

**A REVIEW ON PHARMACOLOGICAL, MEDICINAL AND
ETHNOBOTANICAL IMPORTANT PLANT: PHYLLANTHUS
EMBLICA LINN. (SYN. EMBLICA OFFICINALIS)**

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ABSTRACT

Plants play a pivotal role in the survival and development of human civilization. Medicinal plants are god given gifts to human beings as they promote a disease free healthy life. These plants owing to their interesting antioxidant activities are widely employed in various herbal preparations. *Phyllanthus emblica* Linn. (syn. *Embllica officinalis*), commonly known as Indian gooseberry or amla, belongs to the family Euphorbiaceae. Though all parts of the plant are used for medicinal purposes, the fruits especially are found tremendous pharmacological applications. They are used both as a medicine and as a tonic to build up lost vitality and vigor. They are highly nutritious and form an important dietary source of vitamin C, amino acids, and minerals. In

traditional medicine, the fruits are used for the treatment of diarrhea, jaundice, and inflammation. They also show antidiabetic, hypolipidemic, antibacterial, antioxidant, antiulcerogenic, hepatoprotective, gastroprotective, and chemopreventive properties. The present review mainly discusses the historical, morphological and pharmacological aspects of this highly valuable medicinal plant.

KEYWORDS: Medicinal plants, *Phyllanthus emblica*, antioxidant activities, pharmacological aspects.

INTRODUCTION

The Indian gooseberry, *Phyllanthus emblica* Linn. (syn. *Embllica officinalis*), also known as Amla or Amla in Hindi and amalika in Sanskrit, is a deciduous tree of the Euphorbiaceae

family. The Indian gooseberry or Amla is an edible fruit and is sour, bitter, astringent and quite fibrous. It is highly valued by nutritionists and Ayurvedic practitioners owing to their rich wealth of various nutrients. It's a 5000 year old natural healing system of medicine that is indigenous to India. In India, it is common to eat the Amla or Indian gooseberries in the pickle format. It is probably the most important natural source of vitamin C, which is easily absorbed by the digestive system. The Indian gooseberry or Amla is native to tropical southeastern Asia. It is a small to medium sized deciduous tree, 8-18 meters height with thin light grey bark. The leaves of the plant are simple, feather-like, and closely set along the branchlets. Flowers are greenish yellow, in axillary fascicles, unisexual, males numerous on short slender pedicels, females few, sub sessile, ovary 3-celled; fruits globose, fleshy, pale yellow with six obscure vertical furrows enclosing six trigonous seeds in 2-seeded 3 crustaceous cocci. The fruits, which ripen in autumn around October till December and are commonly harvested by hand after climbing to the branches bearing the fruits. The fruits are commonly used in the Indian diet.^[1, 2, 3] They can be either eaten raw or can be consumed in various ways such as juice, chutneys, pickles, Murabbas, and can be used with other recipes in its powder form.



Figure: Fruits of *Phyllanthus emblica*.

Taxonomical Classification

Kingdom	Plantae
Division	Angiospermae
Class	Dicotyledonae
Order	Geraniales
Family	Euphorbiaceae
Genus	Emblica
Species	Officinalis Geartn

Vernacular names

▪ Botanical name	Phyllanthus emblica
▪ English name	Indian Gooseberry
▪ Hindi	Amla
▪ Arabic	halilaj
▪ Indonesia	Balakka
▪ Bengali	Amloki
▪ Chinese	Anmole
▪ Gujarati	Amla
▪ Kannda	Bettada neilkkayi
▪ Malaysia	Melaka
▪ Malyalam	neilli
▪ Marathi	avala
▪ Punjabi	Aula
▪ Tamil	Nelli
▪ Urdy	awla
▪ Telgu	Usiri kaay
▪ Maithili	Dhatric

History

Amla is the greatest boon to the humanity and one of the effective traditional herbal medicines, which had been used to treat and manage diseases since the ancient times. It is the reservoir of minerals, vitamins and other bio-chemical substances. A method of emblica preparation was described in the first century AD in Sanskrit. Records of the medicinal use of emblica also have been found in Arabic, Tibetan, and Egyptian texts, as well as in the Sidha (Indian), Ayurvedic, and Unani systems of medicine. All parts of the plant including the fruit, seed, leaves, root, bark, and flowers are used in both dried and fresh forms. In the Ayurvedic system, the amla fruit is noted for its light and dry qualities, as well as being cooling in energy. In India, the fruit is commonly eaten as a pickle.^[2,3]

