

## Medicinal and Therapeutic Potential of *Phyllanthus emblica* (Amla-Indian Gooseberry): A Review

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### ABSTRACT

Amla (*Phyllanthus emblica*/*Emblica officinalis* Gaertn.) also known as Indian gooseberry is one of the most important therapeutic plants in Indian traditional system of medicine (ayurveda, unani and siddha). Almost all the parts of amla are considered to be useful in the treatment of various diseases. Fruit of amla is most important part among all. Amla as a medicine in Indian system are used as diuretic, laxative, liver-tonic, refrigerant, stomachic, restorative, anti-pyretic, hair tonic, ulcer preventive and for common cold, fever as alone or in combination with other plants. Various plant parts show antidiabetic, hypolipidemic, antibacterial, antioxidant, antiulcerogenic, hepatoprotective, gastroprotective, and chemo-preventive properties.

**Keywords:** Indian gooseberry; Amla; *Emblica officinalis*; *Phyllanthus emblica*; Therapeutic Potential; Phytoconstituents; Phenolic compound

### INTRODUCTION

In the present scenario, there are lot of exertions the researchers and scientists making-out to make an improved and healthy existence of humans. Nature has gifted us with various medicinal plants to overcome various diseases and infirmities and living a healthy life [1]. Medicinal plants, as a group comprises approximately 8000 species and account for about 50% of higher flowering plant species in India. Various medicinal plants and its parts are found in traditional Indian system. Indian gooseberry or amla, commonly known as *Phyllanthus emblica* Linn. (Syn. *Emblica officinalis* Gaertn.) belongs to the family Euphorbiaceae, which is a substantial beneficial herb in ayurveda and unani systems of medication. It is immensely used as a stimulant to reinstate the lost body's energy and stamina. Fruits of amla are considered as best among rejuvenating and anti-aging drugs. Amla is extremely nutritious and might be a chief dietary source of vitamin C, amino acids, and minerals. Entire parts of the plant are used for medicinal purposes, particularly the fruit, which has been used in Ayurveda as a powerful rasayana and in customary medicine for the treatment of diarrhea, jaundice, and inflammation [2]. The fruit is used either alone or in combination with other plants to treat many ailments such as common cold and fever; as a diuretic, laxative,

liver tonic, refrigerant, stomachic, restorative, alterative, antipyretic, anti-inflammatory, hair tonic; to prevent peptic ulcer and dyspepsia, and as a digestive agent. Moreover, plant parts show antidiabetic, hypolipidemic, antibacterial, antioxidant, anti-ulcerogenic, hepatoprotective, gastroprotective, and chemo preventive properties [3].

### LITERATURE REVIEW

#### Taxonomy

**Kingdom:** Plantae

**Division:** Flowering plant

**Class:** Magnoliopsida

**Order:** Malpighiales

**Family:** Euphorbiaceae

**Tribe:** Phyllanthae

**Sub tribe:** Flueggeinae

**Genus:** *Phyllanthus*

**Species:** *Phyllanthus emblica*

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## Vernacular names

**Sanskrit:** Dhatriphala, amla, amaliki, amalakan, sriphalam, amalaka, dhatri

**Arabic:** Haliilaj or ihliilaj

**Bengali:** Amlaki, amla, dhatri, amloki, amlati, aunlah

**Chinese:** An mole

**English:** Emblica myroblan, Indian gooseberry

**French:** Phyllanthe emblica

**Hindi:** Amla, amlika, anola, anuli

**Italian:** Mirabolano emblico

**Kashmiri:** Amlī, embali

**Malaysian:** Pokok melaka

**Marathi:** Aavalaa, awla, avalkathi

**Nepalese:** Amba, amala

**Portuguese:** Mirabolano emblico

**Tamil:** Nellikkai, nelli

**Tibetan:** Skyu-ru-ra

**Urdu:** Amla, amlaj

## Botanical description

Amla (*Phyllanthus emblica* L.) is a small to medium sized deciduous tree belonging to the family Euphorbiaceae. It grows as wild or cultivated throughout tropical India. It is one of the most commonly used and important herbs in ayurvedic medicine. Amla's flowers are generally greenish-yellow. The fruit, being pretty smooth and solid on appearance, is almost spherical and light greenish yellow, with six vertical stripes or grooves [4].

