


**Review Article**
**PHARMACOLOGICAL STUDY OF AMALAKI WITH SPECIAL REFERENCE TO ITS ANTIMICROBIAL ACTION**
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**ABSTRACT**

*Emblica officinalis* popularly known as *Amalaki* and Indian Goose Berry in English belongs to family *Euphorbeaceae*. *Amalaki* is gift of nature to mankind and is known as *Amritphala* in Sanskrit which means "Fruit of Heaven". *Amalaki* is widely distributed in tropical and subtropical areas and has therapeutic potential against deleterious diseases. Earlier it becomes a notable fruit for its rich amount of vitamin C, polyphenols such as tannins, gallic acid, ellagic acid, flavonoids like quercetin and rutin. *Emblica officinalis* (*Amla*) are widely used in the Indian system of medicine and believed to increase defense against diseases. *Emblica officinalis* is a versatile plant due to its various medicinal properties. *Emblica officinalis* seeds, leaves and fruits are commonly used for medicinal purpose. The various medicinal properties of *Emblica officinalis* such as Antioxidant, Antipyretic, Analgesic, Cytoprotective, Anti-ulcer, Immune modulatory, Anti Inflammatory, Antitussive and Gastro-protective have been studied. *Emblica officinalis* having a strong Memory enhancing property, cholesterol lowering, applicable in ophthalmic disorder, are reviewed. The effects of *Emblica officinalis* also take account as an Antimicrobial action and in neutralizing snake venom are also included. It is used as a single remedy and as content in many medicinal preparations. The current review is to summarize Description, Phytochemistry, Therapeutic Activity, Pharmacological Activity of *Emblica officinalis*, which may be helpful to establish a Standard Natural drug as an Antimicrobial.

**KEYWORDS:** *Emblica officinalis*, *Amalaki*, Antimicrobial action, Phytochemistry, Pharmacology.

**INTRODUCTION**

*Emblica officinalis* is used to treat large number of diseases as mention in texts. It is best used to make the equilibrium of three *Dosha*. In Charaka Samhita it is explained in *Vyasthapana*, *Virechanaopaga Mahakasaya*<sup>[1]</sup> and in Sushruta Samhita in *Triphala*, *Parushakadi Gana*.<sup>[2]</sup> Its fruit is used in various forms as juice, candy, powder etc. for the treatment of numerous disorders in Ayurveda and other system of medicine with its mystic effects. Its fruits is naturally rich in vitamin C, are used in many of the Ayurvedic medicinal preparations. Fruits are goose, fleshy, pale yellow in color and is proved to be effective against Diabetes, Cough, Asthma, Bronchitis, Dyspepsia, Hyperacidity, Peptic ulcer, Skin diseases, Inflammations, Anemia, Jaundice, Diarrhea, Hemorrhage, Leucorrhoea, Cardiac disorders, Intermittent fevers and Greying of hair. The plant is known for digestion power, improving liver functions and is liver protective. Another important pharmacological property of *Emblica officinalis* its Antimicrobial effect. Infectious diseases are the leading cause of death worldwide. As Antibiotics are a miracle drug but due to recent failure of antibiotic due to dramatic emergence of multiple drug resistance pathogens and rapid spread of new infections has become a global concern and has urge the health organization's to change the strategy. So the world is being attracted towards the alternative sources of natural antimicrobial, employed in our traditional system of medicine. Since centuries and found to have competitive effects compared to commercial antibiotics. *Emblica officinalis* have numerous secondary metabolites such as Saponines, Tannin, Flavonoids,

Alkaloids, Alkenyl Phenols, Glycoalkaloids, Lactones, etc. having antimicrobial properties. According to Fransworth et al, 1985, as microorganism develop new strength to live long and resist, same plants have more strength to develop, new, faster, and natural Antimicrobials than manmade Antimicrobial. And that is explaining why plants are succeed in fighting against microbes.

**Vernacular Names**

**Sanskrit:** *Amalaka*, *Amritphala*, *Dhatri*, **Hindi:** *Amla*, **Tamil:** *Nellikai*, **Gujarati:** *Ambala*, **Urdu:** *Amla*, **Marathi:** *Anvaḷa*, **Kannada:** *Nellikayi*, **Punjabi:** *Aula*, **Bengali:** *Amla*, **Nepali:** *Amlain*, **Assamese:** *Amlaku*, **Oriya :** *Anala*.<sup>[3]</sup>

**Morphology**

*Emblica officinalis* tree is commonly found in the mixed deciduous forests of India ascending to a height of 4, 500 ft. in the hills. The tree is small to medium in size, reaching 1–8 m (3 ft 3 in–26 ft 3 in) in height. The branchlets are not glabrous or finely pubescent, 10–20 cm (3.9–7.9 in) long, usually deciduous; the leaves are simple, sub sessile and closely set along branchlets, light green, resembling pinnate leaves with small narrowly oblong, pinnately arranged leaflets The flowers are greenish-yellow. The fruit is nearly spherical, light greenish yellow, quite smooth and hard on appearance, with six vertical stripes or furrows and are depressed, globose, fleshy and obscurely 6-lobed, Containing 6 trigonous seeds. The fruit is Ripen in autumn and are the berries are harvested by hand after climbing to upper branches bearing the fruits.

