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Indian gooseberry (*Emblica officinalis*): Complete pharmacognosy review

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Abstract
Medicinal plants are natural gift to human lives to promote disease free healthy life. *Phyllanthus emblica*, commonly known as Amla 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* is a natural, efficacious an antioxidant with the richest natural source of Vitamin C (200- 900 mg per 100 g of edible portion). *Emblica officinalis* is amazingly effective natural antiageing product. *Emblica officinalis* is very effective in treatment of acidity and peptic ulcers. *Emblica officinalis* is rich in Vitamin C, Calcium, Iron, essential amino acids and many other vitamins and minerals and anti-oxidants. Research reports on Amla reveals its analgesic, anti-tussive, antiatherogenic, adaptogenic; cardio, gastro, nephro and neuroprotective, chemopreventive, radio and chemo modulatory and anticancer properties. Amla is also reported to possess potent free radical scavenging, antioxidant, anti-inflammatory, anti-mutagenic, immunomodulatory activities, which are efficacious in the prevention and treatment of various diseases like cancer, atherosclerosis, diabetes, liver and heart diseases. In this article, we discuss the nutritional value, biochemical constituents, traditional uses, medicinal value of Amla and its use as a household remedy. We also emphasized the mechanisms behind the pharmacological activities based on the recent research reports and tried to summarize the results of research done from the past 6 years with proper specifications on the future prospects in a pharmacological perspective.

Keywords: Amla, Chemical constituents, nutritional value, pharmacological activities, mechanism, traditional uses, ayurveda

Introduction
Amla (*Emblica officinalis*) (EO) has a hallowed position in Ayurveda- an Indian indigenous system of medicine[1]. According to belief in Indian mythology, Amla is the first tree to be created in the universe; which belongs to the family of Euphorbiaceae and is also known as *Phyllanthus emblica* or Indian gooseberry [1]. Amla is native to India and also grows in tropical and subtropical regions of Pakistan, Uzbekistan, Sri Lanka, South East Asia, China and Malaysia [1]. The fruits of Amla are widely used in the Ayurvedic preparation and are believed to increase defence against diseases [2]. It has a beneficial role in degenerative diseases like cancer, diabetes, liver treatment, ulcer, anemia, heart trouble[1] and also is an important constituent in hepatoprotective formulas available[2]. Amla is highly nutritious and is one of the richest sources of vitamin-C, amino acids and minerals [3]. It contains several chemical constituents like tannins, alkaloids and phenols.[4] among all hydrolysable tannins, Emblicanin A and B; gallic acid, ellagic acid are reported to possess biological activity. Almost all parts possess medicinal properties, particularly fruit, which has been used in Ayurveda as a powerful rasayana and in customary medicine in the treatment of diarrhoea, jaundice, inflammation and several other ailments [5]. Amla fruit is widely used in the Indian system of medicine as alone or in combination with other plants and is used to treat common cold and fever, as diuretic, laxative, liver tonic, refrigerant, stomachic, restorative, anti-pyretic, hair tonic; to prevent ulcer and dyspepsia.

Pharmacological research reports on Amla reveal its analgesic [6], anti-tussive [7], anti-atherogenic [8], adaptogenic [9]; cardio [10], gastro [11], nephro [12], neuro [13] protective and anticancer [14] properties. Amla is also reported to possess chemopreventive [15], radio [16], chemo [17] and immunomodulatory [18], free radical scavenging [19], antioxidant [19], anti-inflammatory [21], anti-mutagenic activities. These properties are efficacious in the prevention and treatment of various diseases like cancer, atherosclerosis, diabetes, peptic ulcer, anemia, liver, heart diseases and various other disorders.

Classification
- Kingdom: Plantae
- Division: Angiospermae
- Class: Dicotyledonae
- Order: Geraniales
- Family: Euphorbiaceae
- Genus: Emblica
- Species: officinalis Geartn.

