of herbs by various communities in the country. Traditional Medicines derived from medicinal plants are used by about 70% of the world's population. Medicinal plants existing even before human being made their appearance on the earth. The raw materials for Ayurvedic medicine were mostly obtained from plant sources in the form of crude drugs.There has been a rich heritage of ethno botanical usage of herbs by various colorful tribal communities in the country.The primitive man used herbs as therapeutic agents and medicament, which they were able to procure easily. The nature has provided abundant plant wealth for all living creatures, which possess medicinal virtues. Owing to rich medicinal properties, *Mangifera indica* commonly known as Mango (Aam) of family Anacardeace has a long history of use in the home as an herbal remedy since ancient times. Various parts of the plant have been used for curing various ailments. Mango is not only a fruit but an important medicinal plant. This review deals with chemical ,pharmacological, ethnomedical and toxicological aspects of this medicinal plant and it also provides supportive evidence about the therapeutic effects using herbal drugs as a therapeutic agent might have to reduce the economic burden due to easy availability in nature it also help to reduce side effect of various allopathic medicines.

Keywords: Ailments, Ayurvedic, Ethno botanical, Therapeutic agents

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INTRODUCTION

India having various systems of health like Ayurveda, Unani, Siddha, Homeopathy and Naturopathy that mentioned even in the Vedas and other scriptures. These systems existed side-by-side with Allopathy containing very long, safe and continuous usage of many herbal drugs [1]. Herbal drugs used by millions of Indians regularly as spices, home-remedies, and health foods like Turmeric, Fennel, Fenugreek, Clove, Garlic, Ginger, Asafetida, Neem, Tulsi, Cinnamon for treating various ailments for skin allergy the prescribed Ayurveda medicines are Azadiractaindica, Tinosporacordifolia, Rubiacordifolia, Curcuma longa, mixture of clove, cinnamon and almond in a paste form is effective medicine for headache, applying the mixture of lime juice and gooseberry juice can cure dandruff, Asafetida, clove and onion are used in Ayurveda to treat toothache clove reduces the pain using its antiseptic and astringent content A boiled mixture of cinnamon, pepper and honey is said to be the best Ayurvedic cure for fever [2].

Traditional medical systems have played an important role in the healthcare in all societies. According to a WHO report, in developing countries up to 80% of people use traditional medical therapies against various alignments as the first line of defense [3].

Ayurveda is the mother of all forms of modern medicine. It is based on the belief that health and wellness depend on a delicate balance between the mind, body, and spirit. The primary focus of Ayurvedic medicine is to promote good health, rather than fight disease. Ayurveda recognizes the interaction between humans and nature (elements that compose our body also make up the Earth) [4].

Ayurveda says that every person is made of a combination of five basic elements found in the universe:

- Space
- Air
- Fire
- Water
- Earth

These elements combine in the human body to form three life forces or energies, called doshas. They control how your body works. The three doshas are:

- Vatadosha (space and air)
- Pitta dosha (fire and water)
- Kaphadosha (water and earth)

Everyone inherits a unique mix of the three doshas.Each dosha controls a different body function so it is believed that the chances of getting sick are linked to the balance of your doshas [5].

The term "Ayurveda" contain two words *ayur*(life) and *veda*(science or knowledge) it is one of the oldest systems of medicine in the world, as practiced in India. Ayurvedic physicians prescribe individualized treatments, including proprietary ingredients, diet, exercise, compounds of herbs and also lifestyle recommendations [6]. Many Ayurvedic practices having written records and handed down by word of mouth. The Great Trilogy was written in Sanskrit more than 2,000 years ago which considered as a basis of Ayurveda. *Vedas* the world's oldest existing literatures include first documentation of Ayurveda. *Charaka Samhita* and *Sushruta Samhita* are the original text for Ayuevedic medicine [7].

Vedic sciences have been communicated from generation to generation through verbal means thus the exact period of *Vedas* is also not known because for an unknown period, However historians believe that the period of documented literature falls between 1000 and 2000 BC [8].

