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A Review on Phytoconstituents and Pharmacological Action Found in Fruitage and Foliolo



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ABSTRACT

Now a day People try to avoid more unnecessary consumption of medicine, so they are trying to consume more innumerable fruits and vegetable which has valuable nutrition in it like vitamin A,B,C, essential minerals, and many more, they also have some property like antioxidant, antimicrobial, anti-inflammation, anticancer, which is helpful to fight from various disease, which improve the quality of life, so we find out all the property at some extend like **Papaya, Guava leafs, Blueberry, Mango leafs**. In papaya, there is the present of proteolytic enzyme like papain and chymopapain which have antiviral, antifungal and antibacterial properties. This Property is capable to inhibit the growth of microorganisms. **Guava Leaves** has been have various property like antioxidant, antibacterial, hepatoprotective, hypoglycemic, lipid lowering activity. It has important phytoconstituents like urosolic acid, beta-sitosterol, tanins, titerpenes, flavonoids, saponins, carotenoids, lectins, leucocynidin, ellagic acid, favonoid:qercetin, pentacyclic, triterpenoid:guajanoic acid. Biological property of blueberry include polyphenolic content for regular diet of blueberry reducing risk of developing degenerative diseases like diabetes, hypertension, obesity, hypercholesterolemia, cancer, coronary heart disease. **Mango** has a physiological/pharmacological activity including health promotion of gut and regulatory because of its diverse health-promoting chemical constituents including mangiferin, a natural polyphenol of C-glycosylxanthone structure. The extract of mango leaf consist of immunomodulatory anti-diabetic, anti-hyperlipidemic and anti-cancer properties mango leaf also involving the free radical scavenging activity of mangiferin as well as the anti-inflammatory activity by inhibiting the expression of the TNF.



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INTRODUCTION

The Herbal Product today symbolize safety in contrast to the synthetic that are regarded as unsafe to human and environment, Ayurveda, it is an Indian system of medicine it is popular in many part of the world. Ayurveda had developed certain dietary and therapeutic measure to delay ageing and rejuvenating whole function dynamics of the body organs ^[1]. It is useful for the treatment of wound infection it will improve the efficacy of phagocytic cell that destroy bacteria ^[2].

PAPAYA:

In vitro studies skin and seeds of both unripe and ripe *Carica papaya*, from extracts, from flesh gave antibacterial activities against various microorganisms including *Bacillus cereus*, *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, *Enterobacter cloacae*, *Proteus vulgaris*, *Klebsiella pneumoniae*, *Salmonella typhi*, *Pseudomonas aeruginosa* and *Shigella flexner* ^[3].

Carica papaya belongs to Caricaceae family and it is commonly known as 'papaya'. In Ayurvedic medicine, the *Carica papaya* is used from very long time. *Carica papaya* is also used as an anti-inflammatory, antioxidant, diuretic, abortifacient, antibacterial, hypoglycemic, antihelminthic, antifungal, vernifuge, immunomodulatory activity. Scientific evidence suggest their versatile biological function that supports its traditional use in different disease. Phytochemical studies of *Carica papaya* contain mainly glycoside, carposides, sugars, tannins, flavonoids, gamma terpene, alkaloids carpaine, pseudocarpaine, carcin etc. The Papaya is cultivated at various part of the world like Central America, Northern South America, the papaya is now day cultivated in most tropical countries ^[1].



Figure No. 1: Fruits of *Carica papaya* plant^[4]

CHEMICAL CONSTITUENTS

Carica papaya Linn fruit contains vitamin C, thiamine, iron, malic acid, phosphorous, calcium, minerals, carbohydrates, fibre, fat and proteins (green fruit) volatile compounds : 4-hydroxyphenyl-2-ethyl-B-D-glucoside, Linalol, benzyl isothiocyanate, cis and trans 2,6-dimethyl-3,6-epoxy-7octan-2-ol. Alkaloid; carpaine, benzyl-B-d glucoside. Acid-oleic acids and vaccine, Juice-n-oceanic acids, n-hexanoic, n-butyric, lipid-myristic, palmitic, steric, linoleic, linolenic^[5].