## Chemical constituents

*E. officinalis* is one of the most extensively studied medicinal plant containing different bioactive compounds like tannins, alkaloids, and phenolic compounds. The higher concentration of vitamin C and minerals, proteins and amino acids like proline, aspartic acids, alanine, cysteine, glutamic acids, lysine etc. has been reported in the fruits of *E. officinalis*. It was found that the fruit juice of *E. officinalis* contains phenolic constituents like gallic acid, L-malic acid 2-o-gallate, corilagin chebulagic acid, putrajivain A, elacocarpusin, mucic acid, 1-o-galloyl- $\beta$ -D-glucose, mucic acid 2-o-gallate, mucic acid 6-methyl ester 2-o-gallate, Mucic acid 1,4- lactone 2-o-gallate and so on. Phytochemical research discovered that *E. officinalis* contains higher amount of flavonoid like quercetin and fruits were also analyzed for their alkaloidal content. The infra-red spectral studies and chromatography confirmed that alkaloids like phyllantine and phyllantidine are present in the fruit of amla [5].

## Potential therapeutic applications

**Antioxidant:** Nature has gifted us with protective antioxidant mechanisms catalase, Glutathione (GSH), superoxide dismutase, reductase, GSH peroxidases, vitamin C, vitamin E (tocopherols and tocotrienols), etc., along with a number of dietary constituents. Indian spices and medicinal plants derived from natural dietary components are known to possess antioxidant activity. It was reported by [4] investigated the antioxidant properties and chemistry of *Emblica officinalis* fruit extracts and found positive responses in the total phenol, total flavonoid, and total tannin assays. Antioxidant activity of phenolic compounds of *E. officinalis* was attributed mainly by the phenolic content such as gallic acid and tannic acid which were identified as the most important antioxidant components in the phenolic elements of this fruit [6]. According to the report of Shivananjappa, et al. the aqueous extracts of *E. officinalis* have potency to control basal oxidative markers and enhance endogenous antioxidant resistances using a hepatocyte cell line (HepG2). Due to the presence of high amounts of low and medium molecular weight hydrolysable tannins (gallo-ellagi) (65%-70%), the fruit of *E. officinalis* possesses strong antioxidant properties. The two new tannins-emblica nin A and emblica nin B have a very strong antioxidant action and found to preserve erythrocytes against oxidative stress induced by asbestos, a generator of the superoxide radical [7].

**Antidiabetic:** A numerous experiments and investigations have proved amla as a potential and promising agent for lowering the level of blood glucose in diabetic patients as well as in healthy people. Amla, an ancient herb has been used as folk medicine for the treatment of particularly diabetes along with several health ailments. Daily routine foodstuffs like garlic, onion, turmeric, and amla etc. shows positive effect in controlling the diabetes level by inhibiting gluconeogenesis and glycogenolysis. Daily intake of approximately 2 g-3 g of amla powder capably helps in improving the high-density lipoprotein cholesterol level and controlling the LDL cholesterol level. Likewise, amla fruit has also been in use for the treatment of neuropathy development, for diabetic patient. Many research studies reported that the high vitamin C content present in amla plays an important role in controlling the glucose level on blood, hence controls the diabetes in patients [8].

**Anticancer:** Numerous phytochemicals identified and isolated from amla has proven anticancer properties. It has been found that the polyphenols present in amla is effective against Dalton's Lymphoma Ascites (DLA) and human cervical cancer cell by bringing the process of apoptosis by several mechanisms such as membrane babbling, internucleosomal breaking and condensation of chromatin. Phenolic contents and pyrogallol found in amla have been found to be responsible for the antiproliferative action of amla whereas, polyphenols and hydrolysable tannin derived compounds have been stated to prevent mutagenesis and lipid peroxidation induced by carcinogens [9]. Extracts of *Phyllanthus emblica* have been demonstrated to have strong tumor repressive properties against a number of cancer types both *in vitro* and *in vivo*. The aqueous extract from *Phyllanthus emblica* berries induced apoptosis at concentrations ranging from 50 mg/ml to 100 mg/ml.