Chemistry

The fruits are rich in ascorbic acid i.e. Vitamin C. In addition, they contain phenols, including ellagic acid, gallic acid, quercetin, kaempferol, corilagin, geraniin, furosin, gallotanins, emblicanins, flavonoids, glycosides, and proanthocyanidins.^[4,5,6,7,8,9,10] The roots contain glycosides and tannins.^[11,12] The importance of amla is mainly attributed to its strong antioxidant action.^[8,13,14,15,16] The ascorbic acid content of the fruit mainly accounts for 45% to 70% of the antioxidant activity.^[17] Other compounds having antioxidant properties include the emblicanins, gallic acid, methyl gallate, corilagin, furosin, and geraniin.^[6,17,18] The following table shows the type and chemical constituents of amla.

Type and Chemical constituents of Amla

Type	Chemical Constituents
Hydrolysable Tannins	Emblicanin A and B, Punigluconin, Pedunculagin, Chebulinic acid (Ellagitannin), Chebulagic acid (Benzopyran tannin), Corilagin (Ellagitannin), Geraniin (Dehydroellagitannin), Ellagotannin
Alkaloids	Phyllantine, Phyllembein, Phyllantidine
Phenolic compounds	Gallic acid, Methyl gallate, Ellagic acid, Trigallayl glucose
Amino acids	Glutamic acid, Proline, Aspartic acid, Alanine, Cystine, Lysine
Carbohydrates	Pectin
Vitamins	Ascorbic acid
Flavonoids	Quercetin, Kaempferol
Organic acids	Citric acid

Ethnobotanical importance of Emblica

According to believe in ancient Indian mythology, it is the first tree to be created in the universe. The plant is mentioned as rasyana in charaka samhita and is known to prevent aging and promote longevity. The plant is mentioned as rasyana in charaka samhita and is known to prevent aging and promote longevity. It has a natural balance of five tastes i.e. sour, astringent, sweet, bitter and pungent. It is an ingredient of triphala and number of herbal formulations. Fresh and dry fruits are extensively used as laxatives. It is richest natural source of vitamin C and the amount is more than orange and tomato. In ayurvedic texts, it is described as potent antacid. It helps in reducing all the three bodily humors (vata, pitta and kapha). It is having rejuvenating properties and is one of the ingredients of renowned herbal formulations, chayavanprasha. The fruits are known to possess antibacterial, antifungal and antiviral properties. Fruits are diuretic and used for the treatment of diarrhoea, ingestion, ulcers, inflammation, nausea, scurvy, fever, skin sores and wounds. The pericarp of the fruit is used in decoction along with other ingredients. This decoction is applied to boils and spots. The fruits are excellent antioxidants and act as potent scavengers of free radicals. Roots are used to cure dental problems. Juice of bark is used to cure gonorrhoea. Fruits are also known to prevent premature graying of hairs and make them strong and free from dandruff. Its regular use improves immunity and protects heart, brain and other vital organs of body.

Nutritional Value of Amla or Amla

- Raw Amla provides 600 milligram Vitamin C per 100 gram.
- Pressed juice provides 920 milligram / 100ml.
- Dehydrated Amla provides 2500 to 3500 milligram Vitamin C per 100 gram.
- Dried and powdered Amla provides 1800 to 2600 milligram Vitamin C per 100 gm.

Pharmacological importance

1. *Emblica* as an anti-inflammatory agent

Animal models of acute and chronic inflammation show limited anti-inflammatory effects, with reduced edema and granulomatous tissue at higher dosages.^[19,20] Research reveals no clinical trial data on the use of *Emblica* as an anti-inflammatory agent. However, in vitro studies using bronchial epithelial cells extracted from a patient with cystic fibrosis demonstrated inhibition of pro-inflammatory cytokine expression.^[21] Inhibition of collagenase and hyaluronidase by dried emblica fruit extract using donor cartilage from osteoarthritic patients was also demonstrated in vitro.^[22] Crude extracts have also induced apoptotic cell death of mature osteoclasts without affecting osteoclastogenesis, possibly via modulation of transcription factors.^[23, 24]

2. *Emblica* as an Antimicrobial agent

Alcoholic and aqueous extracts of *Emblica* showed positive results against common human pathogens, including bacteria, viruses, and fungi. Activity appears to be stronger against gram-positive bacteria, and only limited efficacy against fungi.^[25, 26, 27, 28] Activity against herpes simplex viruses 1 and 2 has been attributed to the phenolic content,^[29] while activity against the coxsackie virus was found for phyllaemblicin B extracted from the roots of the plant.^[30, 31] Induced *Klebsiella pneumoniae* in mice responded in the long term (30 days) to dietary supplementation with powdered fruit. However, colonization was not prevented in the short term (15 days).^[32]