In 1827, Ayurvedic classes of medicine began at the Government Sanskrit College, Calcutta.

In 1927 Banaras Hindu University offered five-year degree course in Ayurvedic medicine and surgery was at from.

In 1970, the *Ayurvedic formulary of India* was published in two volumes by the Government of India. It contains over 600 compound Ayurvedic formulations.

In 1999, Part I of the *Ayurvedic pharmacopoeia of India*.

In19th century the western system of medicine was introduced by British [9].

Herbal remedies have used extensively in ethno medical and ethno veterinary practice proved to be useful in the treatment of diseases. The limited availability of medicines especially to rural prohibitive and their cost have driven the continued dependence on herbal drug as well as on their formulation [10]. The nature has provided abundant plant wealth for all living being, which possess medicinal quality thus the primitive man used herbs as therapeutic agents, which they were able to procure easily [11].

Plant derived active principles represent numerous chemical compounds they have possible use in the treatment of various diseases. Medicinal plants have been reported to possess various activities due to presence of different type of active principles [12]. Traditional system of medicine have been described a number of Medicinal plants used for the treatment of different disease. *Aloe Vera* is used worldwide for several medical purposes like ant diabetic, antihyperlipidemic and anti oxidative activity. *Allium sativum* traditionally uses for its anti diabetic, antimicrobial, antiviral activity. *Ocimum sanctum* is a holistic medicinal plant continuously used in India for cough and cold, fever and diabetes like disease[13].

Among various herbal drug Mangifera indica is an important herb in the Ayurvedic and indigenous medical systems for over 4000 years with high nutritional and medicinal value. It is also known as mango consists of about 30 species of tropical fruiting trees belonging to family Anacardiaceae has a long history of use in the home as an herbal remedy since ancient times. Various parts of

the plant have been used for curing various ailments. Mango is not only a fruit but an important medicinal plant varied medicinal properties are attributed to different parts of mango tree [14].

Apart from medicinal uses mango can be used in various filed like it have high stearic acid content, the fat is desirable for soap-making. The seed residue after fat extraction is usable for cattle feed and soil enrichment. After soaking and drying to 10% moisture content, the kernels are fed to poultry and cattle [15].The bark possesses 16% to 20% tannin and has been employed for tanning hides. It yields a yellow dye, with turmeric and lime, a bright rose-pink. Gum obtained from mango a somewhat resinous, red-brown gum from the trunk is used for mending crockery in tropical Africa. In India, it is sold as a substitute for gum arabic. The wood from mango is greenish-brown, coarse-textured, medium-strong, hard, and easy to work and finishes well. It is used for, window frames, agricultural implements, boats, plywood, shoe heels and boxes [16].

BOTANICAL DESCRIPTION

The genus Mangifera originates in tropical Asia, with the greatest number of species found in Borneo, Java, Sumatra, and the Malay Peninsula. Current distribution Mango is now cultivated throughout the tropical and subtropical world for commercial fruit production, as a garden tree, and as a shade tree for stock [17].

Mango is a long-lived evergreen tree that can reach height of 15–30 m (50–100 ft). Mango trees typically branch 0.6–2 m (2–6.5 ft) above the ground and develop an evergreen, dome-shaped canopy. The leaves are spirally arranged on, 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 odor when crushed [18].

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 . T The seed is solitary, ovoid or oblong, encased in a hard compressed fibrous endocarp the inflorescence occurs in panicles consisting of about 3000 tiny whitish-red or yellowish - green flowers. The most-cultivated Mangifera species, M. indica (mango), has its origins in India and Myanmar [19].

TAXONOMICAL CLASSIFICATION[20]

Kingdom- Plantaey
Class- Mangoliopsida
Phylum- Mangoliophyta
Order- Sapindales
Family- Anacardiaceae
Genus- Mangifera
Species - Indica.