PHARMACOLOGICAL ACTIVITY

Antifungal activity

Candida albicans growth inhibited by the synergistic action of latex papaya, fluconazole. This synergistic effect lead to the degradation of all wall due of the lack of polysaccharide constituent in the outermost layer of fungal all wall and release of cell debris into the all culture. The protein in the latex is responsible for the antifungal action & minimum protein concentration for producing complex inhibition^[6].

Antibacterial Anticancer activity

The proteolytic enzyme papain is present in the papaya. It is used as an adjuvant to treat of malignant disease. The papaya *in vitro* study, it will treat anticancer activity & cancer cell line. The cell wall break down by the papain. The fibrin cancer cell wall and protein into amino acid it breakdown by the papain. The papain is reactive towards oxygen and free radical, it is also contain lycopene which is highly reactive.

The Isothiocyanates it is inhibiting both the formation & development of cancer cell. It is effective against the breast, lung, colon, pancreas, prostate as well as leukemia^[7].

Anthelmentic activity

The plant extract is traditionally used for the treatment of helminths infection, which are rich in the proteolytic enzyme known to digest nematode cuticle. It has low toxicity & traditionally used against gastrointestinal nematodes^[7].

TRADITIONAL USES

1. In wounds and injuries, the leaves of papaya are used for dressing.
2. In thinning of the blood the papain is helpful.
3. It reduces swelling, fever, adhesion, after the surgery.
4. It is a natural pain reliever^[7].
5. As a contraceptive, the unripe papaya is commonly used in Pakistan, India, and Srilanka.
6. As vermifuges, the papaya seeds are used.
7. In papaya the papain are present which is used against heartburn indigestion.
8. It is used as antiulcer in medicine and as disinfectant^[8].

TABLE NO. 1: Total Production and Area of Papaya in the Countries of the World^[9]

Country	Production (1000 tones)	Area (thousand hectare)
India	5,639,300 million	133,360
Brazil	1,603,351 million	32,031
Nigeria	850,000	94,200
Indonesia	840,121	9,384
Mexico	836,370	14,533
Congo	220,483	13,043

BLUEBERRY:

In blueberry both in the pulp and peel shows a greater polyphenol concentration. High level of Anthocyanidins are found mostly in the water-soluble purple pigment of the peel. This

progressive is dependent on seeralendogeneous (Chronological aging) and exogenous (photoaging) factors with signs appearing from an age range as early as the thirties or more being perceived by the sixties. The cause's skin aging is related to age, genetic tendencies environmental factors and lifestyle. It is for the aging process, with increases in reactive oxygen species production leading to oxidative stress. Thus, there is a constant preoccupation in cosmetology to prevent and mitigate skin aging using research and study of an effective antioxidant agent. The study aimed to produce and evaluate lyophilized containing potential antioxidant cosmetic formulation. These molecules promote collagen synthesis, providing benefits to the skin and also supporting the vascular system, this being one of the main structural components of dermal connective tissue. Additionally, these antioxidant molecules can prevent the deleterious effects of oxidation, inhibiting the onset of lipid peroxidation, sequestering free radicals and protecting aerobic organisms from oxidative stress, which defied as increases in the formation of reactive oxygen species. Polyphenols are a secondary product of plant metabolism constituting a complex phytochemical group of more than 8000 known structures. From the age 20 onwards, almost imperceptibly, the human skin begins to lose som properties of strength and self-regeneration. It is a slow and irreversible process, which varies according to skin type. In a biological context, have important roles in cell signaling and reactive oxygen species are formed as a natural byproduct of the normal metabolism of oxygen and homeostatis^[10].