The taste of *Emblica officinalis* Sour, Bitter and Astringent, and it is quite fibrous.<sup>[4]</sup>

#### Taxonomy<sup>[5]</sup>

Kingdom: Plantae

Division: Angiospermae

Class: Dicotyledonae

Order: Geraniales

Family: Euphorbiaceae

Genus: *Emblica*

Species: *officinalis* Geartn

#### Distribution

*Emblica officinalis* is widely distributed in India, Pakistan, Uzbekistan, Sri Lanka, South East Asia, China and Malaysia. In India, it is very easily found growing in semi-arid regions and plains of northern India. Uttar Pradesh, Tamil Nadu, Rajasthan, and Madhya Pradesh.<sup>[6]</sup> *Emblica officinalis* fruits are available from October till April, leaves from March to April and flower from February to May. So during this time it is collected and preserved in large numbers to be made available during rest of the year.<sup>[7]</sup>

#### Description

**Macroscopic:** Fruit, globose, 2.5 – 3.5 cm in diameter, fleshy, smooth with six prominent lines, greenish when tender, changing to light yellowish or pinkish color when mature, with a few dark specks, taste, sour and astringent followed by delicately sweet taste.<sup>[8]</sup>

**Macroscopic:** Transverse section of mature fruit show an epicarp consisting of single large dermis and 2-4 layers of hypodermis, epidermal cell, tabular in shape, covered externally with a thick cuticle and appear in surface view as polygonal, hypodermal cells tangentially elongated, thick walled, smaller in dimension than epidermal cells, mesocarp forms bulk of fruit, consisting of the thin walled parenchymatous cells with intercellular spaces, peripheral 6-9 layers smaller, ovoid or tangentially elongated while rest of cells are larger in size, mesocarp consisting of xylem and phloem, xylem composed of tracheal element, fibretracheids and xylem fibre.<sup>[9]</sup>

#### Properties

*Amalaki* is having *Amla pradhan Panch Rasa* and *Madhura Vipaka* and *Sheeta Veerya*. It have *Guru, Ruksha, Sheeta Guna*. It is *Tridhosahara*, due to *Amla Rasa* it is *Vatahar*, *Pittashamak* due to *Madhura* and *Sheeta Guna* and *Kapha Shamak* due to *Ruksha* and *Kasaya Rasa* and mainly *Pittashamak*. It act as *Deepan* (Enhance appetite), *Paachan* (Enhance digestion), *Amlatanashak* (Antacid), *Yakrituttejak* (Hepatoprotective), *Anuloman* (to treat constipation), *Chakshushya* (Beneficial for eyes), *Hridaya* (Nourishes the Heart), *Raktaprasadana* (Blood Purifier), *Shonikstambhana* (Stop bleeding), *Vrishya*, *Grabhasthapan*, *Mutrala* (Diuretic), *Pramehaagan* (Antidiabetic), *Jvaraghna* (Antipyretic), *Kasahara* (Reduce Cough), *Rasayan* (Rejuvenation).<sup>[10]</sup>

#### Chemical composition

*Emblica officinalis* primarily contains tannins, alkaloids, phenolic, amino acids and carbohydrates. Its fruit juice contains the highest amount of vitamin C (478.56 mg/100 mL). Compounds isolated from *Emblica*

*officinalis* were gallic acid, ellagic acid, 1-O galloyl-beta-D-glucose, 3, 6-di-Ogalloyl- Dglucose, chebulinic acid, quercetin, chebulagic acid, corilagin, 1, 6- di-O -galloyl beta D glucose, 3 Ethylgallic acid (3 ethoxy 4, 5 dihydroxy benzoic acid) and isostrictiniin. <sup>[11]</sup>

#### Pharmacological and Biological Activities

Various phytochemical, pharmacological, experimental clinical investigation are done on *Emblica officinalis* by many Scientist, Researchers etc. to clearly understand the different usages such as.