Polyphenols or simple aqueous extracts have also revealed cytotoxic activity counter to cervical and ovarian cancer cells. The aqueous extract of this fruit remarkably reduced the proliferation of six human cancer cell lines (A549 (lung), HepG2 (liver), HeLa (cervical), MDA-MB-231 (breast), SK-OV3 (ovarian) and SW620 (colorectal), according to the investigation of Ngamkiti de chakul and coworkers. Roy et al., reported that amla extract is defensive against clastogenicity and mutagenicity induced by lead and aluminum [10].

**Cardio-protective:** Several investigations have reported amla as a substantial protective measure against modifications in myocardial system because of the strong antioxidant along with free radical scavenging activity of amla. It improves cardiovascular health by decreasing triglycerides and increasing cholesterol profile [11]. Oral supplementation of amla for four weeks helps to modify the lipid level by reducing almost 90% LDL cholesterol and improve the HDL cholesterol level. Furthermore, the decrease in total triglyceride level well as total cholesterol level helps protection against cardiovascular diseases. The polyphenol present in fruit juice of amla is beneficial for the treatment of myocardial damage associated with type 1 diabetes mellitus and considered as an effective remedy for heart disease. Similarly, water extract reduces the pressure of blood, maintains the rate of heart and respiration by combined effect and activity of histamines and cholinergic receptors [12]. Juice of amla administered at 1 ml/kg orally for 2 months revealed defensive action against several heart disorders myocardiopathy and tension raised by stressed heart rate and decreases blood pressure in rats with myocardial dysfunction. Amla maintains the enzyme and lipid profile as well as oxidative potential. The polyphenols present in amla fruit is helpful in protection from CVD, atherosclerosis.

**Antimicrobial:** Traditional plants enriched with bioactive compounds, served as a principal for the development of many novel antibiotics used clinically. The active constituents present in amla such as alkaloids has shown potent antibacterial and anti-oxidant activity which might serve as an important lead for the development of safe and efficacious treatment at reasonable costs. An *in-vitro* study revealed the methanol extract of *Emblica officinalis* i.e. alkaloids and several volatile components like beta-caryophyllene, beta-bourbonene, 1-octen-3-ol, thymol, and methyl eugenol present in amla showed anti-microbial action against various gram-positive bacteria as well as gram negative bacteria. Anti-fungal activity was also found in water extract of amla fruit showing effect against pathogenic microbes.

**Hepatoprotective:** The fruits of *Emblica officinalis* have been reported to be used for hepatoprotection in ayurveda. Severity of hepatic fibrosis induced by thioacetamide and carbon tetrachloride is decreased by hydroalcoholic (50%) extract of fruit of *Emblica officinalis* (*Emblica officinalis*-50). Due to its antioxidant activity *Emblica officinalis*-50 effectively reversed the fibrogenic events. The phenols present in amla such as ascorbic acid, tannins and flavanols protects against disruption of hepatic cells and toxic moiety. Water extract of amla has positive hepato and nephron in Ochratoxin A (OTA) induced oxidative stress in all vital organs as well as reduced the oxidation of lipids and levels of serum glutamic oxaloacetic transaminase and pyruvic

transaminase are elevated. Abnormality in the histopathology indicating pre-fibrogenic incidents is caused by chronic treatment of CCl<sub>4</sub> and thioacetamide. Amla has the property to adjust such modifications with substantial regenerative developments revealing its defensive role in pre-fibrogenesis of liver. There are wide variety of hepatotoxic agents, such as ethanol, paracetamol, carbon tetrachloride, heavy metals, ochratoxins, hexachlorocyclohexane and anti tubercular drugs. The phytochemical constituents present in amla such as quercetin, gallic acid, corilagin and ellagic acid were also observed to be hepatoprotective against such agents along with mitigating hyperlipidemia, metabolic syndrome, hepatocellular carcinoma and hepatotoxicity resulting from iron overload. The main phytochemical constituent's quercetin, gallic acid, corilagin and ellagic acid were also observed to be hepatoprotective against the toxicity of paracetamol, micro cystins, galactosamine and lipopolysaccharide [13].