COMMON NAME AND DIFFERENT SPECIES

Table 1: Common Name and Different Species [21]

S.N.	COMMON NAME	DIFFERENT SPECIES
1	Sanskrit: Ambrah; Madhuulii; Madhuula; Madhuulaka	Mangiferaaltissima.
2	English: Mango	Mangiferapersiciformis
3	Hindi: Aam	Mangiferacamptosperma
4	French: mangot;mangue; manguier	Mangiferacaesia
5	Portuguese: manga; mangueira	Mangiferadecandra
6	Dutch: manja	Mangiferalaurina
7	Tamil: Ambiram; Mambazham; Mambalam; Mangai	Mangiferaodorata
8	Punjabi: Amb; Wawashi	Mangiferalongipes
9	Gujarati: Ambo, Keri; Marvo (unripe)	Mangiferafoetida

MACROSCOPY OF DIFFERENT PARTS

[22- 23]

Leaves

Leaves are dark green, glabrous, entire and acute apex. Surface of the leaf is green and pubescent with an entire margin and lanceolate -oblong shape. The shape of the leaves is lanceolate 6-16 inch long and alternate. Petiole of leaves is 1-4 inch long and swollen at base.

Stem bark

The bark is usually dark grey-brown to black. Stem-bark has a hard texture.

Root

The root is light brown in color consists of a long and unbranched tap root with a dense mass of superficial feeder roots.

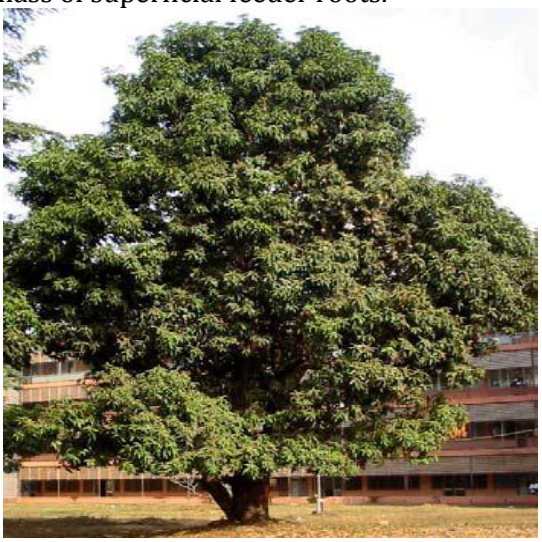

Figure 1: Vegetative (First), flowering (Second) and fruiting (Third) stages of *Mangifera indica*[24].

MICROSCOPY OF DIFFERENT PARTS [25]

Leaf

The transverse section of the leaf denoted the presence of the epidermis, palisade and spongy mesophyll and vascular bundles.

Stem

Presence of cork cells, bundles of fibres, single fibres, prisms of calcium oxalate crystals, pitted vessels and sclereids in the stem. The transverse section stem bark revealed the presence of epidermis, cork, cortex, vascular bundles and the pith

Root

Anisocytic stomata, epidermal cells, unicellular trichomes, starch granules, xylem vessels in the leaf and bundles of fibers, cork cell, prism of calcium oxalate crystals, bundles of fib res with calcium oxalate crystals and single pitted fibers with lumen in the root. The transverse section of root revealed the presence of epidermis, cortex, vascular bundle and the pith.

PHYSIOLOGICAL PARAMETERS

Table 2: Physiological Parametrs of *mangifera indica* [26]

Parameters	Stem Bark	Root	Leaf
Total ash	4.80%	5.05%	5.50%
Acid insoluble ash	1.97%	1.60%	1.78%
Sulphated ash	6.39%	5.41%	7.10%
Water soluble ash	1.80%	3.70%	1.75%
Alcohol soluble extractive	1.04%	0.82%	0.78%
Water soluble extractive	2.11%	0.60%	0.82%
Moisture content	7.9 %	6.30 %	5.80 %

LEAF CONSTANT

Table 3: *Mangifera Indica* Leaf Constant [27]

Leaf Constant	Number
Vein islet no	3
Vein termination no	14
Stomatal no(lower epidermis)	43
Stomatal index(lower epidermis)	23.9