Figure No. 2: Fruits of blueberry plant^[11]

CHEMICAL CONSTITUENTS

As there are phenolic compound is present in the blueberry fruits, they are further classified into two groups; non-Flavonoids and Flavonoids. Flavonoids has a 15 carbon in it basic chemical structure, there are different classes of flavonoids include flavanones, flavanols, isoflavones, anthocyanin, flavans that differ from each other with respect to oxidation around the heteocyclicring oxygen. The colour purplish-blue colour is print due to present of anthocyanin have been explored for their good source of antioxidants it can be used as a food. There also presence of carbohydrates commonly like monosaccharides, disaccharide, tetrasaccharide form are attached with anthocyanidins are galactose, glucose, arabinose, xylose, a rhamnose. The outer layer of fruits that hypodermis layer will only have anthocyanin. While the rest the pulp of the frits will never content the anthocyanins^[12].

PHARMACOLOGICAL ACTIVITY

Antioxidant and Anti-inflammatory

The anthocyanins are present in blueberry which is a benefit for cardiovascular health via antioxidant, anti-inflammatory effect. The Blueberries act as various ways by vascular responsiveness, blood pressure, arterial stiffness. These involve NO metabolism, effect on endothelium composition and plasma lipids. In berry the non-flavonoid catabolites predominate in the large intestine it will interact with the microbiota to produce an anti-inflammatory response. In a study with hih-Fat fed rats, the moderate intake of blueberry is given, the negative effect of the high-fat diet on insulin and inflammation, and which also led to gut microbiota modification ^[13].

Ophthalmic-protective

Blueberries have the potential in blocking effect of light that abuse on eyes for 4 week with whole blueberries. The blueberry have a protective effect on retinal pigment epithelium was evaluated, against uv light, visible. The enriched diet of blueberry was investigated as a potential to protect against light-induced retinopathy. Blueberry have potential to delay aging, apoptosis and also down the regulation of vascular endothelial growth factor (VEGF). Given as gauge for 2 to 7 week, it develop retinal protection before subjecting to 2 hours of intense light regimen^[14].

Cardio-protective and hypotensive

The flavonoid rich food intake is suggested for exerts cardiovascular benefit. It has a richness of antioxidant, that protect against reactive oxygen species (ROS). The role of blueberry in improving contractile, machinery of endothelial layer, the relaxation of aorta significantly greater in response to acetylcholine. The nutritional effect of angustifolium consumption in oxidative stress, endothelial function, inflammation^[14].

TRADITIONAL USES

1. These wild berries have been used since and ancient times to prepare stews, soap and meats.
2. The number of dishes with the blends of tasty flavour.
3. The cold and cough is treated by the berries juice.
4. It is popular and started to be as preserved in bulk as the canning industry grow.
5. It is used to removing free radicals from the blood.
6. It is protective against digestive disease and neurodegenerative^[15].

Table No. 2: Total Production and Area of blueberry in the Countries of the World^[16]

Country	Production (Tones)	Acreage (Hectare)
United States of America	269.277	37.555
Canada	178.745	54.535
Mexico	29.067	2.946
Poland	14.721	5.039
Germany	10.710	2.714

GUAVA LEAF:

Guava Leaf extracts has properties like analgesic, antimicrobial, hepato-protective, anti-inflammatory, antioxidant. These effect is due to phenolic compounds ^[7,12,17]. In white and red guava leaves (*Psidium guajava* var. pomifera L.) thus presence of higher amounts of phenolic compound with antioxidant activity was reported by jimenez-Escrig *et al* ^[18], wang *et al*^[19], and Haida *et al* ^[20] as compared with other vegetable spices. Gallic acid, catechins,

epicatechins, rutin, narigenin and kampferol in the leaves was found by wuetal^[21], melo *et al*^[22] and Chen *et al*^[23]. Gallic acid and epicatchin inhibit pancreatic cholesterol esterase which can decrease the cholesterol levels. Catachins are important as a prevention treatment for obesity and diabetes type 2. Quercetin has associated to decreases incidence of stroke and mortality from heart disease and in quercetin present antioxidant activity and hypo cholestolemic. Narigenin and kaempferol can promote moderate cytostatic activity against all cell lines^[24,25,26,27,28,29].