## DISCUSSION

### Eye disorders

*E. officinalis* and its tannoids are used for the remedy of eye disorders by decreasing the possibilities of oxidative pressure as there was a reversal of adjustments with appreciates to carbonyl content of protein, lipid peroxidation and roles of antioxidant enzymes. Also, the accumulation and insolubilization of lens proteins resulting from hyperglycemia is prevented by amla. The juice of Indian gooseberry and triphal powder (made by mixing over of hirda, behde and amla powder) with honey is helpful in maintaining eyesight and treatment of glaucoma and conjunctivitis along with reduction of intraocular tension in significant way. The use of amla in traditional medicines helps to cure different eyesight disorders like redness, lacrimation, itching and burning of the eye. Tannoid rich fractions of *E. officinalis* is found to have shown protective action against diabetic cataract owing to inhibition of aldose reductase. In another treatment, an infusion of the seeds and exudate collected from incisions made on fruit is also used as a collyrium and applied in the inflammations of the conjunctiva and other eye complaints.

### Anti-inflammatory, analgesic and anti-pyretic

The leaves and fruits extracts of *Emblica officinalis* possess analgesic and anti-pyretic, as well as anti-inflammatory action. Aqueous and ethanolic extract of amla have been claimed to have analgesic properties because of peripheral mechanism and have been used traditionally to cure fever, pain and inflammatory illness. Whereas, the contents like alkaloids, phenolic compounds, tannins, amino acids and carbohydrates have been proved having anti-pyretic effects. Fruit extracts of amla reduces the production of a number of chemokines, restricting immune cell infiltration into the affected area and encouraging the production of immune protective cytokines to speed up the recovery procedure and regulating inflammatory reactions. Emblicanin's, ellagic acids and gallic acid are some of the phytoconstituents of amla that showed free radical scavenging activity while some of the phytochemicals reported to

have Nitric Oxide (NO) scavenging activity are methyl gallate, gallic acid, geraniin, corilagin, and furosin. Butanol extract *i.e.*, the water fraction of amla has the potential anti-inflammatory efficacy against indomethacin-induced gastric ulcer [14].

### Anti-ageing

Indian gooseberry, a rich source of vitamin C is considered to have revitalizing effects and valuable in preventing ageing and in maintaining strength in old age. It increases body resistance and defend the body against infection and reinforces the hair, skin, heart and different gland in the body. Damage of various cells and tissues, mainly by oxygen free radicals results in ageing. Vitamin C present in amla breaks them down as it acts as a scavenger of free radicals, thus acts as an anti-ageing agent.

### Immunostimulant

Amla also shows immunostimulatory effects on lymphocyte function, particularly in immunosuppressive disorders regardless of several therapeutic effects of amla. Vitamin C present in amla fruit pulp acts as an immune stimulant. A number of products derived from amla including tonics, syrups, dried extracts, etc. have positive effects in improving the immune system, provides energy and prevent disease. These products are also known as immunomodulator because it decreases the apoptosis and disintegration of DNA as well as improves the cryoprotection. It has been demonstrated that extracts of *E. officinalis* fruit (Amalaki churna and Amalaki swaras) have significant pharmacological action along with immunomodulatory, immunostimulant and moderate cytoprotective activity [15].

### CONCLUSION

Amla, a useful plant due to its numerous therapeutic properties, is one of the oldest medicinal plants stated in Ayurveda. Amla has been used for centuries in almost all older medicinal systems worldwide because of its exceptional curative and revitalizing potential. Amla prevents innumerable health disorders due to its strong antioxidant and biological properties. It contains essential nutrients and has highest amount of vitamin C. A variety of phytochemicals (tannins, flavonoids, terpenoids, and alkaloids) are reported to show numerous pharmacological properties such as antioxidant, anticancer, antitumor, antigen toxic, and anti carcinogenic effects. It is stated that amla has been beneficial against many severe diseases, like diabetes, respiratory disorder, heart diseases, and dental disease. Other key applications are in the form of anti-diarrheal, neuroprotective, and anti-cholesterol activity. Amla is also one of the three fruits that are the part in triphala and it is the main component in the rasayan formulation chyavanprash. Amla progresses healthy metabolism, digestion and elimination. Moreover, it possesses anti-inflammatory properties as well as nourishes body tissue and organs. Many researchers discovered that amla's various extracts and herbal formulations exhibited potential therapeutic benefits against various diseases. Amla has various medicinal properties since eternities still there is an

immense need to scientifically discover and evident its medicinal values at molecular level with help of several modern biotechnological tools and methods.

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