Vernacular names
- English: Emblic myrobalan,
- Indian Goose berry
- Sanskrit: Aamalaki
- Hindi: Amla
- Kannada: Nelli Kayi
- Marathi: Amla

- Gujarati: Ambla
- Malayalam: Nelli Kayi
- Tamil: Nelli
- Telugu: Usirikaya
- Kashmir: Aonla

Morphology

Amla tree is a small to medium sized deciduous tree with an average height of 8-18 m, with thin light grey bark exfoliating in small thin irregular flakes, exposing the fresh surface of a different color underneath the older bark. The average girth of the main stem is 70 cm. In most cases, the main trunk is divided into 2 to 7 scaffolds very near to the base [22]. Leaves are 10 -13 mm long, 3 mm wide, closely set in pinnate faishon3 which makes the branches feathery in general appearance. After setting of the fruits leaves develop. Flowers are unisexual, 4 to 5 mm in length [23], pale green in color, borne in leaf axils in clusters of 6 to 10. Fruits are fleshy, almost depressed to globose shape, 2.1-2.4 cm in diameter, 5.3-5.7 g in weight, 4.5-5.0 mL in volume. The stone of the fruit is 6 ribbed, splitting into three segments [23] each containing usually two seeds; seeds are 4-5 mm long and 2-3 mm wide, each weighing 572 to 590 mg [23-24].

Fig 1: Amla Fruits

Fig 2: Amla seeds

Fig 3: Amla leaves

Fig 4: Amla tree

Chemical composition of Amla

Amla is one of the most extensively studied plants. Reports suggest that it contains tannins, alkaloids and phenols [4]. Fruits have 28% of the total tannins distributed in the whole plant. The fruit contains two hydrolysable tannins Emblicanin A and B [25], which have antioxidant properties; one on hydrolysis gives gallic acid, ellagic acid and glucose wherein the other gives ellagic acid and glucose respectively. The fruit also contains Phyllemblin [26]. Activity directed fractionation revealed the presence of several phytochemicals like gallic acid, corilagin, furosin and geraniin [27]. Flavonoids like quercetin, alkaloids like phyllantine and phyllantidine are found. Along with these, it primarily contains amino acids, carbohydrates and other compounds given in Table 1. Its fruit juice contains the highest concentration of vitamin-C (478.56mg/100mL). Vitamin C levels are more than those in oranges, tangerines and lemons [28, 29].

Table 1: Amla fruit: 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

Nutritive value Amla is well known for its nutritional qualities. It is rich in polyphenols, minerals and is regarded as one of the richest source of vitamin C (200- 900 mg per 100 g of edible portion).

Table 2: major components of nutritional impottance are reported

Carbohydrate	**14.1**
Proteins	0.5
Fat	0.1
Fibers	3.7
Mineral matter	0.7
Calcium	0.05
Phosphorus	0.02
Iron	1.5 mg /100g
Vitamin c	600 mg/ 100 g
Nicotinic acid	0.2 mg /100 g
Moisture	81.2

Traditional uses [31-37]

The fruits are sour, astringent, bitter, acrid, sweet, cooling, anodyne, ophthalmic, carminative, digestive, stomachic, laxative, alterant, aphrodisiac, rejuvenative, diuretic, antipyretic and tonic. They are useful in vitiated conditions of tridosha, diabetes, cough, asthma, bronchitis, cephalalgia, ophthalmopathy, dyspepsia, colic, flatulence, hyperacidity, peptic ulcer, erysipelas, skin diseases, leprosy, haematogenesis, inflammations, anemia, emaciation, hepatopathy, jaundice, strangury, diarrhoea, dysentery, hemorrhages, leucorrhoea, menorrhagia, cardiac disorders, intermittent fevers and greyness of hair.