3. *Emblica* as a Anticancer agent

Much interest surrounds the potential for *Emblica* use in treating cancer; however, there are no published clinical trials or epidemiological data. In response to heavy metal carcinogens (arsenic, chromium, nickel), rats given *Emblica* extracts showed a reduction in the number of chromosomal aberrations, number of damaged cells, frequency of micronuclei in bone marrow cells, free radical production, and increased cell survival.^[33, 34, 35, 36] Rodents fed *Emblica* extracts showed an increase in activity of natural killer cells, antibody-dependent cellular cytotoxicity, and survival in response to tumor cells (lymphoma and mammary carcinoma).^[37, 38, 39] In 1 of these experiments, there was no effect on tumor development, but a decrease in tumor volume was shown.^[33] Cytotoxicity to tumor cells has been demonstrated by organic acid gallates and hydrolysable tannins.^[7] One report has been published in which *emblica* had no effect in reducing lung cancer parameters in mice.^[40] *Emblica* extracts

protected irradiated mice from radiation sickness, increased the 30-day survival rate, and decreased total mortality.^[41, 42, 43] Research reveals no clinical trial data regarding the use of *Emblica* in cancerous conditions. However, in vitro studies using human cancer cell lines including lung, liver, cervical, ovarian, and breast cells have been conducted.^[44, 45, 46, 47] Various extracts of emblica inhibited hepatocarcinogenesis as measured by parameters such as tumor incidence, enzyme measurements, and other liver injury markers.^[37, 48, 49, 50, 51]

4. *Emblica* in skin protection

Animal experiments have been conducted, as well as in vitro studies using human skin fibroblasts demonstrating increased cell proliferation and collagen production at wound and ultraviolet B light (UBV) photo-aged sites.^[52, 53, 54] Limited clinical studies have been conducted using *Emblica* extracts in combination with other agents in skin-lightening creams as an alternative to hydroquinone.^[55]

5. GI effects of *Emblica*

Alcoholic and aqueous extracts of *Emblica* have shown protective and healing effects in induced gastric ulcers in animal experiments.^[56, 57, 58] One experiment, however, established a biphasic effect with healing observed at lower doses of ethanolic fruit extracts and ulceration evident on histology with higher doses.^[59] In vitro studies using rodent jejunum and ileum as well as in live mice show antidiarrheal and spasmolytic effects on castor oil-induced diarrhea, possibly due to muscarinic action and calcium channel blockade.^[60] Research reveals no clinical data regarding the use of *Emblica* in gastric ulcers or diarrhea.

6. *Emblica* as a Hepato- and renal-protective agent

Alcoholic and aqueous extracts of *Emblica* fruits have shown hepatoprotective properties in experiments in rats. Hepatic insults include antituberculosis drugs, arsenic, ethanol, thiacetamide, carbon tetrachloride, and cyclophosphamide. The experiments demonstrated histological and/or enzymatic protective and restorative effects. A decreased severity of hepatic fibrosis was also demonstrated, and some studies included improved renal and pancreatic indices.^[61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71] Research reveals no clinical data regarding the use of *Emblica* in renal disease; however, in patients with uremia consequent to end-stage renal disease (ESRD), *Emblica* reduced markers of oxidative stress. No effect on hepatic, renal, or diabetic indices was observed.^[72]

7. Hyperlipidemic effects of *Emblica*

A number of animal experiments report improved lipid profiles.^[73, 74, 75] Flavonoid extracts from the fruits of *Emblica* inhibited synthesis and enhanced degradation of cholesterol via increased hepatic HMG-CoA reductase.^[10] Fresh *Emblica* fruit juice administered to rabbits resulted in induced aortic plaques regressing to near normal, while serum and tissue lipids decreased,^[76] and ethanol extract of *Emblica* improved the lipid profile, as well as reduced hypertension in induced metabolic syndrome in rats.^[74] In a human clinical trial, healthy and hypercholesterolemic men (35 to 55 years of age) given *Emblica* supplementation for 28 days experienced a decrease in serum cholesterol levels. The condition was reversible upon discontinuation of the supplement.^[77] In volunteers with and without type 2 diabetes, 2 to 3 g daily of powdered, dried *Emblica* fruit improved the lipid profile (decreased total cholesterol, low-density lipoprotein, and triglycerides; increased high-density lipoprotein) at 21 days. Only among the volunteers with diabetes was there a decrease in total lipids at the 3 g daily dose.^[78]