#### Anti-Inflammatory Activity

Leaves and fruits of *Phyllanthus Emblica* L. have been used for the anti-inflammatory and Antipyretic treatment of rural populations. In a study, leaves of *Phyllanthus Emblica* were extracted with ten different solvents (n hexane, diethyl ether, and methanol, acetic acid, dichloromethane, toluene, chloroform, water etc.). The inhibitory activity of the extracts against human polymorph nuclear leukocyte (PMN) and platelet functions was studied. The Methanol extracts (50 micrograms/ml) inhibited leukotriene B4-induced migration of human PMNs by 90% and N-formyl-L-methionyl- L-phenylalanine (FMLP)-induced degranulation by 25-35%. Diethyl ether extract inhibited calcium ionosphere A23187-induced leucotrienes, release from human PMNs by 40% thromboxane B2 production in platelet during blood clotting by 40% and adrenaline induced platelet aggregation by 36%. Anti-inflammatory activity was found in the water fraction of methanol extract of the plant leaves too.<sup>[12]</sup>

#### Antioxidant activity

Free radicals are the fundamental to any biochemical process and represent an essential part of the aerobic life and our metabolism. There is a dynamic balance between the amount of free radicals generated in the body and Antioxidant to scavenge them. When an overload of free radical cannot be gradually destroyed their accumulation in the body generates a phenomenon called oxidative stress. *Emblica officinalis* was studied against the cold stress-induced alterations in the behavioral and biochemical abnormalities. *Triphala* administered orally about 1g/kg/animal body weight for 48 days significantly prevented cold stress-induced behavioral and biochemical abnormalities in albino rats. Thus, *Triphala* supplementation can be regarded as a protective drug against stress.<sup>[13]</sup> Vitamin C in *Emblica officinalis* accounts for approximately 45-70% of the antioxidant activity. Rats were examined for the antioxidant properties of *Emblica officinalis* extracts and its effect on the oxidative stress in streptozotocin induced diabetes was also reported. The extracts showed strong free radical scavenging activity.<sup>[14]</sup>

#### Immunomodulatory Activities

*Emblica officinalis* has an Immune activation property which is an effective as well as protective approach against emerging infectious diseases. This property of *Emblica officinalis* has been proved by assessing the immunomodulatory activities of *Triphala* on Albino rats. On oral administration of *Triphala* appears to stimulate the neutrophil functions in the immunized rats

and stress induced suppression in the neutrophil functions were significantly prevented by *Triphala*.<sup>[15]</sup>

#### **Antitussive, Gastro-protective activity**

*Emblica officinalis* has been mentioned by Acharya Charaka as *Kasagana*.<sup>[16]</sup> Its antitussive activity has been seen in conscious cats by mechanical stimulation of the laryngo-pharyngeal and trachea-bronchial mucous areas of airways. Its Antitussive activity was more effective than the non-narcotic antitussive agent dropropizine but less effective than shown by the classical narcotic antitussive drug codeine. The dry extract of *Emblica officinalis* exhibit the antitussive activity not only due to Antiphlogistic, Antispasmodic and Antioxidant efficacy effects, but also to its effect on mucus secretion in the airways.<sup>[17]</sup>

*Emblica officinalis* has been reported for its Cytoprotective and Immune modulating properties against chromium (VI) induced oxidative damage. It inhibited chromium induced Immune suppression and restored gamma-IFN production by macrophages and phagocytosis.<sup>[18]</sup>

#### **Anti-ulcer Activities**

*Emblica officinalis* has significant ulcer protective property and ulcer healing effect due to its offensive and defensive mucosal factors. A study has been done by its methanolic extract against ulcer<sup>[19]</sup>. *Emblica officinalis* (ethanolic extract) was investigated for its Antisecretory and antiulcer activities using various experimental models in rats, including pylorus ligation Shay rats, Indomethacin, Hypothermic restraint stress induced gastric ulcer and necrotizing agents. It was then reported that *Emblica officinalis* extract exhibit Antisecretory, Cytoprotective and Antiulcer properties.<sup>[20]</sup>

#### **Anti-cancerous Activities**

*Emblica officinalis* is valued for its unique tannins and flavanoids, which exhibit very powerful antioxidant properties and inhibition of tumor. Fruit extract of the plant has been evaluated on skin carcinogenesis in Swiss albino mice. Chemo preventive potential of *Emblica officinalis* fruit extract on 7, 12-dimethylbenz (a) anthracene (DMBA) induced skin tumorigenesis in Swiss albino mice have been found.<sup>[21]</sup>

#### **Memory Enhancing Effects**

*Emblica officinalis* churn has proved to be a useful remedy for memory improvement of young and aged and in the management of Alzheimer's disease and reversed the amnesia induced by scopolamine and diazepam due to its multifarious beneficial effects such as memory improvement and reversal of memory deficits.<sup>[22]</sup>