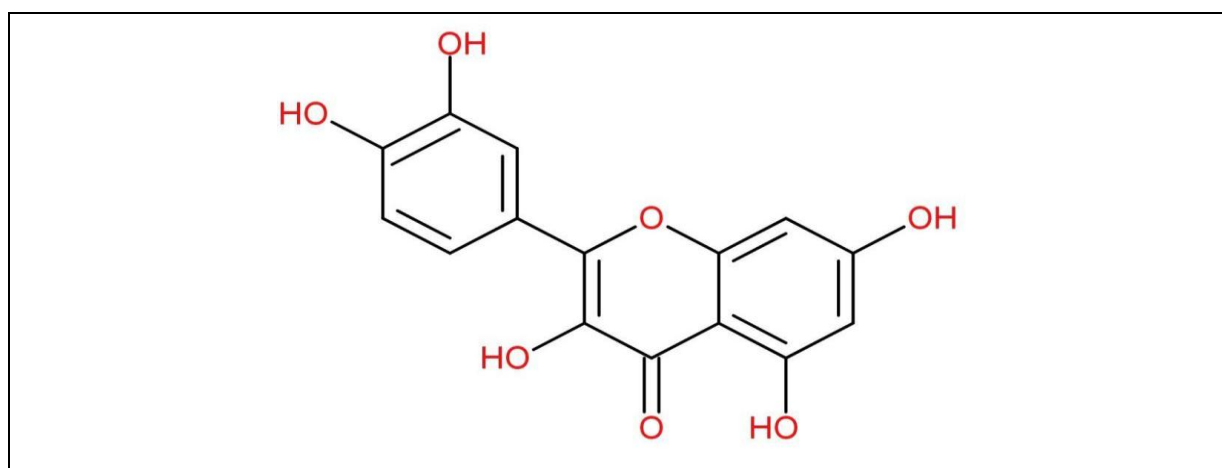


Figure No. 3: Fresh leaves of *Psidium guajava* plant^[30]

CHEMICAL CONSTITUENTS:

In guava leaves found the structure of three novel sesquiterpenoid- based meterpenoids of psidial A-C elucidated Fu *et al*^[31]. By isolated two terpenoids from the Guava leaf extract (betulinic acid and lupeol) and report their potential phytotoxic activities Ghosh *et al.*^[32]. For the treatment of cardiovascular disease, diabetes, obesity and atherosclerosis, betulinic acid and lupeol can be used^[33]. By isolation of two novel sesquiterpenoid-diphenylmethane-diphenylmethane meroterpenoids with unusual skeletons Psiguadialsan and B, along with a pair of known epimers, psidial A and gujodialshao *et al*^[34]. By isolation of four new, Psiguanins A-D (1-4), triterpenoids with 13 know compound from the *Psidium guajava* leaves^[35]. From the fresh leaves of Guava they can also identify one benzophenone and one diphenylmethane and eight flavonoids (2,6-dihydroxy-3-formaldehyde-5-methyl-4-O-(6'-o-galloyl-B-D-glucopyranosyl)-diphenylmethane; 2,6-dihydroxy-3,5-dimethyl-4-o-(6'-o-gulloyl-B-D-glycopyranosyl)-decreases reynoutrin, hyperoside; aviculurin; guaijaverin; isoquercitrin; quercitrin; quercetin; kaempferol; qercitrin; quercetin; benzophenone Shu *et al.*^[35]. Guaijaverin has a high potential of antibacterial agent by inhibiting the growth of the *Streptococcus mutans*^[36]. Rats are experimentally infected with Trypanosoma a bruccibrucie