FORMULATIONS AND VARIANTS

Vimang is an aqueous extract of *Mangifera indica* have been derived from the stem bark traditionally used for its analgesic, anti-inflammatory, antioxidant and immunomodulatory properties. Vimang has *mangiferin* as its major component [28].Preclinical studies reported that Vimang prevented tumor necrosis factor α -induced IκB degradation and the binding of nuclear factor κB to DNA, which induces the transcription of genes implicated in the expression of some mediators and enzymes involved in inflammation, pain, oxidative stress and synaptic plasticity [29].

Vimang® capsules were prepared with 300 mg of dry extract obtained from Mangifera indica L. stem bark. This extract was prepared by decoction with water for 1 h and then it was concentrated by evaporation and spray-dried to obtain a fine homogeneous brown powder with a particle size of 30–60 mm. (Nuñez-Sellés et al 2002). The quality control analysis reported more than 50% of total polyphenols from Novatec Laboratory (La Habana, Cuba) [30].

Patients with acute herpetic neuralgia using Vimang in an hospital in cuba received daily dose of 1800 mg of extract (two coated Vimang® tablets 300 mg each, three times daily before meals, results suggested that vimang® supplementation might be beneficial to prevent and treat neuropathic pain [31].

NUTRITIONAL IMPORTANCE

Nutrients from various food components have played vital role to in maintaining normal function of the human body. These functional or medicinal foods and phytonutrients or phytomedicines play positive roles in maintaining and enhancing health and modulating immune function to prevent specific diseases [32].

Mango is the most popular fruits due to its unique flavor and good nutritional value. It is a good source of vitamin like vitamin A, B,C. It contains different minerals such as calcium, magnesium, potassium, sodium, phosphorous and iron. Citric, Tartaric, Malic acid is also present in mango in small quantity [33].

Some important nutrients which abundantly found in mango are:-

IRON

Mango having iron in large amount useful for people who is suffering from anemia. Women become week after their menopause they should take mangoes for fulfillment of iron requirements.

VITAMIN A

Vitamin A is essential content of mango.It is essential for vision and protection against aged relaxed muscular degeneration. It helps to stimulate the circulation of blood in the mucous membrane and skin thus beneficial for various skin disease treatments [34].

VITAMIN B_6

Vitamin B_6 is also known as pyridoxine mango is a very good source of this vitamin. Homocystein is an amino acid present in the blood that damage blood vessel linings vitamin B6 have ability to lowering the level of homocystein within the blood thus helpful in preventing heart disease like stroke, coronary artery disease.

VITAMIN C

The level of vitamin c is high in unripe as well as ripe mango that has been shown to lower LDL cholesterol level within body. Consumption of mango helps in the development of resistance against infectious agents and scavenges harmful oxygen free radicals [35].

OTHERS

FIBER- It is rich in fiber content which help in digestion by breaking down protein which facilitate absorption of food.

PREBIOTIC FIBER- Present in mango helps in growth of beneficial bacteria in the gut and prevent from various gastrointestinal

disorder like ulcer, irritable bowel syndrome [36].

PECTIN- It is a chemical compound that are high in mango, According to various study it was shown that pectin have effective action against gastrointestinal tract cancer.

COPPER-Mango peels are rich in copper which required for the production of blood cells and act as a co factor for many enzymes [37].

PHYTOCHEMICLS

Various phytochemicls like Beta carten, quercetin, astragalin protect body against free radical damage.

POTASSIUM is an important component of cell and body fluids that helps controlling heart rate and blood pressure. Fresh mango is a very rich source of potassium [38].