1. **As a Vermifuge**: Juice of the fruit with honey is used. The recommended dose is from 1 to 3 drachms.
2. **Appetizer:** Use of pickles and preserves made from the green fruits.
3. **Irritability of the bladder, in retention of urine, to the forehead in cephalalgia**: Use a paste of the fruit alone or with Nelumbium speciosum, Saffron and rose water. Applying it over the affected region.
4. **As a febrifuge and in diabetes**: Using an infusion of the seeds.
5. **For hiccup and for painful respiration**: Use of juice or extract of the fruit combined with honey and pipli.
6. **For hemorrhage, diarrhea and dysentery**: Using dried fruit. A decoction prepared from the fruit combined with T. chebula and T. belericais useful in chronic dysentery and biliousness, in doses of 1 oz. once or twice daily.
7. **For diarrhea of children**
   - A compound powder of the Amla seed, Chitrak root, chebulic myrobalan, pipli and palelone is given in suitable doses, according to age, in warm water twice daily, morning and at bed time.
   - Tender shoots given in butter-milk cure indigestion and diarrhea; green fresh leaves combined with curds have a similar effect.
   - Leaves are used as infusion with fenugreek seeds in chronic dysentery and as a bitter tonic.
   - Soak one tola of the seeds in a tinned vessel during the night. Grind it. Add cow's milk and use. This is a good remedy for biliousness.
8. **For anemia, jaundice and dyspepsia:**
   1. Use dried fruit with iron.
   2. Fermented liquor prepared from the root is used in jaundice, dyspepsia, cough, etc.
   3. Take 20 to 40 grains of Dhatri Leha for anemia, jaundice and dyspepsia.
   4. Dhatri Arista is used for jaundice, dyspepsia, indigestion, and cough.
   5. For burning in the vagina:
   6. A mixture of the fruit juice and sugar is prescribed as a remedy for burning in the vagina. Juice of the bark combined with honey and turmeric is a remedy for gonorrhea.
9. **To stop nausea and vomiting:** A powder of the Amla seed and red sandalwood is given with honey, to stop emesis.
10. **For bleeding of the nose**: Seed fried in ghee and ground in conjee is applied as Lep to the forehead to stop bleeding from the nose.
11. **For scabies or itch:** Apply the seed burnt, powdered and mixed in oil for scabies or itch.
12. **As a restorative invigorator**:
    - Make a powder from an equal quantity of Amla seed and root of Withania somnifera. Add ghee and honey. Mix well. This is a restorative invigorator, especially in winter days.
    - Combine half a drachm each of Amla seed and gokhru. Grind and make them into a powder. Mix with 15 grains of essence of Gulancha. Give this in early morning with ghee and sugar. This is a nutrient tonic.

Other uses of Amla

- It helps in regulating blood sugar.
- It is very powerful anti-inflammatory herb, a wonderful antioxidant and a natural Source of Vitamin C. Amla helps scavenge free radicals.
- Amla is powerful food for the brain and helps lower cholesterol.
- Amla also helps maintain the functioning of the liver,

increases haemoglobin, red blood cell count. It is useful for Cough, Bronchitis, and Asthma.
- Amla cleanses the mouth, strengthens the teeth. Its decoction is used in hyperacidity and with honey as an anthelmintic.
- The presence of Amla results in an enhanced cell survival, decreased free radical production and higher antioxidant levels.
- There are various classic Ayurvedic preparations, such as Chyawanprash in which Amla is used as a chief ingredient. It help improve intelligence and memory power.
- Triphala and Brahmarasayana are other classic medicine in which Amla is being used since time immemorial.

Table 3: Amla: home remedies [38]