showed anti-trypanosomal properties by aqueous extract of guava leaf [37]. It shows a strong antibacterial activity and it act against the multi-drug-resistant *Vibrio cholera* when aqueous mix. of and water-soluble methanol extract from *Psidium guajava* leaves Rahim *et al.* [38]. Guava leaves also have a broad spectrum antimicrobial activity for controlling diarrhea is cause due to wide range of pathogen Birdi *et al* [39]. Birdi *et al* [40] Guava leaves show antimicrobial activity because of flavonoids are present on them. *Psidium guajava* leaves infusion to reduce, hypercholesterolemia, hypoadiponectinemia in the animals for their study and also improved hyperinsulinemia in murine models. Deguchi and Miyazaki [41] *Psidium guajava* leaf and peel extracts have hypoglycemic effects on experimental models drug-induced to serve conditions of diabetes [42,43,44]. Guava leaves on the inhibition of the activity of intestinal glycosidases related with postprandial hyperglycemia. Suggested it used for treatment of individuals with type 2 diabetes and marar^[45,46]. Guava leaves contain a compound that promotes free radical scavenging activity showing antioxidant properties Kim *et al* [47]. Anti-inflammatory activity of it is showed by ethanol extract of guava leaves Dutta and Dos [48]. The ethyl acetate extract of Guava leaves have a therapeutic application for atopic dermatitis and other inflammatory skin disease has *et al* [49]. Methanol extract of Guava leaves is used for the treatment of gastric ulcer disorder due to the presence of volatile oil, flavonoids and saponins^[50] and also used for wound healing effect due to the presence of tannins and flavonoids [51,52] and the extract of Guava leaves is also useful for as anti-cough agent Jaijarj *et al.*^[53]



Structure of Quercetin

PHARMACOLOGICAL ACTIVITY

Antidiarrhoeal activity

Diarrhoea is commonly occurring in children and adult, the laxative effect is found in the ripe fruit of guava which can be use in constipation. The guava leaf decoction has been used for the gastroenteritis and chronic diarrhoea, but the young leaves of guava has a dysentery and diarrhoea is reported. The Quercetin component is present in the guava leaf extract. The guava leaf extract is used for the inhibition of intestinal movement and capillar permeability is reduced in abdominal cavity and inhibit increase of watery secretion that occur in the acute diarrhoel disease. In guava there is a galactose specific lectin, which was bind to *Escherichia coli*, that preventing it adhesion to the intestinal wall, thus it preventing the infection which cause diarrhoea^[54].

Antimicrobial activity

Due to the tannins constituent present in the guava leaf extract has the antimicrobial activity against the gram-positive and gram-negative. The antimicrobial activity is found in the leaf extract of *Psidium guava* against the *Propionibacterium acnes*, so it is used for the treatment of acne, the extract is also used against the *Streptococcus mutasis*, *Psuedomonas aeurginosa* which causes the infection in human intestine. *Psidium guava* are effective against bacteria like *Bacillus strearothermophilus*, *Escherichia coli*, *Pseudomonas fluorescens*, *Salmonella enterica*, *Staphylococcus aureus* and *Vibrio cholera*. The trypanocidal properties are found in guava leaf which has a broad antimicrobial and iron chelating activity, flavonoids, tannis respectively^[54].

TRADITIONAL USES

1. In India Guava is used for Gastrointestinal, Anti-spasmodic and Rheumatism.
2. Guava is used for Diabetes Mellitus, Diarrhea, and Antiseptic in China.
3. In southeast Asia, it is used for Skin/Wound, Astringent, and Diuretic.
4. It is also used for Diabetes Mellitus, Anti-inflammatory, Anti-bacterial and cough in Pakistan.
5. In Mexico Guava is used for Skin/Wound, Gastrointestinal, Anti-inflammatory and cough.