FOOD VALUE PER 100 G OF RIPE MANGO

Table 4: Food Value of MangiferaIndica [39-40]

Calories	**62.1-63.7**
Moisture	78.9-82.8 g
Protein	0.36-0.40 g
Fat	0.30-0.53 g
Carbohydrates	16.20-17.18 g
Fiber	0.85-1.06 g
Ash	0.34-0.52 g
Calcium	6.1-12.8 mg
Phosphorus	5.5-17.9 mg
Iron	0.20-0.63 mg
Ascorbic Acid	7.8-172.0 mg
Tryptophan	3-6 mg
Methionine	4 mg
Lysine	32-37 mg
Vitamin A (carotene)	0.135-1.872 mg

PHYTOCHEMICAL STATUS, TRADITIONAL AND ETHANOMEDICAL USES

Table 5: Photochemical status, Traditional and Ethanomedical Uses

S.N.	Plant Parts	Chemical constituents	Traditional & Ethanomedical uses
1	Stem bark	Terpenoidalsaponins, indicosideA and B, Manghopanal, Mangoleanone, fridelin, cycloartan-3β-30-diol and its derivatives [41]. MangosterolManglupenone,Mangocoumarin, n-tetacosane, nheneicosane, n-triacontane [42].	Aqueous extract traditionally used for the treatment of, syphilis, anemia, scabies, diabetes, cutaneous infections, menorrhagia, diarrhea. Bark infusion has been use as remedy for mouth infections in children [53]
2	Leaves	protocatechic acid, catechin, mangiferin, alanine, glycine, kinic acid, shikimic acid [43]tetracyclic triterpenoids cycloart-24-en-3β,26 diol, 3- ketodammar-24(E)-en-20S,26-diol [44].	Juice of leaves used for dysentery. Ashes of burned leaves used for scalds and burn. To treat relapse sickness [54].
3	Fruit	Mangiferin, cis-9, cis-15-octadecadienoic acid, Xanthophyll esters, carotenes, and tocopherols [45].	Help to prevent colon cancer, Calming inflammation, Fruit Juice is act as a restorative

			tonic used in heat strok [55]
4	Seed	Polyphenols such quercetin, Kaempferol, gallicacid, tannin, xanthone [46].	Seed kernel in hemorrhages and bleeding hemorrhoids, seed can also applied on burn, to treat Asthma [56].
5	Flower	alkylgallates such as gallic acid, methyl gallate ethyl gallate[47]. 4-phenyl gallate n-propyl gallate, n-octylgallate n-pentylgallate, 6-phenyl-n-hexyl gallate [48].	Dried mango flowers serve as astringents in cases of diarrhea, chronic dysentery. Powder help to reduce allergy (dermatitis [57].
6	Root	chromones, 3-hydroxy-2-(4'-methylbenzoyl)-chromone and 3-methoxy-2-(4'-methyl benzoyl)-chromone [49]	Paste of Mango roots applied on palms and soles cures fever. Paste of root helpful in healing of mouth wound [58]
7	Pulp	vitamins A and C, β-carotene and xanthophylls and Root of mango contains the chromones, 3-hydroxy-2-(4'-methylbenzoyl)-chromone [50]	Mango pulp mixed in drinking milk after it provides energy, strength to the body. Pulp of mango used for sauces, soups, making [59].

The bioactive compound *mangiferin* found in mango tree (*Mangiferaindica*) is main constituents from all parts of plant as primary sources. The structure of mangiferin has been established as 2-C-β-D-gluco-pyranosyl- 1,3,6,7-tetrahydroxyxanthone [49].