Stabilizer of blood sugar	**Amla seeds or dried Amla powder in the form of capsules with bitter gourd juice daily**
Natural cholesterol remedy	It strengthens the heart muscles and causes a significant decrease in total cholesterol, LDL cholesterol, VLDL cholesterol and triglycerides. A 500 mg capsule of dried Amla powder can be added to your daily routine after consulting with doctor.
Treats hypertension	High vitamin-C helps control blood pressure. Amla choorna (powder) or in the form of triphala tablets or decoction. Triphala, a combination of Amla and two other herbs is an excellent medication for high blood pressure.
Natural cure for Anemia	Amla is rich in Vitamin-C or ascorbic acid, an essential ingredient that helps in the absorption of Iron.
Herbal cough remedy	Add a teaspoon of Amla juice or powder to a glass of warm milk and drink this thrice a day. This will clear an unpleasant throat, adding some ghee to this decoction will clear a cough. Mix Amla powder with honey and suck this mixture twice a day to cure a chronic dry cough. Amla is invaluable in the treatment of tuberculosis, asthma and bronchitis.
Natural eye tonic	Fresh Amla juice or dried Amla capsules are a good supplement to improve near-sightedness, cataract and glaucoma. It reduces intra ocular tension and corrects the vision.
Promotes hair growth	Dried Amla fruits are boiled in coconut oil and then ground to form Amla oil. This is a very effective conditioner and prevents balding and greying of hair. For oily hair, mix half a cup of Amla juice, half a cup of lime juice and some water. Apply this to make an anti-grease hair wash.
A pitta pacifier	Amla boiled in coconut water and the ground mixture is applied to the scalp. Amla oil is an excellent way to reduce heat associated with summer season. It is a good remedy to pacify pitta conditions.
Treats white spots on the nails	As a source of Vitamin C, serves as an effective remedy in vitamin deficit condition. Addition of Amla juice/powder in diet overcomes this condition.
Remedy for menstrual disorders	White discharge can be relieved with powdered and dried Amla Seeds. Mixture of Amla with honey and saunf (fennel) or mixing it with squished banana and consuming.

The ayurvedic description of Amla [39-40]

According to the Ayurvedic classifications, Amla fruit exert below properties:

- **Rasa (taste)**: Sour and astringent are the most dominant, but the fruit has five tastes, including sweet, bitter, and pungent.
- **Veerya (nature)**: Cooling, treatment of burning sensation in inflammation and fever which are considered to be manifestations of pitta (fire) agitation.
- **Vipaka (taste developed through digestion)**: Sweet
- **Guna (qualities):** Light, dry
- **Doshas (effect on humors):** Quietens all three doshas: vata, kapha, pitta, and is especially effective for pitta. Based on this, Amla has been considered the best of the Ayurvedic rejuvenative herbs. Inimitably, Amla exerts natural balance of tastes (sweet, sour, pungent, bitter and astringent), that stimulates brain to rebalance the three main components (water, fire and air in the body) of all physiological functions.

Pharmacological activities [41] mechanisms [42] and health assets of Amla

Alteration in basic homeostatic balance of the body is the origin of disease. Imbalance between pro-oxidant and anti-oxidant homeostasis place a major role in majority of ailments. Pro-oxidant condition dominates either due to increased generation of free radicals and/or their poor quenching/scavenging by the anti-oxidants (which protects the body against the deleterious effects of free radicals) [19, 43].

Anti-cancer and anti-oxidant activity

Amla is one of the richest sources of vitamin-C and low molecular weight hydrolysable tannins which makes Amla a good antioxidant. The tannins of Amla like emblicanin-A (37%), emblicanin-B (33%), punigluconin and pedunculagin are reported to provide protection against oxygen radical included haemolysis of rat peripheral blood erythrocytes [44]. The mechanism behind antioxidant activity is due to the recycling of sugar moiety and conversion of the polyphenol into medium and high molecular weight tannins. The powerful antioxidant Ellagic acid, present in Amla, can inhibit mutations in genes and repairs the chromosomal abnormalities [45].

Amla inhibits the growth and spread of various cancers like breast, uterus, pancreas, stomach and liver cancers. It can prevent and/or reduce the side effects of chemotherapy and radiotherapy [25, 45]. More than 18 compounds were identified in Amla fruit which can exert anti-proliferative activity on gastric and uterine cancer cells. The main mechanism behind its activity is by enhancing Natural Killer (NK) cell activity in various tumor cells [14]. Emblicanin A & B of Amla fruit are reported to possess strong antioxidant and anti-cancer

properties.