6. And also it is also used for Astringent in Philippines^[55].

Table No. 3: Total Production and Area of Guava in the Countries of the World ^[56]

Country	Production (Tones)	Acreage (Hectare)
India	18.779.000	2.237.000
China	4.771.038	586.027
Thailand	3.432.129	410.694
Mexico	2.197.313	206.423
Indonesia	2.184.399	167.783

MANGO LEAVES

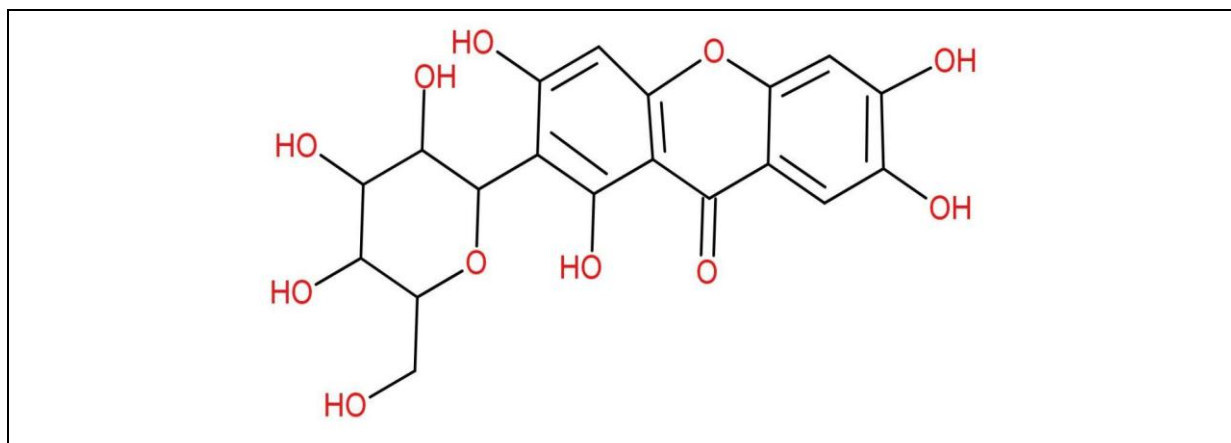
In India mango trees can be cultivated for thousands of years, mango trees are cultivated in east and West Africa since in 10th century AD. Also, *Mangifera indica* trees can be cultivated in Southern Europe, especially in coastal subtropical environment of canary island, Spain, Portugal as well as they grown in West Indies, Brazil, Mexico, and Caribbean Island ^[51]. Various literature recommends various parts of mango trees such as leaves, raw and ripe fruit, bark seeds have a various nutritional properties phytochemical composition, pharmacological; medicinal and health benefits ^[57-61]. In Hindu culture mango leaf are used traditionally in many of occasion. Mango leaves has various activities like antioxidant, anti-inflammatory, anti-viral, anti-microbial, anti-dysentery, anti-tumor, anti-diabetic, anti-bacterial, anti-pyretic, anti-spasmodic, wound healing, cardio-protective, anti-carcinogenic, hepatoprotective, immunomodulatory, gastro protective and hypolipidermic effect.



Figure No. 4: Fresh leaves of *Mangifera indica* plant ^[62]