8. Anti Diabetic effects of *Emblica*

In single- and multidose experiments, *Emblica* decreased blood glucose levels in rats with an induced diabetic state.^[13, 14, 15, 73] Triphala (a mixed herbal preparation containing *Emblica*) showed a stronger effect than *Emblica* alone,^[79] and another mixed preparation reduced blood glucose in a manner similar to that of glibenclamide.^[14] Serum creatinine was reduced, and serum albumin increased within 20 days in rats fed *Emblica*.^[14] In rats with induced diabetes, neuropathic pain was reduced with supplemental *Emblica* possibly via an antioxidative mechanism.^[80] In vitro studies also suggest inhibition of alpha-amylase and glucosidase as potential mechanisms.^[81] However, in another study in rats with diabetes, dried fruits did not prevent hyperglycemia despite delaying cataract progression.^[82] Decreases in fasting and 2-hour postprandial serum glucose were demonstrated in a clinical study using both healthy and type 2 diabetic volunteers. One to 3 g of powdered, dried fruit was consumed daily in 30 mL of water for 21 days.^[78] In another study in patients with ESRD and uremia, no effect on diabetic indices was observed.^[72]

9. Analgesic/Antipyretic effects of *Emblica*

Alcohol and aqueous extracts of *Emblica* fruit were tested for analgesic and antipyretic activity in mice. Results were similar to those of aspirin, except for response to heat pain model in which emblica had no activity.^[83]

10. Antitussive effect of *Emblica*

An alcoholic extract of the fruits showed a dose-dependent effect similar to that of dropropizine in cats, but was less active than codeine.^[84]

11. *Emblica* extracts as Antivenom

An alcoholic extract of *Emblica* roots showed neutralizing capacity against the hemorrhagic action of snake venom in mice.^[85]

12. Cardiac effects of *Emblica*

The *Emblica* fruits showed a protective effect against ischemic reperfusion injury in rats.^[86] In another study, the emblicanins were demonstrated to prevent oxidative stress.^[9]

13. Effects of *Emblica* on CNS

Studies in rats have demonstrated improved memory and reversal of drug-induced amnesia with the Ayurvedic preparation anwala churna.^[87, 88] Aqueous fruit extract exerted a protective effect on alcohol-induced brain mitochondrial dysfunction in rats.^[89]

14. Immune functions of *Emblica*

Rats exposed to noise stress for 15 days and given Triphala showed an increased neutrophil function and lowered cortisone release.^[90] However, in another experiment, an aqueous extract of *Emblica* fruits had no effect on cold stress-induced cortisone release.^[91]

15. *Emblica* extracts in Ophthacare

Emblica is one component of a mixed herbal eye drop formulation (Ophthacare) that showed activity in mild infections and inflammatory eye conditions in a clinical study; however, the quality of study methodology was limited.^[92]

16. Spermatotoxicity

Sperm count, motility, and viability were increased in mice and in human sperm with ripe *Emblica* fruit extract.^[93]

Recent reports on *Emblica*

Jain *et al.*,^[94] reported medical applications of *Emblica*. Dong Wook *et al.*,^[95] reported analgesic effect of Indian *Emblica officinalis* fruit extracts on postoperative and Neuropathic pain in Rats. Patel *et al.*,^[96] reported the growth promoting activity of *Emblica* in commercial broiler chickens. Sanjib Kumar *et al.*,^[97] reported Important uses of *Emblica officinalis* in

Indian system of medicine with pharmacological evidence. Pallavi *et al.*,^[98] reported the protective effects of Ethanolic Extract of *Emblica officinalis* (amla) on Cardiovascular Pathophysiology of Rats, Fed with High Fat Diet. Renuka *et al.*,^[99] reported the antioxidants of *Phyllanthus emblica* L. Bark Extract Provide hepatoprotection against ethanol-Induced hepatic damage.

CONCLUSION

Medicinal plants have been used since prehistoric period for the cure of various diseases. Even to date nearly about 80% of the world's populations still depend upon traditional remedies. *Emblica* with its multi faceted properties is occupying prominent position in herbal medicinal systems. It is for sure that herbal medicine may become a new era of medical system in the next few decades for the management of human diseases. However, advancement of modern drug development sometimes tends to make people adopt faster healing procedures ignoring the rich ayurvedic heritage of our country. In such situations, it is necessary to generate ethnobotanical awareness among people along with sensible use of these exhaustive resources for healthy life. It is also the need of hour to develop and characterize new natural drugs from plants and other natural sources with the aid of better screening methods.

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