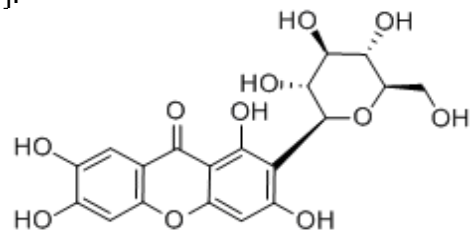

Figure 2: Mangiferin

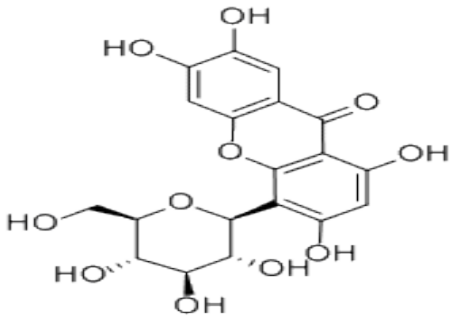

Figure 3: Isomangiferin

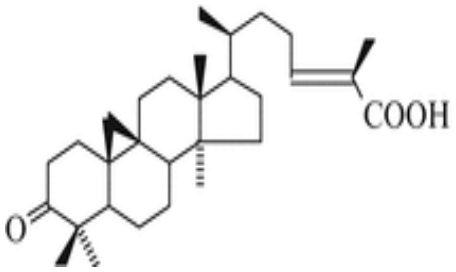

Figure 4: Mangiferonic acid

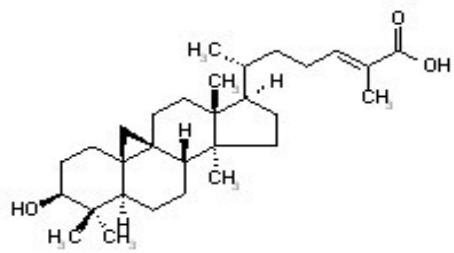

Figure 5: Mangiferolic acid [51,52].

PHARMACOLOGICAL ACTIVITY

Anti-inflammatory

To determine anti-inflammatory activity two extract namely ethyl acetate and ethanol extracts at the dose level of 300 mg/kg has shown significant activity when compare to the standard drug . The standard drug used

was Diclofenac sodium (10 mg/kg) [60].Aqueous extract of leaves of Mangiferaindica also showed significant anti-inflammatory activity. The activity was evaluated by carrageenan induced rat paw edema method for acute inflammation and cotton pellet granuloma method for chronic inflammation. There are various mechanism by which MI produce anti-inflammatory response like scavenging of free and elevating antioxidant molecule thus the production of cytokines are prevent the major mediator of progression of acute inflammation [61].

Antihyperglycemic

Mangiferin showed appreciable alpha amylase inhibitory effect (IC50 value 74.35±1.9µg/ml) and alpha glucosidase inhibitory effect (IC50 41.88±3.9µg/ml) when compared with standard drug acarbose (IC50 83.33±1.2µg/ml).By lowering FBS, TC, TG, LDL, and VLDL levels *mangiferin* showed significant anti-diabetic but also with elevation of HDL level in type 2 diabetic model rats [62].Streptozotocin was used to induced diabetes in mouse. The possible ant diabetic activity of *mangiferaindica* was suggested that it stimulate beta cells of pancreases to release insulin and inhibit the absorption of glucose in the intestine[63].

Antioxidant

Three methods like DPPH radical scavenging activity, ABTS cation radical scavenging activity and ferric thiocyanate assay in comparision to α-tocopherol, ascorbic acid, methylgallate and tannic acid has been used to determine antioxidant capacity of plants[64]. The result of the study revealed that the extract has significant anti oxidant activity and the data demonstrated MI bark extract inhibit lipid per oxidation which protect against lipofundin-induced oxidative stress [65].

Antiulcer

Antiulcer activity of ethanolic extract of Mangiferaindicaseed kernel was evaluated using acid alcohol induced ulceration model. Ethanolic extract of Mangiferaindi afford gastric protection against gastric injury most possibly through antisecreatory action and it significantly reduced LPO activity, increased SOD and GSH activity when compared to the disease control [66].The phytochemicals like tannins, flavonoids were responsible for antiulcer activity. Flavonoids prevents ulcer by free radicals scavenging mechanisms [67].

Analgesic

Analgesia was produced in mice by thermally (hot plate method) and chemically (acetic aicd) nociceptive pain stimuli. The pain reducing effect is to be related to the *mangiferin* content, which was effective in dosage of 12.5-50mg/kg.Oral administration of a water extract from the stem bark of *mangiferaindica* (125-500mg/kg) with Vitamin C (1mg/kg injection) daily for a week prior to administration of formalin was able to reduce pain[68]. There are many chemical constituents flavonoids,mangiferin, tritrpinoids were present in the plant may involve in analgesic acativity [69].