CHEMICAL CONSTITUENTS

Mango leaf extracts have antioxidant and free radical scavenging activities [63, 64]. In mangiferin the four hydroxyl groups are present which shows the antioxidant properties by scavenging the noxious oxygen free radical. Production of noxious hydroxyl radicals can prevent by potent in chelator and also protects against UV radiation [65]. The antioxidant activity of mangiferin is demonstrated using the DPPH assay by Dar *et al.* which is comparable to rutin; a potent antioxidant is used for medical purposes [66]. It induced lipid peroxidation in human peripheral blood lymphocytes by lowers the hydrogen peroxide [67]. It also exhibit antidiabetic activity by induced lipid peroxidation (TBARS) [60, 68]. Mango leaf extracts has an antioxidant potential that counterbalances the iron-induced oxygen free radical formation by Fe^{2+} accumulation and iron-induced toxicity [69,70]. Mango leaves are hepatoprotective against the carbon tetrachloride which induced liver injury which can support the free radical scavenging activities [70]. Molecular mechanism of mangiferin which acts against the lipopolysaccharide (LPS) and D-galactosamine which induces acute liver injury and inflammation investigated by Pan *et al* [71]. Mangiferin increased CD73 expression in kidneys suffering from ischemia-reperfusion injury, inhibited pro-inflammatory response, tubular apoptosis and also enhanced adenosine production [67]. By metabolization of mangiferin into phenolic acid metabolite in the colon by human bacterial enzymes, these are capable to exhibiting biochemical and pharmacological effect [72]. It is demonstrated that phenolic extract included 3, 4-dihydro-phenylacetic acid, 2, 4, 6,-trihydroxybenzoic acid, 3, 4, 5-trihydroxybenzoic acid and 3, 4-dihydrobenzoic acid this metabolism by intestinal micro flora of animals treated with mangiferin[73]. In mango leaves about 2-15% of mangiferin content, and about approximately 60% of mangiferin content in extracts of mango leaves which are rich in sesquiterpenes and also contains mangiferin, b-caryophyllene, b-selinene, alpha-gurjunene and delta-carene. Phytochemical analysis showed that mango leaves contains alkaloids, Flavonoid, Tannins, Saponins and Phenols, as well as mango leaves, contains xanthonoids, mangiferin and gallic acid type of polyphenolic antioxidants in high amount [74, 75]. Mango leaves also contain phosphorus, copper, cadmium, sodium, zinc, potassium, magnesium and calcium as well as it has good source of thiamine, niacin, riboflavin, ascorbic acid [57,58].



Structure of Mangiferin

PHARMACOLOGICAL ACTIVITY

Alpha-amylase inhibitory Activity

Alpha-amylase is a digestive enzyme, the catalyze the hydrolysis of alpha-1,4glycosidic linkage of carbohydrates. The large starch molecule is cleaved into a small fragment of sugar to cross the gut epithelium. In healthy person, the excess amount of sugar is getting converted into an energy source. In the high level of blood glucose are due to more activity of alpha-amylase result in hyperglycemia. In alpha-amylase activity are inhibited due to which it reduce postprandial hyperglycemia and present the risk of diabetes development. The ethanol extract of *M. indica* leaves has a capability against the alpha-amylase activity. The mainly inhibiting the carbohydrate digestive enzyme, currently present drug are acarbose, voglibose, miglitol, the carbohydrate digestive enzyme are alpha-amylase, sucrose, maltase, alpha-glycosidase. The acarbose is given to mice and which leads to the breakdown of the starch and sucrose. So the *M. indica* leaves extract to produce an inhibitory effect on alpha-amylase activity may contribute to hypoglycemia in the type 2 diabetes ^[76].

TRADITIONAL USES

1. It is known as Kalpavraksha, it is found in forest the plant leaves are being offered to Gods.
2. The plant part such as bark, leaves, flower, and fruit are used for worship and medicinal uses.
3. The young leaves are used for several diseases like dysentery, hemorrhoids, ulcer, kidney stone, diarrhea, burning sensation.

4. Seeds powder is used for bread.
5. Against diabetes, the leaves are used.
6. Raw mango is used for pickles, making curry.
7. The plant roots are used against diarrhea, pneumonia^[77].

Table No. 4: Total Production and Area of Mango in the Countries of the World^[56]

Country	Production (Tones)	Acreage (Hectare)
India	18.779.000	2.237.000
China	4.771.038	586.027
Thailand	3.432.129	410.694
Mexico	2.197.313	206.423
Indonesia	2.184.399	167.783

CONCLUSION

The fruits and the leaves which described in the review indicate the importance of antioxidants, antibacterial, anti-inflammatory and antimicrobial properties. These all properties are contributing to treat various diseases like diabetes, hypertension, obesity, hypercholesterolemia, cancer, coronary heart disease, anti-inflammatory, anticough and gastric ulcer.

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