Action on diabetes
Amla fruit powder enhances to control high blood pressure. Triphala comprises three herbs namely Amla, harada and bihara. The blood sugar level may be increased by the action of an enzyme alanine transaminase which is present in liver. This enzyme can be normalized by taken one teaspoonful of this mixture (equal quantities of Amla, jamun and bitter gourd powder) once or twice per day. Chromium, a mineral present in Amla fruits responsible for the anti-diabetic effect [46].

Eye tonic
Triphala powder (made by mixing over of Hirda, behde and Amla powder) with honey makes the vision of eye bright and keeps shining and also good for the digestive system [47].

Impedes constipation
The irregular and infrequent evacuation of the bowels is known as constipation. This problem is cures by taken of 1 teaspoon of Amla powder with milk or water every morning. On the other hand 4 tea spoon of fresh Amla juice and 3 teaspoon of honey mixed with water may deal this constipation. If constipation is caused by parasites, take 20gms of fresh Amla juice every day may destroy the worms [48].

Jaundice
Fresh Amla fruits are soaking with 4 munnakkas, both are grind with Amla juice after one hour. This portion may gives relief in jaundice.

Gout
Gout is nothing but an inflammation of the big toe caused by defects in uric acid metabolism resulting in acid deposit and its salts in the blood and joints. This problem is cured by taken of Amla juice with old ghee makes softening of joints and helps in curing gout and also removing the spots caused by measles, chicken pox, small pox.

Piles
Drinking fresh Amla juice with half teaspoon of ghee and 1 teaspoon of honey and 100 Gms of milk after lunch cures chronic piles problem.

Respiratory disorder
Amla has been witnessed that it can retrieve the normal respiration while the system gets affected. The paste made by 10gm leaves of *Phyllanthus emblica*, 5 fruits of Terminalia chebula, 9 seeds of Piper nigrum, one garlic are crushed over and mixed with 25 ml ghee made from cow's milk and a clove. The fresh juice of Amla mixed with honey can get back best from asthma, cough, and other respiratory disorders.

Urinary problem
The paste made by 20gms of pulp of dried Amla in 160 gms of water till 40 gms is left. This was mixed with 20gms of Gur. Regular use of this portion may cure urinary problem.

Migraine
Migraine is a severe vascular headache in female rather than men. This is cures by applying the paste made by dried Amla powder with kumkum, neelkamal and rose water.

Recommended dosage of vitamin C
Nowadays, Amla powder is extensively used for enhancing entire immune system. According to U.S. Recommended Dietary Allowance (RDA), daily ingestion of nutritional vitamin C is given as below:
Infants (age below 1 year):30 to 35mg
Children (age 1 to 14 years):40 to 50mg
Adolescent (age 15 to 18 years): 65 to 75mg
Men (age over 18 years): 90mg
Women (age over 18 years):75mg
Various doses have been studied, and there is no proven effective dose for amalaki. 1-2 capsules have been taken three times daily after meals

Conclusion
The use of medicinal plants in the management of various illnesses is due to their phytochemical constituents and dates back to historical age. While being exceptional for its ethnic, ethnobotanical and ethnopharmaceutical use, it is an important ingredient of many Ayurvedic medicines and tonics. It is one of the richest natural sources of Vitamin C and plays a vital role in preventing innumerable health disorders. It is considered to be a safe herbal medicine without any adverse effects. So it can be concluded that the Indian gooseberry is a traditionally and clinically proven fruit for both its application and efficacy. Now a days, research on Indian traditional medicinal plants has gained a new recommence. Although, the other systems of medicine are effective they come with a number of undesired effects that often lead to serious complications. Being natural, herbal medicine alleviates all these problems. *Emblica officinalis* (Amla) has an important position in Ayurveda- an Indian indigenous system of medicine. Amla due to its strong antioxidant and biological properties prevent innumerable health disorders as it contains essential nutrients. It can be used as a possible food additive or in nutraceuticals and biopharmaceutical industries. In this review, we tried to make a summary the traditional and scientifically proven uses of Amla and tried to establish their basic mechanisms.

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