Anthelminthic

The anthelminthic activity has been related to the tannins in immature mangos. Ethanolic and dichloromethane extracts of Phytolacca icosandra produced in vitro anthelminthic activity against the H. contortus greater than 90 % in EHI when used at 0.90 mg ml 1 or higher concentrations. In -vitro test of aqueous extract of immature fruits showed effective anthelminthic activity for LDI (above 90 %) at the concentration of 50.0 mg ml 1oral treatment of rats with *mangiferin* for 50 days evaluated by passive cutaneous anaphylaxis test and inhibit mast cell degranulation. Infected mouse serum sensitization done with high Ige titre then it was stimulated with cystosolic fraction of T. spiralis muscle larvae. Ige play role in pathogenesis of allergic reaction[70]. The tannin present in immature mango could have been related to the anthelminithic activity activity.Tannin change chemical and physical activity of nematodes cuticle by interacting with its proteins [71].

Antibacterial

The standard drug used was amoxicillin 5mg/ml . Ethyl acetate, ethanolic extract of mangiferaindica showed significant activity at dose range 2mg/ml-4mg/ml against four clinical strains of bacteria S. typhi, B.subtilis, E.coli and K.pneumonia [72].

Disc diffusion method was used for antimicrobial screening of bacterial strains. methanol extract shows maximum growth

of inhibition against salmonella.However all exract shows antibacterial activity against pathogenic bacteria strain [73].

Hepatoprotective.

Hepatoprotective activity was evaluated using well maintained G2 cells. Hepatic cell injury induced by administration of 7,12 dimethyl benzanthracene (Dmba) that leads to alteration in liver of mice. Three polyphenolic principles, 1,2,3,4,6-penta-*O*-galloyl-β-D-glucopyranose (PGG), methyl gallate (MG), and gallic acid (GA), were isolated from the ethanolic extract of seed kernels of Thai mango were used to determine hepatoprotective potential against liver injury in rats [74]. The result of the study determine that the extract has significant anti-oxidant activity. It was suggested that *mangiferin* responsible for scavenging ROS and free radicals which involve in cellular injury of mouse liver by modulating cell growth regulators[75].

Anticancer

Antiproliferative effect was preceded by accumulation of cells in G2/M phase of cell cycles with 90% methanolic extract of mango leaves. The the leaves extract of *mangiferaindica* on different concentrations range (62.5-500µg/ml) showed anticancer activity .The leaf extracts inhibit cancer cell proliferation in vitro mainly by accumulating cells in G2/M phase[76]. The potential anticancer effects of the ethanolic kernel extract on breast cancer cells were evaluated using MTT, anti-proliferation, neutral red (NR) uptake and lactate dehydrogenase (LDH) release assaysshowed that the extract is significantly cytotoxic to these cell lines in a dose-dependent manner, and considerably less towards normal breast cells MCF-10A [77]. The cells treated with different concentrations of ethanolic extract of the *M. indica* kernel(10-1000 µg/mL) .*M. indica* extract appears to be more cytoxic to both estrogen positive and negative breast cancer cell lines than to normal breast cells. The extract of *M. indica*, therefore, has potential anticancer activity against breast cancer cells. Antiproliferative activities of mango peel might be due to the synergistic actions of bioactive compounds present in them [78].

Neuropathic Pain Reduction

The model which used to determine neuropathic pain reduction was Formalin-induced Licking and Acetic acid-induced Writhing in Mice. *Mangifera indica* leaf extract contain mangiferin as a therapeutic agent this could be useful in treating and preventing neuropathic pain .The possible mechanism of action may be modulating several molecular targets implicated in central sensitization ,peripheral, central and specific targets of diseases could also be regulated in special glial activation and immune system [79].