#### **In Reducing Cholesterol and Dyslipidemia**

Cu<sup>2+</sup>-induced LDL oxidation and cholesterol fed rats were used to investigate the effects of *Emblica officinalis* on low-density lipoprotein (LDL) oxidation and cholesterol levels *in vitro* and *in vivo*. It was concluded that *Emblica officinalis* may be effective for hypercholesterolemia and prevention of Atherosclerosis.<sup>[23]</sup>

#### **Anti Diabetic**

In single and multiple doses experiments, *Emblica officinalis* decreased blood glucose levels in rats with an induced diabetic state. Serum Creatinine was reduced and

serum albumin increased within 20 days in rats fed *Emblica*. In rats with induced diabetes, neuropathic pain was reduced with supplemental *Emblica* via an antioxidant mechanism and *in vitro* studies also suggest inhibition of alpha amylase and glucosidase as potential mechanisms.<sup>[24]</sup>

#### **Medicinal uses**

Headache, Anuria, Ophthalmic disorders, Hair loss, Alopecia, Cataract, Indigestion, Loss of Appetite, Weakness, Hepatoprotective, Hepatitis, Insomnia, Haememetasis, Cough, Asthma, Tuberculosis, Dysuria, Diabetes, Leprosy, Skin disorders, Leucorrhoea, Inflammation, Weakness, Low memory, Low immunity.<sup>[25]</sup>

#### **Amalaki as Antimicrobial**

Various studies have demonstrated potent antimicrobial properties of *Emblica officinalis* (Ahmed *et al.*, 1998) and it is used as antiviral for cold and flu. In the respiratory infections, it has an antibiotic activity against a wide range of bacteria, used traditionally in the treatment of lungs (Chopra & Simon, 2000). It also has shown antifungal activity. *In vitro* (Dutta *et al.*, 1998). *Emblica officinalis* has an antimicrobial activity against microbes, due to its chemical constituents like flavonoids (quercetin), ascorbic acid, gallic acid, alkaloids (phyllantine, phyllantidine) and hydrolysable tannins (emblicanin A and B)<sup>[26]</sup>. Fruits of *Emblica officinalis* are the richest source of Vitamin C, tannin and flavonoids, etc. Tannin has antimicrobial properties by enzyme inhibition, substrate deprivation, cell wall inhibition by inhibiting oxidative phosphorylation, metal ion deprivation etc<sup>[27]</sup>. Several studies have examined the relationship between Flavonoids structure and antimicrobial activity eg. Quercetin has been partially attributed to inhibition of DNA gyrase. Also sophoraflavone G and epigallocatechingallate inhibit cytoplasmic membrane function and licocholcones inhibit energy metabolism<sup>28</sup>. *Emblica officinalis* have been found to be active against a range of bacteria including *Staphylococcus aureus*, *Escherichia coli*, *Mycobacterium tuberculosis*, *S.typhosa* and *Candida albicans*<sup>[29]</sup>.

#### **Some Classical Ayurvedic Preparation**

*Chavanprasad*, *Braham Rasayan*, *Dhatriloha*, *Dhatri Rasayan*, *Triphala Churna*.<sup>[30]</sup>

#### **Conclusion**

*Emblica officinalis* a versatile plant due to its various medicinal properties. It is one of the oldest medicinal plant mentioned in *Ayurveda* as potential effects for various ailments. Fruit of *Emblica officinalis* are rich in Vitamin C, phyllaemblic compounds, gallic acid, tannins, flavonoids, pectin, and quercetin and also contains various polyphenolic compounds, terpenoids, alkaloids, flavonoids, and tannins reviewed that it posses. Antioxidant, Anticancer, Antitumor, Antigenotoxic, and Anticarcinogenic effects and other pharmacological or biological activities. It is considered to be a safe herbal medicine without any adverse effects. So it can concluded that Indian gooseberry is a traditionally and clinical proven fruit for both its application and efficacy. It detoxifies and excretes toxins and increase the immune system in the body and apart from above properties it also

have an antimicrobial action. From the above review we can conclude that the *Embllica officinalis* having a wide range of medicinal value and important natural products to control Antibiotic Resistant bacteria which are a threat to human health. It can be further investigated on other various parameters to obtain valuable market products.

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#### Cite this article as:

Kavitha Sharma, Preeti Sharma, Rashmi Srivastav, Akhilesh Srivastava, Dalip Sharma. Pharmacological Study of Amalaki with Special Reference to its Antimicrobial action. International Journal of Ayurveda and Pharma Research. 2017;5(5):93-96.

Source of support: Nil, Conflict of interest: None Declared

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