Immunomodulatory

the presence of Catechin, Epicatechin and Oxyresveratrol in Petroleum ether extract of Mangiferaindica extract implicated that these phytoconstituentsposses potent immunostimulants activity because of their strong antimicrobial and antiviral activity. *M. indica*in dose 100-300 mg/kg, p.o. showed significant increased the production of circulating antibodies. The alcoholic extract Effect of *M. indica*pulp alcoholic extract on SRBC induced Humoral antibody titres (HA) in mice .Its influence was observed on sheep erythrocyte-specific hem agglutination antibody titre in mice [80].The possible mechanism of mangiferaindica for immunomodulatory activity may be suggested that mangiferin mediate down or suppress activation of NF-xB which mediate cell death by various inflammatory agents like tumor nuclear factor, intracellular glutathione level [81].

Antidiarrhoeal

Ethanolic extract of MI extract seed kernel given at various dose 100,200 and 400 mg/kg body weight and found to be effective against castor oil induced model of diarrhea. Reduction in the rate of defecation and consistency of faces at the dose 400mg/kg significantly decrease the severity of diarrhea.Ricinolic acid the active metabolite of castor oil causes diarrhea. It changes electrolyte permeability of intestine and stimulate the release of prostaglandins and peristallic activity of small intestine. MI extract increase absorption of water and electrolyte it also increases weight of intestine when compared to loperamide(standard drug) [82].

From the study it was concluded that the flavanoid present in MI inhibit intestinal motility and hydroelectrolytic secretion , it also able to inhibit intestinal secretory responses induced by prostaglandins this may be a possible mechanism which supports the ant diarrheal activity of *mangifera indica* [83].

Anti asthmatic

two asthmatic patients treated with product named Vimang®, an aqueous extract of Mangiferaindica L stem bark, which has been registered as antioxidant and anti-inflammatory. A39 years-old female with persistent moderated asthma and a 43 years-old male with persistent severe asthma were treated orally with Vimang® during three months. Respiratory functional tests and determination of total serum immunoglobulin E (IgE), eosinophil cationic protein (ECP) and metalloproteinase-9 (MMP-9) activity were done at times 0, 6 and 12 weeks, respectively. Measurement of the Force Expiration Volume in one second (FEV1),Determination of serum total IgE and ECP,enzymatic activity of MMP-9 was done as experimental model. Experimental studies in mice have demonstrated the capacity of Vimang® to reduce IgE and IL-5 production, and the maturation and migration of eosinophils might be a mechanism for antiashtamaticactivity.MI extract reduced the total IgE , ECP concentrations, and MMP-9 activity in blood serum and it was found that the respiratory function (FEV1) after treatment with Vimang® capsules during 3 months avoiding the use of steroids was improved [84].

TOXICITY STATUS OF MANGIFERA INDICA

The sap exudes from fruit is somewhat milky at first, also yellowish-resinous. It contains mangiferen, resinous acid, mangiferic acid, and the resinol, mangiferol. It becomes pale-yellow and translucent when dried it act as a potent skin irritant, and capable of blistering the skin of the

Continuous intake of the leaves may be fatal for Cows which formerly fed on mango leaves in India to obtain from their urine euxanthic acid which is rich yellow which has been used as a dye. Some irritant is vaporized as essential oil from the flowers when mango trees are in bloom which contains the sesquiterpene alcohol, mangiferol, and the ketone, mangiferone which result respiratory difficulty itching around the eyes, and facial swelling [85].

Acute toxicity study

The single administration of mango extracts up to 4.0g/kg body weight did not produce any mortality or adverse reaction after the administration of a single limit dose.

Chronic toxicity study

The long-term studies at the doses of MLE (100 mg/kg, 300 mg/kg, and 900 mg/kg) in SD rats for 3 months concluded that, rats in MLE treated groups showed the serum K(+) level of female rats was on the low side but the weights of liver, kidney, and adrenal gland were on the high side slight body weight increase, the serum triglyceride and cholesterol levels and the weight of male rats were a little higher when compared with the control group [86].

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